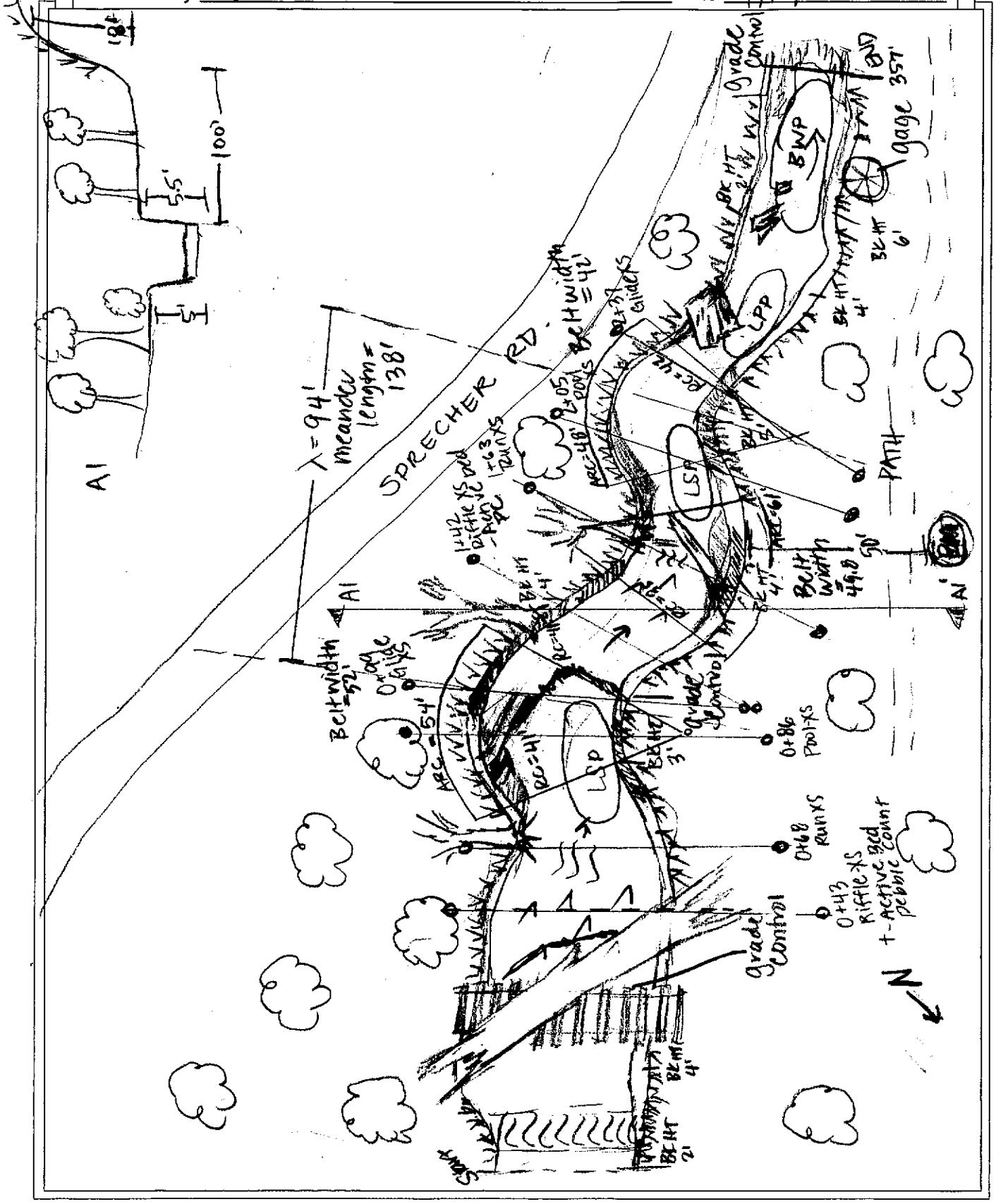
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Marsh Run / 02070004 Site/Reach: 1

Drawn By: Team 1 Date: 4/16/15



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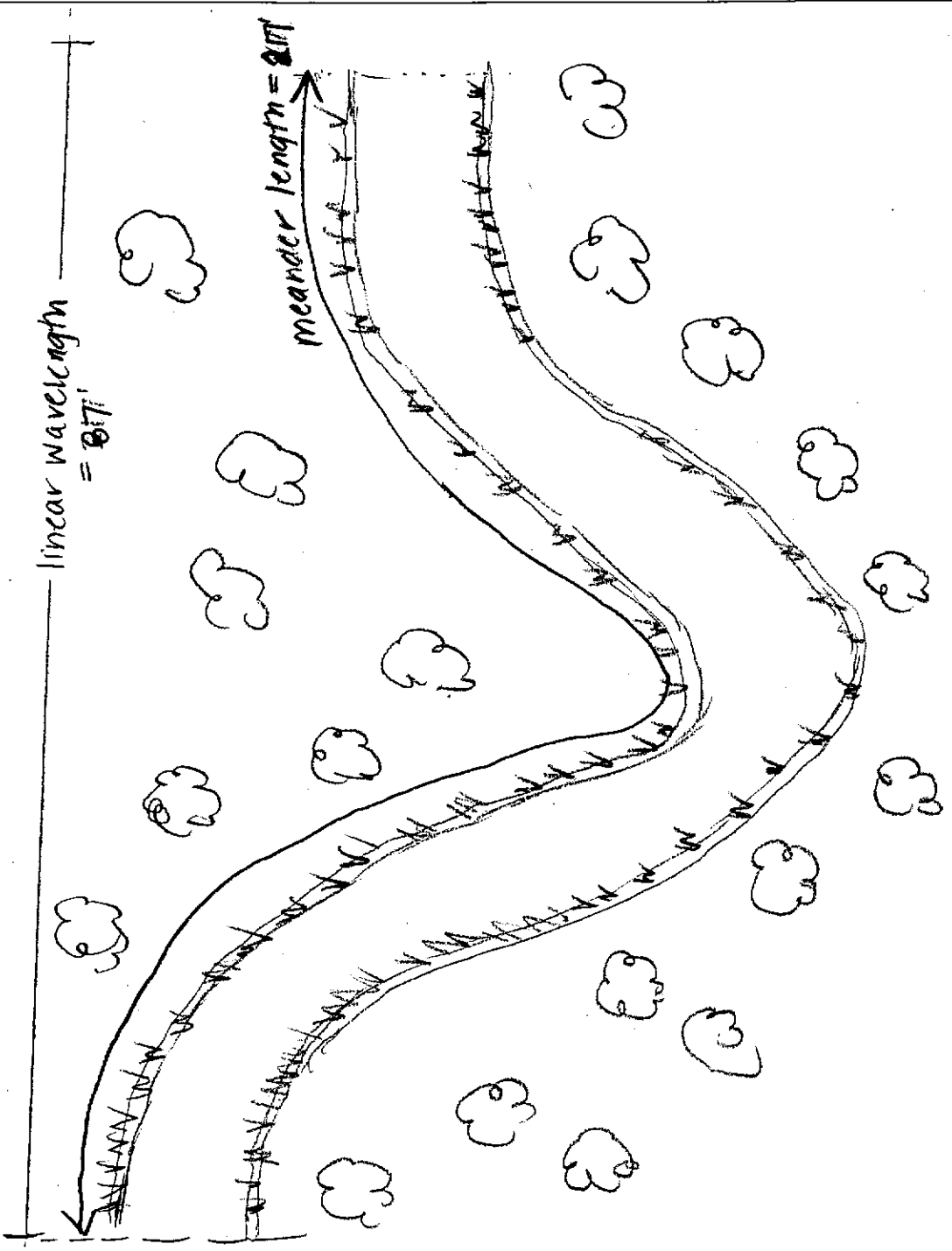
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Marsh Run / 02070004 Site/Reach: 1

