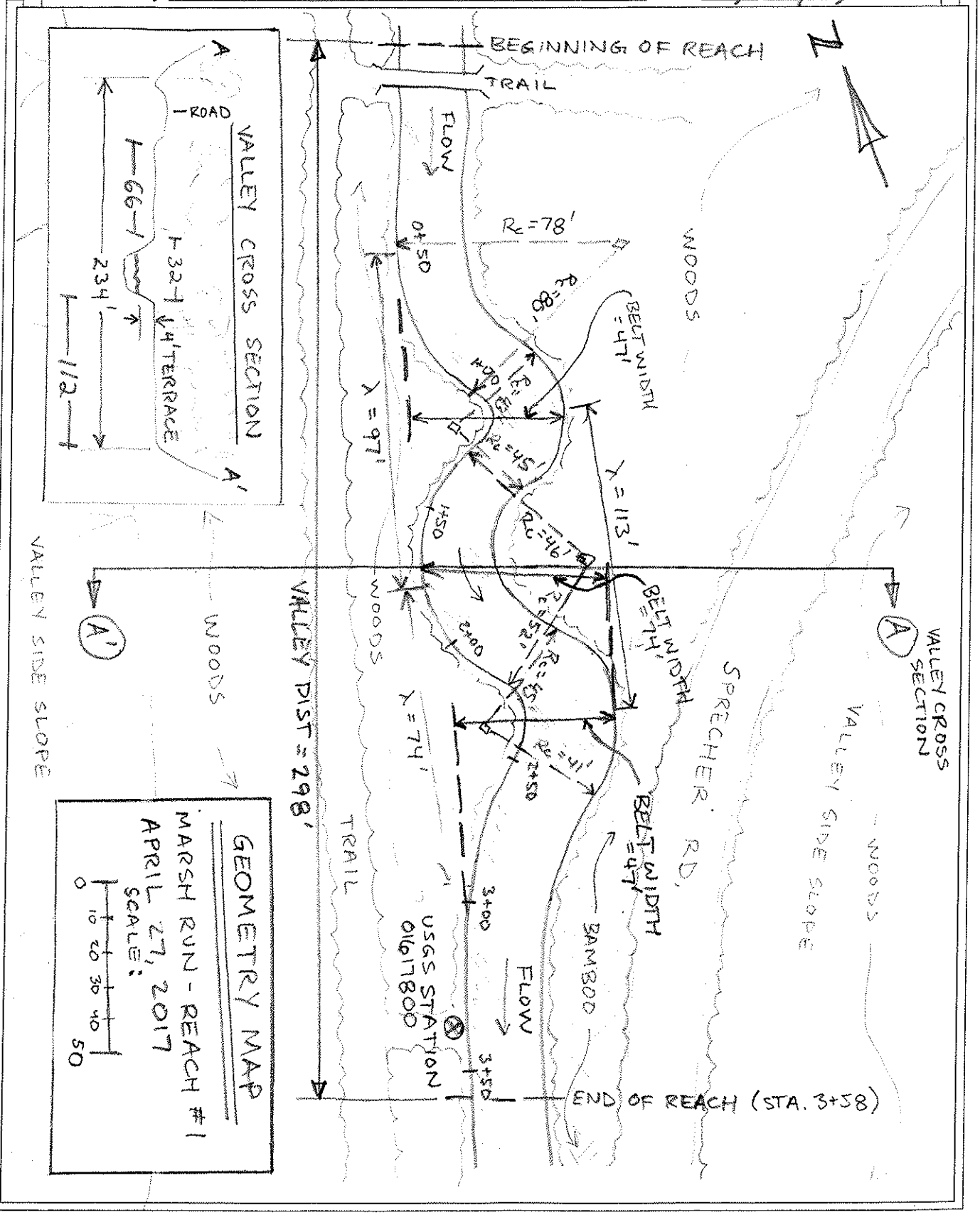
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Marsh Run @ Grimes, MD Site/Reach: Reach 1

