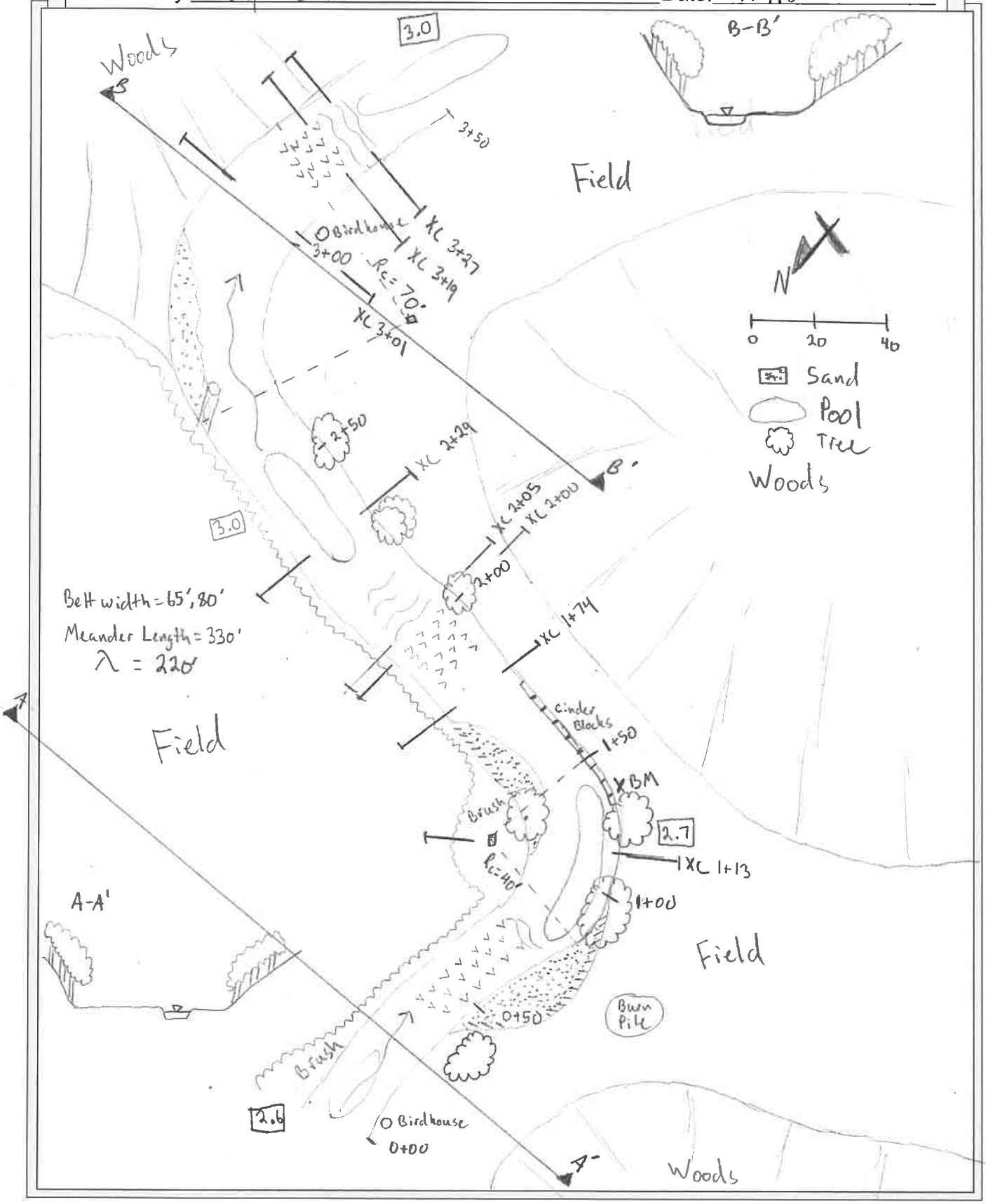
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Marsh Run Site/Reach: 4