Drawn By: Team 1 Date: 4/16/15



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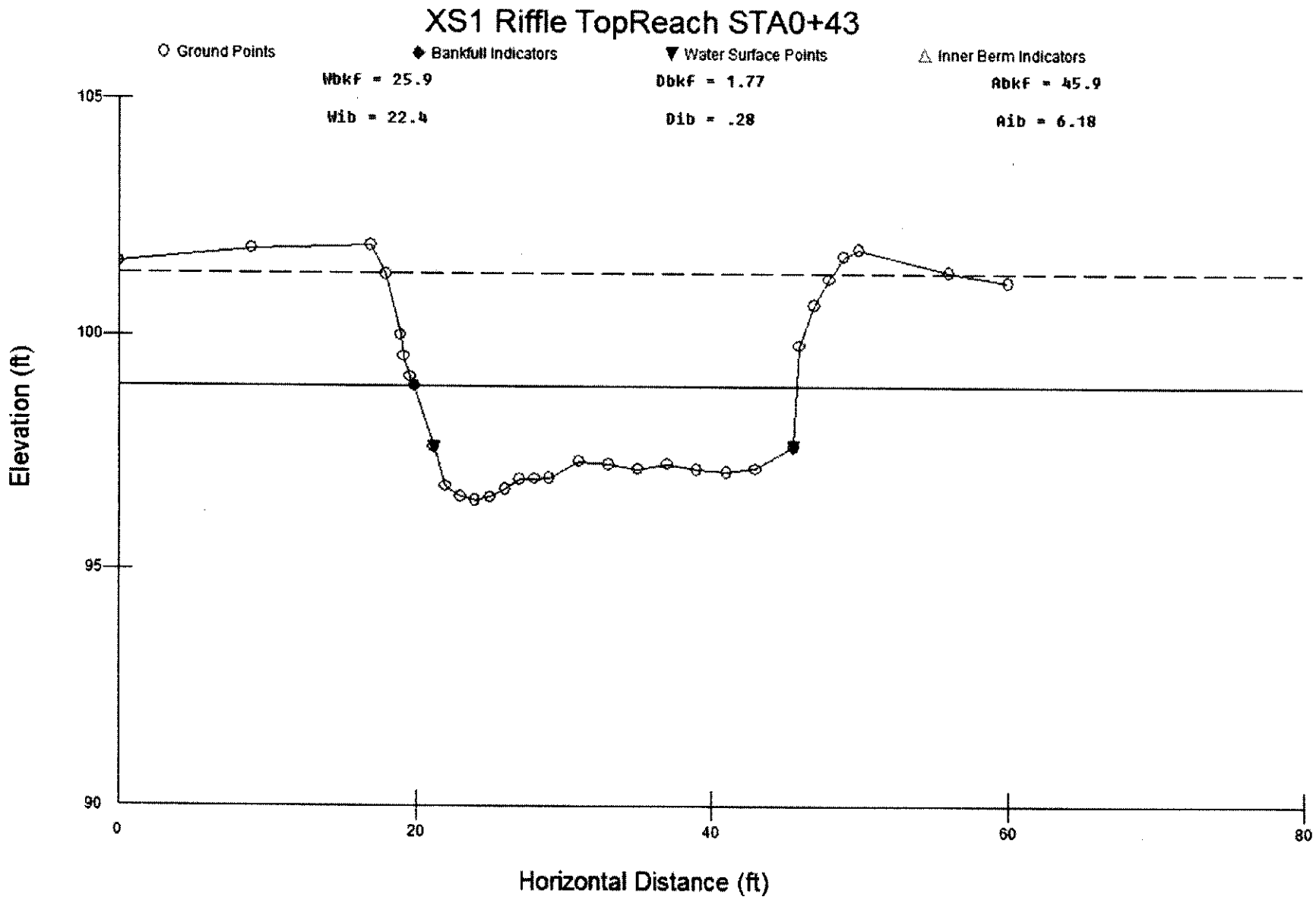
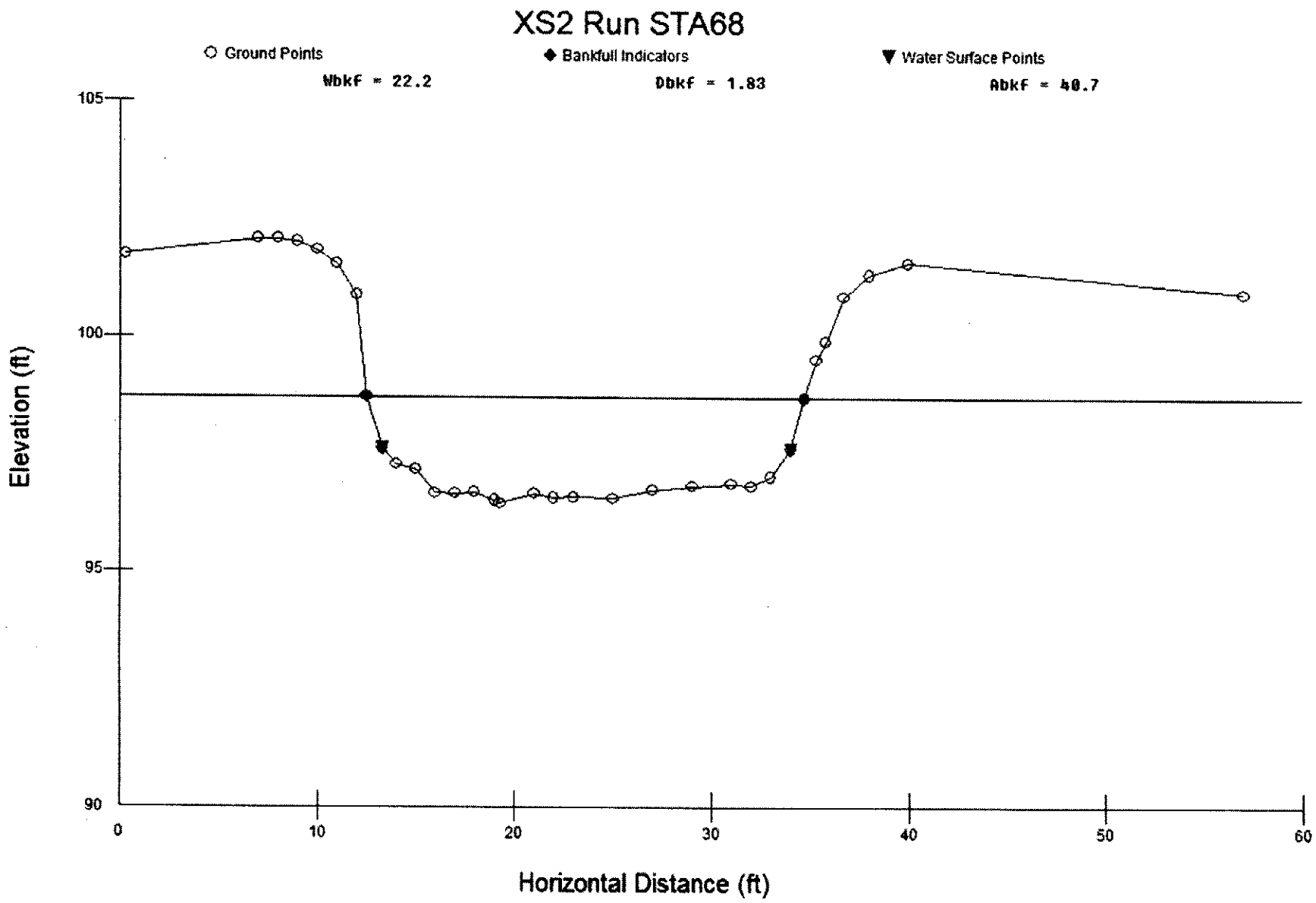
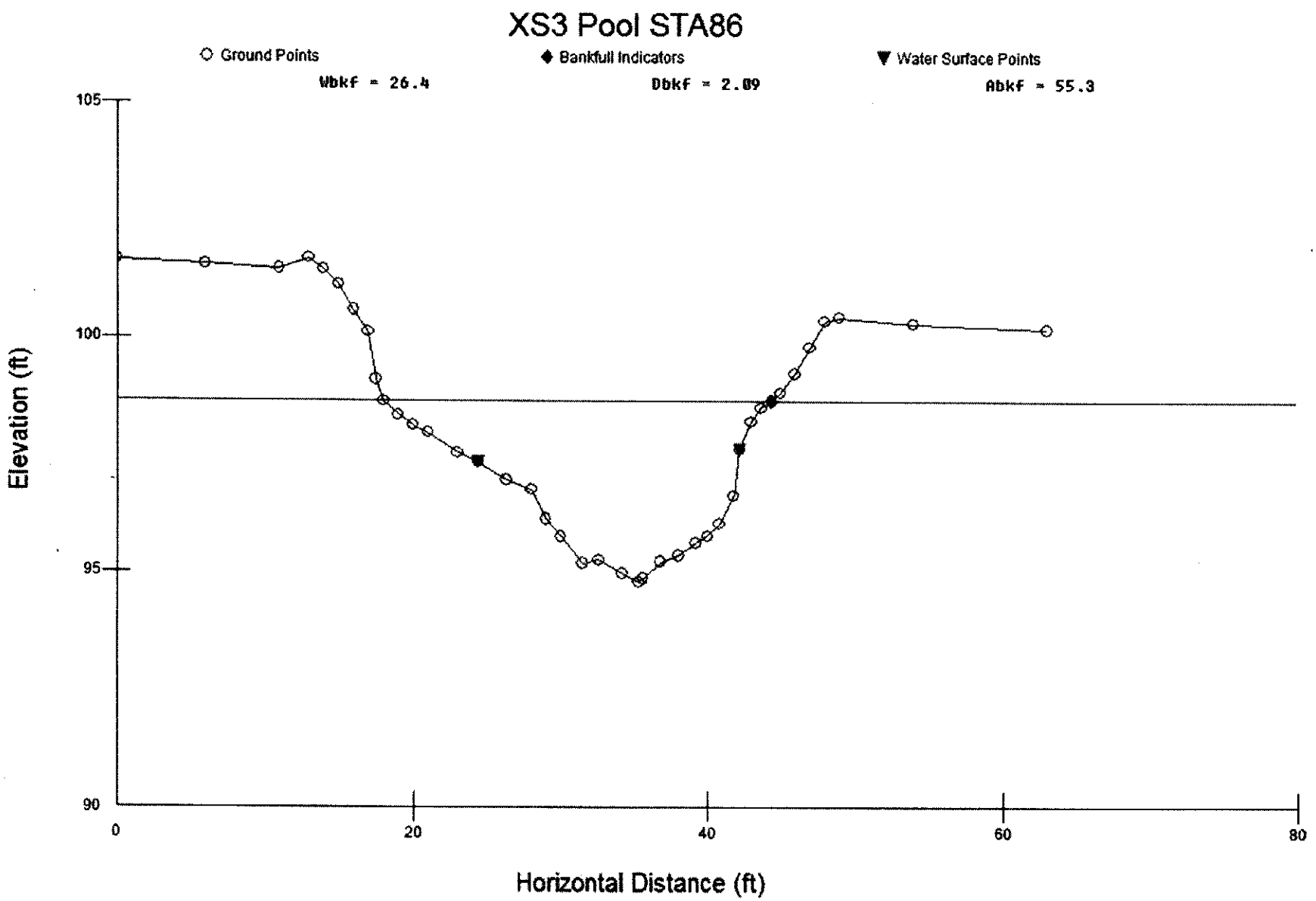
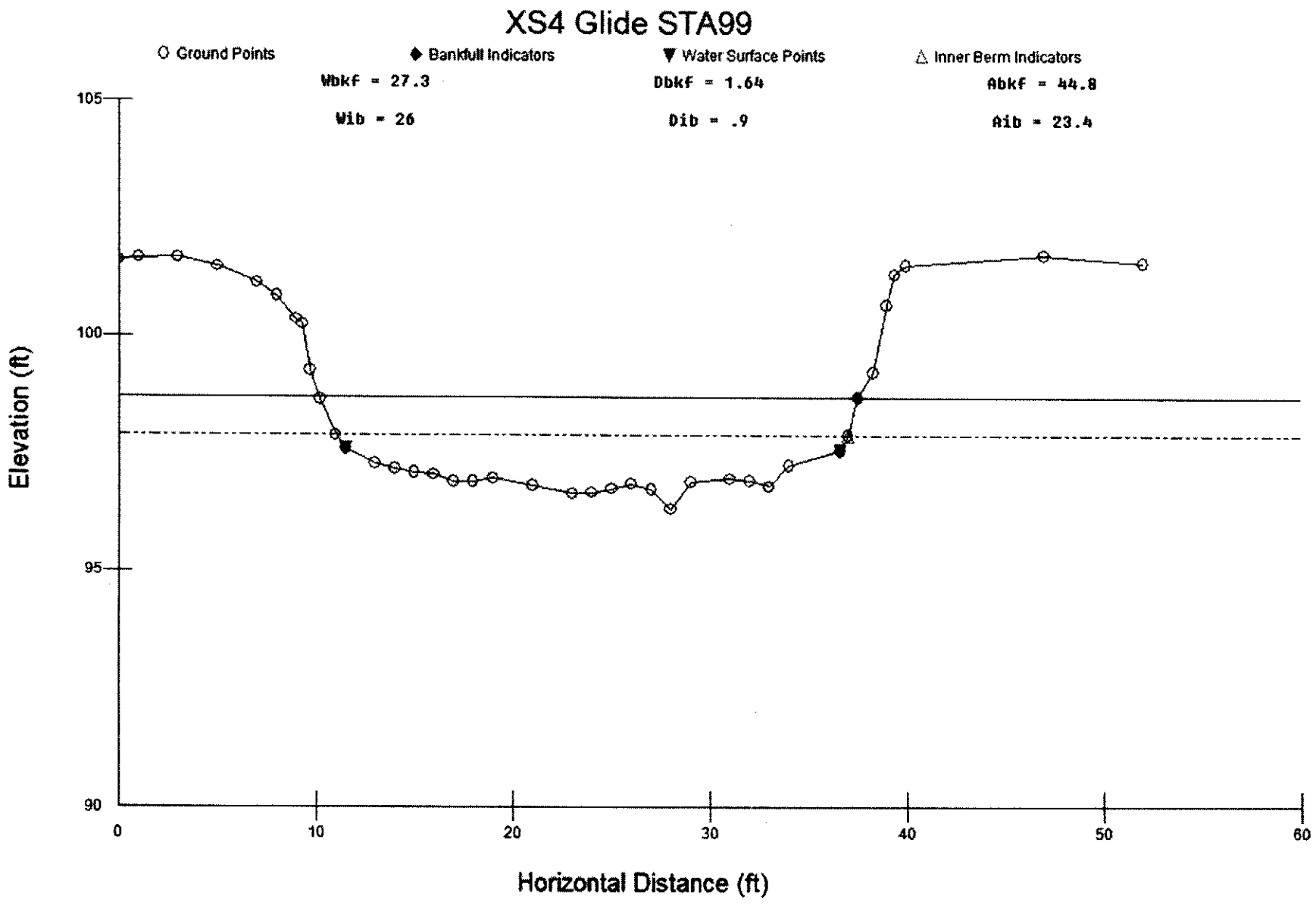
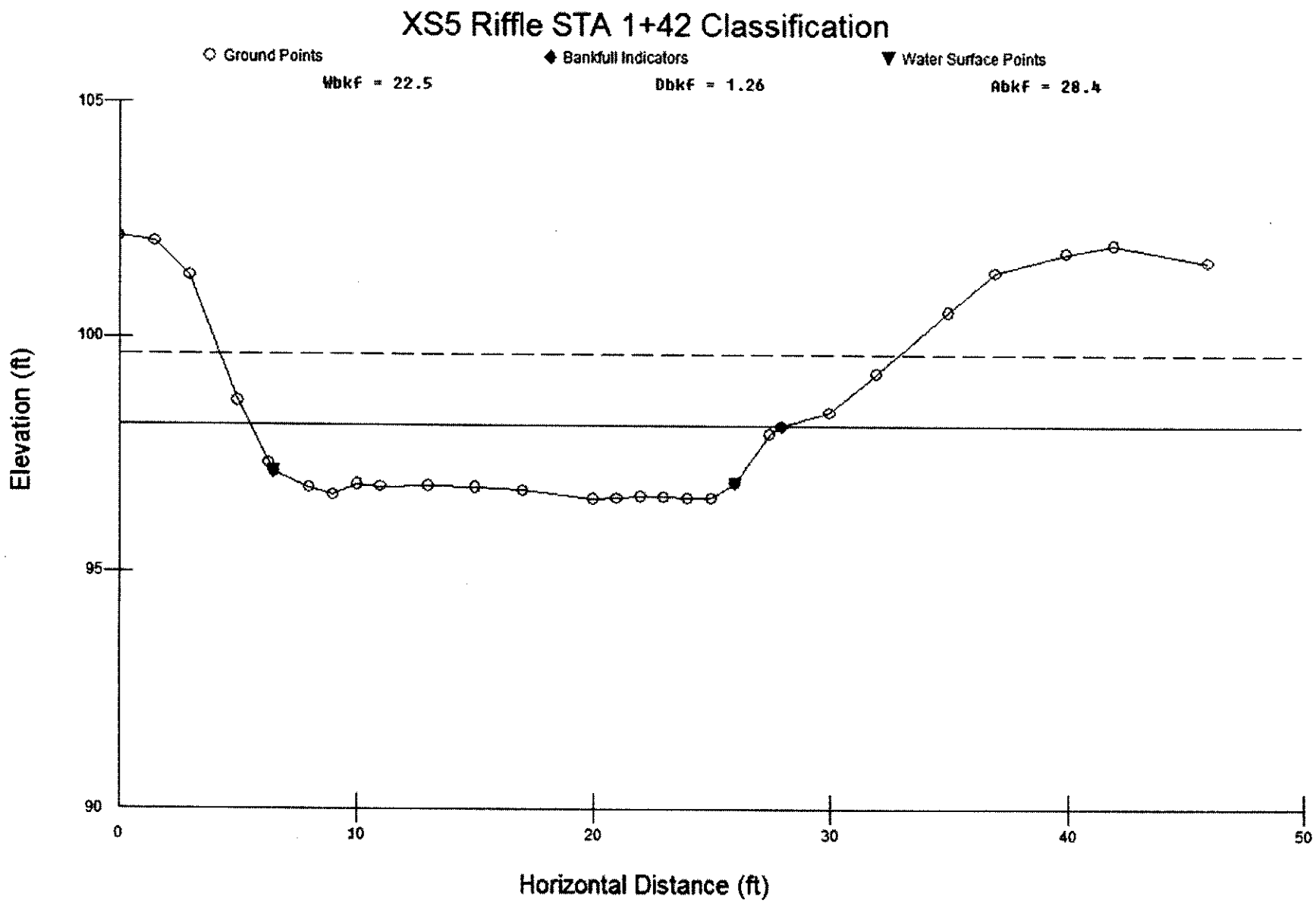
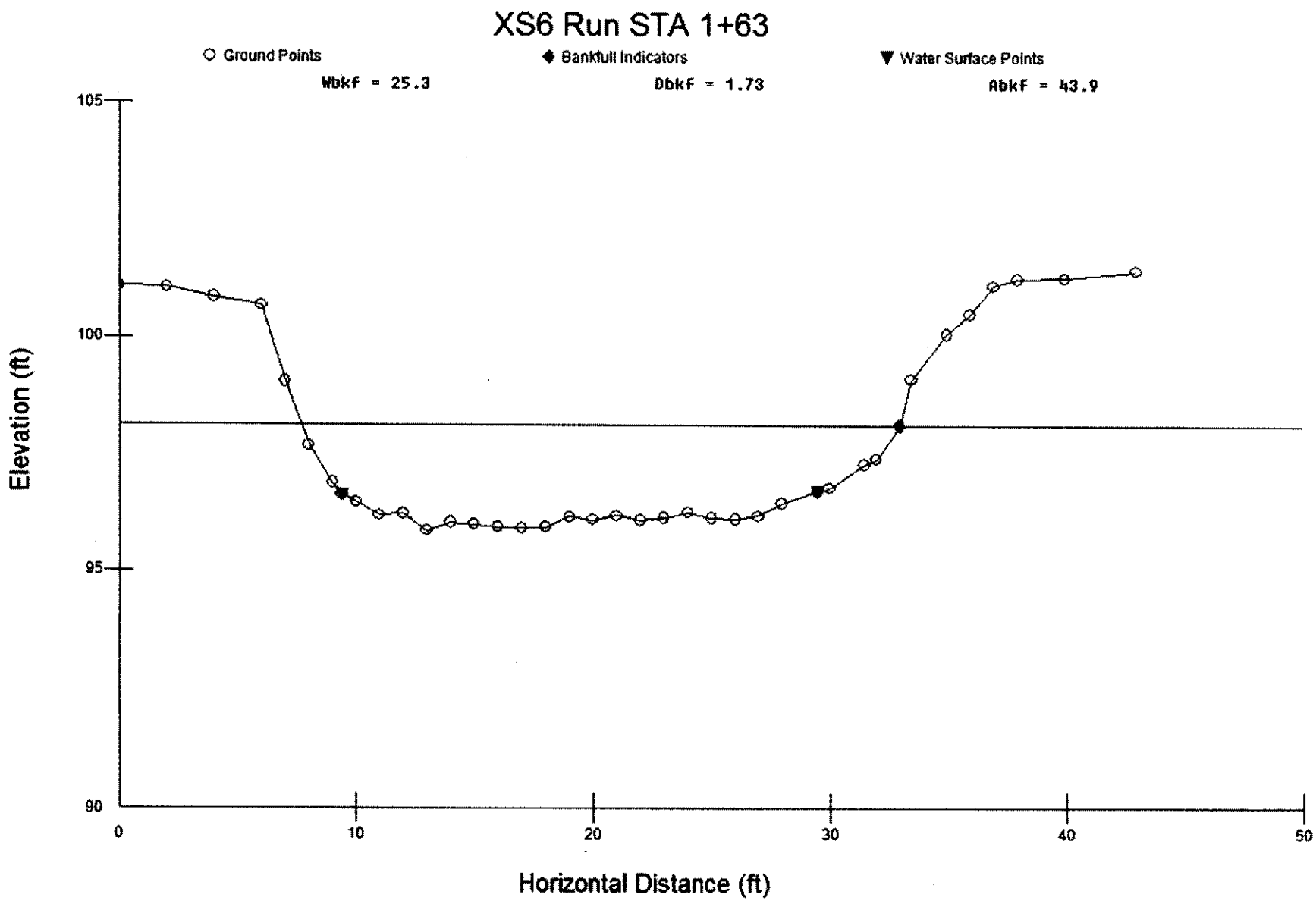