Drawn By: TEAM 1 Date: 4/27/17



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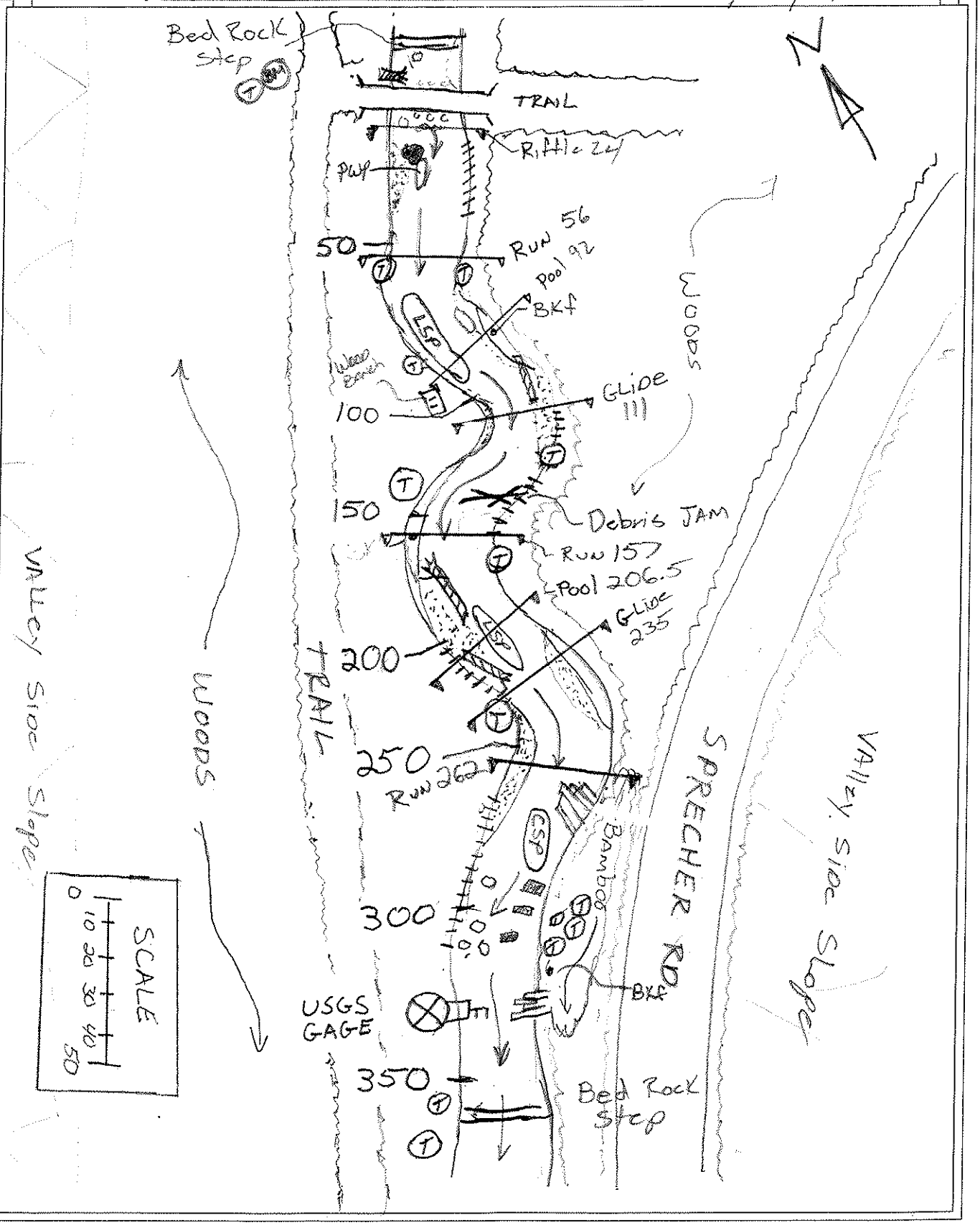
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Marsh Run @ Grimes, MD Site/Reach: Reach 1

Drawn By: Team 1 Date: 4/27/17



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Worksheet B-4. Dimensionless ratios of the ten pool types (*Second Field Day*).

Stream: Marsh Run Location: Reach 1

Observers: Team 1 Stream Type: F/1/5/16 Landscape Type: U-AL-AD Date: 4·27·17

Pool Type		Dimensional Values: Pool Length (L_p)	Pool Max Depth (d_{maxp})	Pool Slope (S_p)		Dimensionless Ratios: Pool Length to Riffle Width (L_p / W_{bkf})	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	Pool Slope to Average Slope (S_p / S)
1. Lateral Scour Pool (LSP)	Mean	30.73	3.32	.0006	Mean	1.28	2.32	.13
	Min.	26.69	3.17	.00051	Min.	1.11	2.22	.11
	Max.	34.77	3.46	.00069	Max.	1.44	2.42	.15
2. Contraction Scour Pool (CSP)	Mean	15.86	3.48	.00122	Mean	.66	2.43	.26
	Min.	—	—	—	Min.	—	—	—
	Max.	—	—	—	Max.	—	—	—
3. Step/Pool (SP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
4. Backwater Pool (BWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
5. Plunge Pool (PP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
6. Pocket Water Pool (PWP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
7. Lateral Protrusion Pool (LPP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
8. Straight Dissipator Pool (SDP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
9. Converging Confluence Pool (CCP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
10. Compound Pool (CP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			

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Worksheet B-5. Procedure to validate hydraulic relations using gage station data.

Validation of Hydraulic Relations

1. Obtain the drainage area associated with the gaging station.
2. Obtain the field-determined bankfull discharge at the gaging station (**Figure B-43**).
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: $n = (1.49R^{2/3}S^{1/2})/\bar{u}$ (use the bankfull mean velocity from Step 3). R=1.38
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. $\frac{1.38}{.3977} = 3.47$
9. Calculate shear velocity: $u^* = (gRS)^{1/2}$. $= (32.2 \times 1.38 \times .00466)^{1/2} = 0.455$
10. Calculate friction factor: $\bar{u}/u^*$. $\frac{2.86}{0.455} = 6.286$
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 B-34**) (Example in **Figure B-39**).
14. Plot Manning's 'n' by friction factor (**Figure B-35**) (Example in **Figure B-40**).
15. Plot Manning's 'n' by stream type (**Figure B-36**) (Example in **Figure B-41**).

Gaging Station Name: Morsh Run at Grimes **Gaging Station Number:** 01617800

1	2	3a	3b	3c	3d	4	5		6	7	8	9	10
Drainage Area (mi²)	Bankfull Discharge Q_{bkf} (cfs)	Bankfull Width W_{bkf}	Bankfull Mean Depth d_{bkf} (ft)	Bankfull Area A_{bkf} (ft²)	Bankfull Velocity $\bar{u}_{bkf}$ (ft/s)	Ave. Water Surface Slope S (ft/ft)	D_{84} (mm)	D_{84} (ft)	Stream Type	Manning's 'n'	Relative Roughness R/D_{84} (ft/ft)	Shear Velocity u* (ft/s)	Friction Factor $\bar{u}/u^*$
18.9	109	21	1.9	38	2.86	0.00466	121.23	0.398	F1/5/6	0.0441	3.47	0.455	6.29