Drawn By: Corey + Seth Date: 4/19/18



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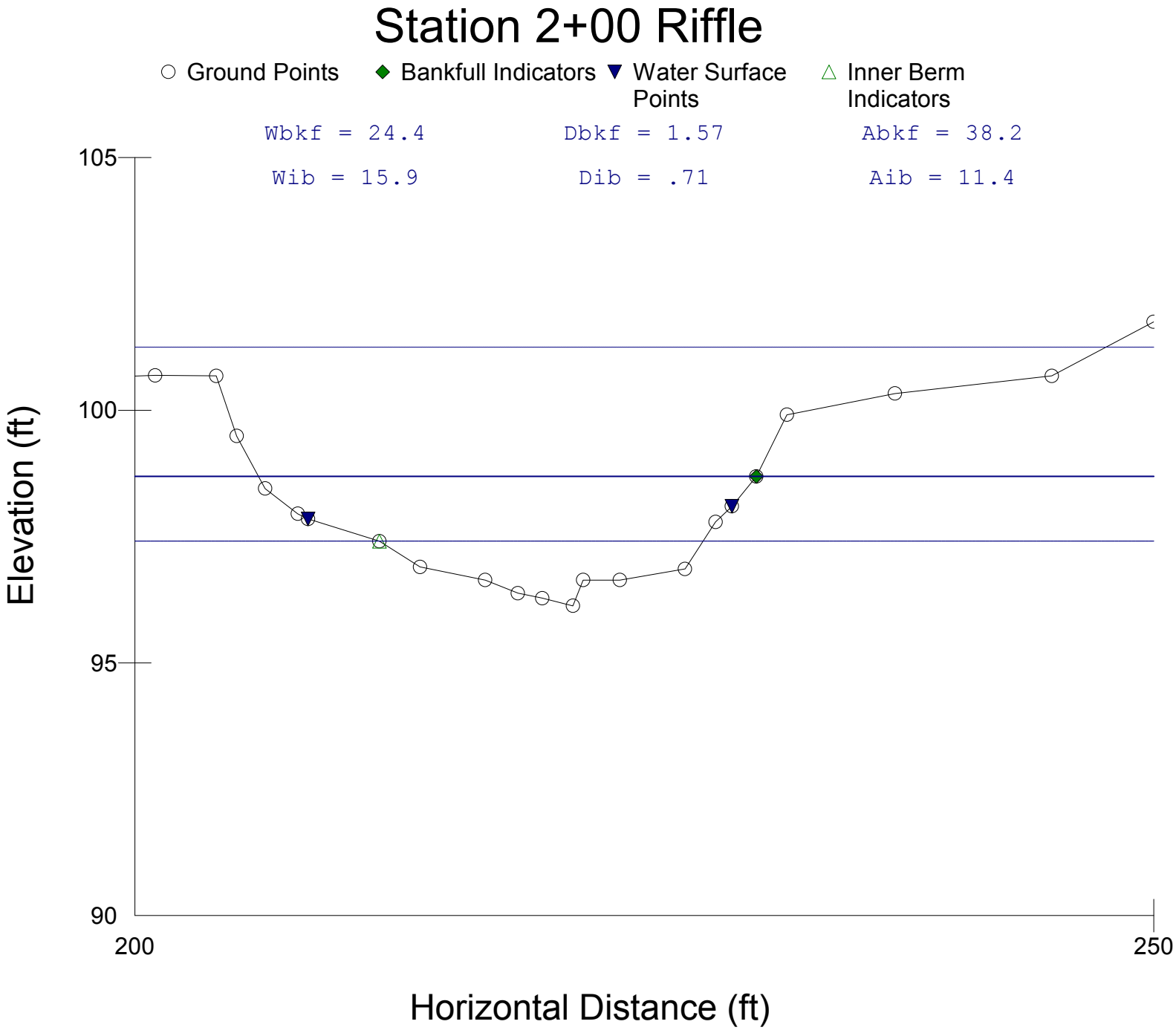
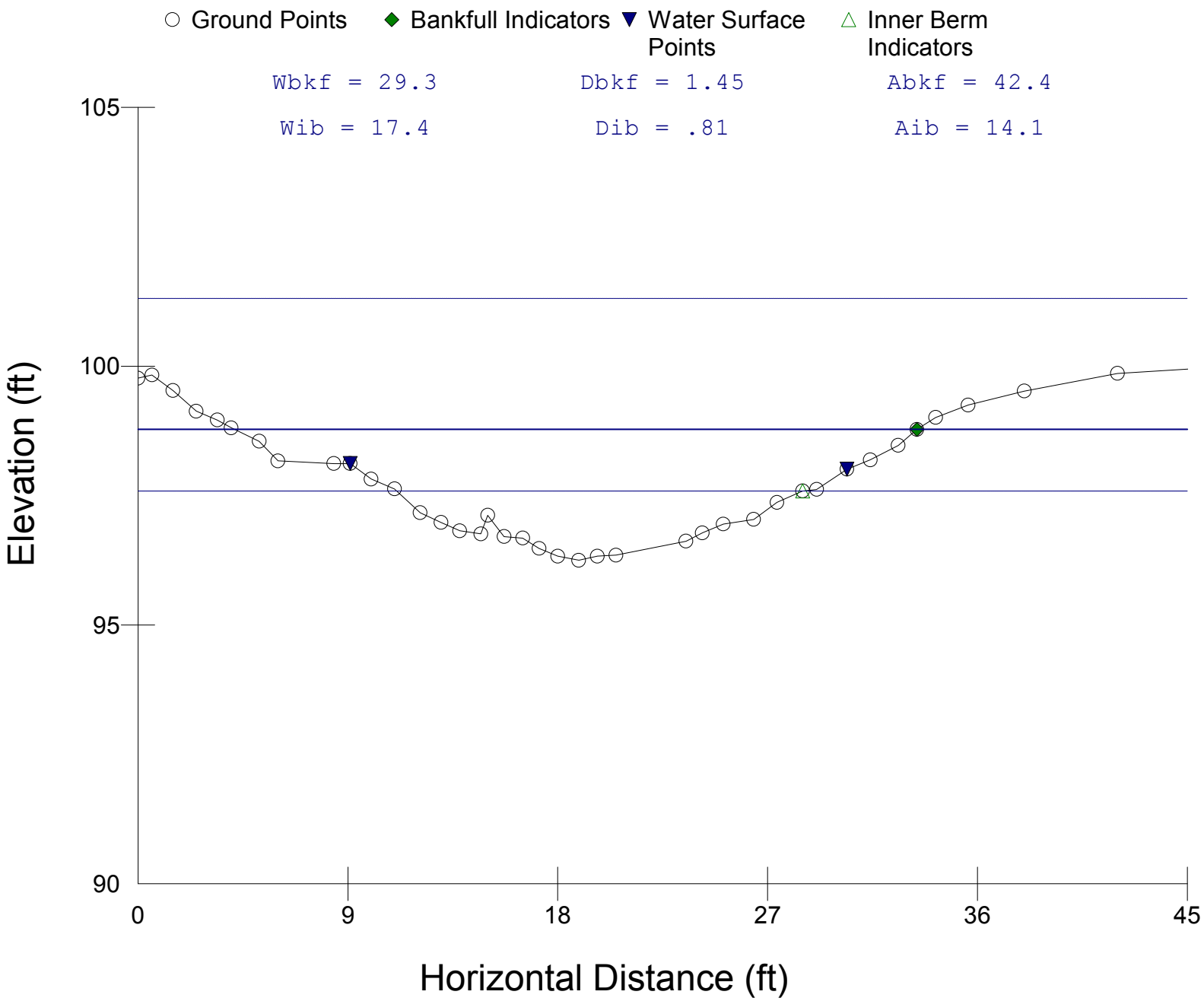
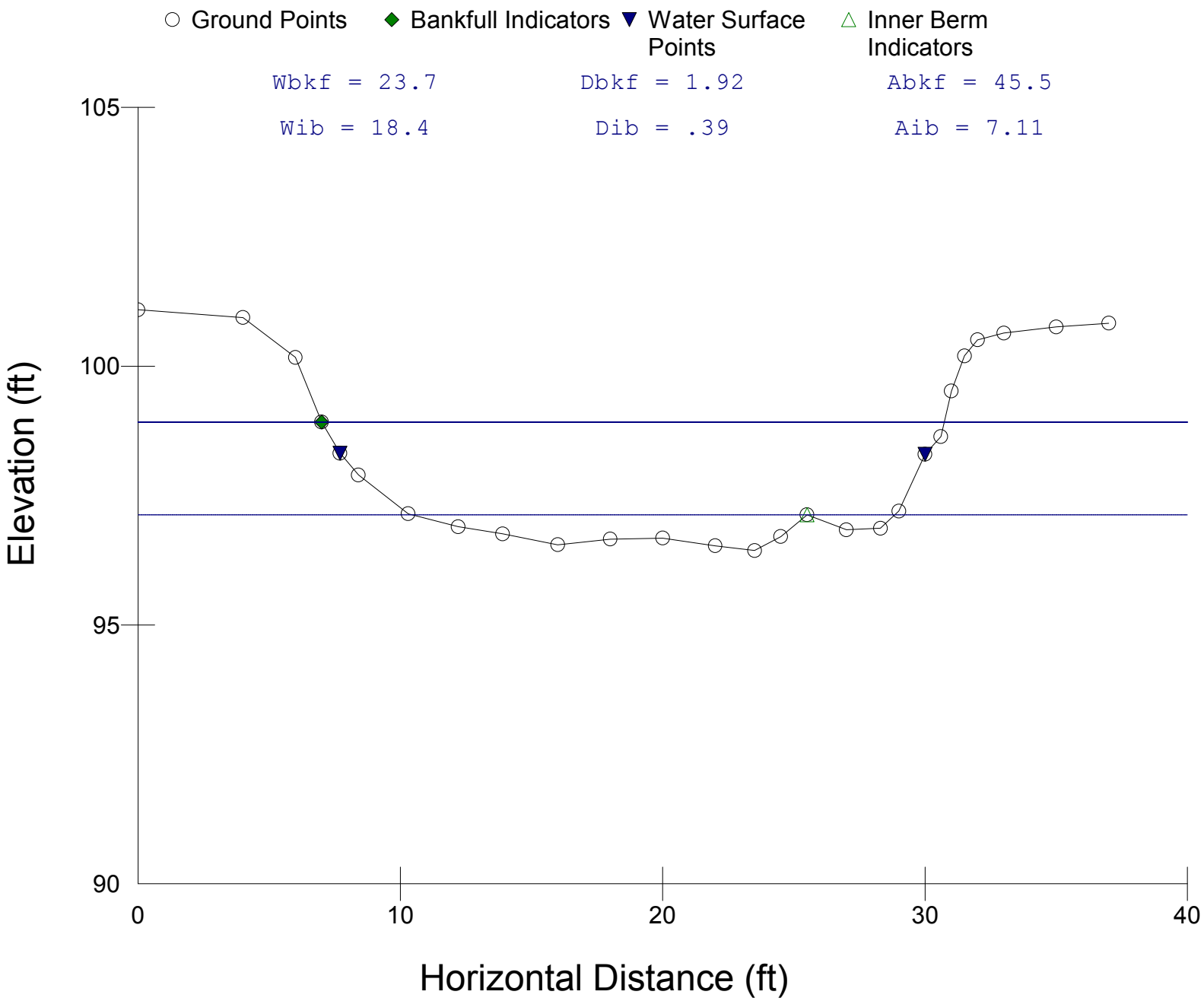