XS1 Riffle TopReach STA0+43
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
WbkF = 25.9
Wib = 22.4
DbkF = 1.77
Dib = .28
AbkF = 45.9
Aib = 6.18
105
100
95
90
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)

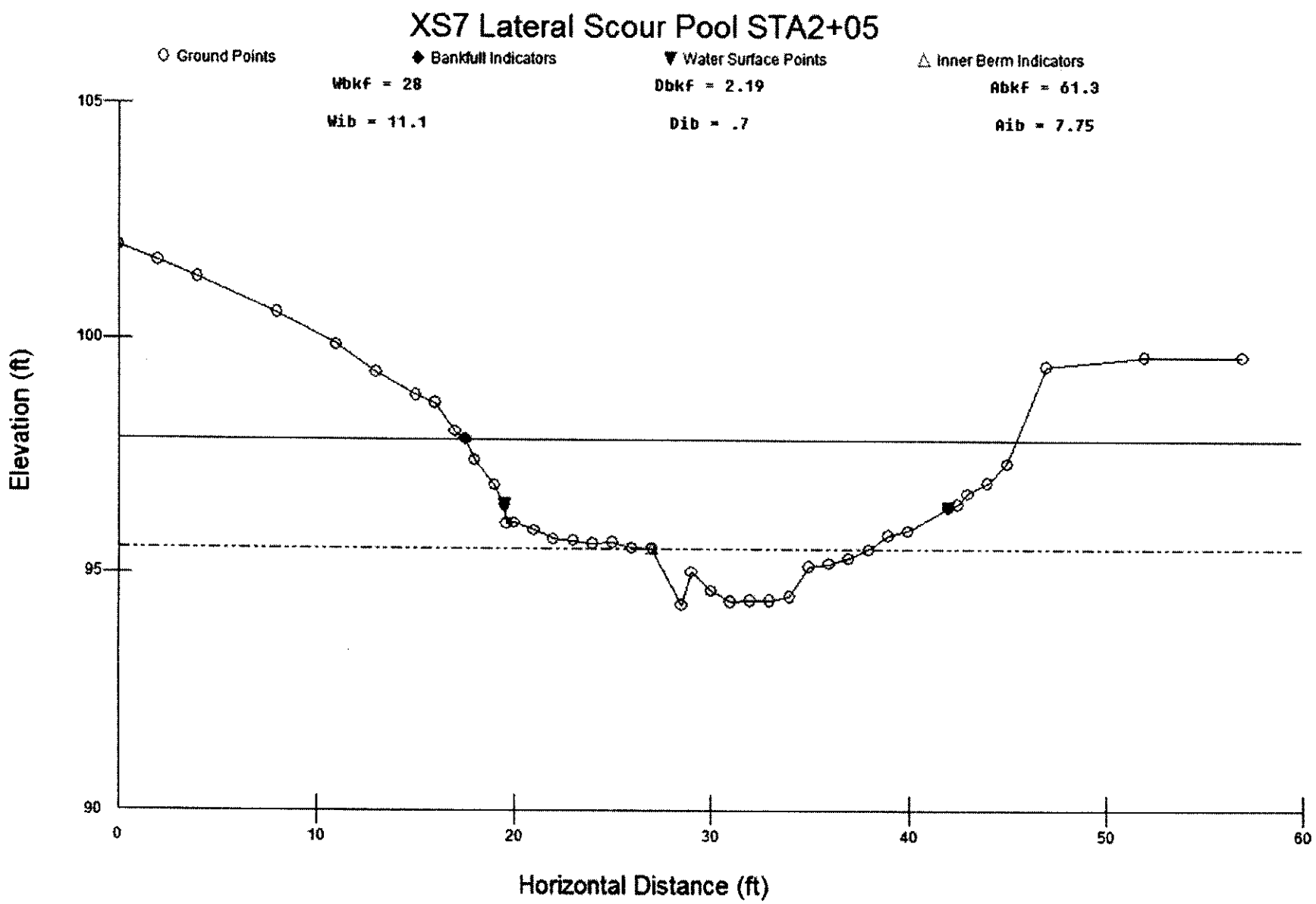

XS2 Run STA68
Ground Points
Bankfull Indicators
Water Surface Points
WbkF = 22.2
DbkF = 1.83
AbkF = 40.7
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
60
Horizontal Distance (ft)

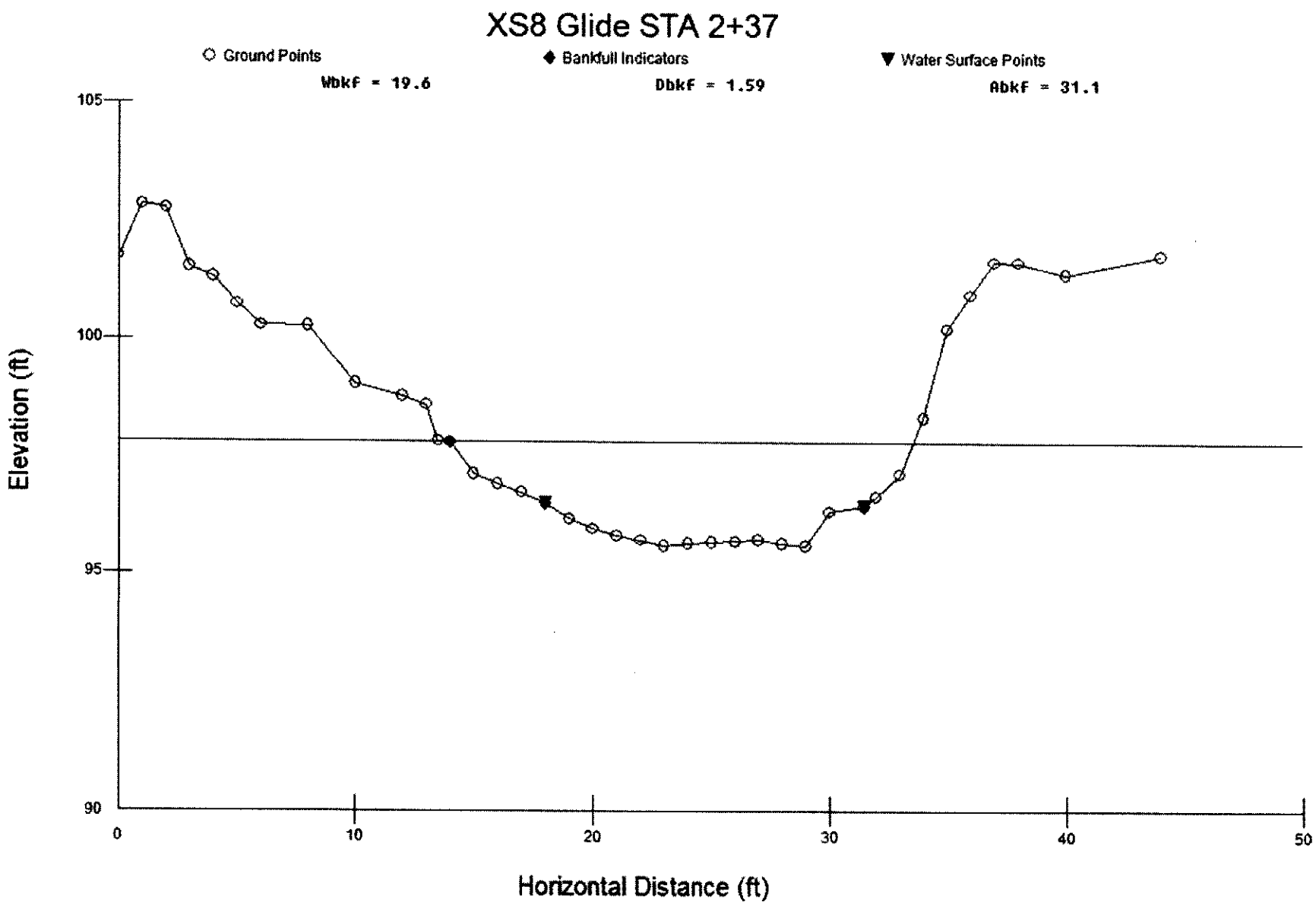

XS3 Pool STA86
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 26.4
Dbkf = 2.09
Abkf = 55.3
105
100
95
90
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)


