TEAM 2

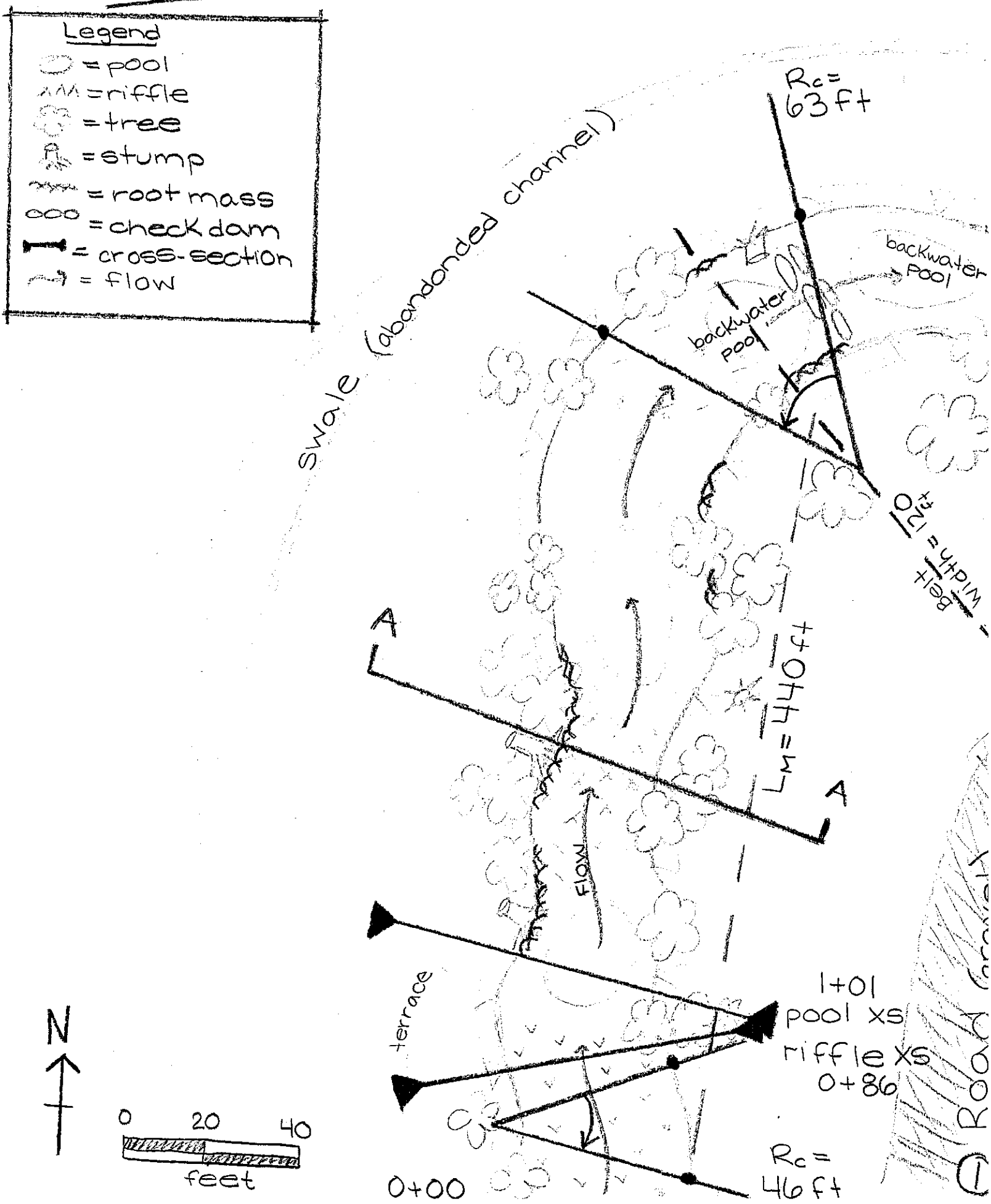
Field Day 2 Presentation Order: Gage Station

River Morphology and Applications

- Sketch Map
- Cross-sections
  - Riffle cross-section
  - Pool cross-section
- Longitudinal Profile
- Pebble Counts
  - Representative pebble count
  - Riffle pebble count
- Velocity (Worksheet B-2)
- Stream Classification (Worksheet B-1)
- Dimensionless Ratios (Worksheet B-3)

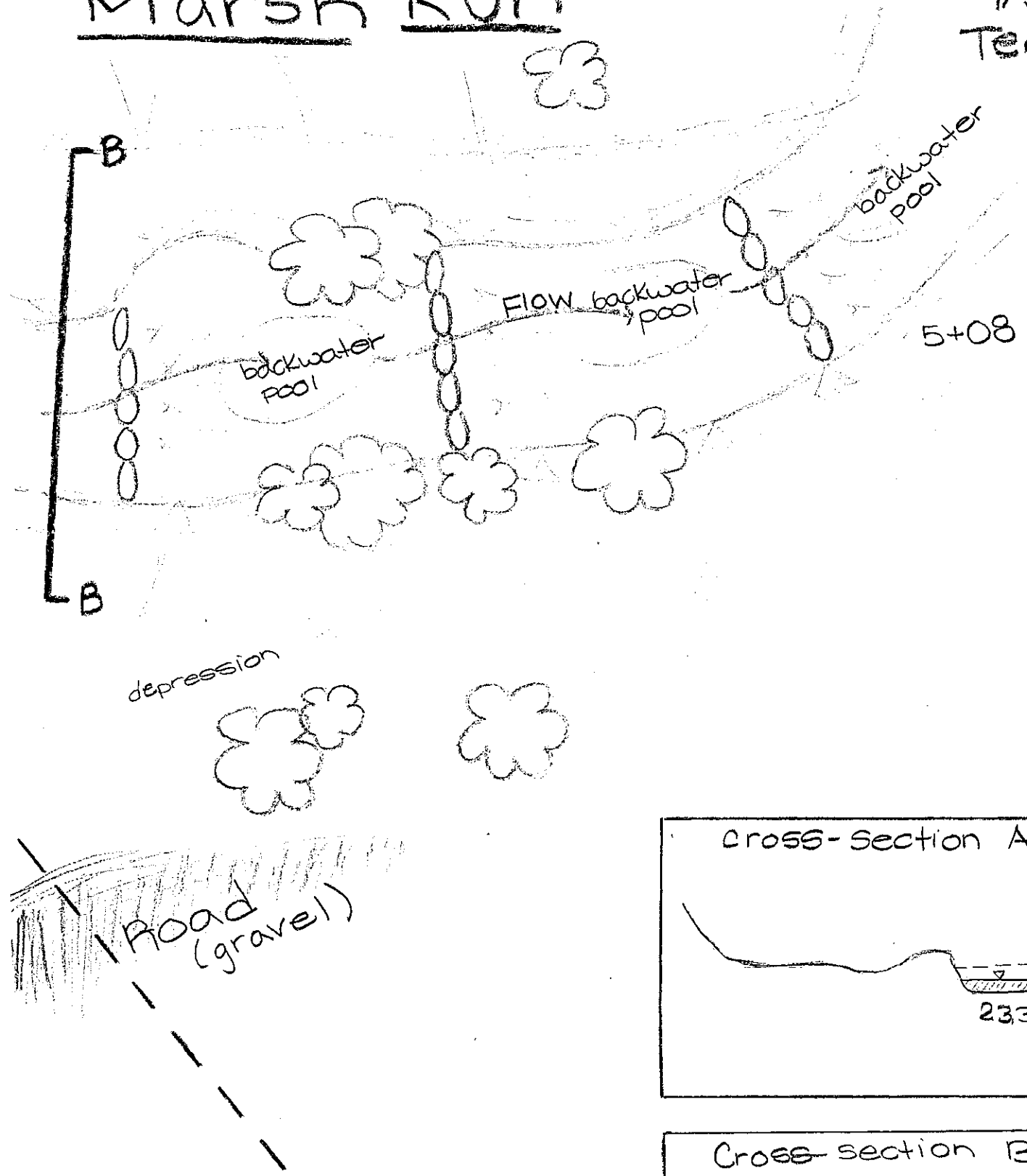
Marsh Run

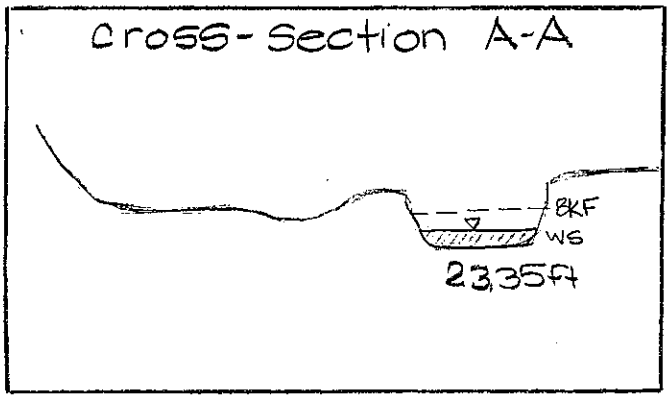
4/30/04
Team 2

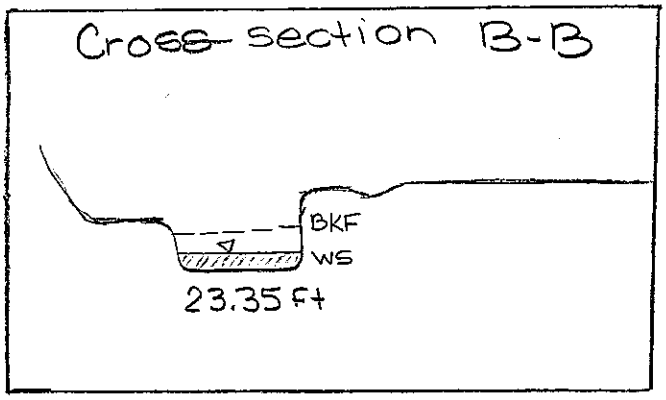


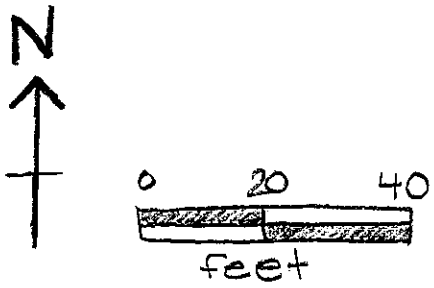
Marsh Run

4/30/04
Team 2









Marsh Run Team2 4-30-09

Table A-7. Procedure to validate hydraulic relations using gage station data from the West Fork San Juan River, Colorado.

