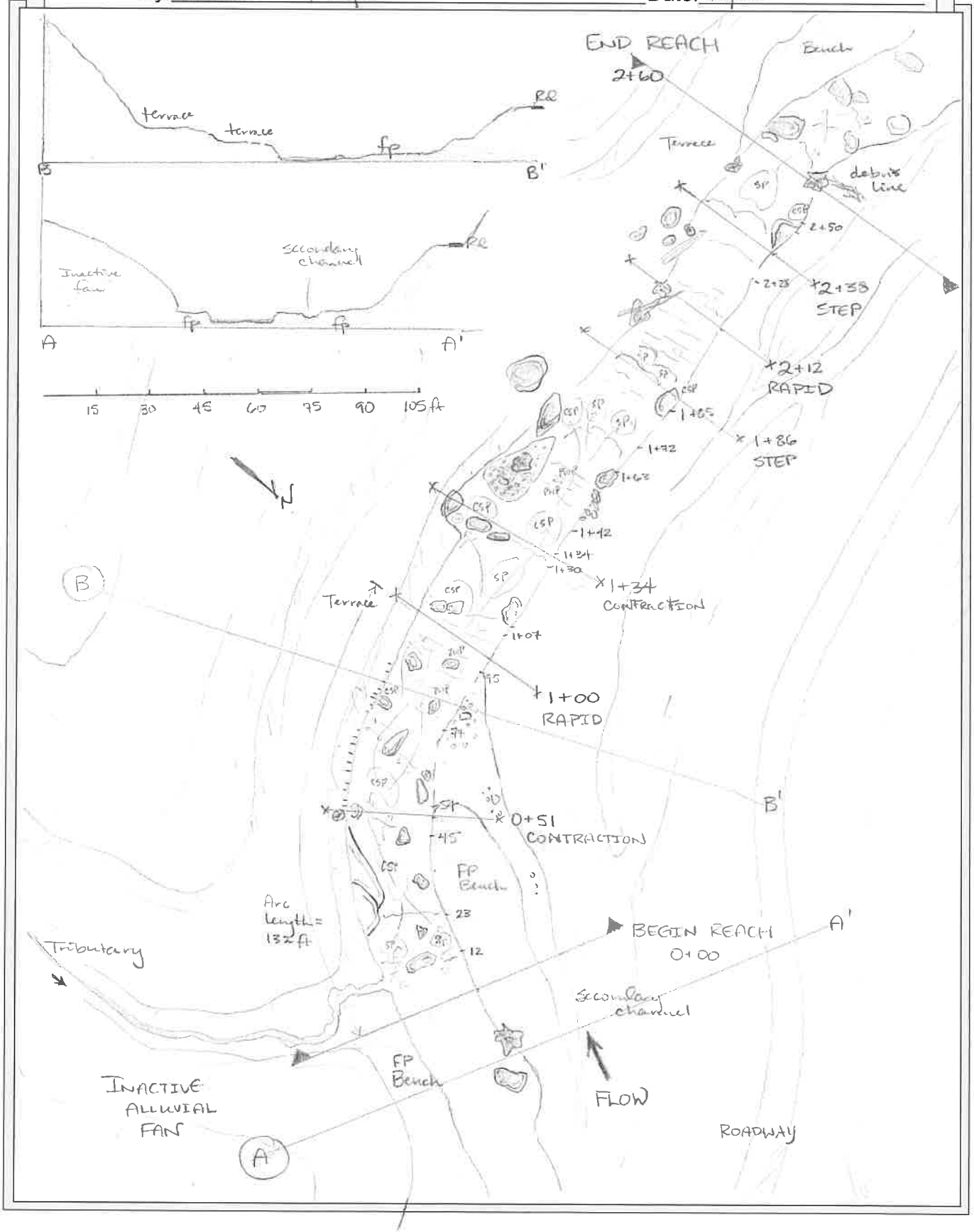
# AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Sharman's Creek Site/Reach: 4