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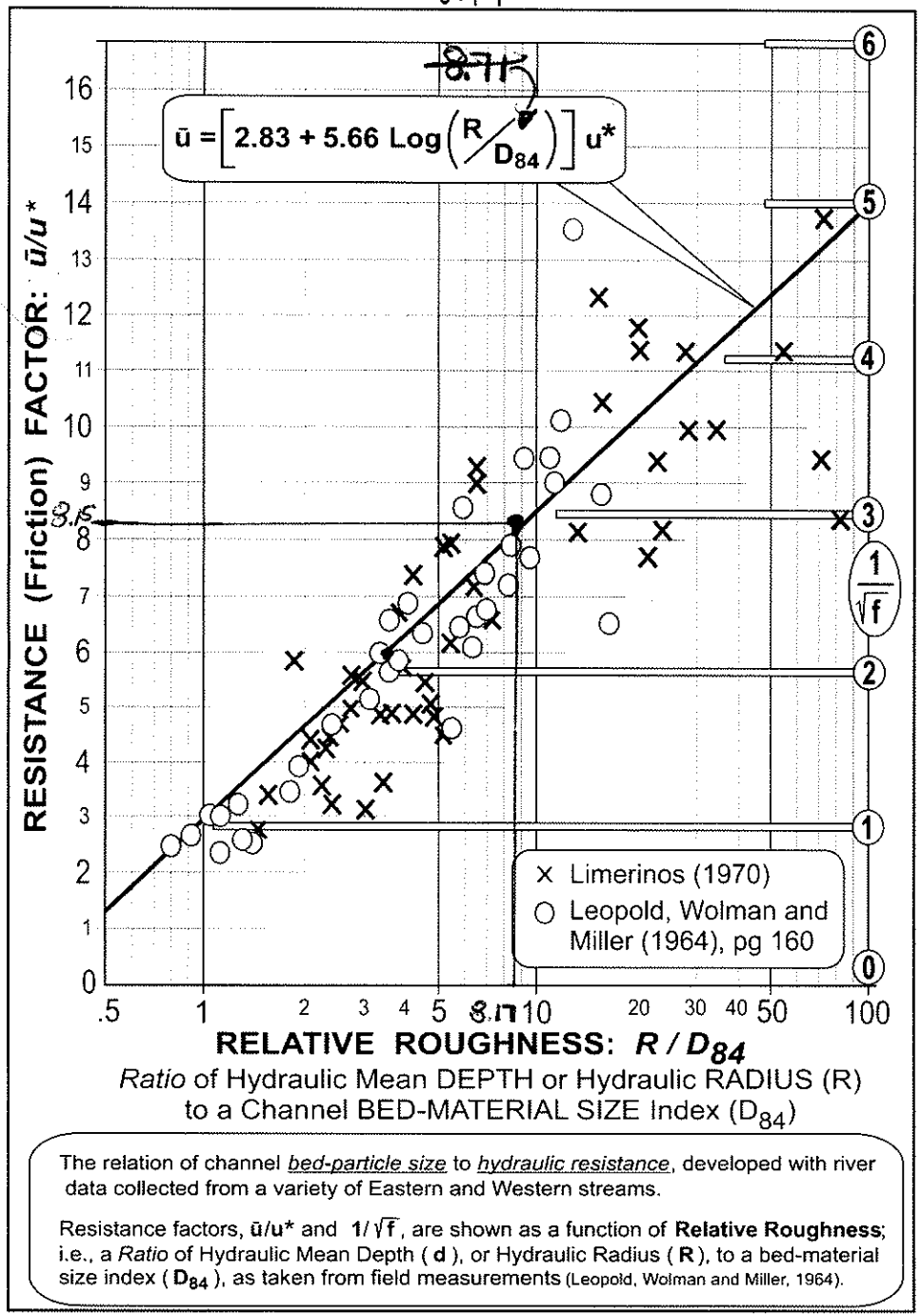

The relation of channel *bed-particle size* to *hydraulic resistance*, developed with river data collected from a variety of Eastern and Western streams.

Resistance factors, $\bar{u}/u^*$ 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 ($\mathbf{D_{84}}$), as taken from field measurements (Leopold, Wolman and Miller, 1964).

Figure B-34. Relative roughness (R/D_{84}) *vs.* friction factor ($\bar{u}/u^*$).

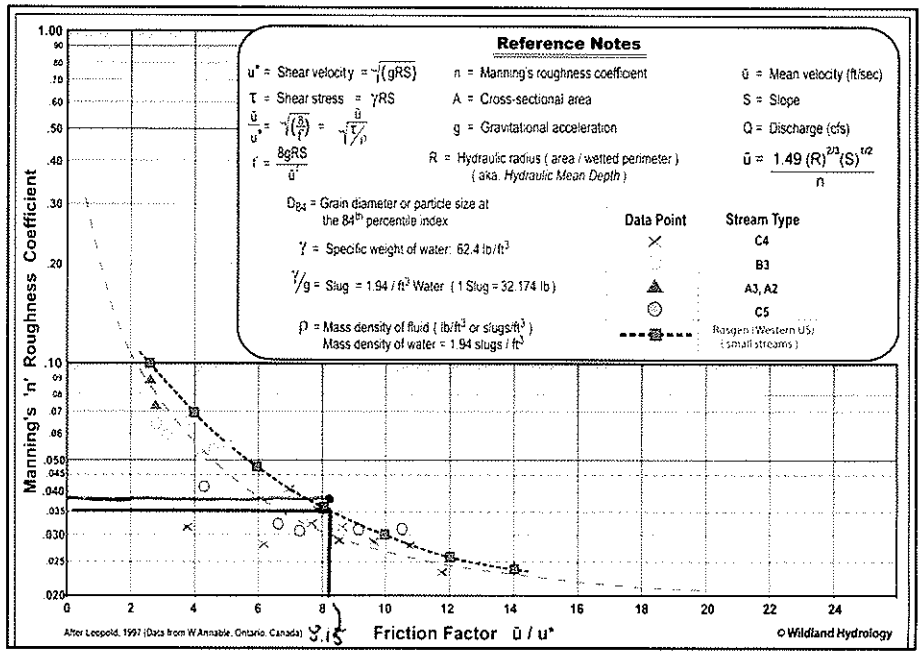

Figure B-35. Friction factor ($\bar{u}/u^*$) *vs.* Manning's roughness coefficient 'n'.