Station 2+00 Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 24.4
Dbkf = 1.57
Abkf = 38.2
Wib = 15.9
Dib = .71
Aib = 11.4
105
100
95
90
200
250
Elevation (ft)
Horizontal Distance (ft)

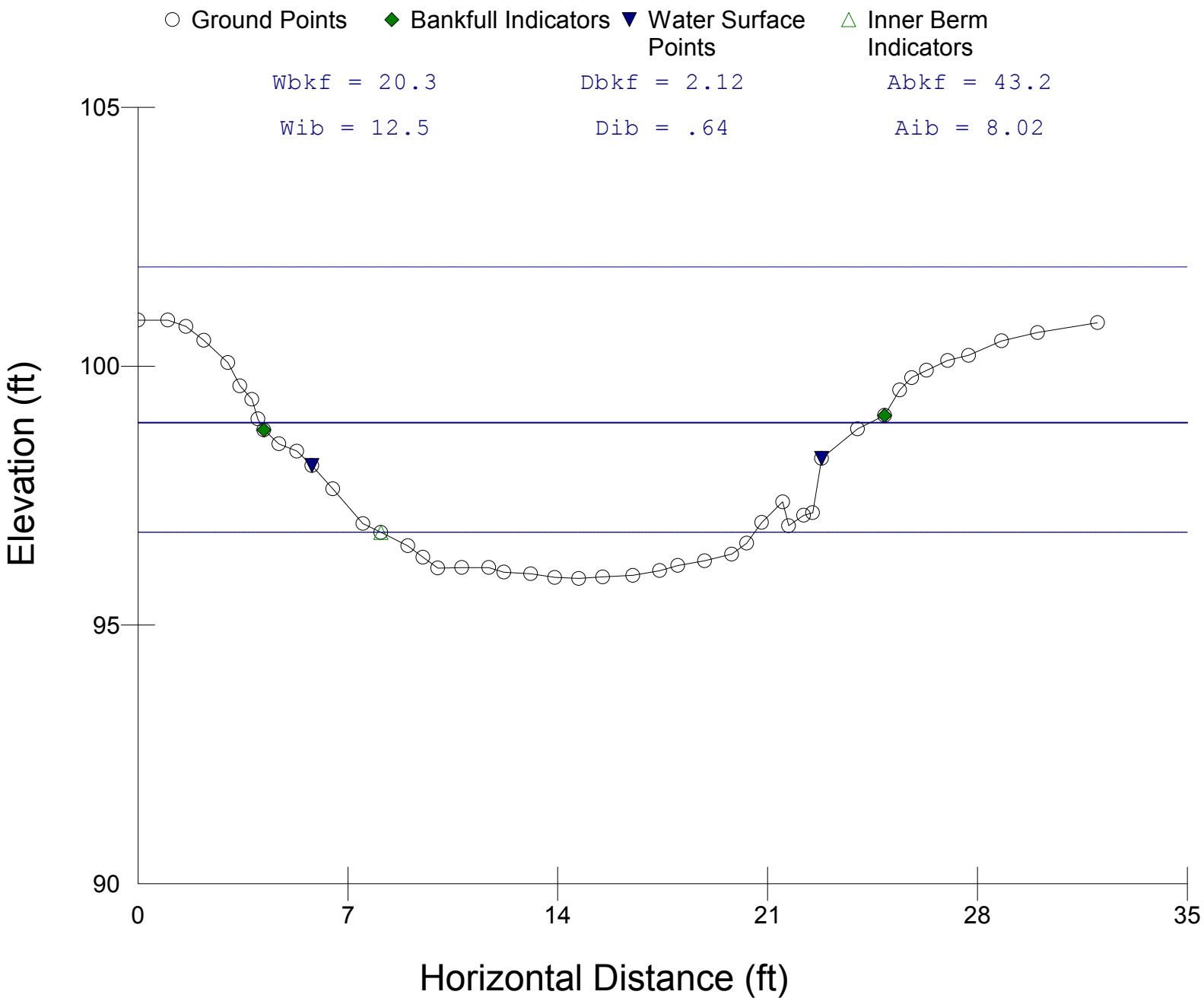