XS4 Glide STA99
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 27.3
Wib = 26
Dbkf = 1.64
Dib = .9
Abkf = 44.8
Aib = 23.4
Elevation (ft)
105
100
95
90
0
10
20
30
40
50
60
Horizontal Distance (ft)


XS5 Riffle STA 1+42 Classification
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 22.5
Dbkf = 1.26
Abkf = 28.4
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)


XS6 Run STA 1+63
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 25.3
Dbkf = 1.73
Abkf = 43.9
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)


XS7 Lateral Scour Pool STA2+05
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 28
Wib = 11.1
Dbkf = 2.19
Dib = .7
Abkf = 61.3
Aib = 7.75
Elevation (ft)
105
100
95
90
0
10
20
30
40
50
60
Horizontal Distance (ft)


XS8 Glide STA 2+37
Ground Points
Bankfull Indicators
Water Surface Points
WbkF = 19.6
DbkF = 1.59
AbkF = 31.1
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

Top of Reach
XS1 Riffle 1/2

STA 43

SURVEY DATA ⟶ **CROSS - SECTION 1**

SITE: Date:

Location:

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	REMARKS / COMMENTS / NOTES
	1		~~5.91~~	~~105.91~~			
	2		5.49	105.49			
60	3	0			4.36		
56	4	4			4.14		
50	5	10			3.66		
49	6	11			3.81		Top of Right Bank
48	7	12			4.29		
47	8	13			4.84		
46	9	14			5.71		
45.6	10	14.4			7.88		Right Edge Water
43	11	17			8.34		
41	12	19			8.41		
39	13	21			8.36		IB
37	14	23			8.24		IB
35	15	25			8.35		IB
33	16	27			8.25		IB
31	17	29			8.19		IB
29	18	31			8.54		
28	19	32			8.56		
27	20	33			8.58		
26	21	34			8.79		
25	22	35			8.96		
24	23	36			9.02		Thalweg
23	24	37			8.82		
22	25	38			8.72		
21.2	26	38.8			7.89		Left Edge Water
20	27	40			6.38		
19	28	41			5.49		

Corrected Stationing

Floodprone width only on riffles

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Top Reach
XS 1 Riffle contour 2/2

SURVEY DATA ⟶ CROSS - SECTION 2

SITE: Date:

	Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
18	29	42			4.20		
17	30	43			3.59		Top left bank
9	31	51			3.65		
0	32	60			3.94		
19.9	33	40.1			6.59		Bankfull (Questionable)
19.6	34	40.4			6.40		Bankfull (Questionable)
19.2	35	40.8			5.95		Bankfull (Questionable)
23	36	37			8.95		
	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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STA 68 on profile. Reach 1 Top Reach XS 2 Run 1/2

SURVEY DATA ⟹ **CROSS - SECTION** 3

SITE: Date:

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29		5.49	105.49			
30	0.3			3.75		
31	7			3.41		
32	8			3.41		
33	9			3.48	102.01	Left Top Bank
34	10			3.65		
35	11			3.95		
36	12			4.61		
37	12.5			6.80	98.69	Bankfull ?
38	13.3			7.91		Edge of water left
39	14			8.24		
40	15			8.35		
41	16			8.85		
42	17			8.86		
43	18			8.83		
44	19			9.00		
45	19.3			9.06	96.43	Thalweg
46	21			8.86		
47	22			8.94		
48	23			8.93		
49	25			8.96		
50	27			8.78		
51	29			8.70		
52	31			8.64		
53	32			8.69		
54	33			8.49		
55	34			7.91		Right Edge water
56	34.7			6.82	98.67	Grade Break, Bankfull
57	35.3			6.00		Grade Break
58	35.8			5.60		Grade Break
59	36.7			4.64		Grade Break

7.91
−6.82
1.09

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SURVEY DATA ⟹ **CROSS - SECTION 4**

SITE: Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	38			4.17		
30	40			3.91	101.58	Top Bank Right
31	57			4.55		
32						
33						
34						
35						
36						
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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Top Reach XS3 Pool
STA 86

Reach 1

SURVEY DATA ⟹ CROSS - SECTION 5

SITE: Date: 3.4.20

5.6,

rise/run 2.2/12 18%

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	BM	5.70	105.76			
30	0			4.05		
31	6			4.15		
32	11			4.24		
33	13			4.02		Top Left Bank
34	14			4.26		
35	15			4.58		
36	16			5.12		Grade Break
37	17			5.60		
38	~~18~~ 17.5			6.62		
39	18			7.09		
40	19			7.38		
41	20			7.60		Top Point Bar
42	21			7.76		
43	23			8.18		
44	24.4			~~8.37~~ → 8.12		Left Edge water, .25 ft sunk into sediment
45	26.3			8.75		
46	28			8.96		
47	29			9.58		
48	30			9.96		
49	31.5			10.52		
50	32.6			10.45		
51	34.2			10.73		
52	35.6			10.84		
53	35.3			10.91		
54	36.8			10.48		
55	38			16.36		
56	39.2			10.09		
57	40			9.94		cobbles present
58	40.8			9.66		cobbles
59	41.8			9.09		cobbles

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Top Reach XS3 Pool
continued 2/2

8.11
- 7.07
1.1

SURVEY DATA → CROSS - SECTION 6

SITE: Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	42.2			8.11		Right Edge Water
30	43			7.51		
31	43.7			7.22		
32	44.4			7.07		Bankfull
33	45			6.90		Grade Break
34	46			6.49		Grade Break
35	47			5.92		
36	48			5.36		
37	49			5.28		Right Edge Bank
38	54			5.41		
39	63			5.53		
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

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Top Reach ~~XS~~4 Glide

STA 99

Reach 1

SURVEY DATA → CROSS - SECTION 7

SITE: Date:

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	BM	5.70	105.70			
30	0			4.10		
31	1			4.05		
32	3			4.04		
33	5			4.23		Top left Bank
34	7			4.58		
35	8			4.86		
36	9			5.36		
37	9.3			5.46		Grade Break
38	9.7			6.46		
39	10.2			7.07		
40	11			7.83		
41	11.5			8.12		left Water Surface
42	13			8.43		
43	14			8.54		Soft Deposition Material (Tail of upstream point bar)
44	15			8.62		
45	16			8.66		
46	17			8.51		
47	18			8.51		
48	19			8.74		End of Dep. Material
49	21			8.89		
50	23			9.06		
51	24			9.04		
52	25			8.96		
53	26			8.85		Limestone
54	27			8.97		
55	28			9.39		
56	29			8.81		
57	31			8.74		
58	32			8.79		
59	33			8.90		

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Top Reach XS4 Glide
cont. 1/2

Reach 1

SURVEY DATA ⟹ CROSS - SECTION 8

SITE: Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	34			8.46		
30	36.6			8.14		Right Edge water
31	37			7.82		IB
32	37.6			7.43		Grade Break
33	38.3			6.49		
34	37.5			7.02		Bankfull ?
35	39			5.05		
36	39.4			4.39		
37	40			4.19		Top Right Bank
38	47			3.98		
39	52			4.14		
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

8.14
6.49

7.10

1.04

.02

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SURVEY DATA ⟹ **CROSS - SECTION** @ 1 #5

SITE: Marsh Run Riffle **Date:** 1+42

Location: Reach 1

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	REMARKS / COMMENTS / NOTES
1	TBM	6.24	106.24		100	
2	0			4.40		Top L Bank - Terrace
3	0+1.5			4.21		
4	0+3			4.94		
5	5			7.62		
6	6.3			8.93		L Toe
7	6.5			9.11		H2O Level
8	8			9.45		
9	9			9.60		
10	10			9.38		
11	11			9.42		
12	13			9.40		
13	15			9.43		
14	17			9.49		
15	20			9.67		Thalweg
16	21			9.65		
17	22			9.62		
18	23			9.63		
19	24			9.65		
20	25			9.65		
21	26			9.34		H2O Level - R Toe
22	27.5			8.29		~~BKFl ? maybe Low~~
23	28			8.13		BKFl -> confident @ station 142
24	30			7.84		
25	32			7.01		
26	35			5.70		
27	37			4.85		
28	40			4.43		

BKFl station - measured until 8.13 Hit FP

+5.4

1.34 = dmax

floodplane = 3.08 depth
width = ~29'

BKFl width - 22.6

BKFl 1.21 →

FP 6.59 →

25 H2O Level 9.32

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SURVEY DATA ⟹ **CROSS - SECTION** 7

SITE: Reach 1 Riffle Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	42			4.25		
30	40			4.62		
31						
32						
33						
34						
35						
36						
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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#8

SURVEY DATA ⟹ **CROSS - SECTION** 6

SITE: Glide → chosen due to compound pool section **Date:**

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29		6.24	106.24		100.24	
30	0			4.51		Top Terrace L
31	1			3.41		
32	2			3.49		
33	3			4.74		
34	4			4.95		
35	5			5.52		
36	6			5.97		
37	8			5.99		
38	10			7.21		
39	12			7.78		Top Bank L
40	13			7.66		
41	13.5			8.43		
42	14			8.45		L BKFl → No good indicators...
43	15			9.14		
44	16			9.35		
45	17			9.53		
46	18			9.75		H2O Level L
47	19			10.08		↑ Deposition IB?
48	20			10.29		
49	21			10.44		
50	22			10.54		
51	23			10.66		Thalweg
52	24			10.60		
53	25			10.58		
54	26			10.56		
55	27			10.53		
56	28			10.60		
57	29			10.65		
58	30			9.92		
59	31.5			9.80		H2O Level - R Toe

14.5 - 8.88

8.16

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SURVEY DATA ⟹ **CROSS - SECTION 4**

SITE: Glide **Date:**

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	32			9.60		
30	33			9.13		
31	34			7.91		
32	35			6.03		
33	36			5.30		
34	37			4.61		Top of Bank (B)
35	38			4.62		
36	40			4.86		
37	44			4.46		Top Terrace
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

2.16 on staff plate @ 30+00

Bench mark @ gauge - 9.61 30+00

BKH @ gauge - 8.70 (17.54) 42+00 BKH = 1.21 Above H2O

H2O level - 9.91 42+00

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SURVEY DATA ⟹ **CROSS - SECTION** 8

SITE: Pool @ 2+05 **Date:**

continued

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS	
29	TBm	6.24	106.24				
30	0+37			10.91			
31	0+38			10.72			
32	0+39			10.42			
33	0+40			10.32			
34	0+42			9.82	96.42	w/level	97.62
35	0+42.5			9.75		Right Toe	97.82
36	0+43			9.52		inner berm	
37	0+44			9.3			
38	0+45			8.88			
39	0+45			8.65		BF	
40	0+47			6.81		Top of ~~left~~ Right Bank	
41	0+52			6.6		Terrace	
42	0+57			6.6		Terrace	
43							
44							
45							
46							
47			105.11				
48							
49	Point Bar			8.13	} 7'	Distance	
50				9.51			
51							
52							
53							
54							
55							
56							
57							
58							
59							