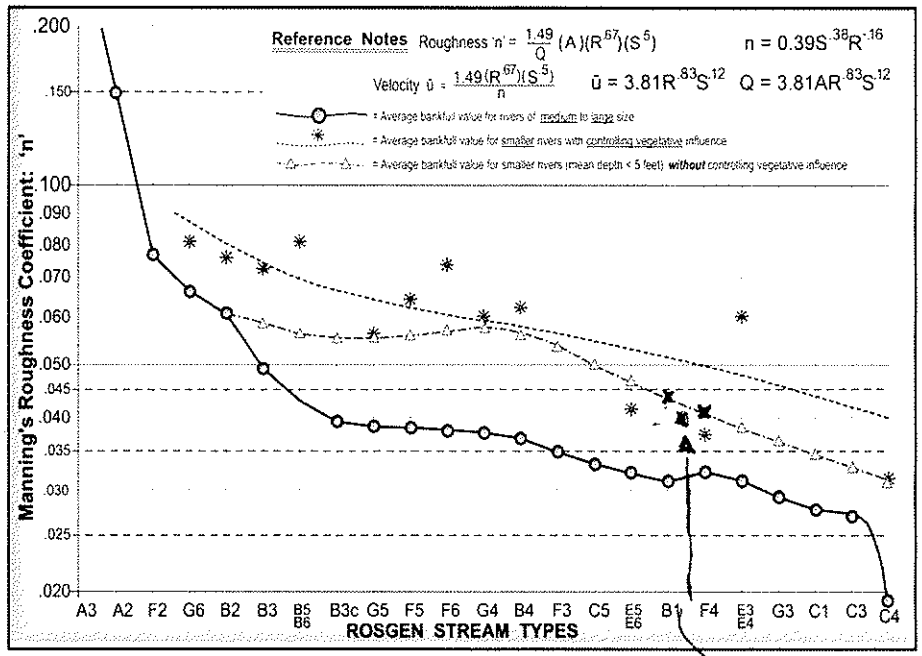

Figure B-36. Manning's 'n' roughness coefficient by stream type.

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

Station NAME:	Marsh Run @ Grimes, MD	Station Number:	1617800
LOCATION:	Grimes, MD		
Period of Record:	53 years (yrs)	Mean Annual DISCHARGE:	2.01 cfs
Drainage AREA:	1296 acres = 18.9 mi^2	Drainage Area Mn Elev:	354.07 ft
Reference REACH SLOPE:	0.00466 ft/ft	Valley Type:	U-AL-AD
Stream Type:	F1/s/6	HUC:	

"BANKFULL" CHARACTERISTICS

Determined from FIELD MEASUREMENT			Determined from GAGE DATA Analysis		
Bankfull WIDTH (W_{bkf})	24.1	ft	Bankfull WIDTH (W_{bkf})	21	ft
Bankfull Mean DEPTH (d_{bkf})	1.43	ft	Bankfull MEAN DEPTH (d_{bkf})	1.9	ft
Bankfull Xsec AREA (A_{bkf})	34.5	ft^2	Bankfull Xsec AREA (A_{bkf})	38	ft^2
Wetted PERIMETER (W_P)	24.9	ft	Wetted PERIMETER (W_P)	24.8	ft
Bankfull STAGE (Gage Ht)	N/A	ft	Bankfull STAGE (Gage Ht)	2.15	ft
Est. Mean VELOCITY (u)	3.16	ft/sec	Mean VELOCITY (u)	2.86	ft/sec
Est. Bkf. DISCHARGE (Q_{bkf})	115.09	cfs	Bankfull DISCHARGE (Q_{bkf})	109	cfs

Bankfull DISCHARGE associated with **"field-determined"** Bankfull STAGE (From Gage Height reading at Staff Plate and tabular Stage-Discharge curve data): 109 cfs

Recurrence Interval (Log-Pearson) associated with **"field-determined"** Bankfull Discharge: 1.96 yrs

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

1.5 Year **R.I.** Discharge =	78	cfs	**10** Year **R.I.** Discharge =	277	cfs
2.0 Year **R.I.** Discharge =	109	cfs	**25** Year **R.I.** Discharge =	440	cfs
5.0 Year **R.I.** Discharge =	198	cfs	**50** Year **R.I.** Discharge =	458	cfs

MEANDER GEOMETRY

Meander Wavelength (L_m)	95	ft	Radius of Curvature (R_c)	57	ft
Belt Width (W_{blt})	56	ft	Meander Width Ratio (W_{blt}/W_{bkf})	2.3	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**).