Drawn By: Connor Kee, Kyle Bucher Date: April 17, 2018

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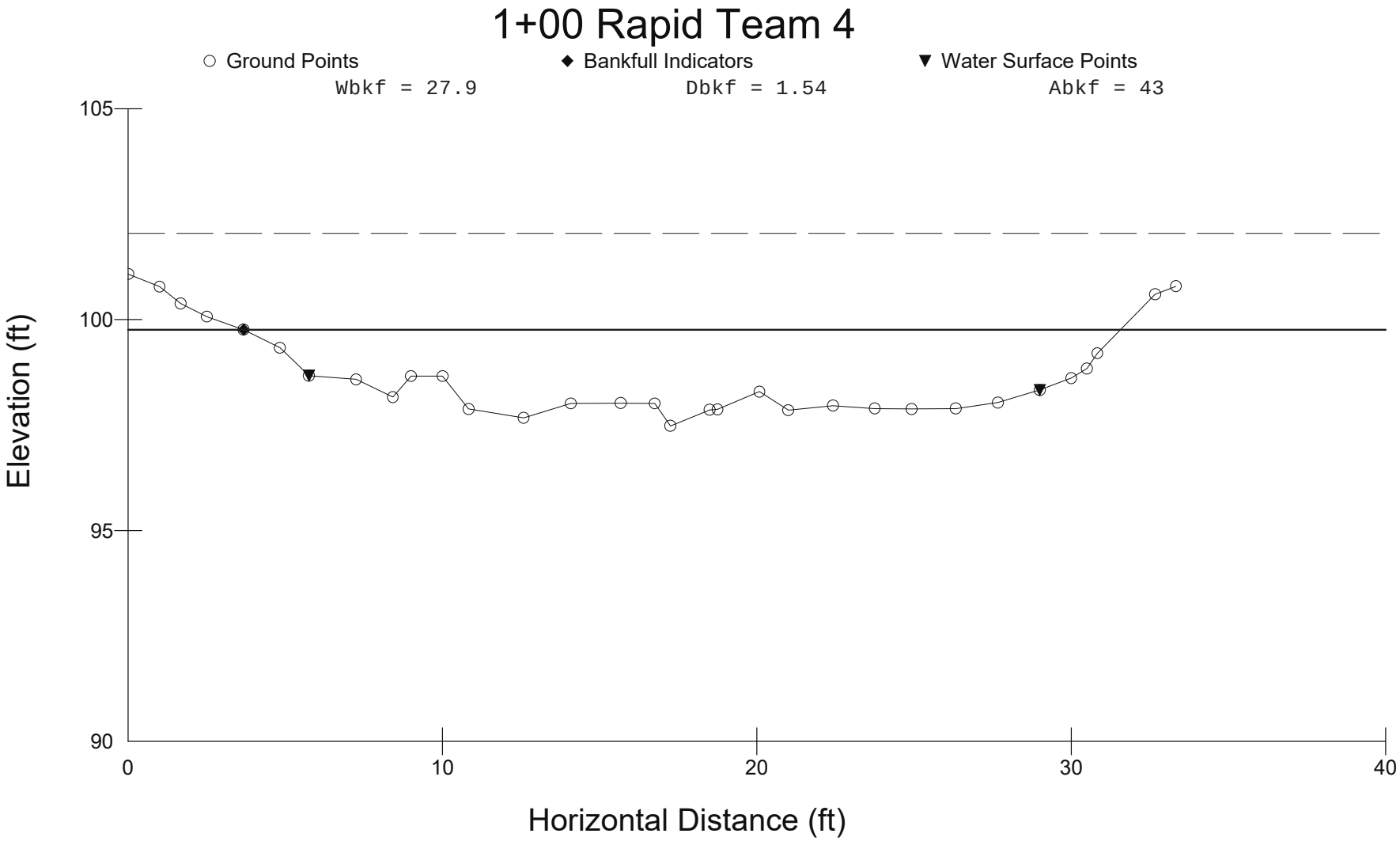
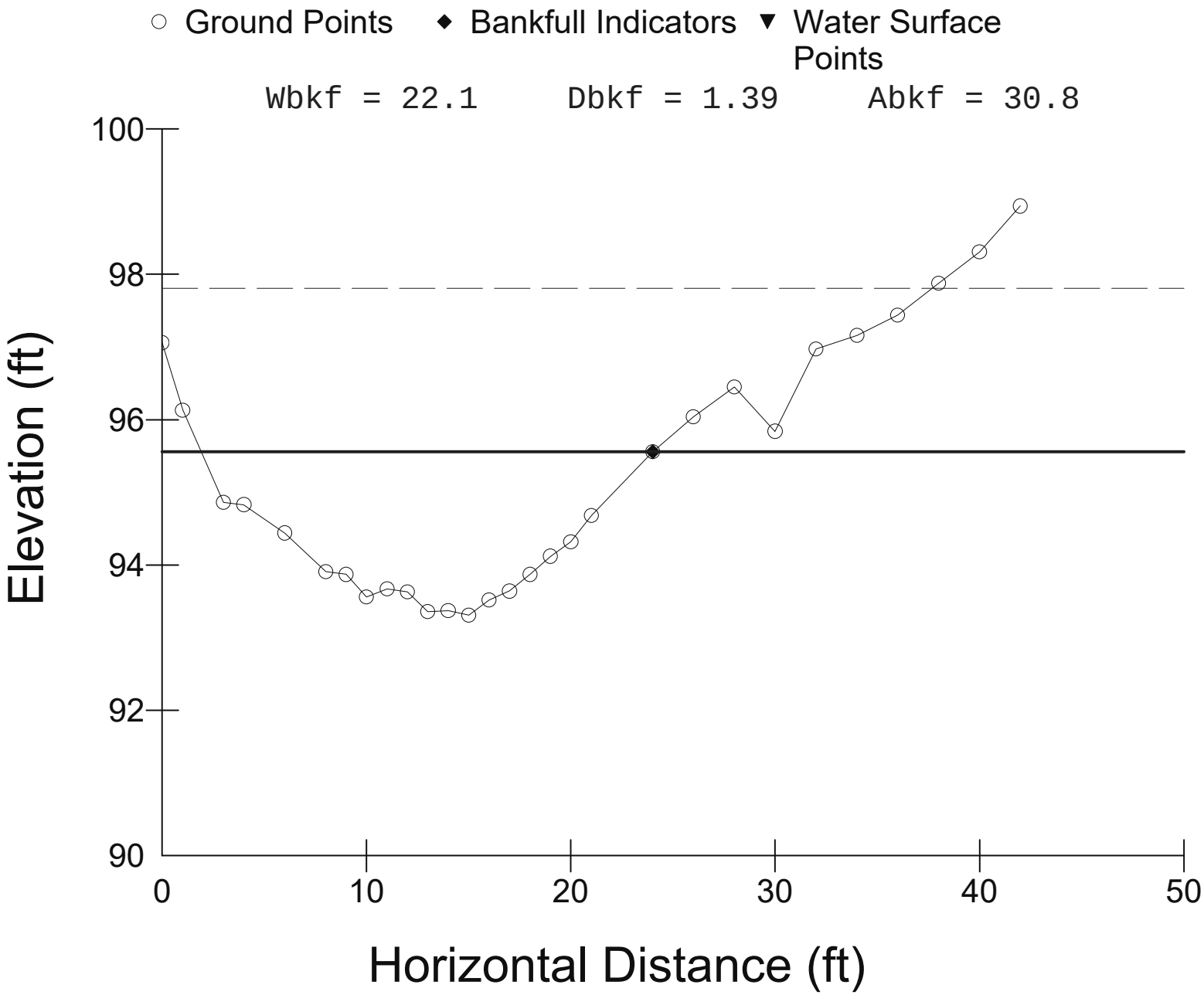
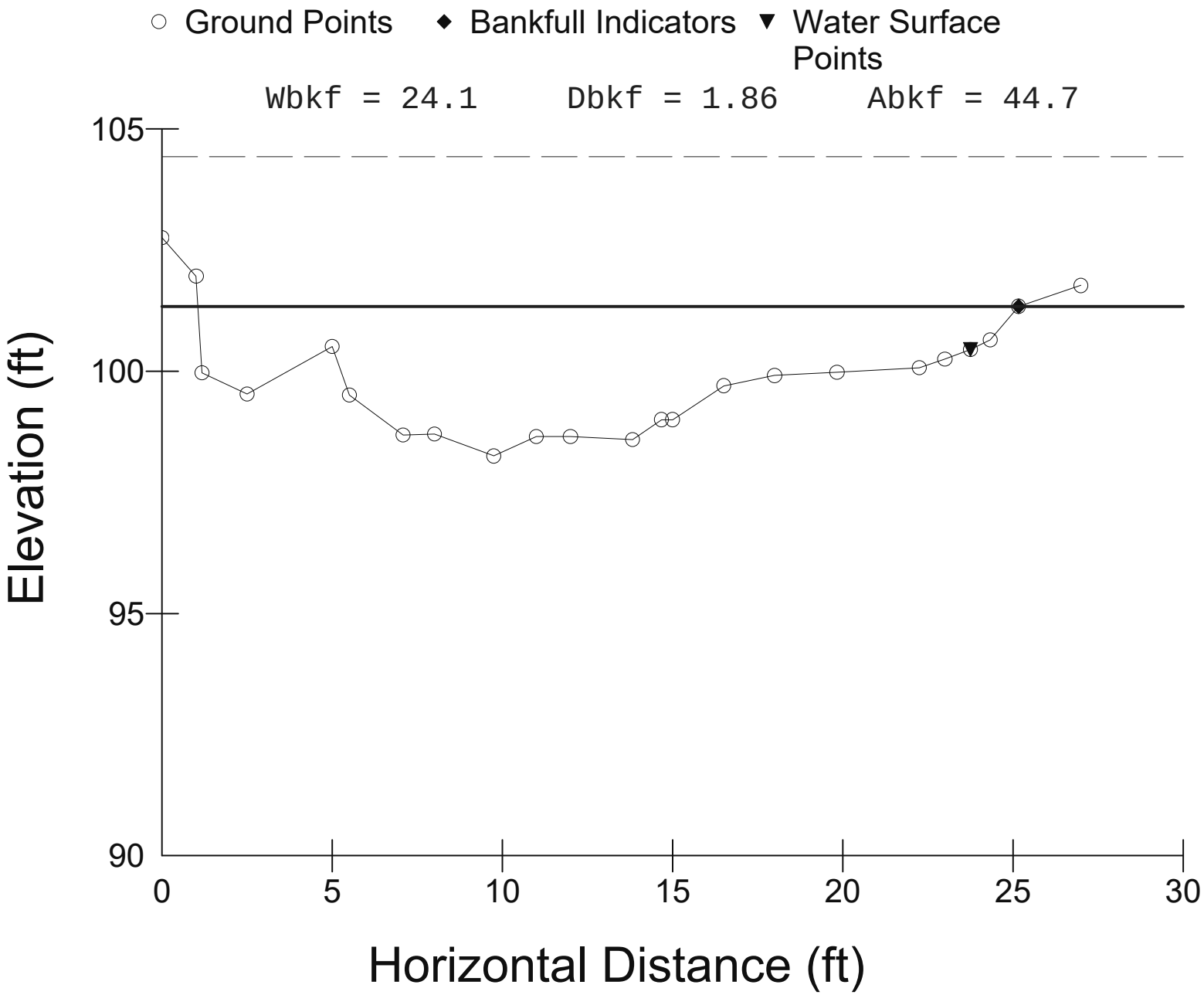