Team 4 - XS @ STA 3+19 - Riffle

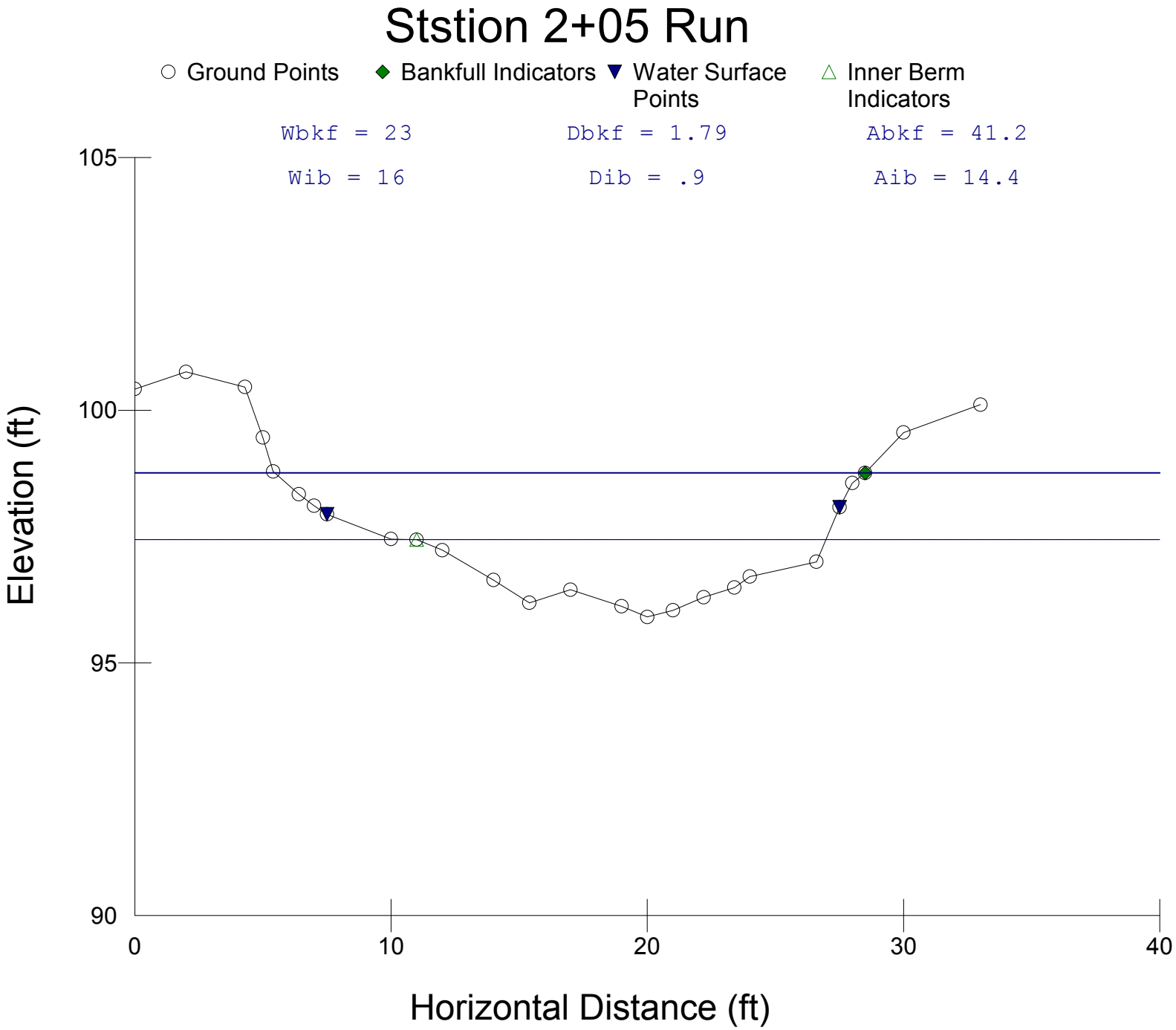


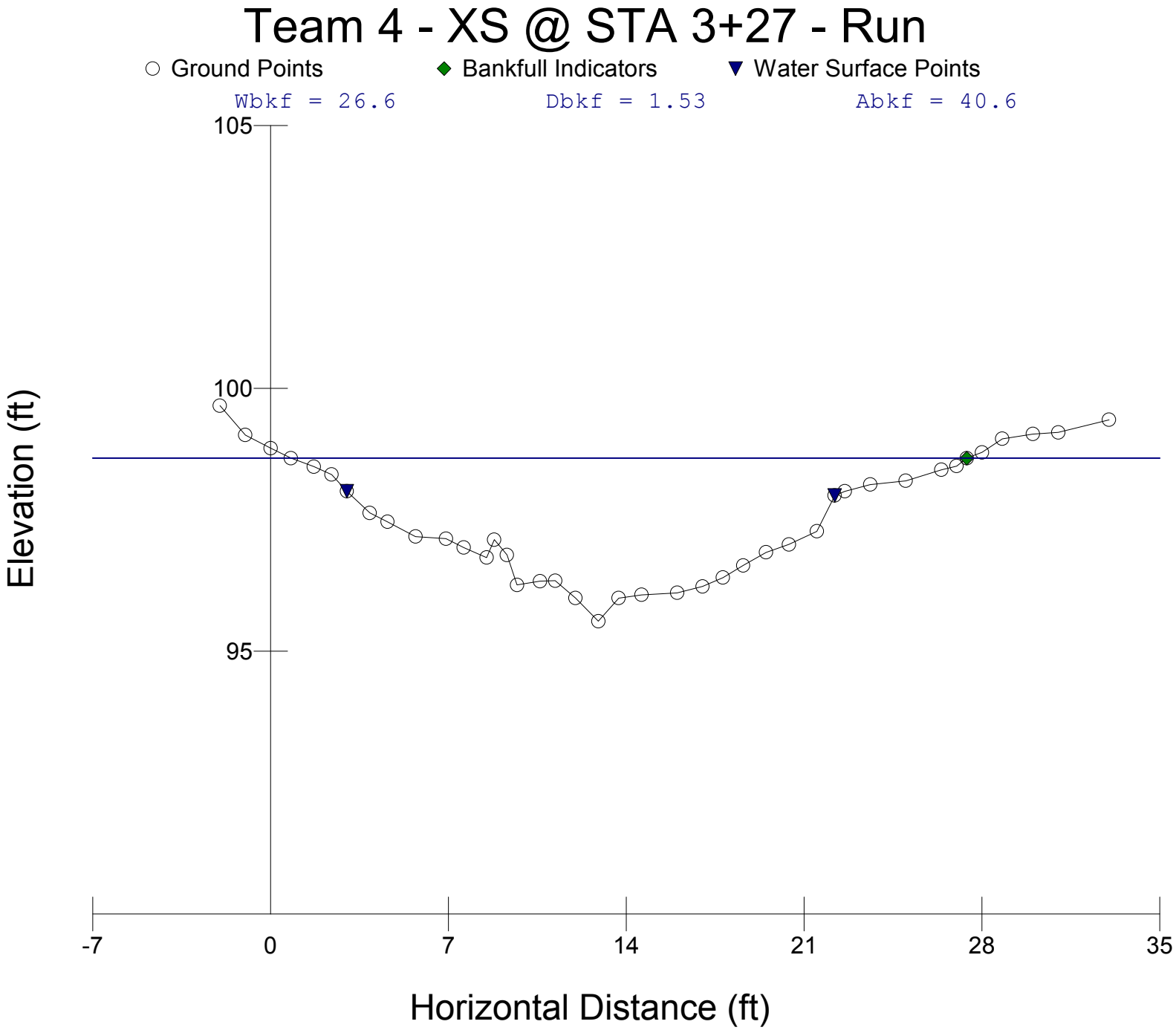
Station 1+12 Pool

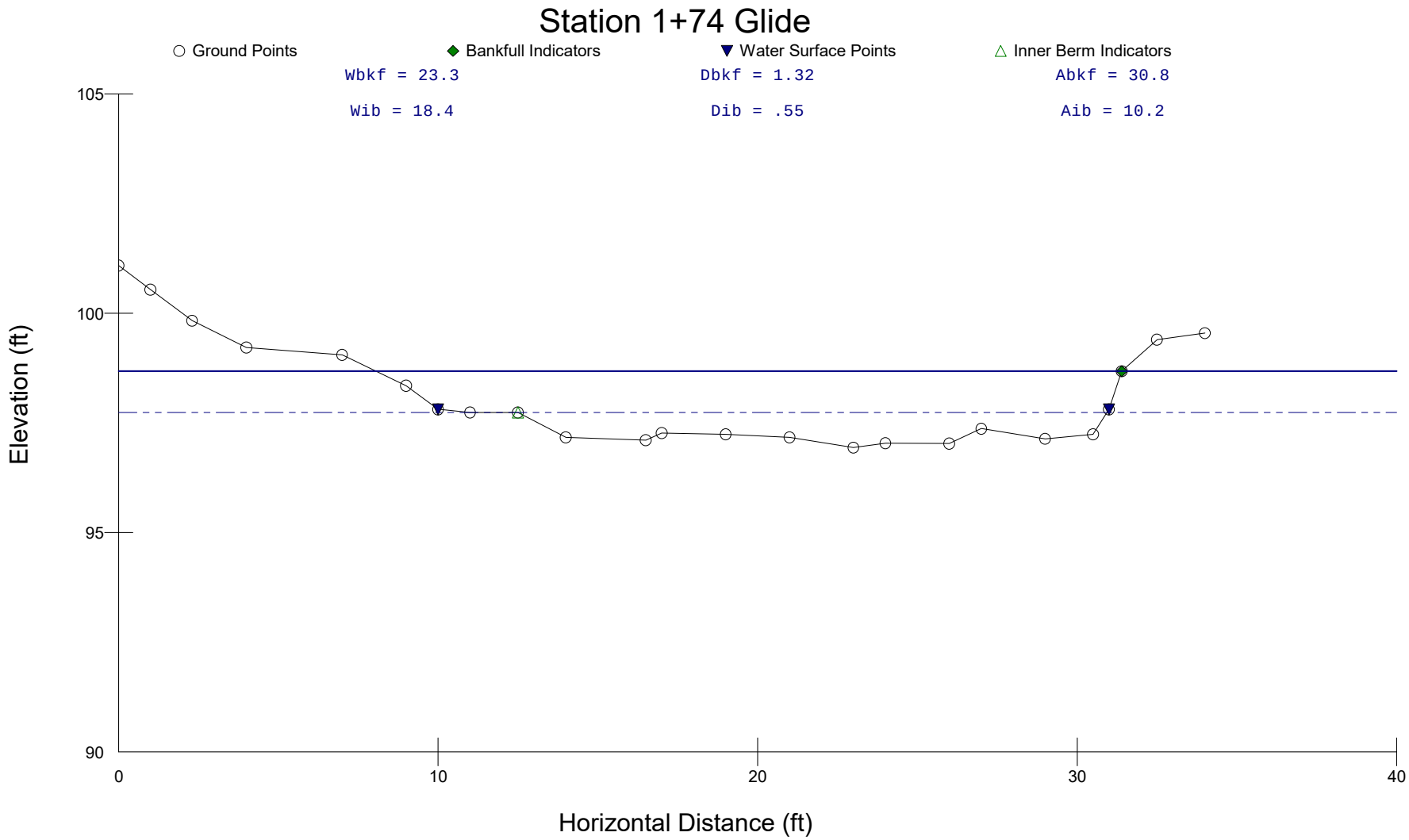


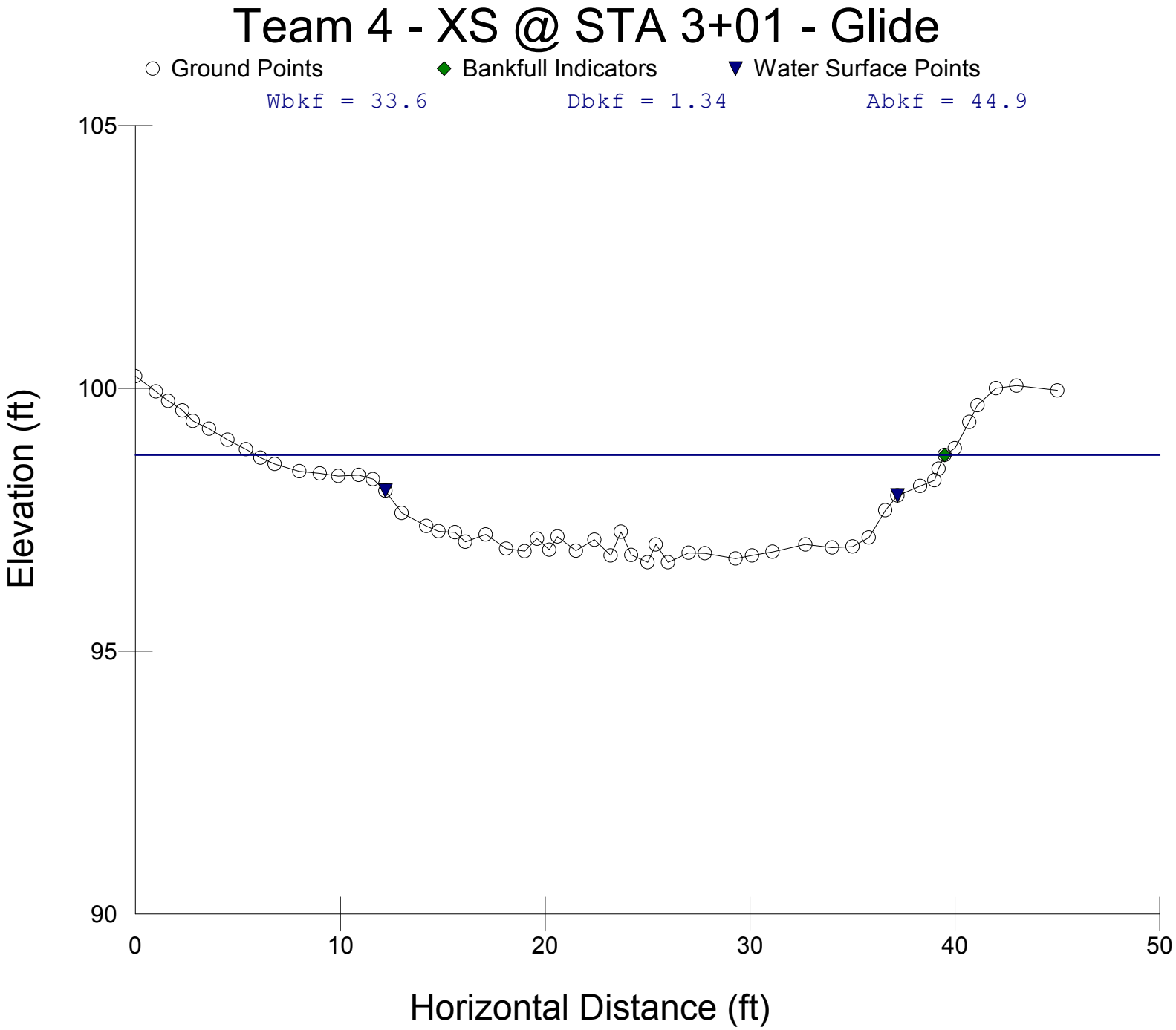
Team 4 - XS @ STA 2+29 - Pool