Validation of Hydraulic Relationships Using Gaging Station Data

1. Obtain the drainage area associated with the gaging station.
2. Obtain the field-determined bankfull discharge at the gaging station(s) (**Figure A-22**).
3. Obtain the bankfull channel dimensions from the gaging station hydraulic geometry relationships (discharge vs. width, depth, area and velocity).
4. Measure the average water surface slope.
5. Perform an active bed pebble count on the riffle to obtain D_{84}.
6. Determine the stream type.
7. Solve for Manning's "n" at the bankfull stage: $n = (1.49R^{2/3}S^{1/2})/u$ (use the bankfull mean velocity from Step 3).
8. Calculate relative roughness: R/D_{84}. Make sure that D_{84} is converted from millimeters to feet. Hydraulic radius (R) and mean depth (d_{bkf}) are often used interchangeably when width/depth ratios are greater than 12.
9. Calculate shear velocity: $u^* = (gRS)^{1/2}$.
10. Calculate friction factor: u/u^*.
11. Plot bankfull discharge as a function of drainage area on the appropriate regional curve.
12. Plot bankfull channel dimensions as a function of drainage area on the appropriate regional curve (note stream type of plotted values using unique symbols).
13. Plot relative roughness by friction factor (**Figure A-16**) (Example in **FigureA-19**).
14. Plot Manning's "n" by friction factor (**Figure A-17**) (Example in **Figure A-20**).
15. Plot Manning's "n" by stream type (**Figure A-18**) (Example in **Figure A-21**).

Marsh Run at Grimes, Maryland 01617800

Gaging Station Name: ~~West Fork San Juan River near Pagosa Springs, Colorado~~ **Gaging Station Number:** ~~09341500~~

1	2	3a	3b	3c	3d	4	5	6	7	8	9	10	11
Drainage Area (mi^2)	Bankfull Discharge Q_{bkf} (cfs)	Bankfull Width W_{bkf}	Bankfull Mean Depth d_{bkf} (ft)	Bankfull Area A_{bkf} (ft^2)	Bankfull Velocity u_{bkf} (ft/s)	Ave. Water Surface Slope S (ft/ft)	~~D_{84}~~ D_{50} (mm)	Protrusion (ft)	Stream Type	Manning's "n" 0.048	Relative Roughness R/D_{84} (ft/ft)	Shear Velocity u* (ft/s)	Friction Factor u/u*
18.9	85.3	23.35	1.47	34.41	2.48	0.0038	124	0.4	F6/1	0.05	3.5	0.42	5.9

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

Bankfull VELOCITY / DISCHARGE Estimates

Site:	MARSH RUN @ GRIMES, MD	Location:	REACH 2
Date:	4/30/09	Stream Type: F6/1	Valley Type: VIII
Observers:	TEAM 2	HUC:	02070004

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Cross-sectional AREA	34.41	A_{bkf} (ft^2)	Bankfull Mean DEPTH	1.47	d_{bkf} (ft)
Bankfull WIDTH	23.35	W_{bkf} (ft)	Wetted PERIMETER ~ $2 * d_{bkf} + W_{bkf}$	24.37	W_p (ft)
D_{84} @ Riffle <PROTRUSION>	124	Dia. (mm)	D_{84} mm / 304.8 =	0.4	D_{84} (ft)
Bankfull SLOPE (reach avg. water surface slope)	0.0038	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.41	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	3.5	
Drainage AREA	18.9	DA (mi^2)	Shear Velocity $u^* = \sqrt{gRS}$	0.42	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE		
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 \log\{R/D_{84}\}]u^*$ .69 = 1.9/124	2.48	ft / sec	85.3	cfs	
2. Roughness Coefficient: a) Manning's 'n' from friction factor / relative roughness $u = 1.4865*R^{2/3}*S^{1/2}/n$ n = 0.048	2.41	ft / sec	82.9	cfs	gage calc f
2. Roughness Coefficient: $u = 1.4865* R^{2/3}*S^{1/2}/n$ b) Manning's 'n' from Jarrett (USGS): $n = 0.39S^{.38}R^{-.16}$ n = 0.0614 Note: This equation is for applications involving steep, step-pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for stream types A1, A2, A3, B1, B2, B3, C2 and E3.	2.62	ft / sec	90.09	cfs	
2. Roughness Coefficient: $u = 1.4865* R^{2/3}*S^{1/2}/n$ c) Manning's 'n' from Stream Type n = 0.067	1.96	ft / sec	67.4	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 = ~2 Year	2.91	ft / sec	100	cfs	Pennsylva
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	2.41	ft / sec	82.87	cfs	

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 the **"protrusion height"** (h_{sd}) of sand dunes above channel bed elevations. Substitute an average sand dune protrusion height (h_{sd} in ft) for the D_{84} term in estimation method 1.
Option 2.	For **boulder-dominated** channels: Measure several **"protrusion heights"** (h_{bo}) of boulders above channel bed elevations. Substitute an ave. boulder protrusion height (h_{bo} in ft) for the D_{84} term in estimation method 1.
Option 3.	For **bedrock-dominated** channels: Measure several **"protrusion heights"** (h_{br}) of rock separations/steps/joints/ uplifted surfaces above channel bed elevations. Substitute an average bedrock protrusion height (h_{br} in feet) for the D_{84} term in estimation method 1.

BF Q @ gage = 82.87

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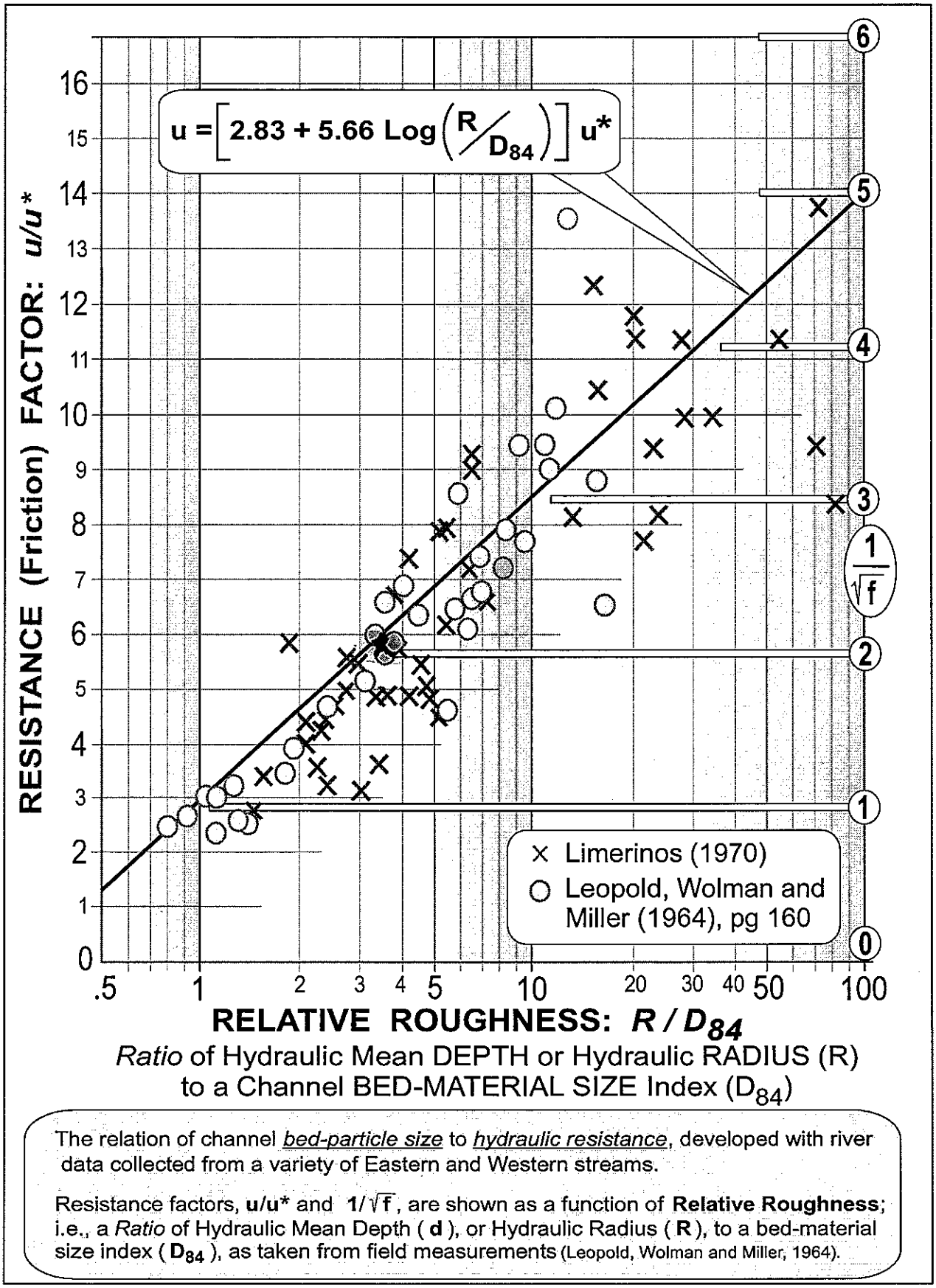

The relation of channel *bed-particle size* to *hydraulic resistance*, developed with river data collected from a variety of Eastern and Western streams.