1+00 Rapid Team 4
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.9
Dbkf = 1.54
Abkf = 43
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

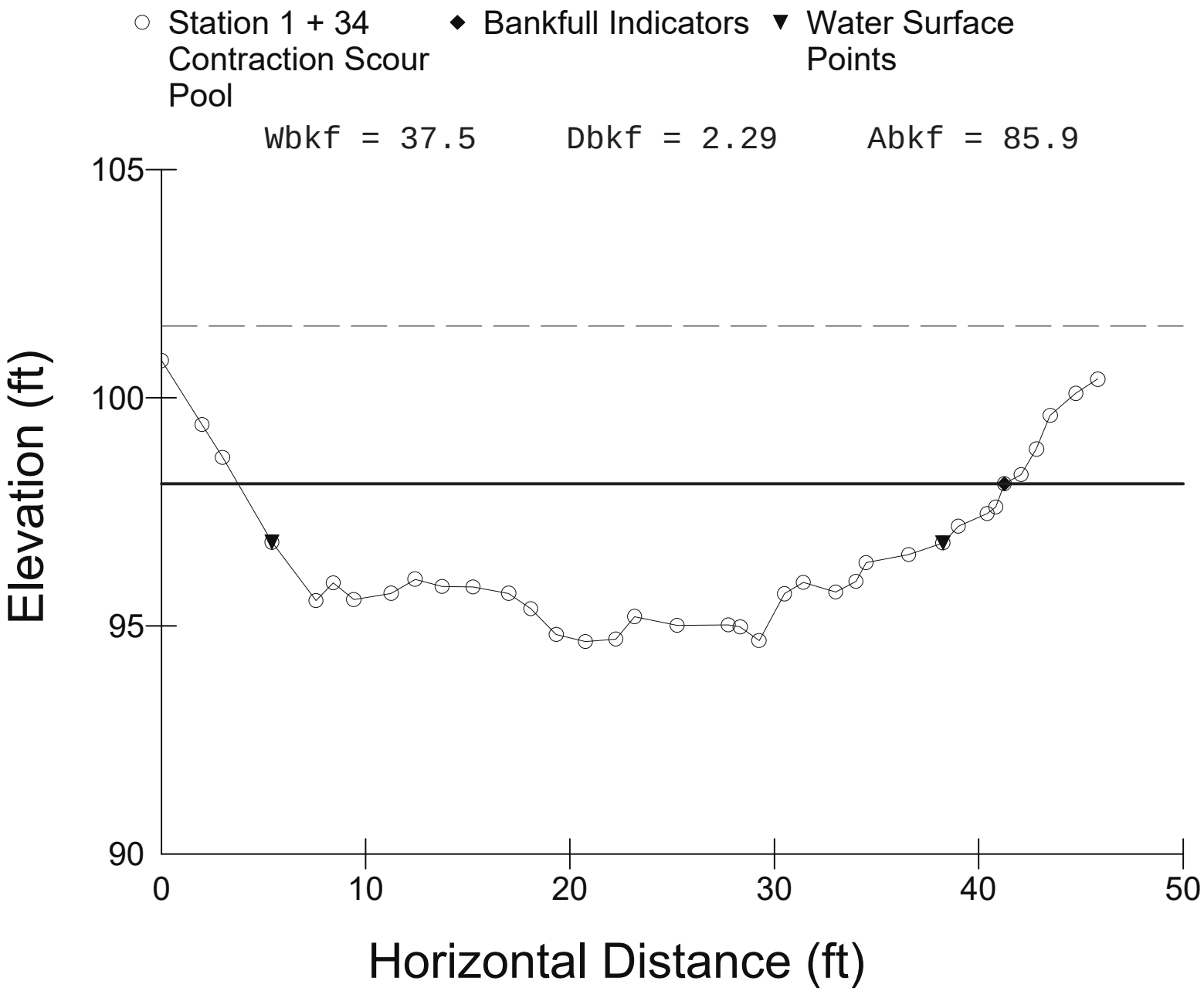
# Team 4 XS 212


Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 22.1
Dbkf = 1.39
Abkf = 30.8
100
98
96
94
92
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