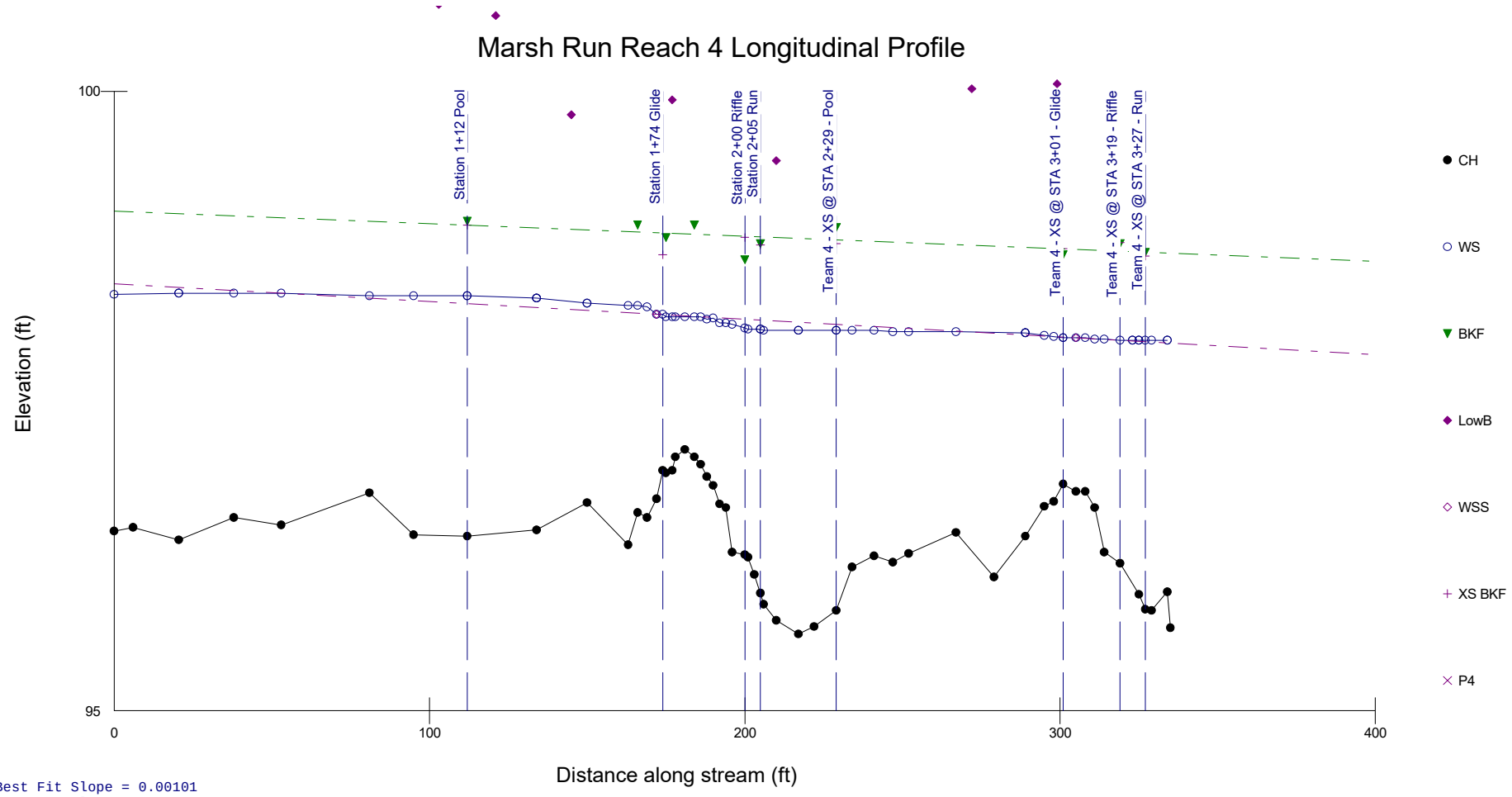



Ststion 2+05 Run
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 23
Dbkf = 1.79
Abkf = 41.2
Wib = 16
Dib = .9
Aib = 14.4
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