Resistance factors, **u/u*** and **$1/\sqrt{f}$**, are shown as a function of **Relative Roughness**; i.e., a *Ratio* of Hydraulic Mean Depth (**d**), or Hydraulic Radius (**R**), to a bed-material size index (**D_{84}**), as taken from field measurements (Leopold, Wolman and Miller, 1964).

Figure B-2. Relative roughness (R/D_{84}) vs. friction factor (u/u*) (Rosgen, 2006b; Rosgen and Silvey, 2007).

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Team 2

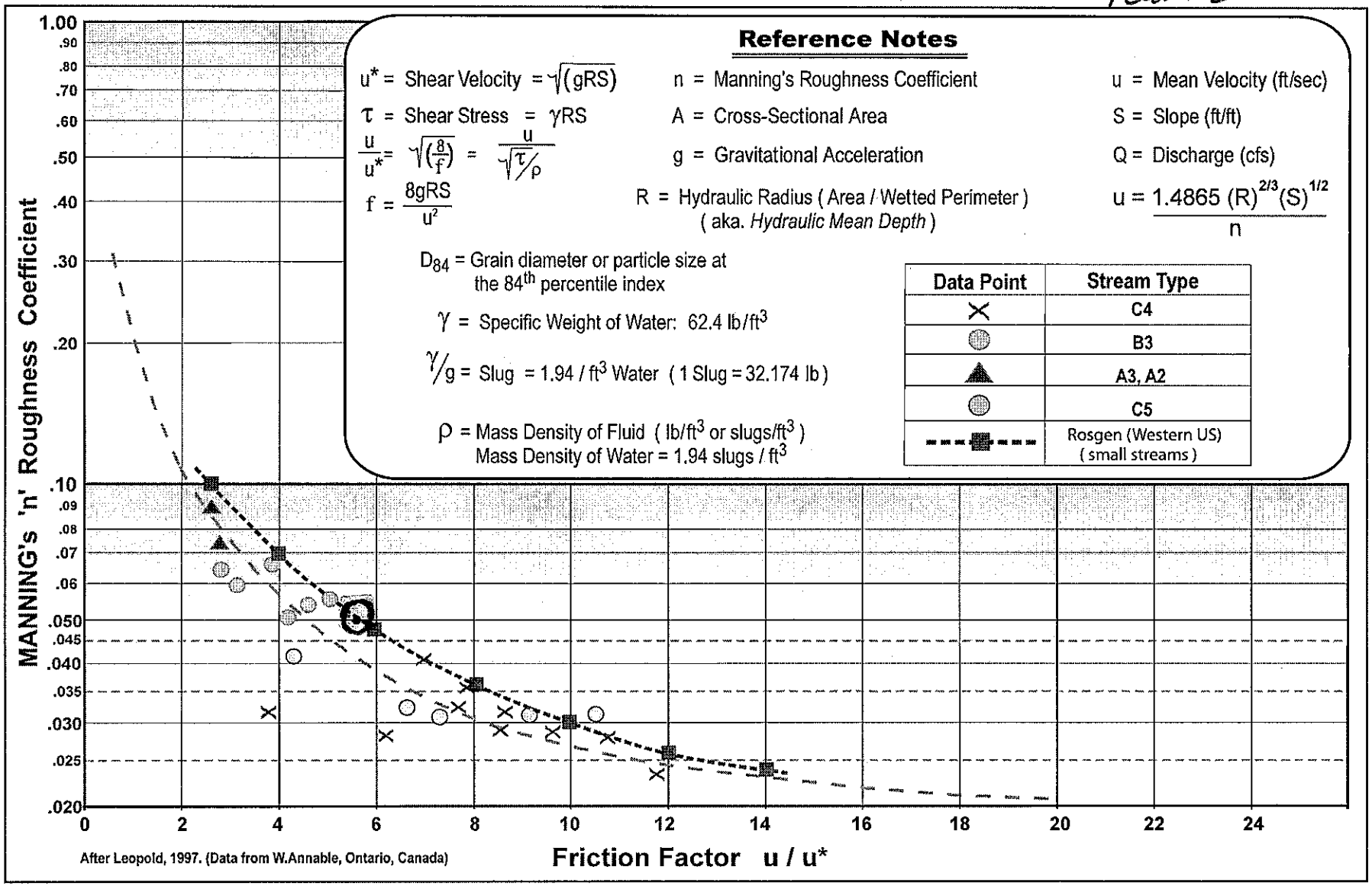

Figure B-3. Friction factor (u/u*) vs. Manning's roughness coefficient "n" (Rosgen, 2006b; Rosgen and Silvey, 2007).

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TEAM 2

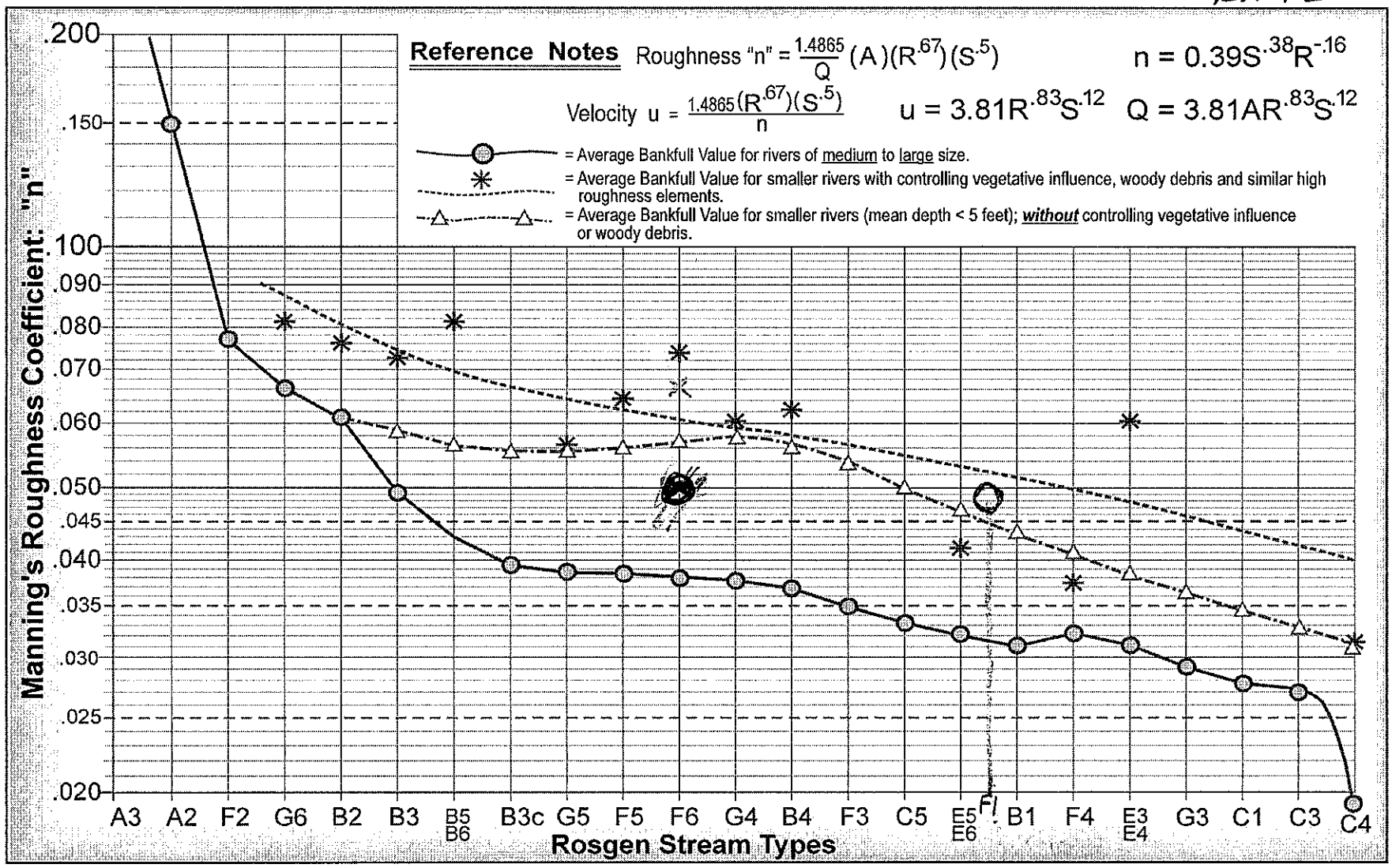

Figure B-4. Manning's "n" by stream type (Rosgen and Silvey, 2007).

n = 0.048

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Protrusion - Riffle #1
0+00 - 0+94

-180	-60
-120	-100
	-80
-130	-50
	-240
-50	-140
-100	-140
-110	-60
	-110
-50	-110
-130	-110
-30	-110
-150	-180
-90	-130
-150	-20
-140	-70
-330	-100
-90	-220
-130	
-30	-90
-180	-90
-40	-160
	-270
-140	-190
-150	-80
	-70
-70	-190
-80	-370
-140	-370
-70	-360
-30	
-210	-360
-130	-140
-140	-10
-70	
-70	-200
-160	-150
-190	-140
-50	-230
-130	-370
-110	-120
-120	-60
-80	-180
-150	-80
-110	-210
-30	-190
-90	-110
-140	-40
-70	-120
-110	

7.90
2.47
3.43

Worksheet B3. Morphological relations, including dimensionless ratios of river reach sites.