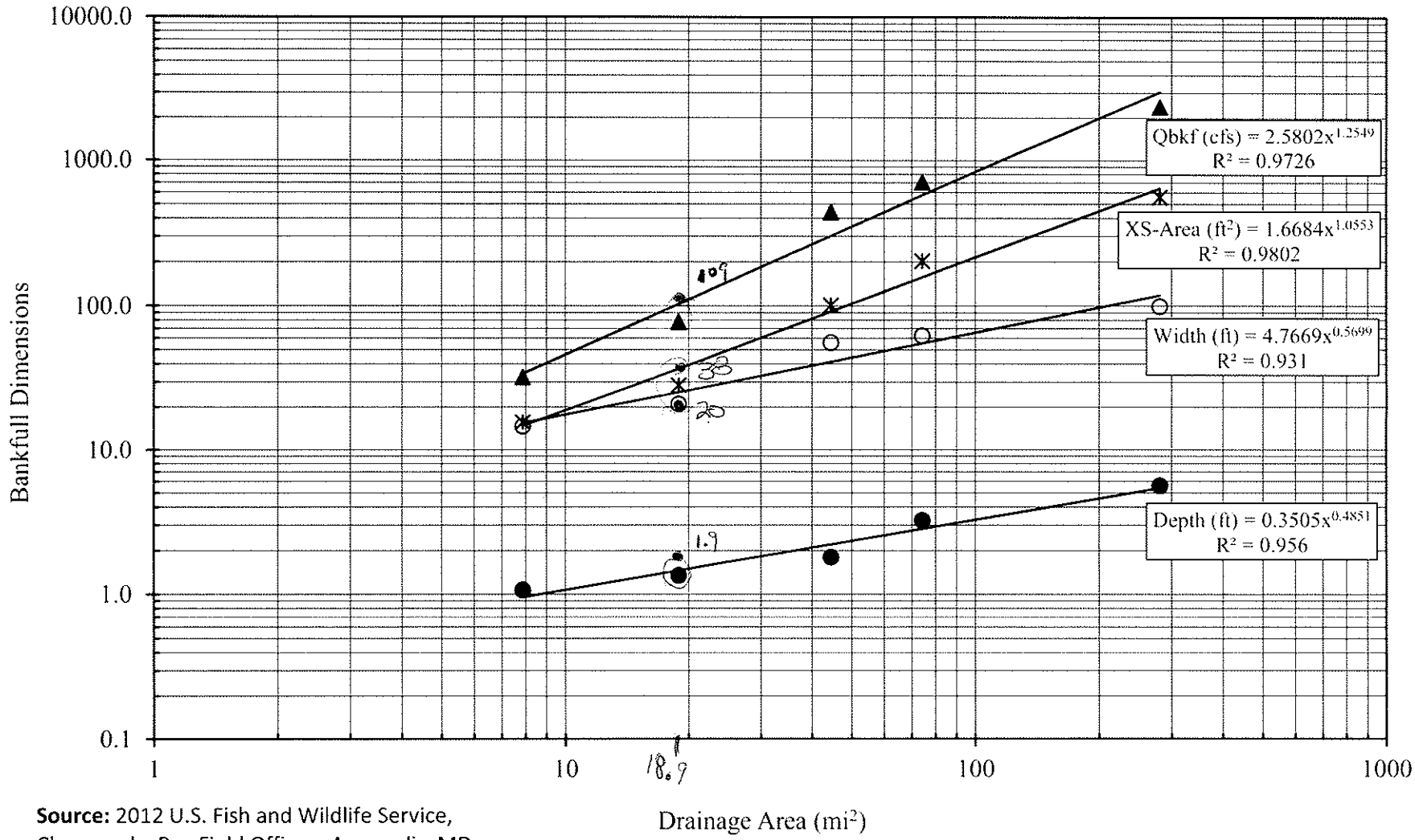
	Width (**W**)	Depth (**d**)	Area (**A**)	Velocity(**u**)
Intercept Coefficient **a**)	9.354	0.379	3.549	0.280
Slope Exponent **b**)	0.186	0.333	0.519	0.483

Hydraulic Radius $R = A / W_P$	1.38	ft	**Manning's "n"** at Bankfull Stage	0.038	Coeff.

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

34.5 1.38 0.0047 115.09

Bankfull Characteristics for Selected USGS Gages in the PA and MD Carbonate Great Valley Section of the Ridge and Valley Province



Source: 2012 U.S. Fish and Wildlife Service, Chesapeake Bay Field Office - Annapolis, MD

SURVEY DATA ⟹ **LONGITUDINAL PROFILE 1**

SITE: Reach 1 - Marsh Run Date: 4/27/17

Location: Washington County, MD

Observers: DS / MD 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 Depth ~~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	5.81	105.81		100							
2	0.0			8.38			0.45					Top Step
3	2.5			8.33			0.24					Mid Step
4	3.5			10.01			0.9					Bottom Step
5												
6	10.0			10.05			0.96					Max
7	15.0			9.95			0.90					
8	16.5			9.40			0.35					Riffle
9												
10	25.0			9.85			0.65					
11	35.0			9.76			0.55					
12												
13	46.5			9.84			0.61					Run
14	56.0			10.1			0.89	8.11		5.11		BKF/LBH from RB
15	60.0			10.22			0.98					
16	68.0			10.40			1.16					
17	71.0			11.20			1.95					Max D
18	82.0			10.50			1.26					Glide
19	84.0			10.87			1.62	8.31				BKF (on LB) ~~too~~?
20	76.0			10.70			1.46					
21	92.0			11.56			2.30					Max D
22	98.0			10.66			1.39					
23	103.0			10.30			1.02					Bedrock Start G
24	105.0			10.23			0.95					Bedrock
25	108.0			10.1			0.80					
26												
27	111.0			9.71			0.40	8.14				Max Glide top riff

Bedrock

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SURVEY DATA → **LONGITUDINAL PROFILE 2**

SITE: Reach 1 - Marsh Run

Date: 4/27/17

Location: Washington County, MD

Observers: DS/MD

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 Depth ~~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	113.0		105.81	9.98			0.70					Run
29	115.0			10.37			1.06					Bedrock
30	116.0			10.26			0.99					
31												
32	119.0			10.13			0.82					
33	120.0			10.16			0.86					Bedrock
34	121.5			10.22			0.90					
35	124.5			10.17			0.89					
36												
37	128.0			10.87			1.58					Max D Pool
38	129.0			10.35			1.05					Start G
39												
40	132.5			10.17			0.82	8.44				Riffle BKF (9)
41	135.0			10.11			9.49 elev.					
42	137.5			10.26			9.75					
43												
44	141.0			10.45			9.95	8.83		5.26		BKF (10)
45	144.0			10.42			10.25 (0.37)					
46												
47	150.0			10.61			10.23					
48												
49	155.0			10.55			0.4	9.22				BKF (12)
50	156.0			10.65			0.55					XS - Riff
51												
52	165.5			10.74			0.49					
53	172			11.09			0.76					N?
54	1[illegible]											