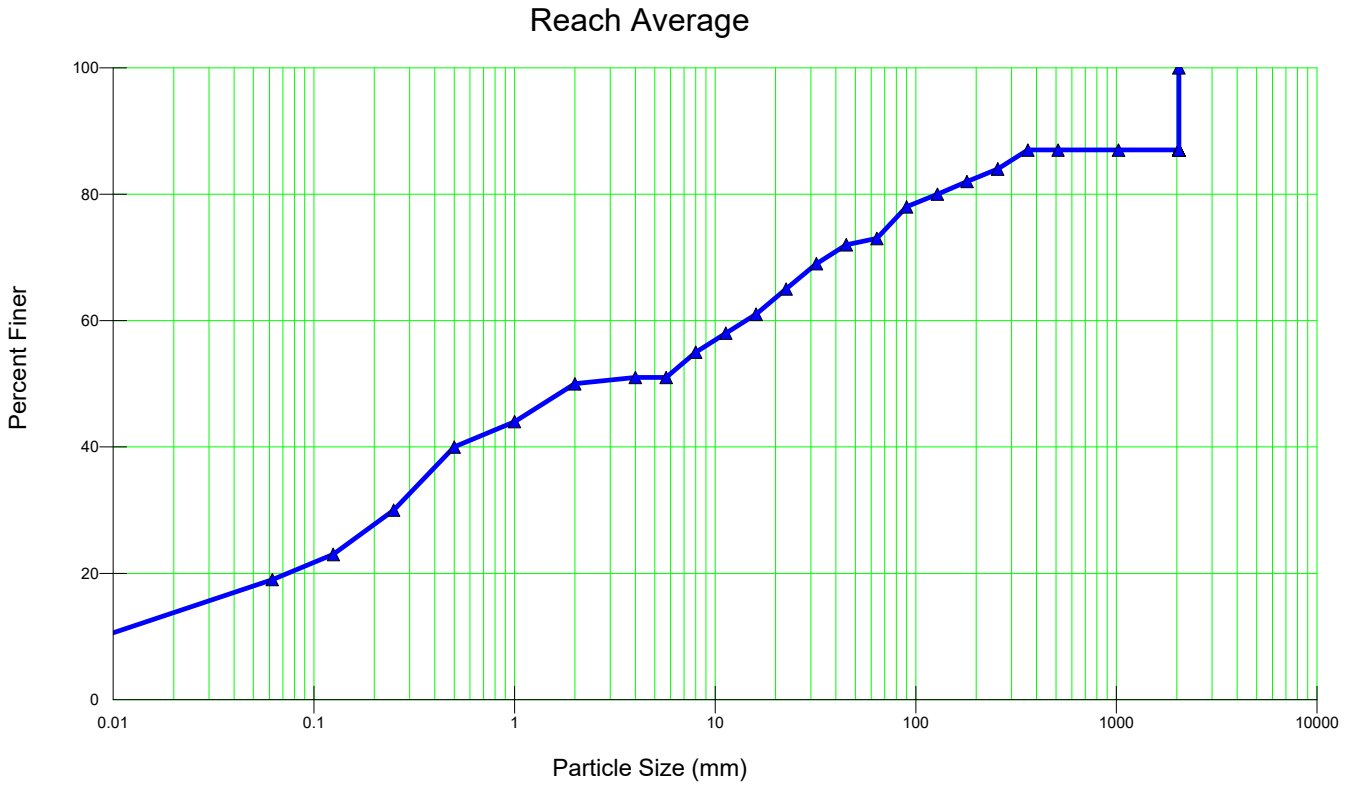

Team 4 - XS @ STA 3+27 - Run
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 26.6
Dbkf = 1.53
Abkf = 40.6
105
100
95
Elevation (ft)
-7
0
7
14
21
28
35
Horizontal Distance (ft)

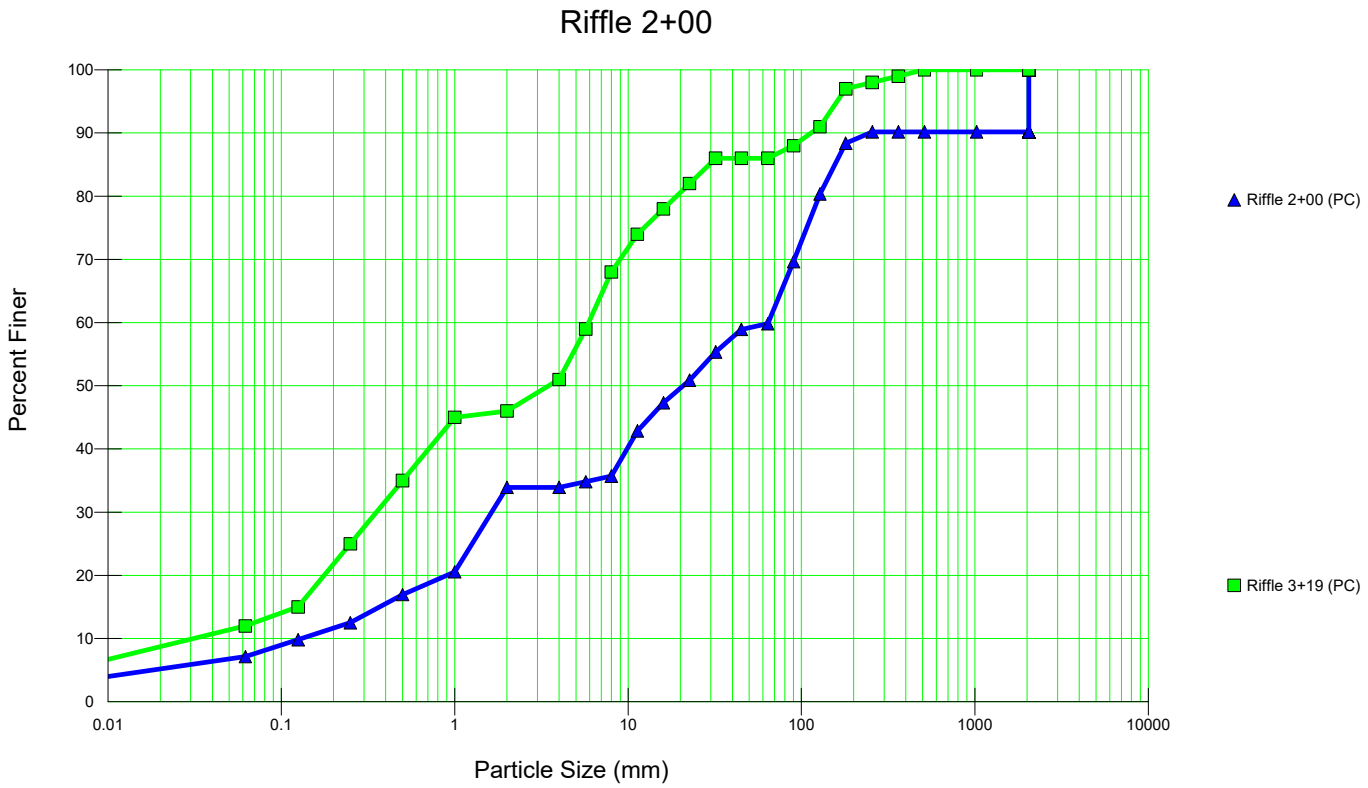

Station 1+74 Glide
Ground Points
Bankfull Indicators
Water Surface Points
Inner Berm Indicators
Wbkf = 23.3
Wib = 18.4
Dbkf = 1.32
Dib = .55
Abkf = 30.8
Aib = 10.2
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)