Stream: Marsh Run Location: Washington County, Maryland

Observers: Team #2 Date: 4/30 Valley Type: ~~VIII~~ Stream Type: F6/1

River Reach Summary Data

Channel Dimension

Mean Riffle Depth (d_{bkf})	1.47	ft	Riffle Width (W_{bkf})	23.4	ft	Riffle Area (A_{bkf})	34.4	ft^2
Mean Pool Depth (d_{bkfp})	2.4	ft	Pool Width (W_{bkfp})	24.1	ft	Pool Area (A_{bkfp})	57.5	ft^2
Mean Pool Depth/Mean Riffle Depth	1.6	d_{bkfp}/d_{bkf}	Pool Width/Riffle Width	1.03	W_{bkfp}/W_{bkf}	Pool Area/Riffle Area	1.7	A_{bkfp}/A_{bkf}
Max Riffle Depth (d_{maxrif})	2.1	ft	Max Pool Depth (d_{maxp})	3.6	ft	Max Riffle Depth/Mean Riffle Depth		
Max Pool Depth/Mean Riffle Depth	2.6		Point Bar Slope	0	ft/ft	Inner Berm Width (W_{ib})	0	ft
Inner Berm Depth (d_{ib})	0	ft	Inner Berm Width/Depth Ratio	0	W_{ib}/d_{ib}	Inner Berm Area (A_{ib})	0	ft^2
Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	2.41	ft/s	Estimation Method	Manning's n				
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	82.9	cfs	Drainage Area	18.9	mi^2			

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Meander Wavelength (L_m)	440	440	440	ft	Meander Length Ratio (L_m/W_{bkf})	18.84	18.84	18.84
Radius of Curvature (R_c)	54.5	46	63	ft	Radius of Curvature/Riffle Width (R_c/W_{bkf})	2.33	1.97	2.70
Belt Width (W_{blt})	120	120	120	ft	Meander Width Ratio (W_{blt}/W_{bkf})	5.14	5.14	5.14
Individual Pool Length	21.1	18.3	24	ft	Pool Length/Riffle Width	.91	.78	1.03
Pool to Pool Spacing	150	150	150	ft	Pool to Pool Spacing/Riffle Width	6.4	6.4	6.4
Riffle Length	85.8	85.8	85.8	ft	Riffle Length/Riffle Width	3.7	3.7	3.7

Channel Profile

Valley Slope (VS)	.0043	ft/ft	Average Water Surface Slope (S)	.0038	ft/ft	Sinuosity (VS/S)	1.26	
Stream Length (SL)	508	ft	Valley Length (VL)	459	ft	Sinuosity (SL/VL)	1.1	
Low Bank Height (LBH) start	5.6	ft	Max Riffle Depth start	1.71	ft	Bank-Height Ratio (BHR) (LBH/Max Riffle Depth) start	3.3	
Low Bank Height (LBH) end	5.9	ft	Max Riffle Depth end	2.11	ft	Bank-Height Ratio (BHR) (LBH/Max Riffle Depth) end	2.8	

Facet Slopes	Mean	Min	Max		Dimensionless Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	.007	.007	.007	ft/ft	Riffle Slope/Average Water Surface Slope (S_{rif} / S)	1.84	1.84	1.84
Run Slope (S_{run})	.001	.001	.001	ft/ft	Run Slope/Average Water Surface Slope (S_{run} / S)	.26	.26	.26
Pool Slope (S_p)	0	0	0	ft/ft	Pool Slope/Average Water Surface Slope (S_p / S)	0	0	0
Glide Slope (S_g)	0	0	0	ft/ft	Glide Slope/Average Water Surface Slope (S_g / S)	0	0	0

Feature Midpoint[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.1	2.1	2.1	ft	Max Riffle Depth/Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.4	1.4	1.4
Max Run Depth (d_{maxrun})	2.6	2.4	2.7	ft	Max Run Depth/Mean Riffle Depth (d_{maxrun} / d_{bkf})	1.7	1.6	1.9
Max Pool Depth (d_{maxp})	3.6	3.6	3.6	ft	Max Pool Depth/Mean Riffle Depth (d_{maxp} / d_{bkf})	2.5	2.5	2.5
Max Glide Depth (d_{maxg})	2.9	2.7	3.0	ft	Max Glide Depth/Mean Riffle Depth (d_{maxg} / d_{bkf})	1.9	1.8	2.1

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	16	2.5		D_{16}	.06	215.47		60.1	mm
% Sand	2	0		D_{35}	180	BR		92.01	mm
% Gravel	12	5		D_{50}	BR	BR		124.43	mm
% Cobble	11	12.5		D_{84}	BR	BR		209.5	mm
% Boulder	1	2.5		D_{95}	BR	BR		307.23	mm
% Bedrock	58	77.5		D_{100}	BR	BR		512	mm

[a] Min, max, mean depths are ave. mid-point values except pools: Taken at deepest part of pool.
[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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Riffle XS

Page 1

SURVEY DATA ⟹ **CROSS - SECTION 1**

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: HUC:

Item	Distance, Point, or STATION ft	Back-Sight B S ft	Height of Instrument H I ft	Fore-Sight F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1		1.41	4.38		2.97	Rebar 1 - Benchmark
2			104.38	—	—	Increased by 100 for (−)
3	0			1.53	102.85	GS Burm
4	3			1.45		GS "
5	6			1.51		GS
6	7			1.58		GS
7	9			1.88		GS
8	12			2.54		GS
9	16			3.11		GS Break
10	18			3.89		GS
11	19			4.03		GS
12	20			4.31		GS Break
13	21			4.58		GS
14	22			5.06		GS
15	22.8			5.39		BKF
16	23			5.58		G
17	24			5.78		G
18	25			6.15		Bank
19	25.5			6.38		
20	25.7			6.63		LEW - Surface
21	25.8			6.88		~~LEW~~ - Bottom
22	27.0			7.14		
23	29.0			6.98		
24	31.0			6.95		
25	33.0			7.06		
26	35.0			7.07		
27	37.0			7.15		Break
28	38.0			7.32		

Rebar 1 = 2.97

@ XS = 86 ft

D_{max} Long → 7.52

BF_{rea} = 34.41

$D_{\bar{x}}$ = 1.47

D_{max} = 2.15

FP_w = 34.03

Ent = 1.46

W/d = 15.88

FP_{el} = 101.14

K = 1.11

BF_{el} = 98.99

W_{BF} 23.35

Wet_P = 24.37

$Hydrol_R$ = 1.41

Slope .0038

6.63 − 5.58 = 1.05

5.77 − 1.06 = 6.63

@ 2.37

6.63 − 5.39 = 1.24

HI − FS = E then EL − FS next EL

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1.41

Page 2

SURVEY DATA → **CROSS - SECTION** #1

SITE: Marsh Run Team 2 Riffle Date: 4-30-09

	Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
	29	39.0			7.45		
	30	40.0			7.54		TW
tree	31	43.0			6.93		
	32	43.7			6.63		REW
	33	45.0			6.17		GS
	34	46.0			5.59		BKF GS
	35	46.3			4.42		GS
	36	47.0			4.24		Break Bottom
	37	48.0			3.66		Break top
tree	38	50.0			3.30		GS
	39	55.0			2.48		GS
	40	57.0			2.27		GS
	41	59.0			2.21		GS
	42	61.0			2.29		GS
	43	63.0			2.35		GS
	44	64.0			2.35		GS Pin
	45						
	46						
	47						
	48						
	49						
	50						
	51						
	52						
	53						
	54						
	55						
	56						
	57						
	58						
	59						

7.54 - TW
5.39
2.15 Dmax
x2
4.30 FP

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depths
3.32
3.66
4.10

Page 1

SURVEY DATA ⟶ **CROSS - SECTION** 2

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: Pool-XS HUC:

XS @ 101

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		3.89	6.86		2.97	Benchmark EL
2						
3	0			4.55		GS
4	3			4.38		
5	5			4.31		
6	7			4.24		
7	9			4.47		
8	11			4.77		
9	12			4.95		top of left Bank
10	13			5.34		
11	14			5.80		
12	15			6.97		
13	16.3			8.06		
14	17.0			8.62		
15	18.3			9.13		LEW - surface
16	19.5			9.58		
17	20.1			9.91		
18	21.1			10.16		
19	22.4			9.91		
20	23.0			10.60		
21	24.1			10.88		
22	26.0			11.22		
23	28.0			11.27		
24	29.3			11.38		
25	30.0			11.50		TW
26	31.0			11.49		
27	32.0			11.42		
28	34.0			11.09		

9.13
8.06
1.07

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Page 2

SURVEY DATA → **CROSS - SECTION 2**

SITE: Marsh Run Team 2 Date: 4-30-09

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	35			10.56		
30	37			9.54		
31	38.2			9.14		wetted edge - REW
32	38.7			8.63		Top of Bank Rt
33	39.8			8.35		
34	40			8.14		GS
35	41			7.36		GS
36	42			6.82		GS
37	44			6.29		GS
38	48			5.90		GS
39	52			5.13		GS
40	55			4.87		GS
41	402			7.90		BKF
42	59			4.97		GS
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

8.0
9.14
8.05
1.09

8
8.14
7.90
1.24

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SURVEY DATA → **LONGITUDINAL PROFILE 1**

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: 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 Elev. ft	Low Bank HI Fore-Sight FS ft	Low Bank HI Elevation Elev. ft	NOTES e.g. Riffle Run Pool Glide
1												WS - BKF DIFF
2	BM	1.42										
3	TRik		4.8									
4	0+00			6.93								
5	LEW			6.05								
? 6	BKF			5.06								0.99
7												
8	Rif											
9	0+05			6.65								
10	Riff											
11	0+10			6.60								
12	Riff											
13	0+15			6.69								
14	Riff											
15	0+20			6.80								
16	0+00			3.43								
17	Rif											
18	0+25			7.09								
19	Rif											
20	0+59			7.23								
21	LEW			6.47		6.47						
22	BKF			5.13								1.34
23	Rif											
24	0+82			7.28								
XS 25	Riff											
26	0+86			7.52								
27												

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 2**

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: 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	B. Riff											
29	0+92			7.92								
30	LBW			6.71		6.71						
31	BKF			5.51								12
32	TO			1.66								
33	U											
34	0+97			8.85								
35	P											
36	0+98			8.91								
37	105			8.55								
38	116			8.54								
39	G											
40	123			8.18								
41	REW			6.7		6.7						
42	0+133			8.1								
43	0+144			7.71								
44	REW			6.69		6.69						
45	BKF			5.12								1.57
46	LB			3.45								
47	149			8.48								
48	159			7.97								
49	174			7.94								
50	185			8.17								
51	REW			6.73		6.73						
52	BKF			5.31								1.42
53	191			8.34								
54	207			7.96								