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SURVEY DATA ⟹ **CROSS - SECTION** 5 #4

SITE: Lateral scour Pool @ 2+05 **Date:**

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	TBM	6.24	106.24			
30	0+00			4.28		left Terrace
31	0+02			4.6		
32	0+04			4.95		
33	0+08			5.7		
34	0+11			6.37		
35	0+13			6.98		
36	0+15			7.45		Top of left Bank ?
37	0+16			7.62		
38	0+17			8.22		
39	0+17.5 0+18			8.58 8.83	BF	BF ?
40	0+19			9.36		
41	0+19.5			9.78		W/L left Bank
42	0+19.6			10.17		Toe of
43	0+20			10.16		Young Bar
44	0+21			10.32		
45	0+22			10.51		
46	0+23			10.54		
47	0+24			10.6		
48	0+25			10.57		
49	0+26			10.69		
50	0+27			10.7		
51	0+28.5			11.9		
52	0+29			11.2		
53	0+30			11.6		
54	0+31			11.83		Thalweg
55	0+32			11.8		
56	0+33			11.8		
57	0+34			11.72		
58	0+35			11.08		
59	0+36			11.02		

Bring this up

Bar

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SURVEY DATA ⟹ **CROSS - SECTION** 2 #6

SITE: Run @ 1+63 **Date:**

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	TBM	6.24				Peg in ground
30						
31	0+00			5.17		Terrace
32	0+2			5.2		
33	0+4			5.4		
34	0+6			5.57		Top of Left Bank
35	0+7			7.22		
36	0+8			8.56		BF ?
37	0+9			9.35		left Toe
38	0+9.4			9.6		W/L Level
39	0+10			9.76		
40	0+11			10.05		97.92
41	0+12			10.62		
42	0+13			10.38		Thalweg
43	0+14			10.2		
44	0+15			10.25		
45	0+16			10.3		
46	0+17			10.32		
47	0+18			10.3		
48	0+19			10.08		
49	0+20			10.14		
50	0+21			10.05		
51	0+22			10.15		
52	0+23			10.1		
53	0+24			9.98		
54	0+25			10.10		
55	0+26			10.13		
56	0+27			10.05		
57	0+28			9.78		
58	0+29.5			9.52	96.72	Water level
59	0+30			9.45		Toe but slumped to creek Deposition

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SURVEY DATA ⟹ **CROSS - SECTION** 3

SITE: Run @ 1+63 cont. Date:

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0+31.5	6.24	106.24	8.95		inner Berm
30	0+32			8.83		
31	0+33			8.32		BF But no good indicator other than undercut
32	0+33.5			7.15		
33	0+35			6.17		
34	0+36			5.75		
35	0+37			5.14		
36	0+38			5.0		
37	0+40			4.98		
38	0+43			4.83		Old Terrace Elevation
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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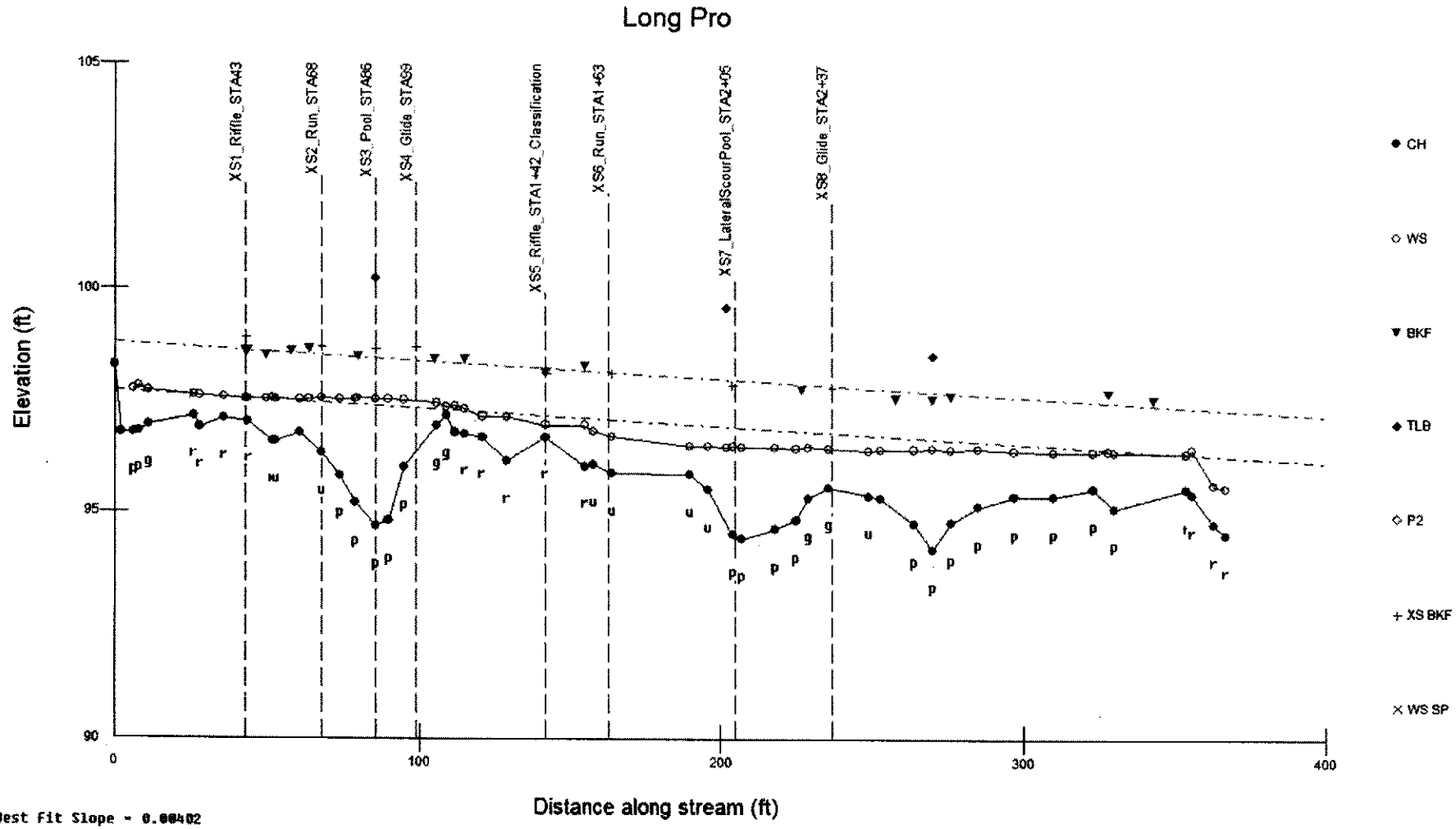

BKF Best Fit Slope = 0.00402
WS_SP Best Fit Slope = 0.00390

SURVEY DATA ⟹ **LONGITUDINAL PROFILE 1**

SITE: Marsh Creek at Grimes - Reach 1 **Date:** 4/16/15

Location: Mary Ann Camp

Party / Notes: Justin, Chris **HUC:**

	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Thalweg Fore-Sight FS (ft)	Thalweg Elevation Elev. (ft)	Water Surface Fore-Sight FS (ft)	Water Surface Elevation Elev. (ft)	Bankfull Fore-Sight FS (ft)	Bankfull Elevation Elev. (ft)	Low Bank HI Fore-Sight FS (ft)	Low Bank HI Elevation Elev. (ft)	NOTES e.g. Riffle Run Pool Glide
1		5.11	105.11									
2	0			6.84		6.14						In pool behind check
3	6			8.34		7.37						Bottom of Check dam
4	26			7.99		7.50						In Riffle (Top under bridge)
5	2			6.67		6.13						Top of Check dam
6	8			8.31		7.31						In Plum Pool dmax
7	11			8.17		7.40						Glide T
8	17											Top of riffle
9	28			8.23		7.52						
10	36			8.03		7.54				3.60		Bottom of riffle
11	44			8.09		7.59		6.52 station 42				~~Bottom~~ of riffle (Mid)
12	52			8.53		7.58						~~Run~~ Riffle
13	53			8.53		7.60				3.70		Run M/T
14	61			8.34		7.61						
15	58					7.54		6.51?				
16	64			6.47		7.59		6.47				
17	69			8.80		7.58				3.79	RB	
18	74			9.29		7.60				4.0	RB	
19	86			10.41		7.60		6.9		4.8	RB	X-Sect Mid pool
20	79			9.90		7.59						
21	90			10.29		7.60						Pool
22	95			9.11		7.61						Top of Glide
23	102			8.53		7.63				4.78	LB	
24	106			8.18		7.68						
25	80					7.56		6.64		4.62		
26	109			7.96		7.76						End of Glide
27	112			8.33		7.74						riffle

Station 43 x-sect 1.1

Bankfull 1.03

2.41 2.84 max depth

4.30 LB opposite bank

Top hydrolyc control T

Bankfull 0.92

hydrolyc control

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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 2**

SITE: Marsh Creek at Grimes — Date: 4/16/1

Location: Reach 1 Team 1

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	115			8.36	7.81	7.81		6.68				In control Riffle
29	121			8.43		7.97						Riffle
30	42			7.59	T.	7.59		6.52				
31	50					7.59		6.61				
32	129			8.96		7.98						
33	142			8.43		8.16		6.97				Mid Riffle x-sect
34	158			9.08		~~8.34~~		7.48				~~Top of run~~
35	158			9.04		8.36						Top of run
36	164			9.23		8.41						Mid run x-sect
37	196			9.59		8.62						bottom of run
38	190			9.26		8.63						
39	155					8.16		6.82				
40												
41	151									3.73	?	
42	164									3.96	?	
43	185									4.51	?	
44	202					8.66		7.57		5.50		
45	204			10.57		8.63		—		—		Pool — Top
46	207			10.68		8.66		—		—		Pool
47	218			10.46		8.65		—		—		Pool — bot
48	221			—		—		—		6.40		
49	227			—		—		7.36		—		
50	225			10.26		8.68						Pool / Glide
51	236			9.53		8.67		—		—		Glide
52	229			9.78		8.64		—		—		Glide
53												
54												

1.13
1.07
0.98
1.19
.89
2nd Bankfull Shot 1.3
*1.1
Pool

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SURVEY DATA ⟹ **LONGITUDINAL PROFILE 4** 3

SITE: Date:

Location: Reach 1 Team 1

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
82	249			9.72	~~8.72~~	8.72		—		—		RUN
83	258			—		—		—		7.55		
84	253			9.78		8.71		—		—		
85	264			10.34		8.69		—		—		LPP
86	270			10.91		8.68		7.56		6.58	?	"
87	276			10.31		8.71		7.51		—		~~RUN~~ Glide
88	285			9.96		8.67		—		—		RUN
89	297			9.73		8.72		—		—		RUN
90	310			9.74		8.75		—		—		RUN
91	323			9.56		8.74		—		—		Glide
92	330			9.99		8.75		—		—		Pool
93	336			—		—		7.74		—		
94	354			9.57		8.78						Riff - Top
95	356			9.69		8.67		—		—		Riff
96	343			—				7.57		—		
97	363			10.34		9.47		—		—		Riff
98	367			10.57		9.53		—		—		Rif - bot
99	328			—		8.73		7.42		—		
100	333							7.68				
101	105			—		—		6.69				
102	155							7.46				
103	237							7.71				
104												
105												
106												
107												
108												