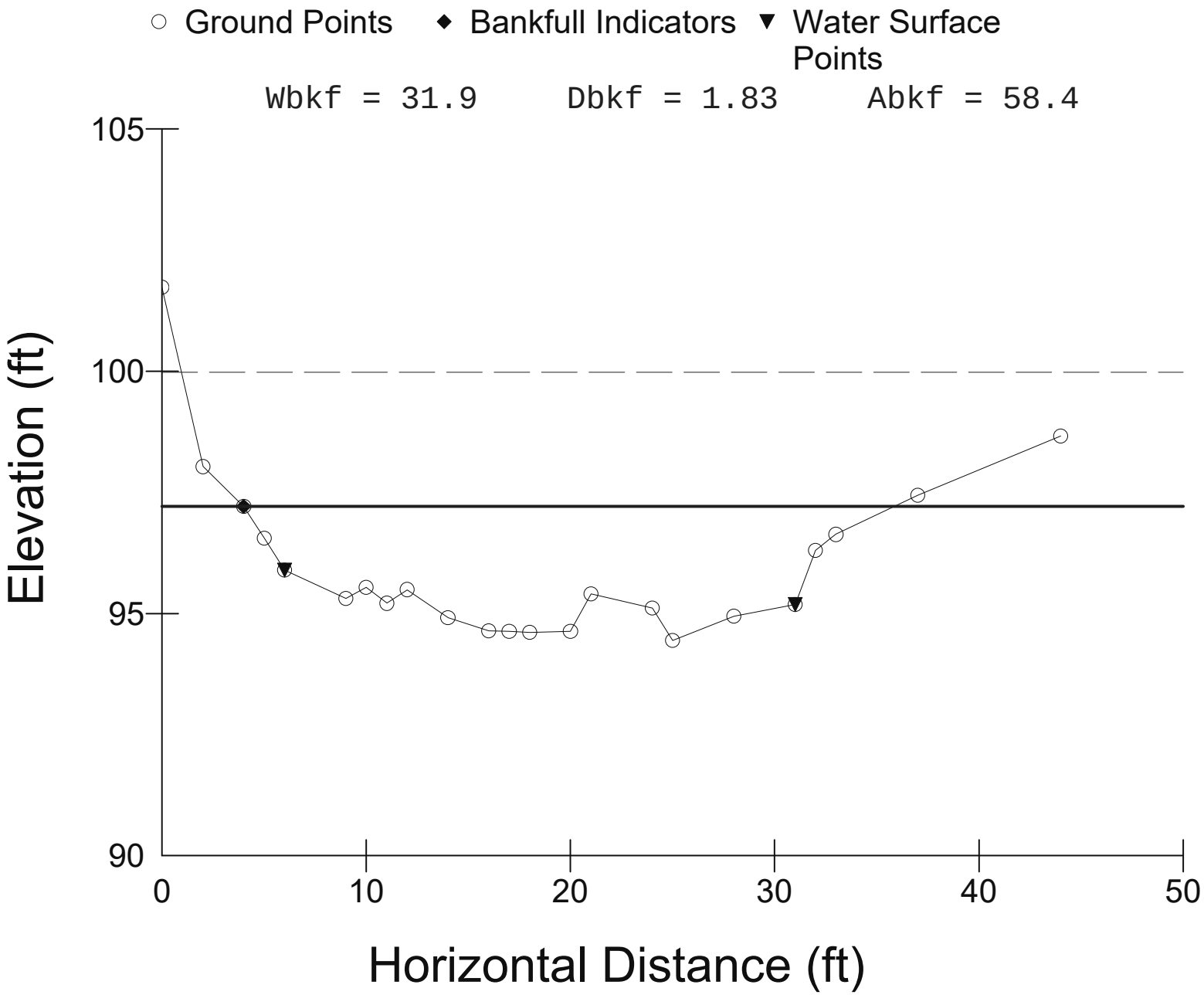
# Team 4 XS 51


Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 24.1
Dbkf = 1.86
Abkf = 44.7
105
100
95
90
Elevation (ft)
0
5
10
15
20
25
30
Horizontal Distance (ft)