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0-3 step
16.5-22 bridge
24 max lift
56 BkF
92 Max P
99 Max G
112-113 ~~108~~ Glide end
131 BkF
128 Max D P
129 G start
134 G end
141 BkF (1.15)
172 BkF (1.1)
190 End R-N
195 End N
206.3 Max P
184 lal protrusion
206 BkF
231 start G
237 end G
248 BKF
277 start G
283 start G
288.5 BKF
311. BkF
341 BKF
358 end top step

SURVEY DATA → **LONGITUDINAL PROFILE 3**

SITE: Reach 1 - Marsh Run Date:

Location: Wash. Co.

Observers: 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
55	180		10.581	10.90		0.54						
56	190		"	11.01		0.74						N?
57	196			11.42		0.97						P
58												
59	198			12.44		1.99						
60	205.5			12.48		2.03						D max
61	210											
62	212			11.83		1.35		9.41				
63												
64	219			12.02		1.63						
65	222			11.97		1.57						
66												
67	227			11.76		1.32						
68												
69	231			11.52		1.01						
70	TP1			9.81								
71	TP1	9.65	105.65									
72	233			11.17		0.84						
73												
74	235			11.02		0.64		9.27				max glide
75												
76	238			11.15		0.82						
77												
78	241.5			11.35		1.01						
79												
80	245			11.14		0.83						
81												

Lateral scour

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SURVEY DATA ⟹ **LONGITUDINAL PROFILE 4**

SITE: Reach 1 - Marsh Run Date:

Location: Wash Co

Observers: 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
82	247		105.65	11.27		0.95		9.23		9.23		N?
83												
84	249			11.37		1.02						
85												
86	255			11.35		1.00						
87												
88	259			11.44		1.09						
89												
90	263			11.62		1.24						P
91												
92	264			12.48		2.11						
93												
94	267			12.48		2.11						
95												
96	269.5			12.62		2.28						Prox
97												
98	272			12.14		1.79						
99												
100	~~274~~ 274.5			11.83		1.47		9.20				
101												
102	278			11.71		1.36						
103												
104	280			11.56		1.19						G
105												
106	285			11.49		1.13						
107												
108	290			11.53		1.16						

lateral protrusion

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SURVEY DATA ⟹ *LONGITUDINAL PROFILE* ~~2~~ 5

SITE: Marsh Run Date:

Location: Wash Co.

Observers: 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	294		~~105.65~~	11.18		0.82						R
29	299			11.56		1.19						
30												
31	303			11.47		1.08						
32												
33	309			11.52		1.09						
34												
35	311			11.37		0.96						
36								9.19 (1)				
37	316			11.24		0.81		~~2.03~~		LB 9.19		
38												
39	320			11.26		0.84						
40												
41	324			11.30		0.89						
42												
43	327.5			11.61		1.19						
44												
45	330			11.71		1.30				LB 1.3		At gage station
46												
47	336			11.66		1.2		9.31 (2)				
48												
49	340			11.40		0.96		9.24				
50	340							9.21				
51												
52	346			11.11		0.66						
53												
54	354			10.97		0.55						

Bookmarked

11.22
0.83
1.0
0.03

358 10.78 0.30

End Reach on RB

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pg 1/2

24

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: Marsh Run Date: 4/27/17

Location: Riffle X5 @ 24' on Long Pro

Observers: Ewald/Allison HUC:

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	REMARKS / COMMENTS / NOTES
BM 1	[redacted]	4.38	104.38		100'	Bench Mark – tree root w/ black "X"
2						
3	0.3			3.55		
4	1.0			3.49		
5	5.0			3.55		
6	8.5			3.57		TOLB
7	9.6			4.68		Break in Bank
8	11.9			7.9		Bottom Bank
9	11.8			7.76		LEW
10	11.6			5.78		Slope on L Bank
11	13.5			8.36		Channel
12	15			8.35		in channel
13	17			8.25		
14	18.5			8.16		
15	20			8.34		
16	22			8.34		
17	24			8.42		
18	25			8.38		
19	26.5			8.52		
20	28			8.35		
21	30			8.05		
22	31.5			8.13		
23	33			8.10		
24	34			7.91		
25	34.8			7.71		REW
26	35.5			7.30		Break
27	37			6.84		BF? Break
28	37.6			6.06		Bank

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Riffle 0+24 (1) Pg. 2/2

pg. 2/2

24

SURVEY DATA → **CROSS - SECTION** ~~4~~

SITE: Marsh Run Riffle x-s @ 24 Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	38.5			4.59		
2	41			3.79		
3	43			3.68		TOB
4	47			3.92		Ground
5	HI	4.38	104.38			
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

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~~Riffle~~ 0-3 step/riffle

16.5-22 bridge

run 45 beginning of run

92 max pool

glide 99 glide

112 end of glide/riffle

↳ ~~backwater riffle~~

128 backwater max pool

129 glide

134 top of riffle

190 end of riffle/run

195 end of run/glide

206.5 deep pool

231 glide

237 end of glide/riffle

259 start of run

265 pool/end run

270 deep pool

277 glide

283 end of glide/riffle

358 end of reach

① X-riffle 24

~~X-pool~~

② X-pool - 92

③ X glide - 112

④ X-riffle - 157

~~X run~~

⑤ X-pool - 206.5

⑥ X-glide - 237

⑦ X-run 262

SURVEY DATA ⟹ **CROSS - SECTION**

SITE: Marsh Run XS8 Run 0+56 Sam pDawn Date: 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	5.15	105.15			Benchmark
2						
3	-3			4.09		~~GND~~ TB
4						
5	-2			4.19		GND
6						
7	-1			4.33		GND
8						
9	0			4.71		GND
10						
11	1			5.26		GND
12						
13	2			5.84		GND
14						
15	3			7.18		GND
16						
17	3.5			7.51		BkF
18						
19	4			8.07		GND
20						
21	4.5			8.54		LEV
22						
23	5			9.48		SB Silt
24						
25	6			9.76		SB Bedrock
26						
27	7			9.88		SB Bedrock
28						
29	8			9.81		SB Bedrock
30						
31	11			9.47		