Comp Pool

1.1

1.2

Plate = 8.46

1.2

@ Gage

XSec Glide

XSec Run

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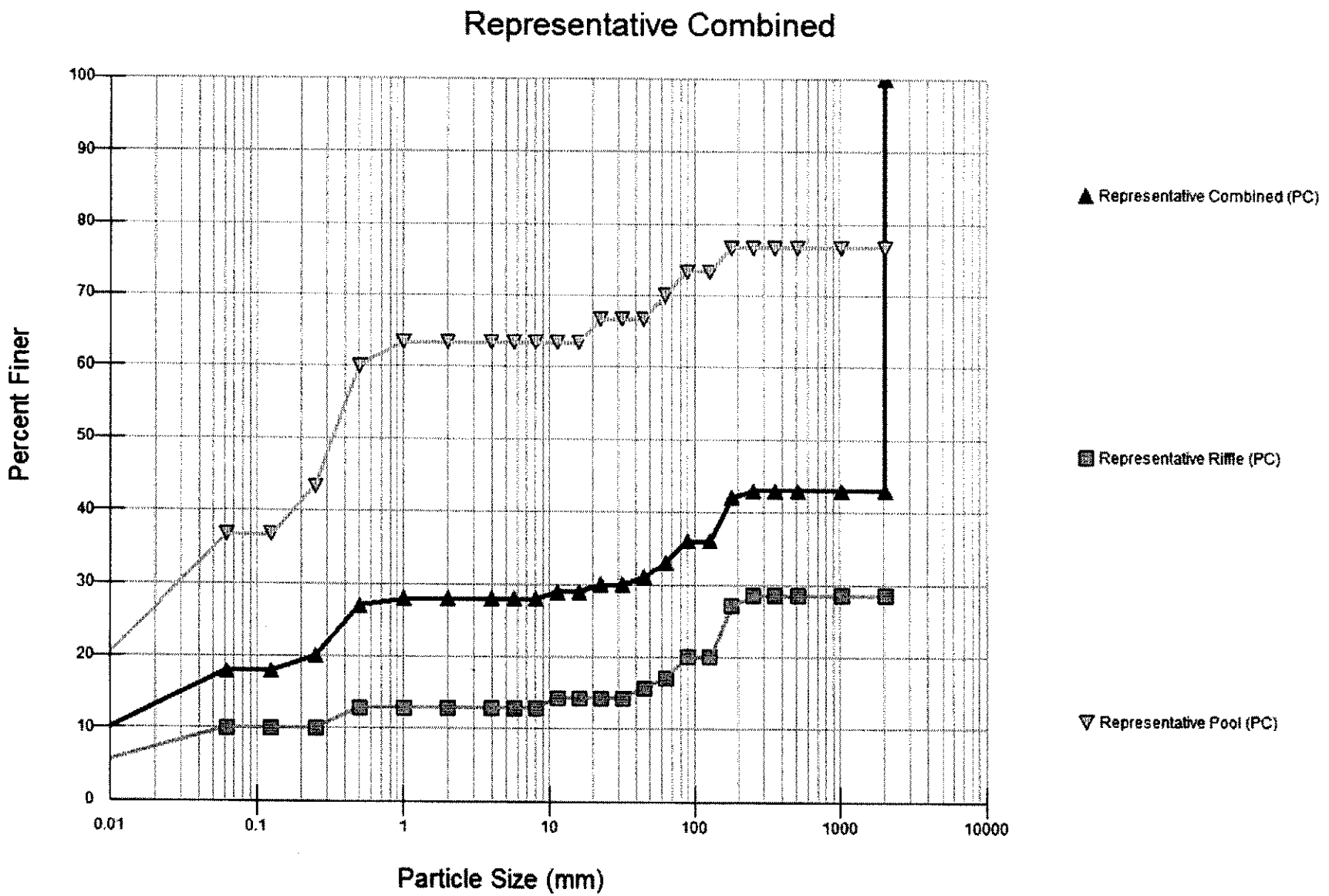
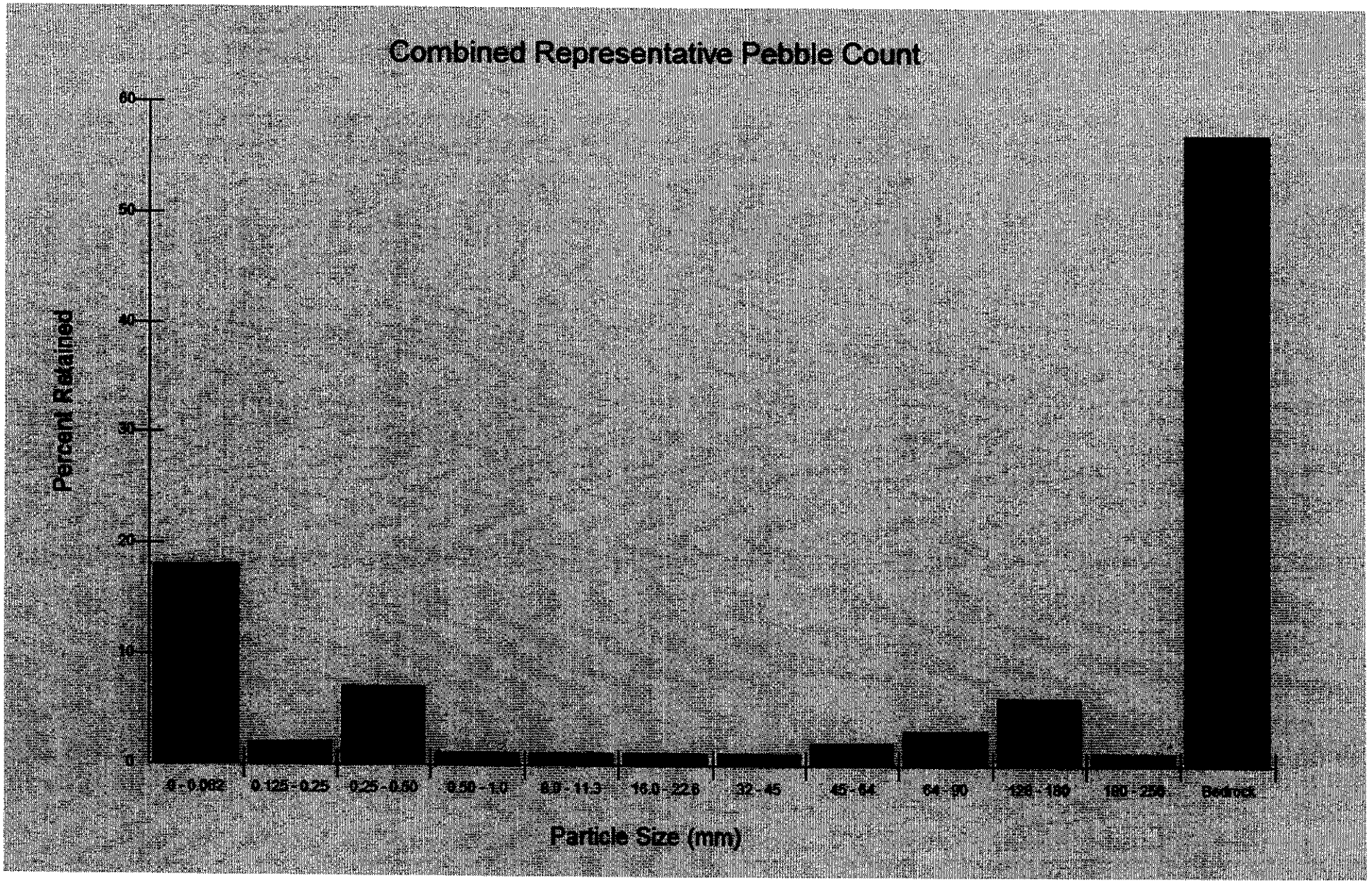
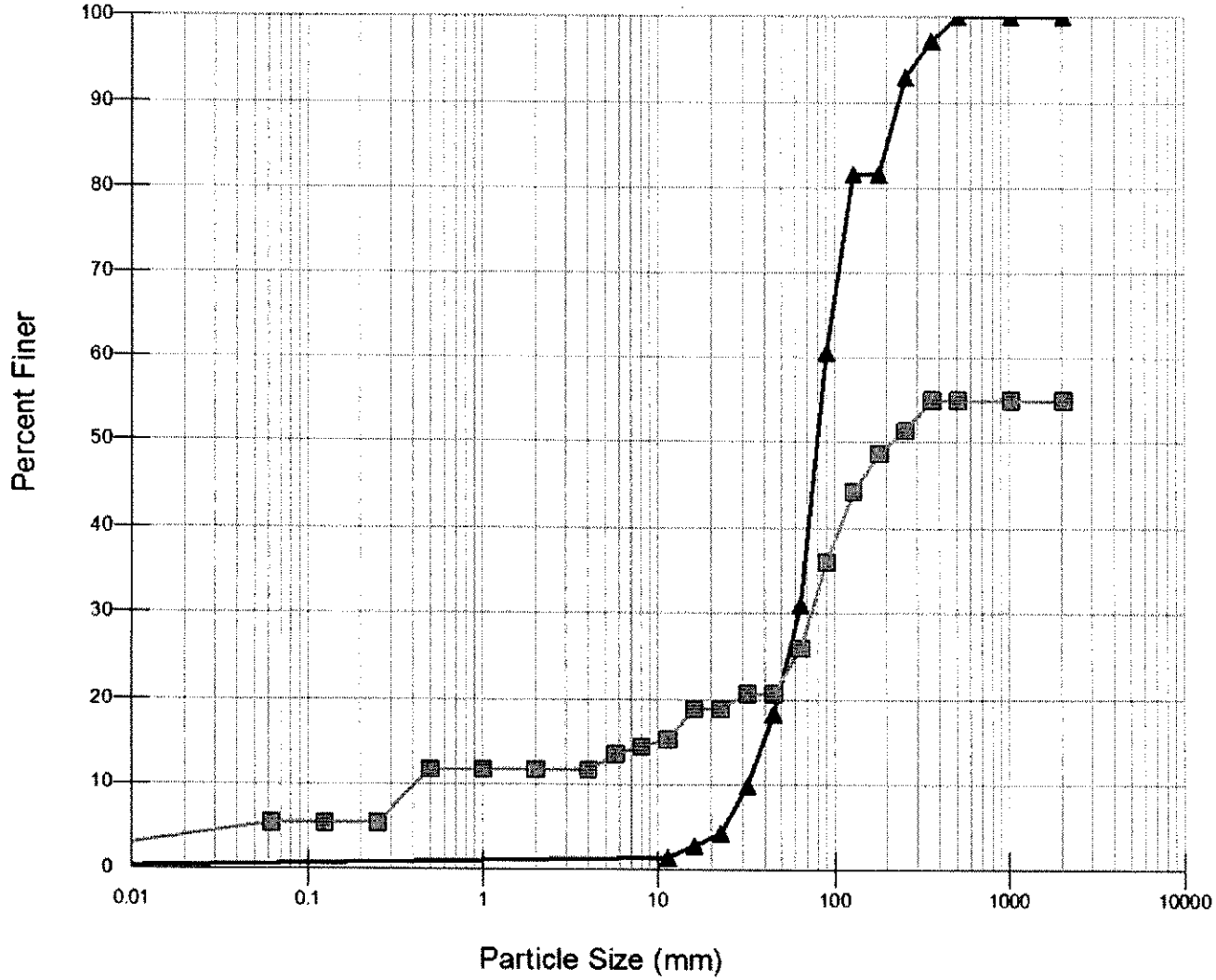

Representative Combined
Percent Finer
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)
Representative Combined (PC)
Representative Riffle (PC)
Representative Pool (PC)


Combined Representative Pebble Count
Percent Retained
60
50
40
30
20
10
0
0 - 0.062
0.125 - 0.25
0.25 - 0.50
0.50 - 1.0
8.0 - 11.3
16.0 - 22.6
32 - 45
45 - 64
64 - 90
125 - 180
180 - 250
Bedrock
Particle Size (mm)