6.73
5.31

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 3**

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: 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
55	218			7.88								
56	TOP RIFF											
57	222			7.85								
58	LEW			6.88		6.68						
59	BKF			4.75				4.75				1.43
60	236			7.97								
61	Pool											
62	246			8.97								
63	249			9.73								
64	LEW			6.68		6.68						
65	260			9.18								
66	G											
67	263			8.45								
68	265			8.13								
69	LEW			6.77		6.77						
70	BKF			5.36				5.36				1.43
71	LB			3.31						3.31		
72	272			7.98								
73	291			7.89		6.74						
74	300			8.30								
75	310			7.94								
76	316			8.63								
77	326			7.30		6.74		5.42		4.9		
78	329			8.30								
79	335			8.68								
80	346			8.57								
81	354			8.87								

old check dam

Run

Pool

Crest Pool

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SURVEY DATA → **LONGITUDINAL PROFILE 4**

SITE: Marsh Run Date: 4-30-09

Location: Team 2

Party / Notes: 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 Elev. ft	Low Bank HI Fore-Sight FS ft	Low Bank HI Elevation Elev. ft	NOTES e.g. Riffle Run Pool Glide
82	362			9.18								
83	368			8.97								
84	374			9.14								
85		3.89										
86	386			11.21		9.23		7.82		7.57		1.41
87	C-Dam											
88	395			9.55								
89	399			10.85		9.77						
90	422			10.49								
91	top Riff											
92	440			11.17		9.74		8.17				1.57
93	448			10.35								
94	452			10.98		10.3						
95	475			11.41								
96	490			11.61						7.65		
97	End Rach											
98	508			11.33		10.47		9.62		9.62		.85
99												
100												
101												
102												
103												
104												
105												
106												
107												
108												

check dam

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Site: Marsh Run @ Grimes, MD Date: 4/30/09

Location: REACH 2 HUC: 0 1 6 1 7 8 0 0

Party: TEAM 2

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE (S 1 US)	Dot Count for POOL (2 G)	Dot Count for 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				1			12			16		
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25	SAND												
	Medium	.25 - .50	SAND												
	Coarse	.50 - 1.0	SAND							1			2		
.04 - .08	Very Coarse	1.0 - 2	SAND												
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7	GRAVEL							1			1		
.22 - .31	Fine	5.7 - 8	GRAVEL										1		
.31 - .44	Medium	8 - 11.3	GRAVEL				1			1			3		
.44 - .63	Medium	11.3 - 16	GRAVEL												
.63 - .89	Coarse	16 - 22.6	GRAVEL							2			2		
.89 - 1.3	Coarse	22.6 - 32	GRAVEL												
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				1			1			4		
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL							1			1		
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128	COBBLE							2			2		
5.0 - 7.1	Large	128 - 180	COBBLE				2			1			3		
7.1 - 10.1	Large	180 - 256	COBBLE				3			3			6		
10.1 - 14.3	Small	256 - 362	BOULDER				1						1		
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK				31			15			58		
						TOTAL→	40			40			100		

Stream Type: F1/6 Valley Type: VIII

Reach: / Date:

Reach: / Date:

Reach: / Date:

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Repr. Riffle

Protrusion Ht.

Site: Marsh Run @ Grimes, MD Date: 4/30/09

Location: REACH 2 HUC: 0 1 6 1 7 8 0 0

Party: TEAM 2

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	~~COMP~~ protrusion	RIFFLE (1) TOT #	ITEM %	% CUM	~~POOL (2)~~ TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
				Reach:			Reach:			Reach:			Reach:		
				Date:			Date:			Date:			Date:		
	Silt / Clay	< .062	S/C	:I			5								
	Very Fine	.062 - .125	SAND	banks											
	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													
.31 - .44	Medium	8 - 11.3		:		1	1			1					
.44 - .63	Medium	11.3 - 16		:			1								
.63 - .89	Coarse	16 - 22.6		:		1	1			1					
.89 - 1.3	Coarse	22.6 - 32		:I		IIII	5			4					
1.3 - 1.8	Very Coarse	32 - 45		:		III	2			3					
1.8 - 2.5	Very Coarse	45 - 64		:		~~IIII~~ II	2			7					
2.5 - 3.5	Small	64 - 90	COBBLE	:	~~IIII~~	~~IIII~~ ~~IIII~~	1			15					
3.5 - 5.0	Small	90 - 128		:	I ~~IIII~~	~~IIII~~ ~~IIII~~	1			16					
5.0 - 7.1	Large	128 - 180		⊔	~~IIII~~ ~~IIII~~	~~IIII~~ ~~IIII~~	7			24			IIII		
7.1 - 10.1	Large	180 - 256		:⊔	~~IIII~~	~~IIII~~ IIII	6			14					
10.1 - 14.3	Small	256 - 362	BOULDER	⊔		III	7			3					
14.3 - 20	Small	362 - 512				III				3					
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK	⊠⊠⊠⊠⊠	⊠		61								
Stream Type: F1/b			Valley Type: VIII			TOTAL→	100								

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Step 14

Summarize USGS gage data: MARSH RUN TEAM 2 4/30/09

Summary....*USGS GAGE STATION* Data / Records for STREAM CHANNEL CLASSIFICATION

Station NAME:	Marsh Run	Station Number:	01617800
LOCATION:	Grimes, Maryland		
Period of Record:	45 yrs	Mean Annual DISCHARGE:	cfs
Drainage AREA:	~~[illegible]~~ acres 18.9 mi²	Drainage Area Mn Elev:	ft
Reference REACH SLOPE:	0.004 ft/ft	Valley Type:	VIII
Stream Type:	E6/1	HUC:	

"BANKFULL" CHARACTERISTICS

Determined from FIELD MEASUREMENT			Determined from GAGE DATA Analysis		
Bankfull WIDTH (W_{bkf})	23.35	ft	Bankfull WIDTH (W_{bkf})	20.0	ft
Bankfull Mean DEPTH (d_{bkf})	1.47	ft	Bankfull MEAN DEPTH (d_{bkf})	1.6	ft
Bankfull Xsec AREA (A_{bkf})	34.41	ft²	Bankfull Xsec AREA (A_{bkf})	32.0	ft²
Wetted PERIMETER (W_P)	24.37	ft	Wetted PERIMETER (W_P)	23.2	ft
Bankfull STAGE (Gage Ht)	2.15	ft	Bankfull STAGE (Gage Ht)	1.96	ft
Est. Mean VELOCITY (u)	2.48	ft/sec	Mean VELOCITY (u)	1.1	ft/sec
Est. Bkf. DISCHARGE (Q_{bkf})	85.3	cfs	Bankfull DISCHARGE(Q_{bkf})	65	cfs

Bankfull DISCHARGE associated with **"field-determined"** Bankfull STAGE (From Gage Height reading at Staff Plate and tabular Stage-Discharge curve data) 82.9 cfs

Recurrence Interval (Log-Pearson) associated with **"field-determined"** Bankfull Discharge 1.7 yrs

From the *Annual Peak Flow Frequency Analysis* data for the Gage Station, determine:

1.5 Year R.I. Discharge =	65	cfs	10 Year R.I. Discharge =	300	cfs
2.0 Year R.I. Discharge =	97	cfs	25 Year R.I. Discharge =	350	cfs
5.0 Year R.I. Discharge =	200	cfs	50 Year R.I. Discharge =	360	cfs

MEANDER GEOMETRY

Meander Wavelength (L_m)	440	ft	Radius of Curvature (R_C)	54.5	ft
Belt Width (W_{blt})	120	ft	Meander Width Ratio (W_{blt}/W_{bkf})	5.1	ft/ft

HYDRAULIC GEOMETRY

Based on *USGS Discharge Summary Notes* data (Form 9-207) and regression analyses of measured discharge (Q) with the hydraulic parameters of Width (W), Area (A), Mean Depth (d) & Mean Velocity (u), determine the *intercept coefficient* (a) and the *slope exponent* (b) values for a power function of the form $Y = aX^b$, when Y is one of the selected hydraulic parameters and X is a given discharge value (Q).

	Width (W)	Depth (d)	Area (A)	Velocity(u)
Intercept Coefficient a)	9.4161	0.4077	3.8388	0.2638
Slope Exponent b)	0.1968	0.3111	0.5080	0.4870

Hydraulic Radius $R = A / W_P$	1.41	ft	Manning's "n" at Bankfull Stage	0.05	Coeff.

$$"n" = 1.4895\,[(\text{Area})\,(\text{Hydraulic Radius}^{2/3})\,(\text{Slope})^{1/2}]\,/\,Q_{bkf}$$