Sheet 1 of 2

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SURVEY DATA → **CROSS - SECTION** 8

SITE: March Run XS Run @ 0+56 Sump Drain **Date:** 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	5.15	105.15		100	
2						
3	14			9.37		SB Bed rock
4						
5	17			9.26		SB Bedrock
6						
7	20			9.21		SB Bedrock
8						
9	21			9.10		~~REW~~
10						
11	22			8.54		~~GND~~ REW
12						
13	23			7.35		BKF
14						
15	24			6.54		GND
16						
17	25			5.40		GND
18						
19	26			4.95		GND
20						
21	27			4.39		Log
22						
23	28			4.44		TB
24						
25						
26						
27	BM			5.15		Close loop
28						
29						
30						
31						

Sheet 2 of 2

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Pool - 0+92 #2

pg 1/2

X-sec #2

pg 1/2

SURVEY DATA ⟹ **CROSS - SECTION**

SITE: Pool XS @ 0+92 Ewald/Alison Date: 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	3.86	103.86		100.0	
2	0.3			3.35		ground
3	3			3.20		
4	5			3.22		
5	7			3.33		
6	9			3.43		break in grade
7	11.6			4.17		TOLB
8	12.5			4.96		bank slope
9	13.3			6.04		bench
10	14.8			6.91		bottom bank dep. feature
11	15.5			7.00		dep. feature
12	17			6.97		
13	18			7.06		
14	19.5			7.28		LEW
15	21			7.82		
16	22			7.62		
17	23			7.52		
18	25.8			7.99		
19	28.5			8.32		
20	30			8.69		
21	32			8.99		
22	33			8.96		
23	34			9.15		41.5
24	35			9.44		
25	36.8			9.16		
26	37.7			9.04		Toe RB
27	38.5			7.87		
28	40.5			7.29		REW
29	41.5			6.44		Bank
30	42.8			5.52		undercut 5.52
31	41.6			4.00		Bank Break

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Pool 0+92 #(2) Pg 2/2

Pg 2/2

SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Pool XS @ 0+92 Date: 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	transpose		to bank	6.08		not on x section BF
2	44				3.66	Top Bank
3	47				3.72	
4	49				3.76	
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

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SURVEY DATA → CROSS - SECTION 7

SITE: Marsh Run STA 1+11 XS-3 Glide

Date: 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	6.88	106.88		100	BM
2						
3	0			4.50		TB
4	2			5.11		GND
5	4			5.54		GND
6	6			6.91		GND
7	8			6.79		GND
8	9			7.56		GND
9	10			8.35		GND
10	11			9.31		LEW
11	12			10.07		SB Silt
12	13			9.90		SB Silt
13	14			9.68		SB Silt
14	15			9.89		SB Silt
15	16			9.28		SB Log
16	17			9.50		SB Log
17	18			10.03		SB BR
18	20			10.04		SB BR
19	22			9.75		SB BR
20	24			9.92		SB BR
21	26			9.69		SB BR
22	28			9.79		SB BR
23	30			9.98		SB BR
24	31			10.07		SB CO
25	32			10.15		SB CO
26	33			10.03		SB CO
27	34			10.94		SB CO
28	35			9.31		REW
29	36.5			8.21		BKF
30	37.5			6.66		GND
31	38			5.92		GND

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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Marsh Run STA 1+11 XS-3 Glide Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	40			5.59		GND
2	42			5.46		GND
3	43			5.42		TB
4						
5						
6	BM	6.89	106.89		100	close Loop
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

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Riffle 1+57 #4 Pg 1/1

Team1

x-sec. #4

Pg. 1/1

SURVEY DATA → **CROSS - SECTION**

SITE: X-section riffle @ 15.7 Marsh Run Team1 Date: 4/27/7

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	Bm	5.81	105.81		100	
2	~~0.3~~			~~4.60~~		
3	1			4.29		
4	2			4.30		
5	4			4.36		
6	6			4.63		
7	9.2			5.43		ToLB
8	10.7			7.05		bank
9	11.3			8.18		
10	12.6			9.45		bottom of bank
11	16.3			10.19		
12	18.5			10.27		
13	21			10.32		
14	24.3			10.05		
15	25.8			10.05		
16	28			10.01		
17	29.9			10.01		
18	31.4			10.02		
19	33			9.97		~~ToRB~~
20	33.6			9.62		REW
21	~~30.5~~			~~7.96~~		~~BKfl?~~
22	35.7			8.49		BKfl/Break
23	36.7			7.38		ToeRB
24	38.5			6.36		Bank
25	40			5.11		ToRB
26	41.5			4.52		
27	43			4.39		
28	47			4.76		
29	50			5.04		
30	14.2			9.71		LEW
31						

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SURVEY DATA ⟶ **CROSS - SECTION**