Riffle #1 Protrusion vs. Normal PB

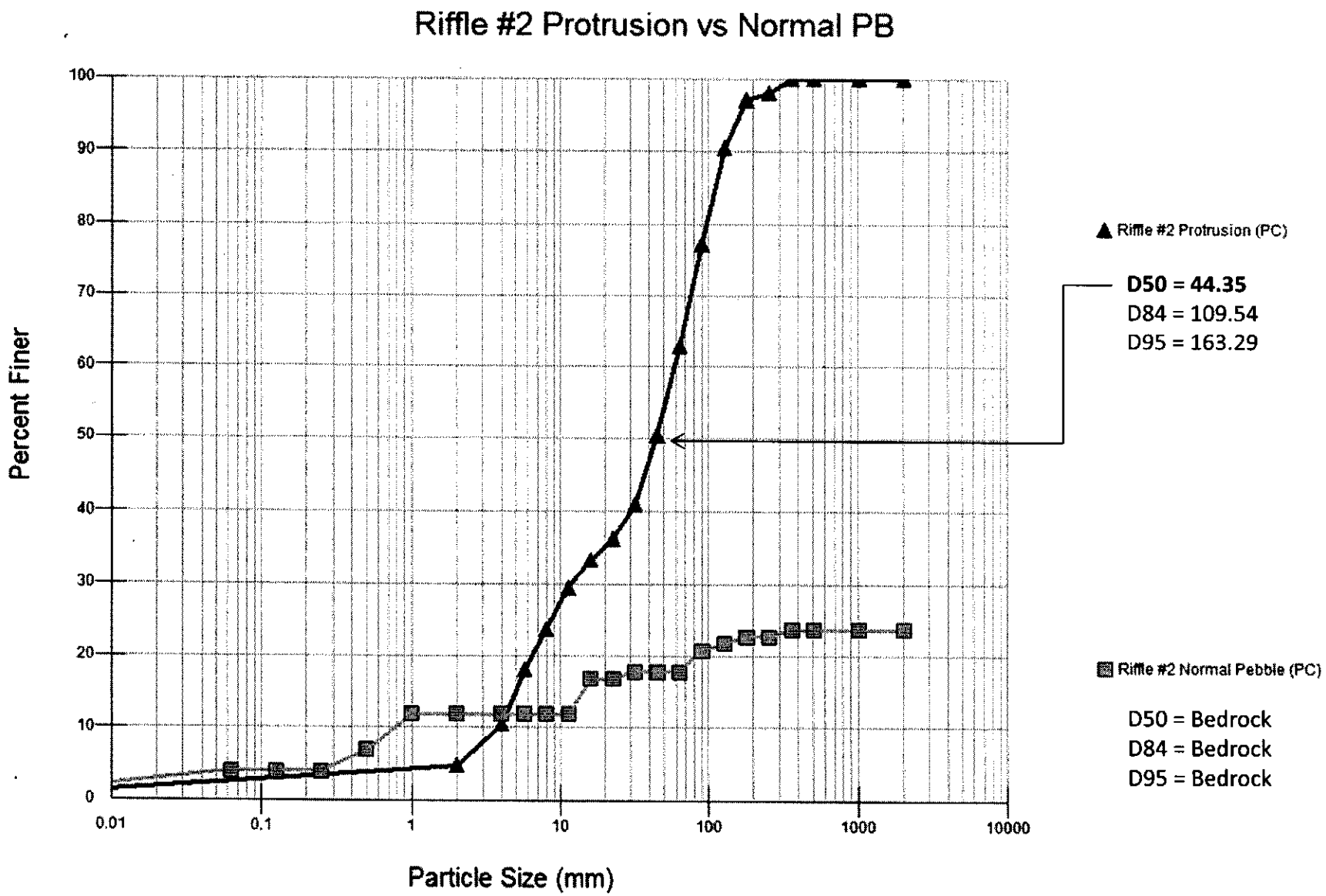


▲ Riffle #1 Protrusion (PC)

D50 = 80.71
D84 = 195.58
D95 = 307.24

■ Riffle #1 Normal Pebble (PC)

D50 = 218
D84 = Bedrock
D95 = Bedrock


Riffle #2 Protrusion vs Normal PB
Percent Finer
Particle Size (mm)
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Riffle #2 Protrusion (PC)
D50 = 44.35
D84 = 109.54
D95 = 163.29
Riffle #2 Normal Pebble (PC)
D50 = Bedrock
D84 = Bedrock
D95 = Bedrock

Riffle #1 Protrusion Heights

Regular Pebble Riffle #1

Riffle 2 Protrusion

Riffle 2 Regular pebble

Reach 1

Site: Marsh Run Date: 4-16-15

Location: MD HUC:

Party: Robinson, Chapman

Dot Count for Riffle

Inches	PARTICLE	Millimeters		RIFFLE 1	~~POOL~~ Riffle 1	~~COMP~~ Riffle 2	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
				Reach:			Reach:			Reach:			Reach:		
				Date:			Date:			Date:			Date:		
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.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												
Stream Type:			**Valley Type:**			TOTAL→									

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STA 1+19 (Riffle) 100 pr
100 active pebble in riffle

D50 only

Site: Marsh Run Team 1				Date: 4/16/15			RIFFLE (1)			POOL (2)			COMPOSITE (3)		
Location:			HUC:				Reach:			Reach:			Reach:		
Party: Jesse Robinson / John Chapman				Dot Count for			Date:			Date:			Date:		
Inches	PARTICLE	Millimeters		RIFFLE 1	POOL 2	COMP. 3	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												
Stream Type:			**Valley Type:**			TOTAL→									

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Worksheet 2-2. Computations of velocity and bankfull discharge using various methods (Rosgen, 2006b; Rosgen and Silvey, 2007).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Marsh Run	Location:	Reach - Team 1
Date:		Stream Type: F1	Valley Type: Unconfined Alluvial
Observers:		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	28.38	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.26	d_{bkf} (ft)
Bankfull Riffle WIDTH	22.49	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	23.38	W_p (ft)
D_{84} at Riffle	109.54	Dia. (mm)	D_{84} (mm) / 304.8	0.36	D_{84} (ft)
Bankfull SLOPE	0.0040	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.21	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	3.37	R / D_{84}
Drainage Area	18.9	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	0.396	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	2.31	ft / sec	65.49	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.0428	2.51	ft / sec	71.12	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0	0.00	ft / sec	0.00	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 $n =$ 0.047	2.31	ft / sec	65.44	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller)	2.41	ft / sec	68.28	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Chezy C	0.00	ft / sec	0.00	cfs
4. Continuity Equations: a) Regional Curves $u = Q / A$ Return Period for Bankfull Discharge Q = 0.0 year	0.00	ft / sec	0.00	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	0.00	ft / sec	0.00	cfs

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

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

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Worksheet 5-3. Field form for Level II stream classification (Rosgen, 1996; Rosgen and Silvey, 2005).

Stream:	**MarshRun, Reach - Reach 1**		
Basin:	Drainage Area: **12096** acres	**18.9**	mi^2
Location:			
Twp.&Rge: ;	Sec.&Qtr.: ;		
Cross-Section Monuments (Lat./Long.):	**0 Lat / 0 Long**	Date: **04/16/15**	
Observers: **Team 1**		Valley Type: VIII(c)	

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	**22.49**	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	**1.26**	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	**28.38**	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	**17.85**	ft/ft
Maximum DEPTH (d_{mbkf}) Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and Thalweg elevations, in a riffle section.	**1.54**	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.	**28.73**	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	**1.28**	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.	**2048**	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.	**0.00402**	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).	**1.21**	

Stream Type **F 6/1** (See **Figure 2-14**)

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Worksheet 5-4. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **MarshRun** Location: **Reach - Reach 1**

Observers: **Team 1** Date: **04/16/15** Valley Type: **XIV** Stream Type: **F 1**

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, ***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios****	Mean	Min	Max
Riffle Width (W_{bkf})	24.2	22.5	25.9	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	37.14	28.38	45.90
Mean Riffle Depth (d_{bkf})	1.52	1.26	1.77	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	16.25	14.66	17.85
Maximum Riffle Depth (d_{max})	1.99	1.54	2.43	ft	Max Riffle Depth to Mean Riffle Depth (d_{max} / d_{bkf})	1.298	1.222	1.373
Width of Flood-Prone Area (W_{fpa})	31.2	28.7	34	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.294	1.277	1.310
Riffle Inner Berm Width (W_{ib})	22.4	22.4	22.4	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	0.862	0.862	0.862
Riffle Inner Berm Depth (d_{ib})	0.28	0.28	0.28	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	0.156	0.156	0.156
Riffle Inner Berm Area (A_{ib})	6.18	6.18	6.18	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	0.135	0.135	0.135
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	80.9	80.9	80.9					

Pool Dimensions*, **, ***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios****	Mean	Min	Max
Pool Width (W_{bkfp})	27.2	26.4	28	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	1.123	1.091	1.155
Mean Pool Depth (d_{bkfp})	2.14	2.09	2.19	ft	Mean Pool Depth to Mean Riffle Depth (d_{bkfp} / d_{bkf})	1.408	1.375	1.441
Pool Cross-Sectional Area (A_{bkfp})	58.3	55.3	61.3	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.570	1.489	1.651
Maximum Pool Depth (d_{maxp})	3.68	3.52	3.84	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.421	2.316	2.526
Pool Inner Berm Width (W_{ibp})	11.1	11.1	11.1	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	0.396	0.396	0.396
Pool Inner Berm Depth (d_{ibp})	0.7	0.7	0.7	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	0.320	0.320	0.320
Pool Inner Berm Area (A_{ibp})	7.75	7.75	7.75	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	0.126	0.126	0.126
Point Bar Slope (S_{pb})	0.190	0.180	0.200	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	15.810	15.810	15.810

Run Dimensions*	Mean	Min	Max		Run Dimensionless Ratios****	Mean	Min	Max
Run Width (W_{bkfr})	23.5	22.2	24.9	ft	Run Width to Riffle Width (W_{bkfr} / W_{bkf})	0.972	0.917	1.026
Mean Run Depth (d_{bkfr})	1.69	1.55	1.83	ft	Mean Run Depth to Mean Riffle Depth (d_{bkfr} / d_{bkf})	1.112	1.020	1.204
Run Cross-Sectional Area (A_{bkfr})	39.6	38.4	40.7	ft	Run Area to Riffle Area (A_{bkfr} / A_{bkf})	1.065	1.034	1.096
Maximum Run Depth (d_{maxr})	2.15	2.04	2.25	ft	Max Run Depth to Mean Riffle Depth (d_{maxr} / d_{bkf})	1.414	1.342	1.480
Run Width/Depth Ratio (W_{bkfr} / d_{bkfr})	14.1	12.1	16	ft				

Glide Dimensions*	Mean	Min	Max		Glide Dimensions & Dimensionless Ratios****	Mean	Min	Max
Glide Width (W_{bkfg})	23.5	19.6	27.3	ft	Glide Width to Riffle Width (W_{bkfg} / W_{bkf})	0.968	0.808	1.129
Mean Glide Depth (d_{bkfg})	1.62	1.59	1.64	ft	Mean Glide Depth to Mean Riffle Depth (d_{bkfg} / d_{bkf})	1.066	1.046	1.079
Glide Cross-Sectional Area (A_{bkfg})	38	31.1	44.8	ft	Glide Area to Riffle Area (A_{bkfg} / A_{bkf})	1.022	0.838	1.206
Maximum Glide Depth (d_{maxg})	2.29	2.21	2.37	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	1.507	1.454	1.559
Glide Width/Depth Ratio (W_{bkfg} / d_{bkfg})	14.5	12.3	16.7	ft/ft	Glide Inner Berm Width/Depth Ratio (W_{ibg} / d_{ibg})	28.859	28.859	28.859
Glide Inner Berm Width (W_{ibg})	26	26	26	ft	Glide Inner Berm Width to Glide Width (W_{ibg}/W_{bkfg})	0.951	0.951	0.951
Glide Inner Berm Depth (d_{ibg})	0.9	0.9	0.9	ft	Glide Inner Berm Depth to Glide Depth (d_{ibg} / d_{bkfg})	0.550	0.550	0.550
Glide Inner Berm Area (A_{ibg})	23.4	23.4	23.4	ft^2	Glide Inner Berm Area to Glide Area (A_{ibg} / A_{bkfg})	0.523	0.523	0.523

Step**	Mean	Min	Max		Step Dimensionless Ratios****	Mean	Min	Max
Step Width (W_{bkfs})	0	0	0	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	0.000	0.000	0.000
Mean Step Depth (d_{bkfs})	0	0	0	ft	Mean Step Depth to Riffle Depth (d_{bkfs} / d_{bkf})	0.000	0.000	0.000
Step Cross-Sectional Area (A_{bkfs})	0	0	0	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.000	0.000	0.000
Maximum Step Depth (d_{maxs})	0	0	0	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	0.000	0.000	0.000
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	0	0	0					

*Riffle–Pool system (i.e., C, E, F stream types) bed features include riffles, runs, pools and glides.

**Step–Pool system (i.e., A, B, G stream types) bed features include riffles, rapids, chutes, pools and steps (note: include rapids and chutes in riffle category).

***Convergence-Divergence system (i.e., D stream types) bed features include riffles and pools; cross-sections taken at riffles for classification purposes.

****Mean values are used as the normalization parameter for all dimensionless ratios; e.g., minimum pool width to riffle width ratio uses the *mean* riffle width value.