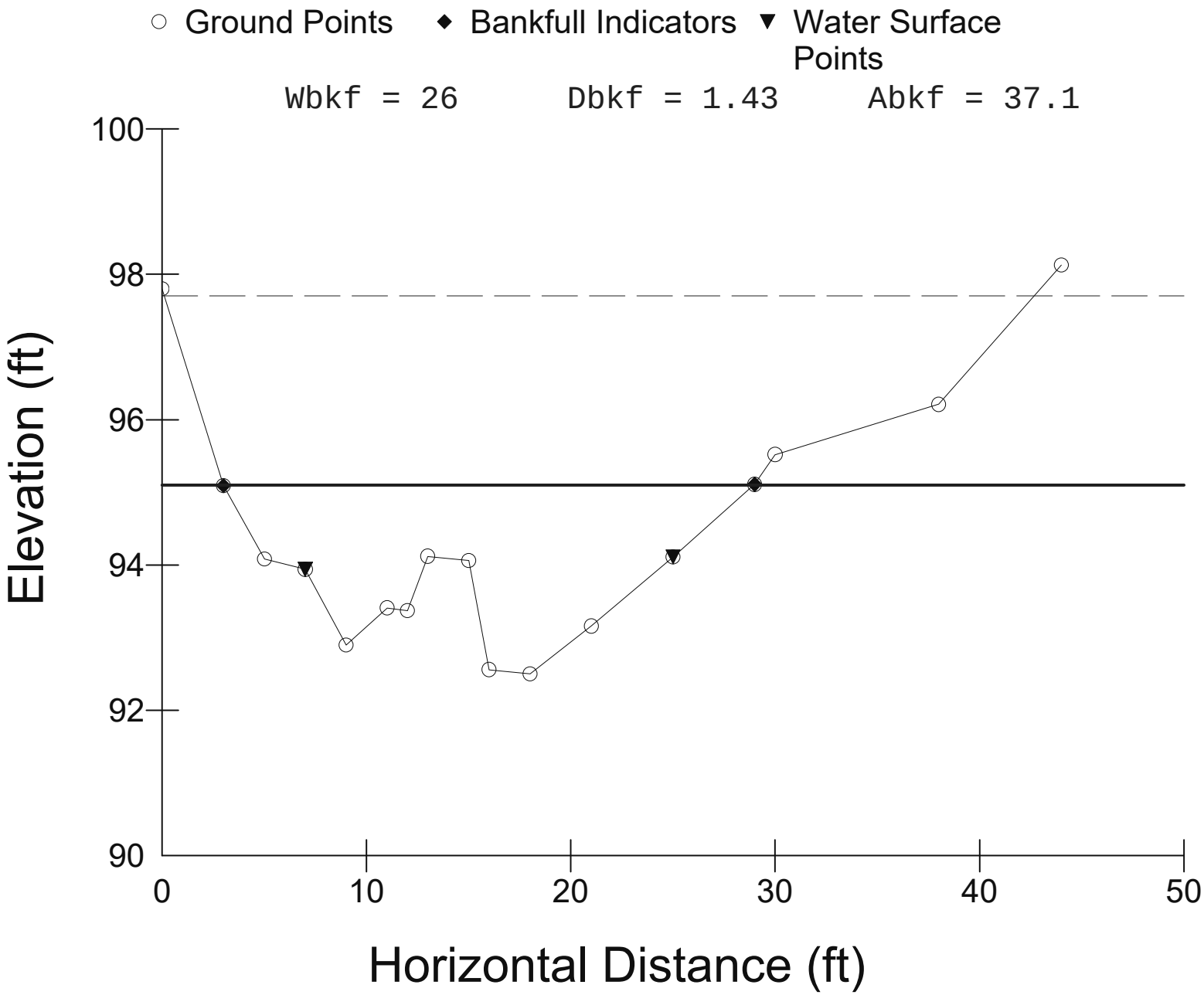
# Team 4 XS 134

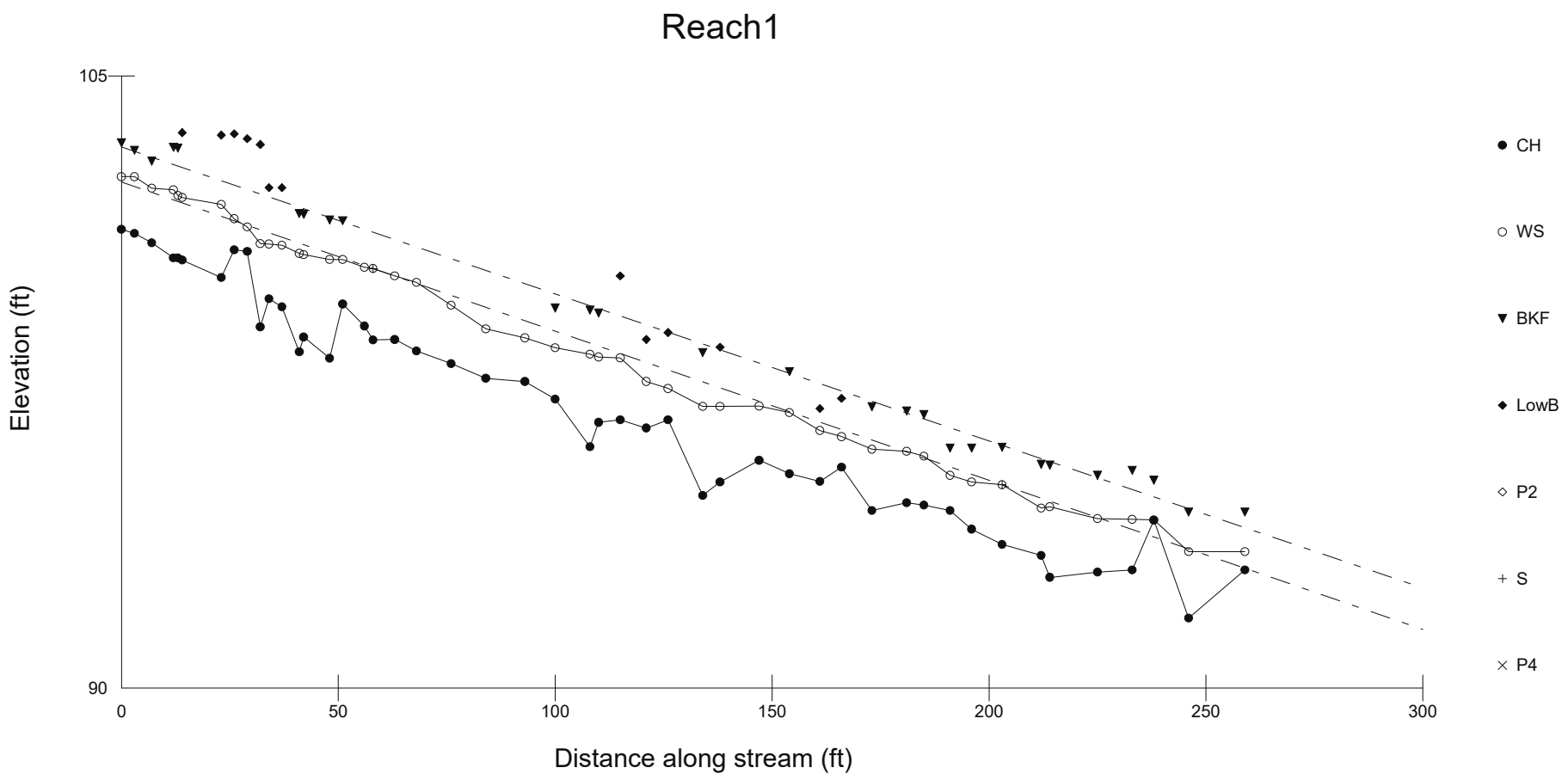

Station 1 + 34 Contraction Scour Pool
Bankfull Indicators
Water Surface Points
Wbkf = 37.5
Dbkf = 2.29
Abkf = 85.9
105
100
95
90
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

# Station 1 + 86 Step Feature



# Station 2+40 Step




Reach1
105
90
Elevation (ft)
0
50
100
150
200
250
300
Distance along stream (ft)
CH
WS
BKF
LowB
P2
S
P4

RIVERMORPH PROFILE SUMMARY

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River Name: Sharman's River is great
Reach Name: Team 4 Day 1 Cross Sections
Profile Name: Team 4 - Reach 4 Long Pro
Survey Date: 04/17/2018

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Survey Data

| DIST | CH | WS | BKF | LowB | P2 | S | P4 |
|---|---|---|---|---|---|---|---|
| 0 | 6.57 | 5.28 | 4.45 | | | | |
| 3 | 6.67 | 5.28 | 4.63 | | | | |
| 7 | 6.9 | 5.56 | 4.9 | | | | |
| 12 | 7.27 | 5.6 | 4.56 | | | | |
| 13 | 7.27 | 5.74 | 4.58 | | | | |
| 14 | 7.32 | 5.79 | | 4.2 | | | |
| 23 | 7.75 | 5.96 | | 4.26 | | | |
| 26 | 7.07 | 6.31 | | 4.23 | | | |
| 29 | 7.11 | 6.51 | | 4.35 | | | |
| 32 | 8.96 | 6.92 | | 4.49 | | | |
| 34 | 8.27 | 6.93 | | 5.55 | | | |
| 37 | 8.47 | 6.96 | | 5.55 | | | |
| 41 | 9.57 | 7.16 | 6.18 | | | | |
| 42 | 9.21 | 7.19 | 6.2 | | | | |
| 48 | 9.73 | 7.31 | 6.34 | | | | |
| 51 | 8.4 | 7.31 | 6.36 | | | | |
| 56 | 8.94 | 7.5 | | | | | |
| 58 | 9.28 | 7.53 | | | | 7.53 | |
| 63 | 9.27 | 7.71 | | | | | |
| 68 | 9.55 | 7.87 | | | | | |
| 76 | 9.86 | 8.43 | | | | | |
| 84 | 10.22 | 9.01 | | | | | |
| 93 | 10.3 | 9.23 | | | | | |
| 100 | 10.73 | 9.47 | 8.5 | | 8.05 | | |
| 108 | 11.9 | 9.63 | 8.55 | | | | |
| 110 | 11.3 | 9.7 | 8.62 | | | | |
| 115 | 11.24 | 9.72 | | | | | |
| 121 | 11.44 | 10.3 | | | | | |
| 126 | 11.24 | 10.47 | | | | | |
| 134 | 13.09 | 10.9 | 9.59 | | | | |
| 138 | 12.76 | 10.9 | | | | | |
| 147 | 12.23 | 10.9 | | | | | |
| 154 | 12.56 | 11.06 | 10.06 | | | | |
| 161 | 12.75 | 11.5 | | | | | |
| 166 | 12.4 | 11.65 | | | | | |
| 173 | 13.46 | 11.96 | 10.92 | | | | |
| 181 | 13.27 | 12.01 | 11.02 | | | | |
| 185 | 13.33 | 12.13 | 11.11 | | | | |
| 191 | 13.46 | 12.6 | 11.93 | | | | |
| 196 | 13.92 | 12.76 | 11.93 | | | | |
| 203 | 14.29 | 12.83 | 11.91 | | | 12.83 | |
| 212 | 14.56 | 13.4 | 12.33 | | 12.25 | | |
| 214 | 15.1 | 13.37 | 12.35 | | | | |
| 225 | 14.97 | 13.66 | 12.6 | | | | |
| 233 | 14.92 | 13.68 | 12.48 | | | | |
| 238 | 14.09 | 13.69 | 12.72 | | | | |
| 246 | 16.1 | 14.47 | 13.5 | | | | |
| 259 | 14.92 | 14.47 | 13.5 | | | | |

Cross Section / Bank Profile Locations

| Name | Type | Profile Station |
|---|---|---|
| Station 1 + 00 Rapids | Riffle XS | 100 |
| Station 0 + 51 Contraction Scour Pool | Pool XS | 51 |
| Station 1 + 34 Contraction Scour Pool | Pool XS | 134 |
| Station 1 + 85 Step Feature | Other XS | 185 |
| Station 2+12 Rapids | Riffle XS | 212 |
| Station 2+38 Step | Other XS | 238 |

Measurements from Graph

Bankfull Slope: 0.0375

| Variable | Min | Avg | Max |
|---|---|---|---|
| S riffle | 0.02583 | 0.03313 | 0.04917 |
| S pool | 0 | 0.01036 | 0.01889 |
| S run | 0 | 0 | 0 |
| S glide | 0 | 0 | 0 |
| S step | 0.09667 | 0.10028 | 0.10667 |
| P - P | 26 | 48.8 | 106 |
| Pool length | 5 | 9 | 13 |
| Riffle length | 12 | 15 | 24 |
| Dmax riffle | 2.29 | 2.41 | 2.53 |
| Dmax pool | 2.65 | 3.3 | 3.75 |
| Dmax run | 0 | 0 | 0 |
| Dmax glide | 0 | 0 | 0 |
| Dmax step | 1.5 | 2.1 | 2.55 |
| Low bank ht | 0 | 0 | 0 |

Length and depth measurements in feet, slopes in ft/ft.