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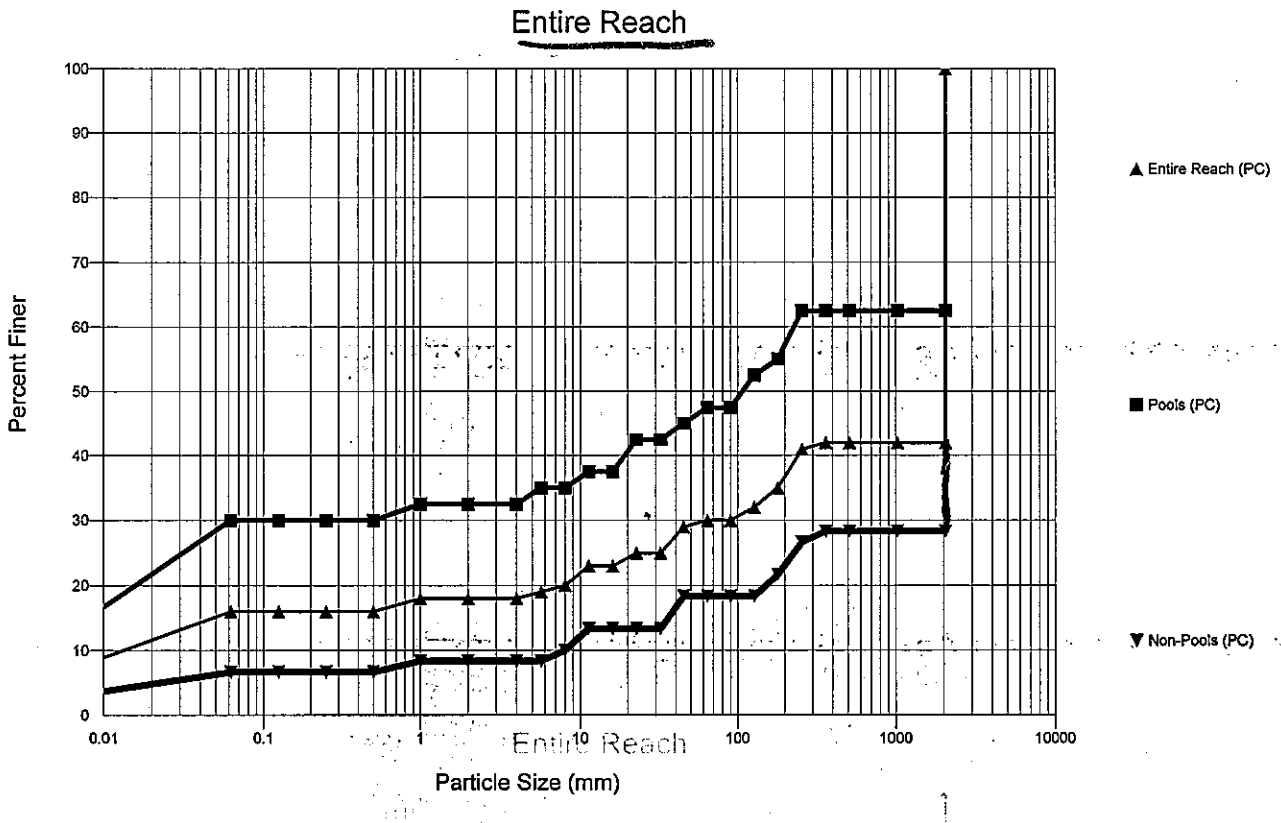
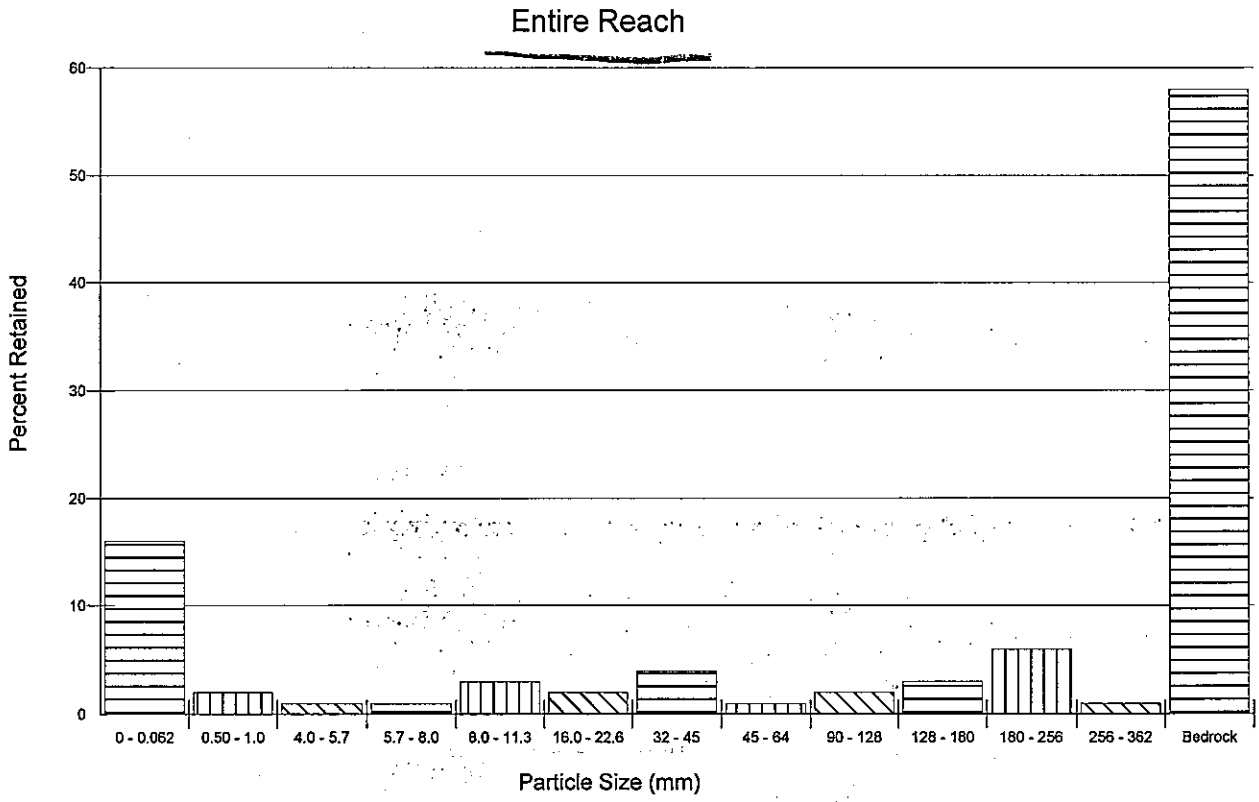
Team 2
Marsh Run