Worksheet 2-2. Computations of velocity and bankfull discharge using various methods (Rosgen, 2006b; Rosgen and Silvey, 2007).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	MarshRun	Location:	Reach - Reach 1
Date: 4/16/2015	Stream Type: F6/1	Valley Type:	Unconfined Alluvial
Observers:		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	28.38	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.26	d_{bkf} (ft)
Bankfull Riffle WIDTH	22.49	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	23.38	W_p (ft)
D_{84} at Riffle	44.35	Dia. (mm)	D_{84} (mm) / 304.8	0.15	D_{84} (ft)
Bankfull SLOPE	0.0040	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.21	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	8.29	R / D_{84}
Drainage Area	18.9	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	0.396	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	3.19	ft / sec	90.50	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.0317	3.38	ft / sec	96.01	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0	0.00	ft / sec	0.00	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 $n =$ 0.047	2.31	ft / sec	65.44	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller)	3.32	ft / sec	94.12	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Chezy C	0.00	ft / sec	0.00	cfs
4. Continuity Equations: a) Regional Curves $u = Q / A$ Return Period for Bankfull Discharge Q = 0.0 year	0.00	ft / sec	0.00	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	0.00	ft / sec	0.00	cfs

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

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

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

Stream: Marsh Run Location: Grimes, MD

Observers: Team 1 Stream Type: F4/6 Valley Type: VIII, Alt 4 Date: 4/16/15

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	22.05	3.6	0.00047	Mean	0.98	2.86	0.117
	Min.	21.2	3.52	0.0002	Min.	0.94	2.79	0.05
	Max.	22.9	3.73	0.00074	Max.	1.02	2.96	0.185
2. Contraction Scour Pool (CSP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
3. Step/Pool (SP)	Mean				Mean			
	Min.				Min.			
	Max.				Max.			
4. Backwater Pool (BWP)	Mean	68.85	2.32	.0021	Mean	3.06	1.84	0.525
	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	12.19	3.5	.0007	Mean	0.54	2.78	0.175
	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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Team 1
4/16/15

Worksheet B-5. Procedure to validate hydraulic relations using gage 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: Marsh Run at Grimes, MD **Gaging Station Number:** 01617800

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)	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	96.01	22.5	1.26	28.38	3.38	0.0040	44.35	0.145	F4/b	0.0313	8.34	0.39	8.77

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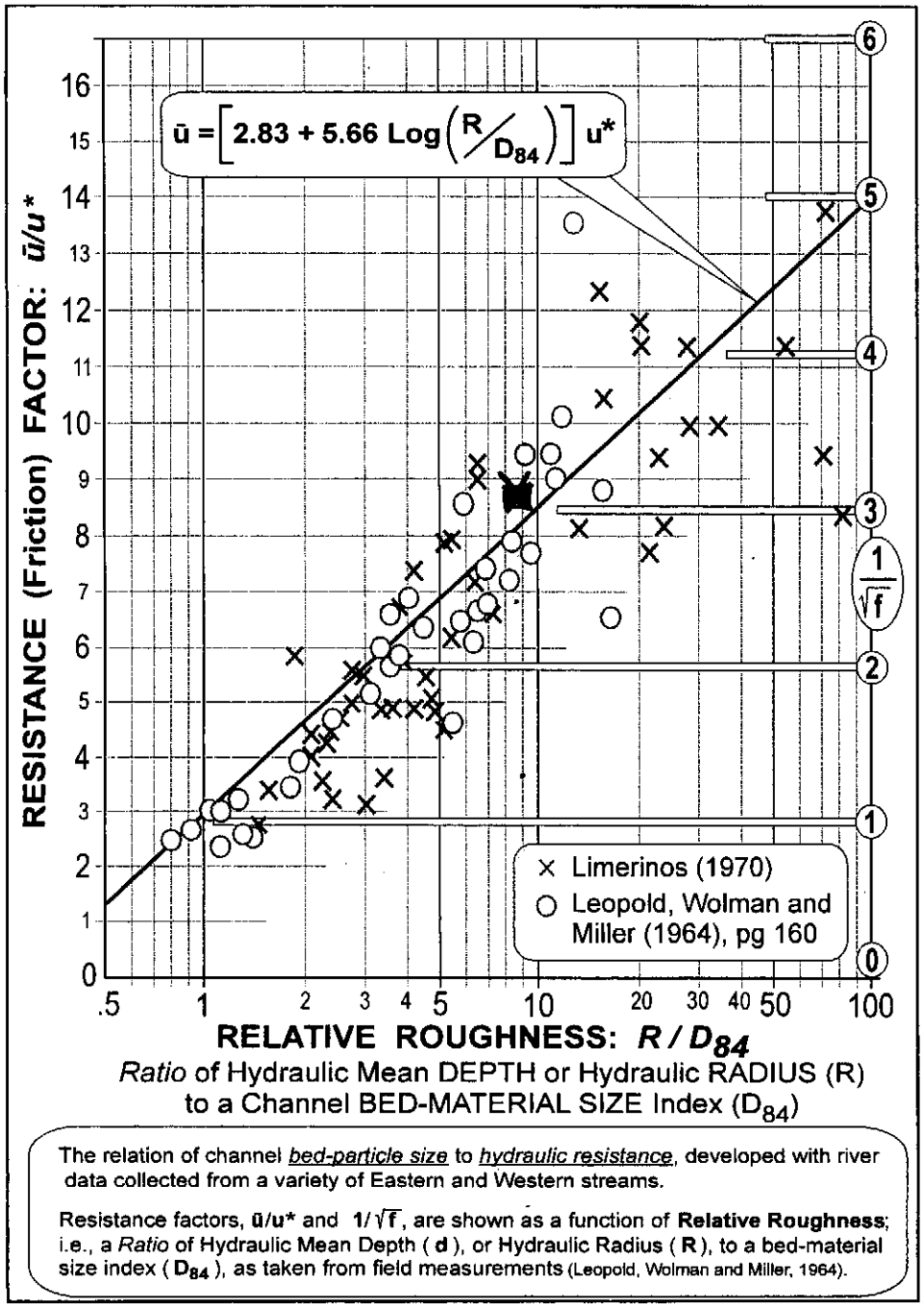

Figure B-34. Relative roughness (R/D_{84}) *vs.* friction factor ($\bar{u}/u^*$).

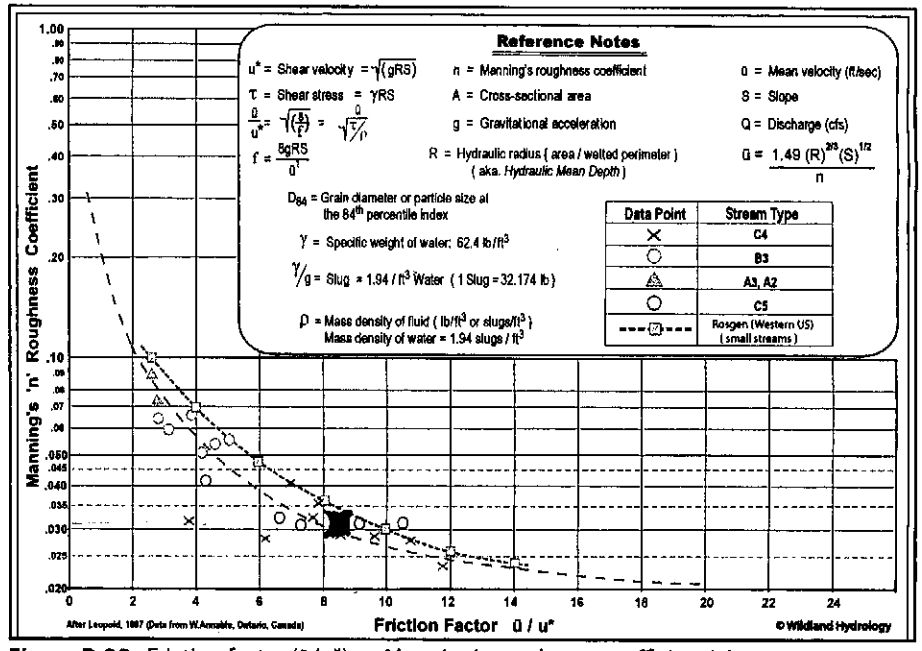

Figure B-35. Friction factor ($\bar{u}/u^*$) *vs.* Manning's roughness coefficient 'n'.

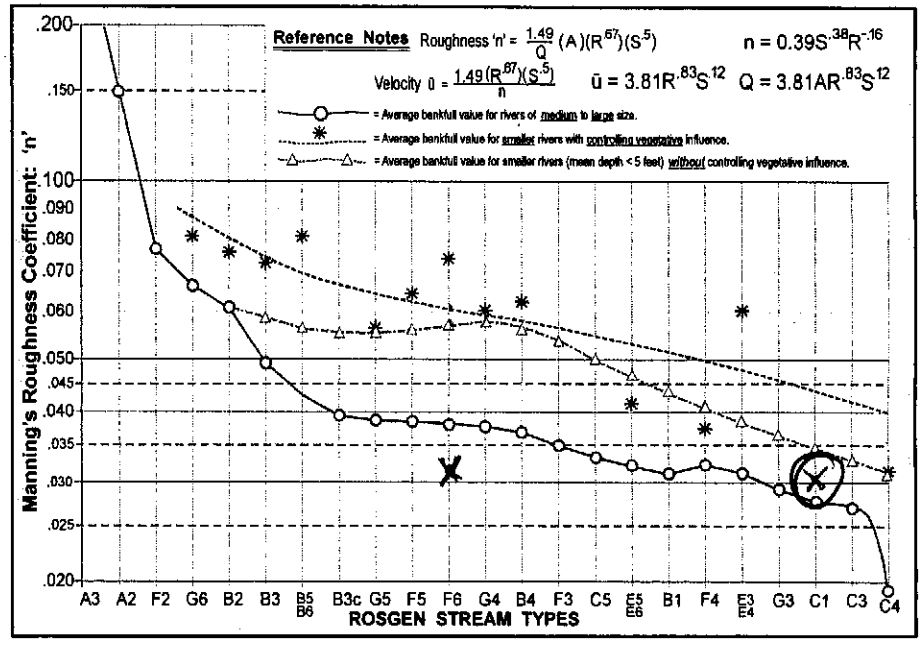

Figure B-36. Manning's 'n' roughness coefficient by stream type.

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

Station NAME:	Marsh Run @ Grimes, MD			Station Number:	01617800
LOCATION:	Grimes, MD				
Period of Record:	52	yrs		Mean Annual DISCHARGE:	0.924 cfs
Drainage AREA:	12096 acres	18.9	mi²	Drainage Area Mn Elev:	354.07 ft
Reference REACH SLOPE:		ft/ft		Valley Type:	AL-U-FD
Stream Type:	F b/b			HUC:	02070004 40

"BANKFULL" CHARACTERISTICS

Determined from FIELD MEASUREMENT			Determined from GAGE DATA Analysis		
Bankfull WIDTH (W_{bkf})	22.5	ft	Bankfull WIDTH (W_{bkf})	15.6	ft
Bankfull Mean DEPTH (d_{bkf})	1.26	ft	Bankfull MEAN DEPTH (d_{bkf})	1.76	ft
Bankfull Xsec AREA (A_{bkf})	28.38	ft²	Bankfull Xsec AREA (A_{bkf})	42.34	ft²
Wetted PERIMETER (W_P)	23.38	ft	Wetted PERIMETER (W_P)	19.12	ft
Bankfull STAGE (Gage Ht)	2.16	ft	Bankfull STAGE (Gage Ht)	2.00	ft
Est. Mean VELOCITY (u)	3.38	ft/sec	Mean VELOCITY (u)	2.63	ft/sec
Est. Bkf. DISCHARGE (Q_{bkf})	96.01	cfs	Bankfull DISCHARGE (Q_{bkf})	111.5	cfs

Bankfull DISCHARGE associated with **"field-determined"** Bankfull STAGE (From Gage Height reading at Staff Plate and tabular Stage-Discharge curve data) — 110 cfs

Recurrence Interval (Log-Pearson) associated with **"field-determined"** Bankfull Discharge — 1.9 yrs

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

1.5 Year R.I. Discharge =	73	cfs	10 Year R.I. Discharge =	276	cfs
2.0 Year R.I. Discharge =	105	cfs	25 Year R.I. Discharge =	442	cfs
5.0 Year R.I. Discharge =	200	cfs	50 Year R.I. Discharge =	458	cfs

MEANDER GEOMETRY

Meander Wavelength (L_m)	90.5	ft	Radius of Curvature (R_C)	39.3	ft
Belt Width (W_{blt})	47.9	ft	Meander Width Ratio (W_{blt}/W_{bkf})	2.21	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)	12.708	0.4066	3.916	0.258
Slope Exponent b)	0.0227	0.3106	0.504	0.4928

Hydraulic Radius $R = A / W_P$	1.21	ft	Manning's "n" at Bankfull Stage	0.0313	Coeff.

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