Team 4 - XS @ STA 3+01 - Glide
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 33.6
Dbkf = 1.34
Abkf = 44.9
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)



BKF Best Fit Slope = 0.00101
WSS Best Fit Slope = 0.00143


Reach Average
Percent Finer
100
80
60
40
20
0
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Riffle 2+00
Percent Finer
Particle Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Riffle 2+00 (PC)
Riffle 3+19 (PC)

Most representative

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 - Reach 4**
Date:	**4/20/2018**	Stream Type:	**C4/1**	Valley Type:	**U-AL-FD**
Observers:	**Team 4**			HUC:	***Note: 319 Active Bed**

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	**42.42**	**A_{bkf}** (ft^2)	Bankfull Riffle Mean DEPTH	**1.45**	**d_{bkf}** (ft)
Bankfull Riffle WIDTH	**29.26**	**W_{bkf}** (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	**30.19**	**W_p** (ft)
D_{84} at Riffle	**27.30**	**Dia.** (mm)	D_{84} (mm) / 304.8	**0.09**	**D_{84}** (ft)
Bankfull SLOPE	**0.0010**	**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)	**15.67**	**R / D_{84}**
Drainage Area	**19.2**	**DA** (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	**0.214**	**u*** (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [\ 2.83 + 5.66 * Log\ \{ R / D_{84} \}\ ]\ u^*$	**2.05**	ft / sec	**87.02**	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2} / n$ $n =$ **0.027**	**2.20**	ft / sec	**93.11**	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2} / n$ $n =$ **0.031**	**1.91**	ft / sec	**81.11**	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 $n =$ **0.027**	**2.20**	ft / sec	**93.45**	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) **Manning's Limerinos n=0.0275**	**2.16**	ft / sec	**91.42**	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) **Darcy-Weisbach (Leopold, Wolman and Miller)**	**2.12**	ft / sec	**90.02**	cfs
4. Continuity Equations: a) Regional Curves $u = Q / A$ **Return Period for Bankfull Discharge** $Q =$ **2.0** **year**	**2.48**	ft / sec	**105.00**	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	**2.68**	ft / sec	**113.50**	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 **"protrustion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

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Worksheet 2-3. Field form for Level II stream classification (Rosgen, 1996; Rosgen and Silvey, 2005).

Stream:	**Marsh Run - Reach 4**				
Basin:		Drainage Area:	**12256** acres	**19.15**	mi^2
Location:	**Washington County, Maryland**				
Twp.&Rge:	**;**	Sec.&Qtr.:	**;**		
Cross-Section Monuments (Lat./Long.):	**0 Lat / 0 Long**			Date:	**04/20/18**
Observers:	**Team 4**			Valley Type:	U-AL-FD

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	**29.26**	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	**1.45**	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	**42.42**	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	**20.18**	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.	**2.53**	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or (2 x d_{mbkf}) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	**93.69**	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	**3.2**	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.	**2**	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.	**0.00143**	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).	**1.32**	

Stream Type **C 5/1** (See **Figure 2-14**)

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Worksheet 2-4a. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **Marsh Run is great** Location: **Reach 4**

Observers: Date: **04/19/18** Valley Type: **U-AL-FD** Stream Type: **C 5/1**

River Reach Dimension Summary Data…..1

***cross sections taken in non-representative areas due to high stage and turbid conditions**

Riffle Dimensions*, **, ***

Riffle Dimensions*, **, ***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios****	Mean	Min	Max
Riffle Width (W_{bkf})	26.8	24.4	29.3	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	40.33	38.24	42.42
Mean Riffle Depth (d_{bkf})	1.51	1.45	1.57	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	17.87	15.55	20.18
Maximum Riffle Depth (d_{max})	2.55	2.53	2.56	ft	Max Riffle Depth to Mean Riffle Depth (d_{max} / d_{bkf})	1.688	1.631	1.745
Width of Flood-Prone Area (W_{fpa})	171	93.7	248	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	6.672	3.202	10.142
Riffle Inner Berm Width (W_{ib})	16.7	15.9	17.4	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	0.623	0.595	0.651
Riffle Inner Berm Depth (d_{ib})	0.76	0.71	0.81	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	0.506	0.455	0.557
Riffle Inner Berm Area (A_{ib})	12.7	11.4	14.1	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	0.315	0.297	0.332
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	21.9	21.5	22.2					

Pool Dimensions*, **, ***

Pool Dimensions*, **, ***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios****	Mean	Min	Max
Pool Width (W_{bkfp})	22	20.4	23.7	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	0.821	0.758	0.884
Mean Pool Depth (d_{bkfp})	2.02	1.92	2.12	ft	Mean Pool Depth to Mean Riffle Depth (d_{bkfp} / d_{bkf})	1.338	1.272	1.404
Pool Cross-Sectional Area (A_{bkfp})	44.3	43.2	45.5	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.099	1.071	1.127
Maximum Pool Depth (d_{maxp})	2.75	2.48	3.01	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	1.821	1.642	1.993
Pool Inner Berm Width (W_{ibp})	15.4	12.5	18.4	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	0.694	0.612	0.775
Pool Inner Berm Depth (d_{ibp})	0.51	0.39	0.64	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	0.252	0.201	0.303
Pool Inner Berm Area (A_{ibp})	7.56	7.11	8.02	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	0.171	0.156	0.186
Point Bar Slope (S_{pb})	0.460	0.260	0.660	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	33.500	19.370	47.630

Run Dimensions*

Run Dimensions*	Mean	Min	Max		Run Dimensionless Ratios****	Mean	Min	Max
Run Width (W_{bkfr})	24.8	23	26.6	ft	Run Width to Riffle Width (W_{bkfr} / W_{bkf})	0.925	0.858	0.991
Mean Run Depth (d_{bkfr})	1.66	1.53	1.79	ft	Mean Run Depth to Mean Riffle Depth (d_{bkfr} / d_{bkf})	1.099	1.013	1.185
Run Cross-Sectional Area (A_{bkfr})	40.9	40.6	41.2	ft	Run Area to Riffle Area (A_{bkfr} / A_{bkf})	1.014	1.006	1.021
Maximum Run Depth (d_{maxr})	2.98	2.85	3.1	ft	Max Run Depth to Mean Riffle Depth (d_{maxr} / d_{bkf})	1.974	1.887	2.053
Run Width/Depth Ratio (W_{bkfr} / d_{bkfr})	15.1	12.9	17.4	ft				

Glide Dimensions*

Glide Dimensions*	Mean	Min	Max		Glide Dimensions & Dimensionless Ratios****	Mean	Min	Max
Glide Width (W_{bkfg})	28.5	23.3	33.6	ft	Glide Width to Riffle Width (W_{bkfg} / W_{bkf})	1.061	0.870	1.253
Mean Glide Depth (d_{bkfg})	1.33	1.32	1.34	ft	Mean Glide Depth to Mean Riffle Depth (d_{bkfg} / d_{bkf})	0.881	0.874	0.887
Glide Cross-Sectional Area (A_{bkfg})	37.9	30.9	44.9	ft	Glide Area to Riffle Area (A_{bkfg} / A_{bkf})	0.939	0.765	1.114
Maximum Glide Depth (d_{maxg})	1.89	1.74	2.04	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	1.252	1.152	1.351
Glide Width/Depth Ratio (W_{bkfg} / d_{bkfg})	21.4	17.7	25.1	ft/ft	Glide Inner Berm Width/Depth Ratio (W_{ibg} / d_{ibg})	16.639	0.000	33.277
Glide Inner Berm Width (W_{ibg})	9.22	0	18.4	ft	Glide Inner Berm Width to Glide Width (W_{ibg}/W_{bkfg})	0.395	0.000	0.790
Glide Inner Berm Depth (d_{ibg})	0.28	0	0.55	ft	Glide Inner Berm Depth to Glide Depth (d_{ibg} / d_{bkfg})	0.210	0.000	0.420
Glide Inner Berm Area (A_{ibg})	5.11	0	10.2	ft^2	Glide Inner Berm Area to Glide Area (A_{ibg} / A_{bkfg})	0.166	0.000	0.331