↑

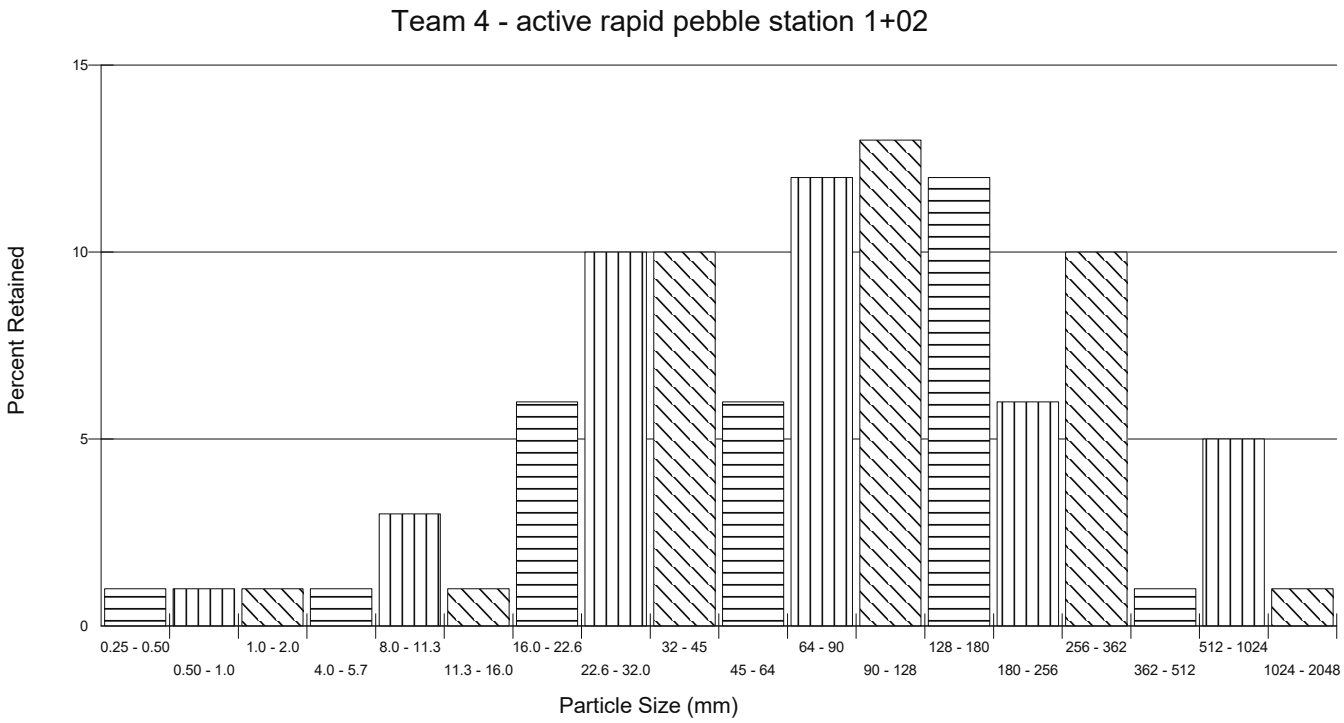
RIVERMORPH PROFILE SUMMARY

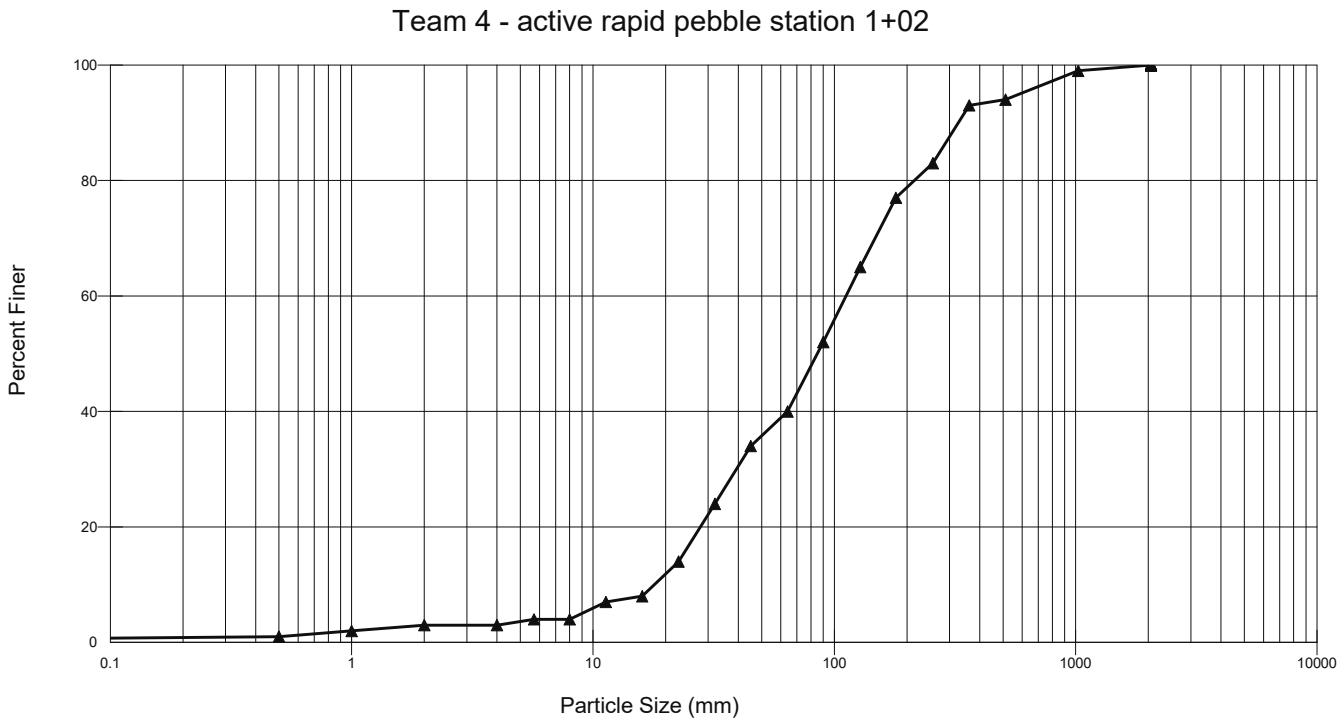
Notes

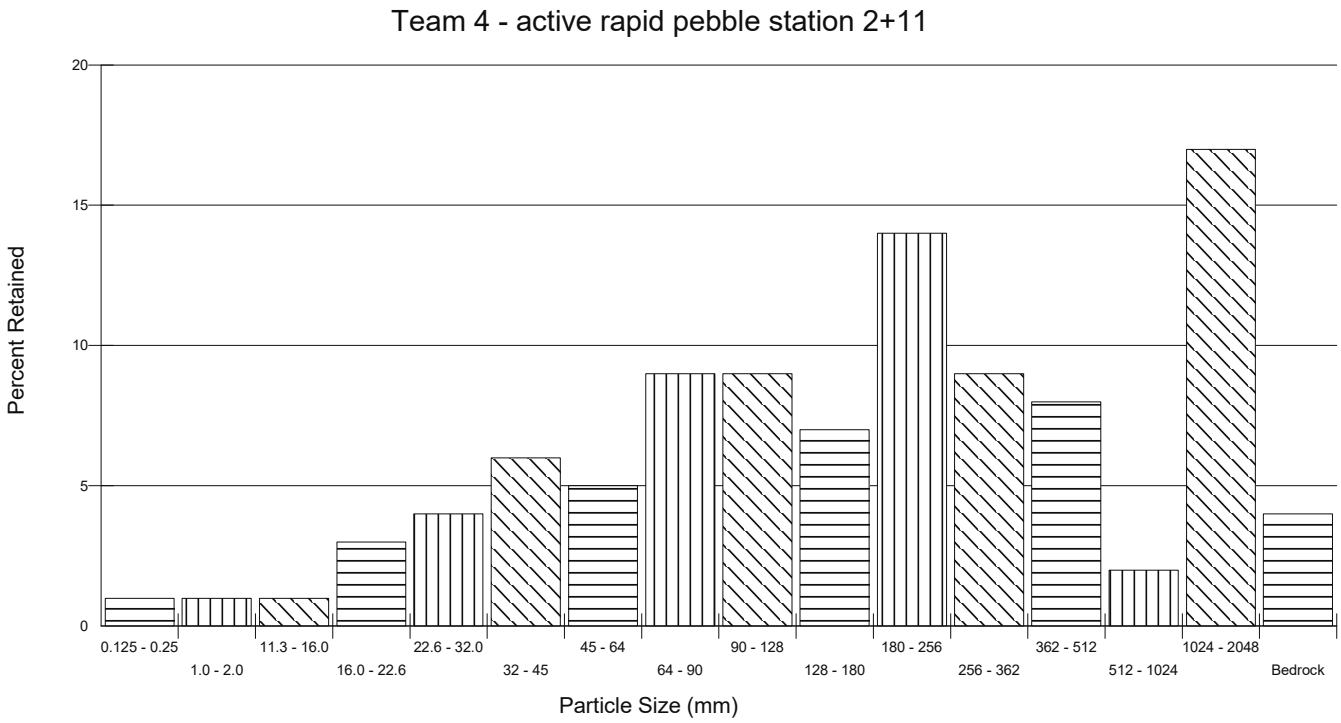
River Name: Sharman's River is great
Reach Name: Team 4 Day 1 Cross Sections
Profile Name: Team 4 - Reach 4 Long Pro
Survey Date: 04/17/2018

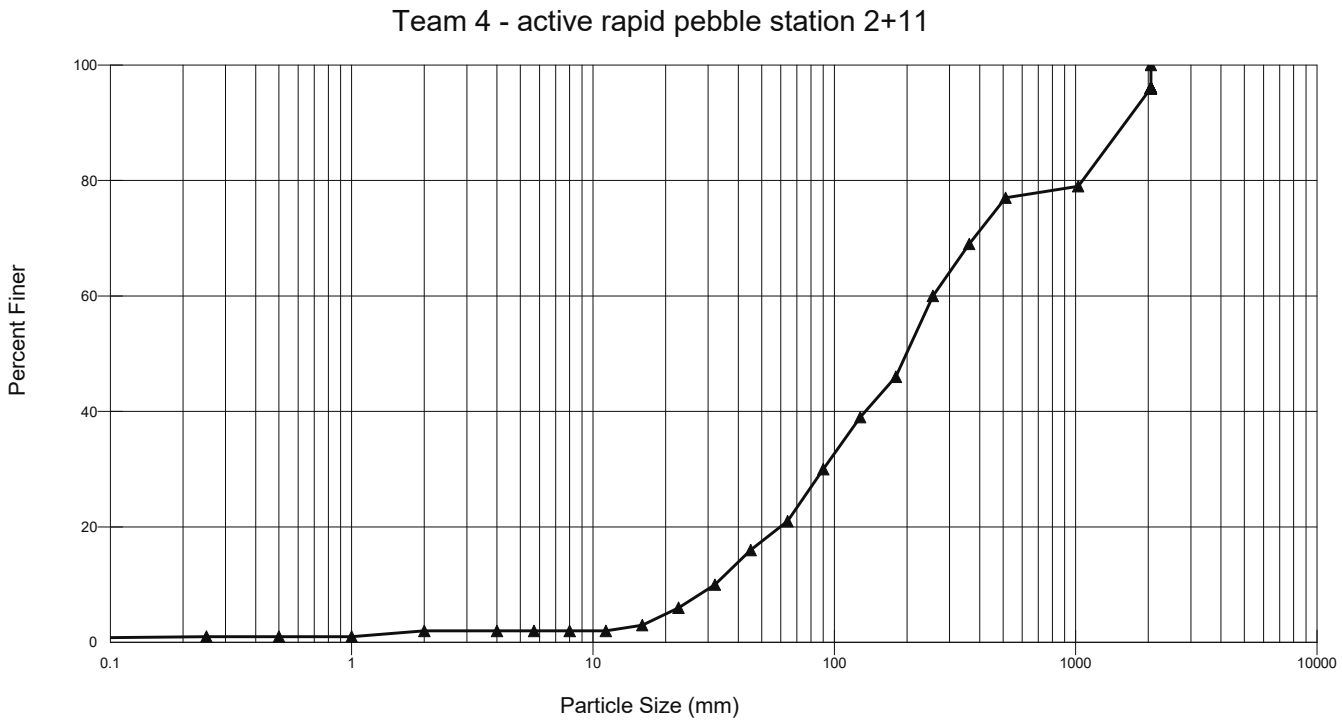
| DIST | Note |
|---|---|
| 0 | Crest |
| 3 | Step Pool |
| 7 | Step Pool |
| 12 | Crest |
| 13 | Step Pool |
| 14 | Contraction Pool |
| 23 | Crest |
| 26 | Contraction Pool |
| 29 | Contraction Pool |
| 32 | Contraction Pool |
| 34 | Crest |
| 37 | Step Pool |
| 41 | Crest |
| 42 | Step Pool |
| 48 | Step Pool |
| 51 | Contraction |
| 56 | Rapid |
| 58 | Rapid |
| 63 | Rapid |
| 68 | Rapid |