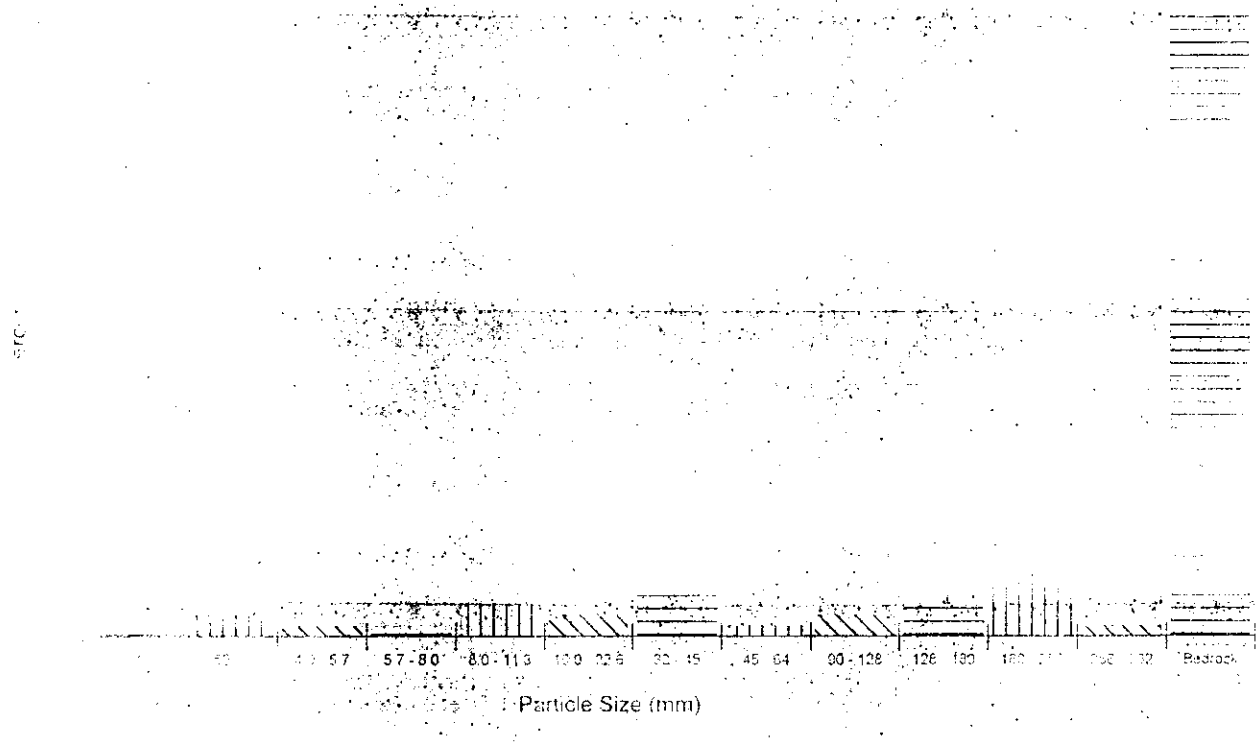
4-30-07



Team 2
Marsh Run

4-30-09

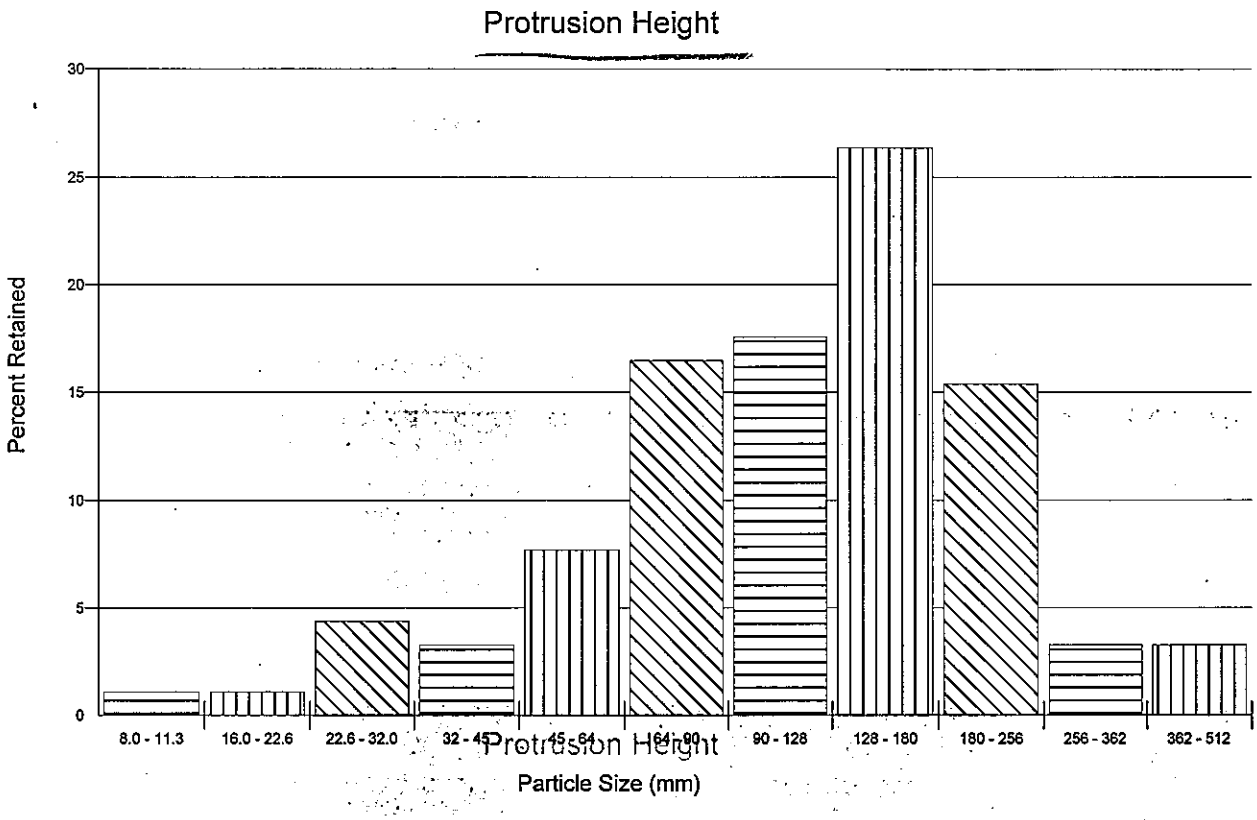




Team 2

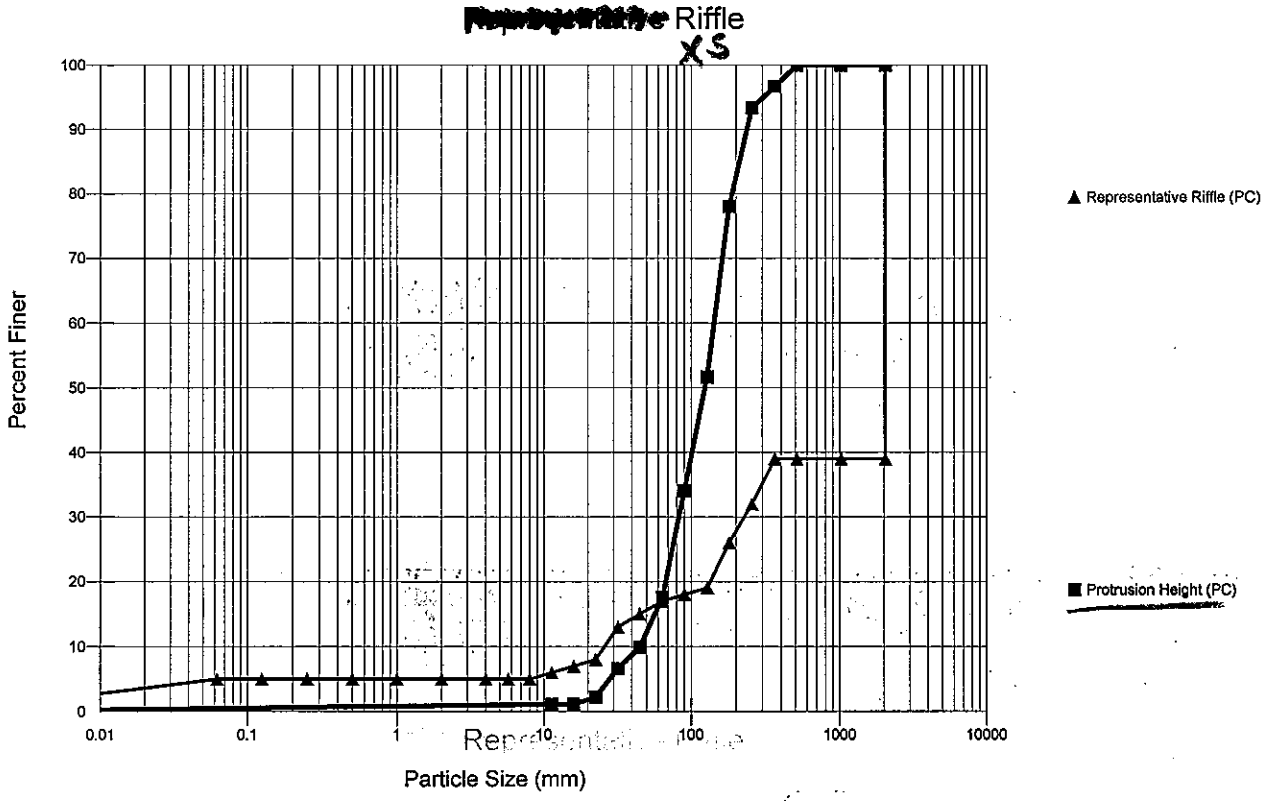
Marsh Run

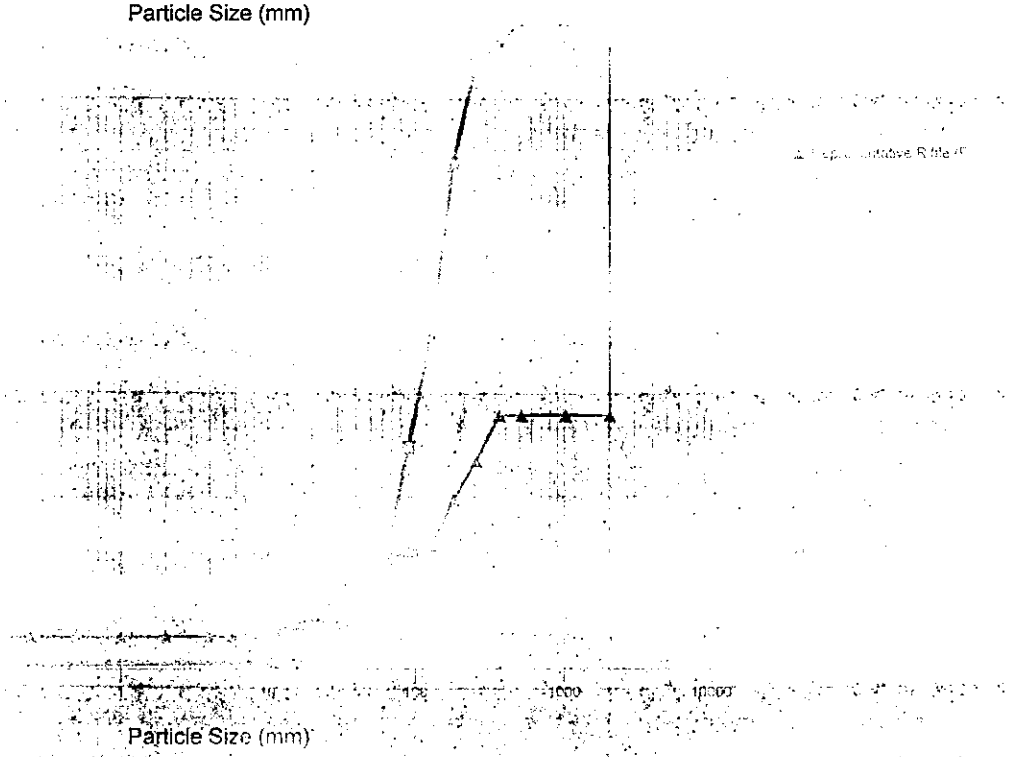
4-30-0



Team 2