Step**

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 2-4b. Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **Marsh Run is great**		Location: **Reach 4**	
Observers:	Date: **04/19/18**	Valley Type: **U-AL-FD**	Stream Type: **C 5/1**

River Reach Summary Data…..2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	2.626	ft/sec	Estimation Method	Manning	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	111.395	cfs	Drainage Area	19.15	mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Linear Wavelength (λ)	220	0	0	ft	Linear Wavelength to Riffle Width (λ / W_{bkf})	8.197	0.000	0.000
Stream Meander Length (L_m)	330	0	0	ft	Stream Meander Length Ratio (L_m / W_{bkf})	12.295	0.000	0.000
Radius of Curvature (R_c)	55	40	70	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	2.049	1.490	2.608
Belt Width (W_{blt})	73	65	80	ft	Meander Width Ratio (W_{blt} / W_{bkf})	2.720	2.422	2.981
Arc Length (L_a)	75	65	85	ft	Arc Length to Riffle Width (L_a / W_{bkf})	2.794	2.422	3.167
Riffle Length (L_r)	13	7	19	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.484	0.261	0.708
Individual Pool Length (L_p)	57	53	61	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	2.124	1.975	2.273
Pool to Pool Spacing (P_s)	111	104	118	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	4.140	3.890	4.389

Channel Profile

Valley Slope (S_{val})	0.0019	ft/ft	Average Water Surface Slope (S)	0.00101	ft/ft	Sinuosity (S_{val} / S)	1.32
Stream Length (SL)	330	ft	Valley Length (VL)	250	ft	Sinuosity (SL / VL)	1.32

Low Bank Height (LBH)	start	2.74	ft	Max Depth (d_{max})	start	1.74	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start	1.57
	end	3.22	ft		end	1.86	ft		end	1.73

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	0.002	0.002	0.003	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	2.465	2.089	2.832
Run Slope (S_{run})	0.001	0.001	0.002	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	1.356	0.733	1.980
Pool Slope (S_p)	0.000	0.000	0.000	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.267	0.158	0.376
Glide Slope (S_g)	0.001	0.000	0.002	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	1.010	0.446	1.564
Step Slope (S_s)	0.000	0.000	0.000	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	0.000	0.000	0.000

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	1.97	1.88	2.06	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.305	1.245	1.36
Max Run Depth (d_{maxrun})	2.15	2.11	2.19	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	1.424	1.397	1.45
Max Pool Depth (d_{maxp})	2.85	2.51	3.17	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	1.887	1.662	2.1
Max Glide Depth (d_{maxg})	1.79	1.71	1.87	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	1.185	1.132	1.24
Max Step Depth (d_{maxs})	0	0	0	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	0	0	0

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	19	12		D_{16}	0.05	0.14		19	mm
% Sand	31	34		D_{35}	0.38	0.5		30.24	mm
% Gravel	23	40		D_{50}	2	3.6		44	mm
% Cobble	11	12		D_{84}	256	27.3		90	mm
% Boulder	3	2		D_{95}	Bedrock	162.67		122.15	mm
% Bedrock	13	0		D_{100}	Bedrock	511.98		256	mm

[a] Min, max & mean depths are measured from Thalweg to bankfull at mid-point of feature for riffles and runs, the deepest part of pools, & at the tail-out of glides.
[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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Worksheet B-4. Dimensionless ratios of the ten pool types (*Second Field Day*).

Stream: Marsh Run Location: Washington County, MD

Observers: Team 4 Stream Type: C5/1 Landscape Type: U-AL-FO Date: 4/19/2018

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	53	2.75	0.00038	Mean	1.81	1.89	0.266
	Min.	53	2.75	0.00038	Min.	1.81	1.89	0.266
	Max.	53	2.75	0.00038	Max.	1.81	1.89	0.266
2. Contraction Scour Pool (CSP)	Mean	61	3.05	0.00016	Mean	2.08	2.10	0.112
	Min.	61	3.05	0.00016	Min.	2.08	2.10	0.112
	Max.	61	3.05	0.00016	Max.	2.08	2.10	0.112
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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Summary....*USGS GAGE STATION* Data / Records for STREAM CHANNEL CLASSIFICATION

Station NAME:	Marsh Run	Station Number:	01617800
LOCATION:	Washington County, MD		
Period of Record:	53 yrs	Mean Annual DISCHARGE:	cfs
Drainage AREA:	12256 acres 19.15 mi²	Drainage Area Mn Elev:	ft
Reference REACH SLOPE:	0.001 ft/ft	Valley Type:	U-AL-FD
Stream Type:	C4	HUC:	

"BANKFULL" CHARACTERISTICS

Determined from FIELD MEASUREMENT			Determined from GAGE DATA Analysis		
Bankfull WIDTH (W_{bkf})	29	ft	Bankfull WIDTH (W_{bkf})	22	ft
Bankfull Mean DEPTH (d_{bkf})	1.45	ft	Bankfull MEAN DEPTH (d_{bkf})	1.9	ft
Bankfull Xsec AREA (A_{bkf})	42.4	ft²	Bankfull Xsec AREA (A_{bkf})	38	ft²
Wetted PERIMETER (W_P)	30.19	ft	Wetted PERIMETER (W_P)	25.8	ft
Bankfull STAGE (Gage Ht)	2.19	ft	Bankfull STAGE (Gage Ht)	2.1	ft
Est. Mean VELOCITY (u)	2.2	ft/sec	Mean VELOCITY (u)	3.0	ft/sec
Est. Bkf. DISCHARGE (Q_{bkf})	81.4	cfs	Bankfull DISCHARGE (Q_{bkf})	114.5	cfs

Bankfull DISCHARGE associated with **"field-determined"** Bankfull STAGE (From Gage Height reading at Staff Plate and tabular Stage-Discharge curve data)	114.5	cfs
Recurrence Interval (Log-Pearson) associated with **"field-determined"** Bankfull Discharge	2.2	yrs

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

1.5 Year **R.I.** Discharge =	70	cfs	**10** Year **R.I.** Discharge =	285	cfs
2.0 Year **R.I.** Discharge =	102	cfs	**25** Year **R.I.** Discharge =	389	cfs
5.0 Year **R.I.** Discharge =	206	cfs	**50** Year **R.I.** Discharge =	468	cfs

MEANDER GEOMETRY

Meander Wavelength (L_m)	330	ft	Radius of Curvature (R_c)	55	ft
Belt Width (W_{blt})	75	ft	Meander Width Ratio (W_{blt}/W_{bkf})	2.6	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**)	11.242	0.3678	4.5328	0.2202
Slope Exponent **b**)	0.1383	0.3303	0.45	0.5513

Hydraulic Radius $R = A / W_P$	1.5	ft	**Manning's "n"** at Bankfull Stage	0.024	Coeff.

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

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: Marsh Run **Gaging Station Number:** 01617800

1	2	3a	3b	3c	3d	4	5a	5b	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 $\bar{u}/u^*$
19.15	114.5	29.0	1.45	42.4	2.70	0.00101	273	0.09	C5	0.022	16.1	0.22	12.3

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