SITE: Marsh Branch Pool XS 5 STA 2060.5 Date: 4/27

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	3.24	103.24		100	Benchmark
2						
3	0			3.24		TB
4	2			3.73		GND
5	6			4.79		GND
6	11			5.58		GND
7						
8	12.6			6.75		BkF
9	12.5			6.46		GND
10	14			7.85		LEW
11	15			8.14		SB Silt
12	17			8.50		SB Silt
13	19			8.59		SB Bedrock
14	20			8.60		SB Bedrock
15	22			8.46		SB Bedrock
16	22.7			9.33		SB Bedrock
17	24			9.59		SB Bedrock
18	25			9.74		SB Bedrock
19	26			9.80		SB Bedrock
20	28			9.57		SB Bedrock
21	30			9.22		SB Bedrock
22	32			9.08		SB Bedrock
23	34			8.26		SB Bedrock
24	34.4			7.82		REW
25	35			7.16		Log
26	37			7.39		GND
27	39			6.79		GND
28	41			5.16		GND
29	42			4.62		GND
30	43			4.55		TB
31	BM	3.24			100	

Sheet 1 of 1

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SURVEY DATA ⟶ **CROSS - SECTION**

Team 1

SITE: X-section glide @ 2+39 Marsh Run T.1 **Date:** 4/27/17

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	2.87	102.87		100	
2	0			2.42		
3	1.4			2.35		To LB
4	3.0			2.63		Bank
5	5.0			3.43		
6	7.5			4.69		Bench
7	11.8			5.48		Start of Bench
8	13.0			6.23		?BKfl?
9	14			6.77		Bench
10	17			7.50		LEW
11	16.			7.31		
12	18.5			8.11		Channel
13	21			8.22		
14	22			8.30		
15	23			8.34		
16	24			8.36		
17	25			8.44		
18	26			8.53		
19	27			8.39		
20	28			8.38		
21	30			7.58		REW
22	31			7.12		Break-silt
23	32.8			5.49		
24	35			2.50		To RB
25	37			2.36		
26	39.5			2.63		
27	44			2.13		
28						
29						
30						
31						

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SURVEY DATA ⟹ **CROSS - SECTION**

SITE: Marsh Run Run STA 2+62 XS7 Date: 4/27

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	3.24	103.24		100	
2						
3	TP			5.18	98.06	TP. 4x6 pointing upstream Black "X"
4		7.21	105.27			
5	-10			5.58		Road Edge
6	0			5.41		GND
7	3			6.06		GND
8	6			7.23		GND
9	9			8.50		GND
10	12			8.99		Bedrock outcrop
11	15			9.11		Bed rock outcrop
12	18			9.26		Bed rock outcrop
13	19.5			9.89		LEW
14	21			11.16		SB
15	22			10.92		Bedrock SB
16	24			10.92		Bedrock SB
17	25			10.90		SB Bed rock
18	26			11.00		SB. Bedrock
19	27			10.67		SB Bedrock
20	28			10.67		SB Silt
21	30			9.91		REW
22						
23	10			8.76		BKF
24	31			8.31		GND
25	32			6.09		GND
26	34			5.11		GND
27	35			4.84		TB
28						
29	TP	5.15	103.21		98.06	Turning point
30	BM		103.21	3.22	99.99	Bench Mark Closed loop ✓
31						

Sheet 1 of 1

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137
20
XS157
177

~~F5/1~~
F1/5/6 — Third
dominant secondary

XS1 XS2

Site:
Location: HUC:
Observers:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE (Prot. / Pebble)	Dot Count for POOL (prot / pebble)	Dot Count for COMP.
	Silt / Clay	< .062	S/C			
	Very Fine	.062 - .125	SAND			
	Fine	.125 - .25	SAND			
	Medium	.25 - .50	SAND			
	Coarse	.50 - 1.0	SAND			
.04 - .08	Very Coarse	1.0 - 2	SAND			
.08 - .16	Very Fine	2 - 4	GRAVEL			
.16 - .22	Fine	4 - 5.7	GRAVEL			
.22 - .31	Fine	5.7 - 8	GRAVEL			
.31 - .44	Medium	8 - 11.3	GRAVEL			
.44 - .63	Medium	11.3 - 16	GRAVEL			
.63 - .89	Coarse	16 - 22.6	GRAVEL			
.89 - 1.3	Coarse	22.6 - 32	GRAVEL			
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL			
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			

RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Reach:			Reach:			Reach:		
Date:			Date:			Date:		
TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM

Stream Type: Landscape Type: TOTAL →

Overlook

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Composite

Site:

Location: HUC:

Observers:

				Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1)	POOL (2)	COMPOSITE (3)
							Reach:	Reach:	Reach:
							Date:	Date:	Date:
Inches	PARTICLE	Millimeters					TOT # ITEM % % CUM	TOT # ITEM % % CUM	TOT # ITEM % % CUM
	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							
.31 - .44	Medium	8 - 11.3							
.44 - .63	Medium	11.3 - 16							
.63 - .89	Coarse	16 - 22.6							
.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						
						TOTAL→			

Stream Type: ***Landscape Type:***

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Worksheet B-5. Procedure to validate hydraulic relations using gage station data.

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 (**Figure B-43**).
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: $n = (1.49R^{2/3}S^{1/2})/\bar{u}$ (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: $\bar{u}/u^*$.
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 B-34**) (Example in **Figure B-39**).
14. Plot Manning's 'n' by friction factor (**Figure B-35**) (Example in **Figure B-40**).
15. Plot Manning's 'n' by stream type (**Figure B-36**) (Example in **Figure B-41**).

Gaging Station Name: **Gaging Station Number:**

1	2	3a	3b	3c	3d	4	5a	5b	6	7	8	9	10
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 $\bar{u}_{bkf}$ (ft/s)	Ave. Water Surface Slope S (ft/ft)	D_{84} (mm)	(ft)	Stream Type	Manning's 'n'	Relative Roughness R/D_{84} (ft/ft)	Shear Velocity u^* (ft/s)	Friction Factor $\bar{u}/u^*$
18.9	109	21	1.9	38	2.9								

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