Marsh Run

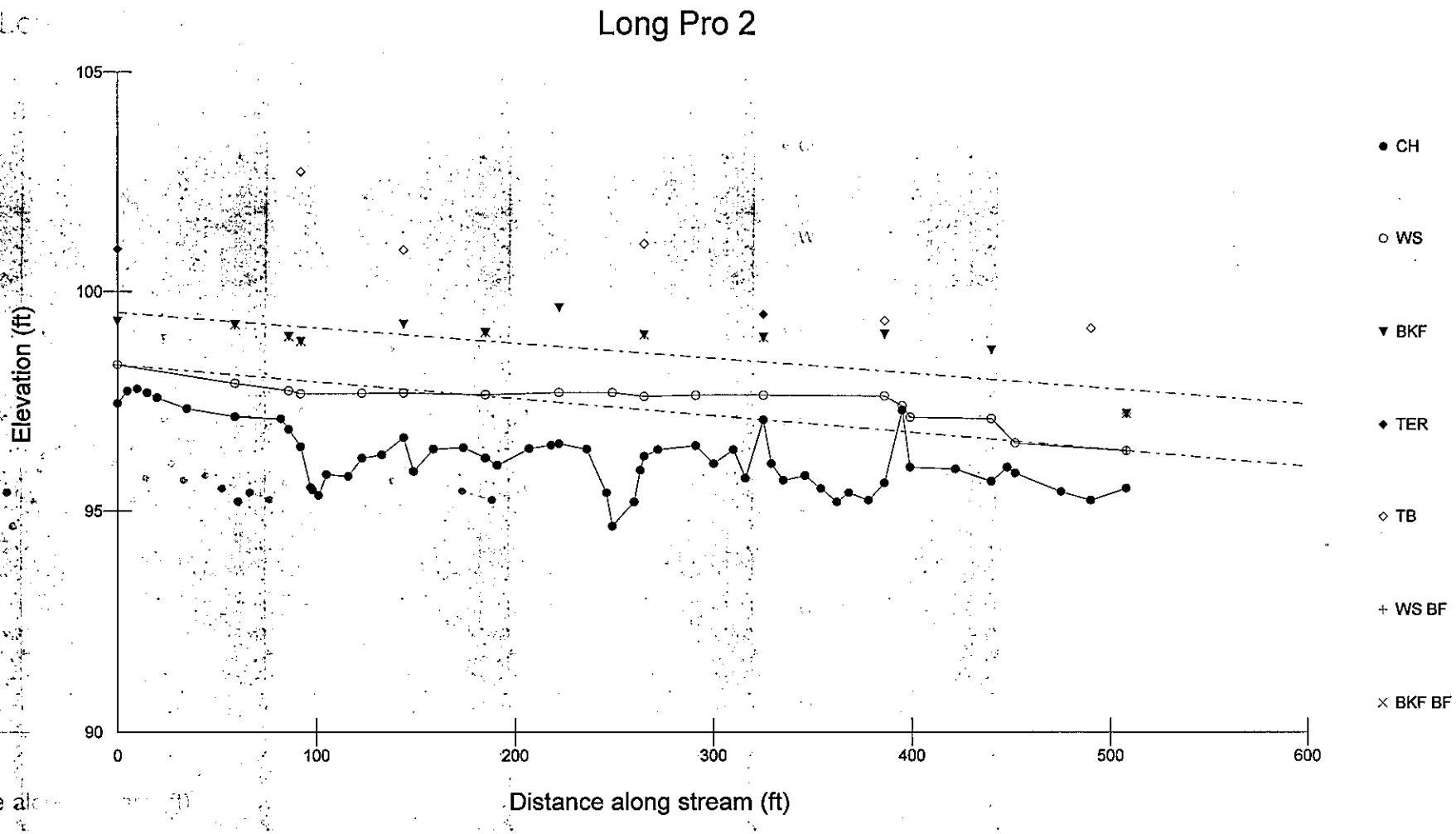
4-30-09





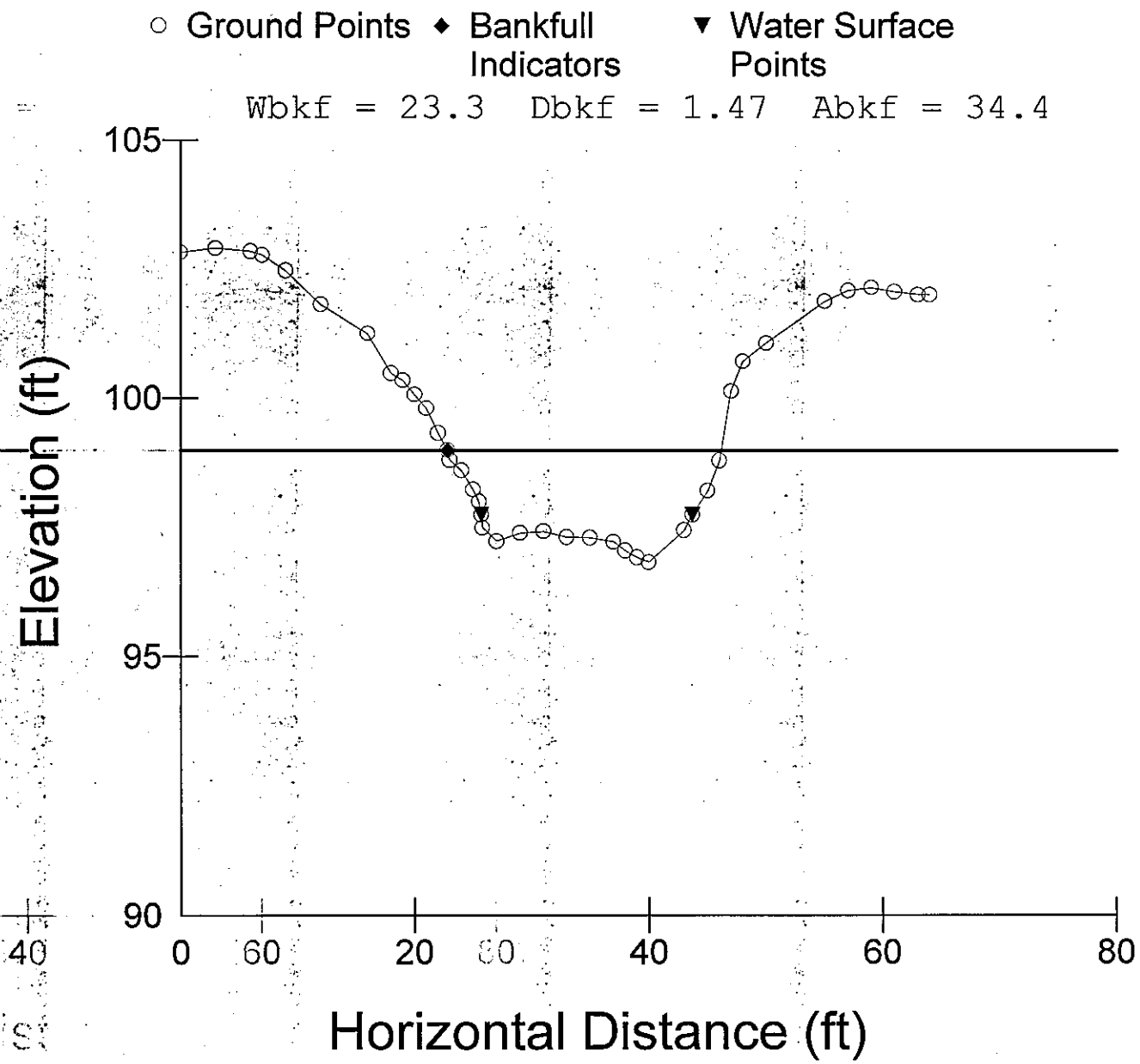
Marsh Run
Team 2

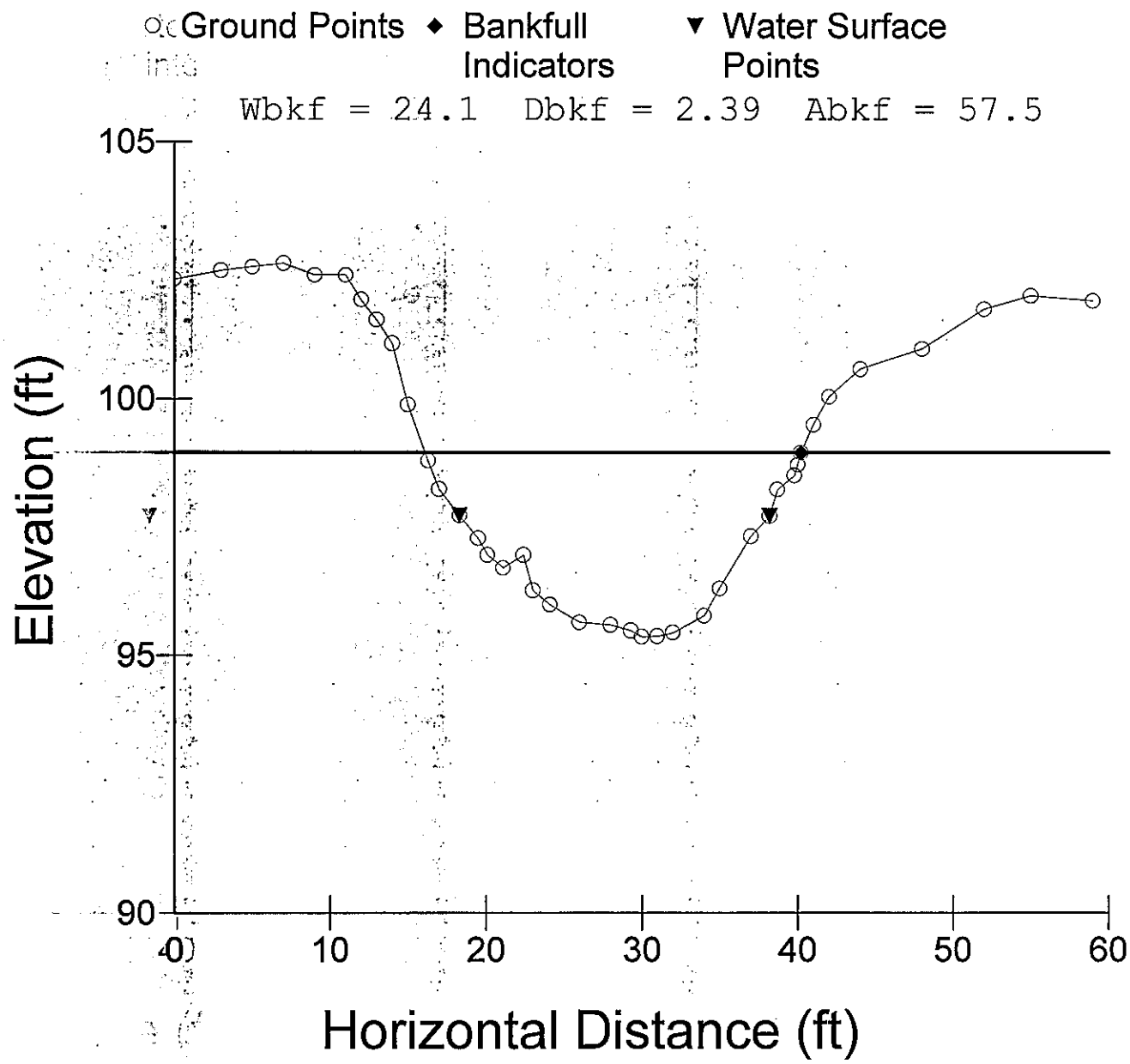
4-30-09



Marsh Run Team2 4-30-09

XS RIFFLE



Marsh Run team 2 4-30-09

XS POOL