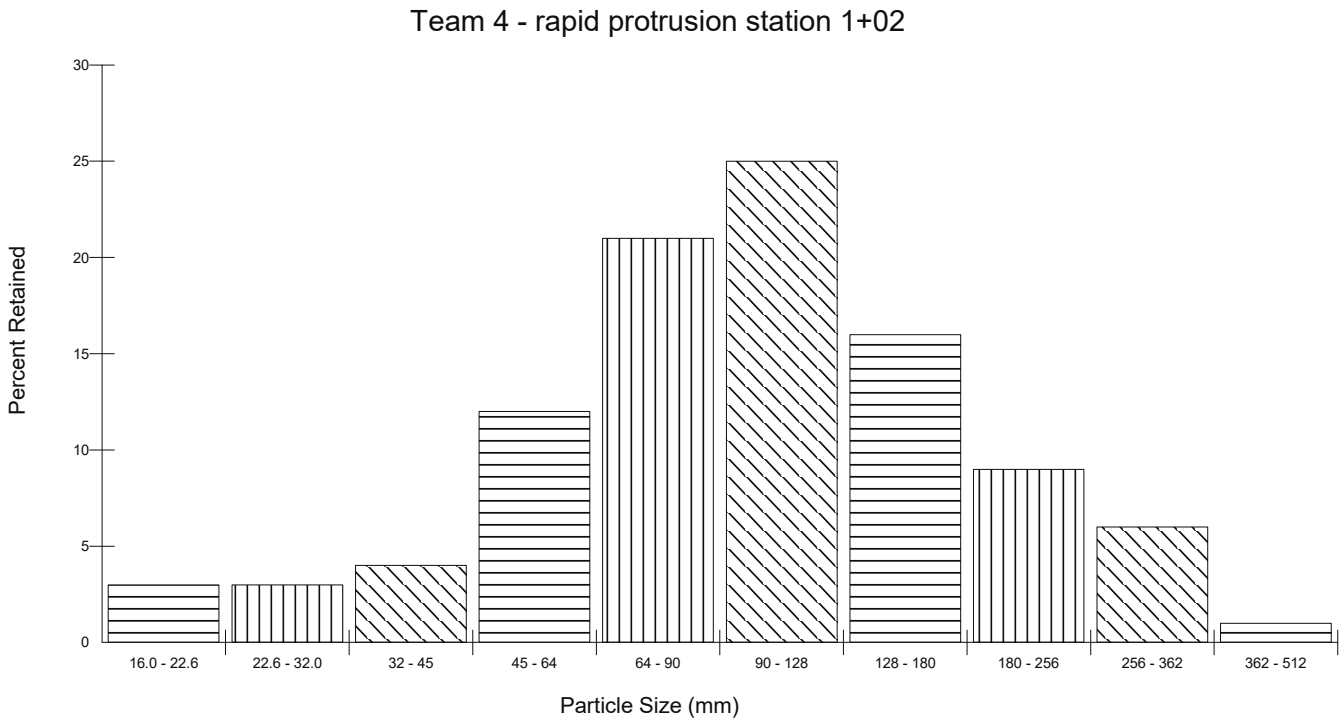
| | |
|---|---|
| 76 | Rapid |
| 84 | Rapid |
| 93 | Rapid |
| 100 | Rapid |
| 108 | Crest |
| 110 | Step Pool |
| 115 | Crest |
| 121 | Step Pool |
| 126 | Crest |
| 134 | Contraction |
| 138 | Contraction |
| 147 | Crest |
| 154 | Step Pool |
| 161 | Crest |
| 166 | Step Pool |
| 173 | Crest |
| 181 | Step Pool |
| 185 | Crest |
| 191 | Step Pool |
| 196 | Step Pool |
| 203 | Rapid |
| 212 | Rapid |
| 214 | Rapid |
| 225 | Rapid |
| 233 | Rapid |
| 238 | Crest |
| 246 | Pool |
| 259 | Crest |

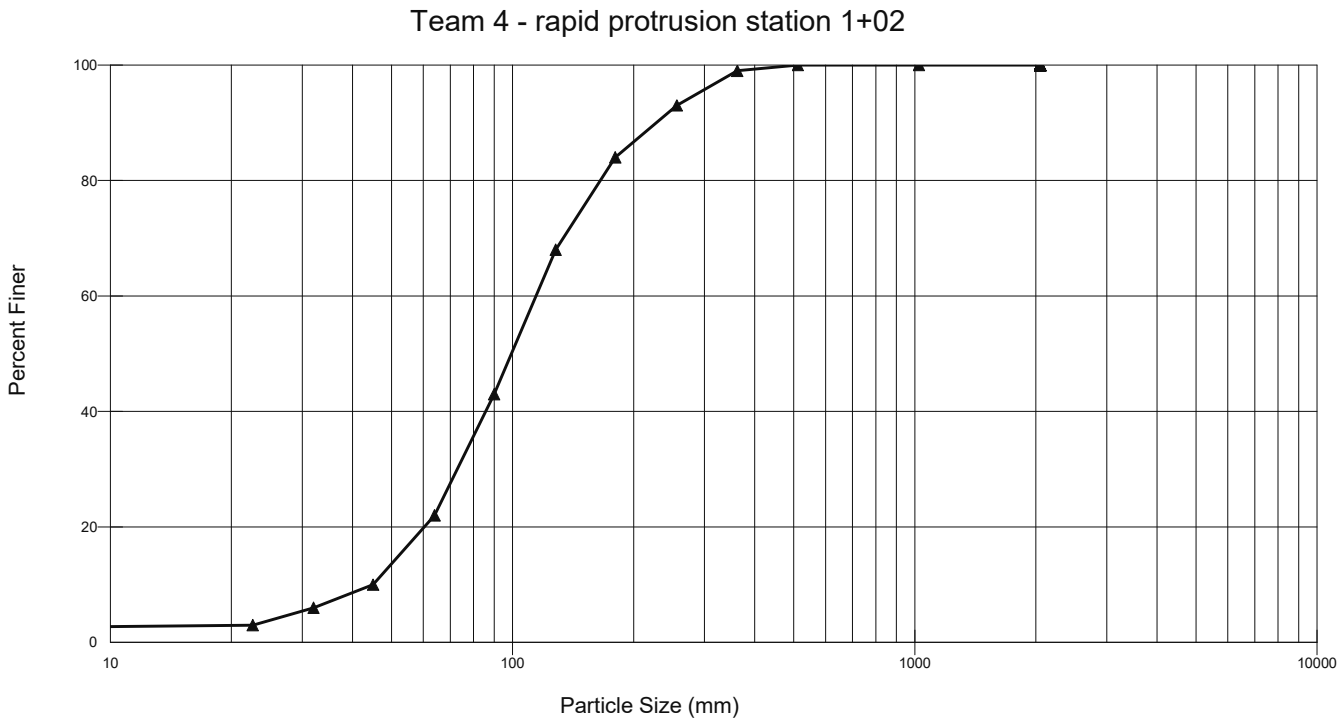

Team 4 - active rapid pebble station 1+02
Percent Retained
15
10
5
0
0.25 - 0.50
0.50 - 1.0
1.0 - 2.0
4.0 - 5.7
8.0 - 11.3
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
Particle Size (mm)

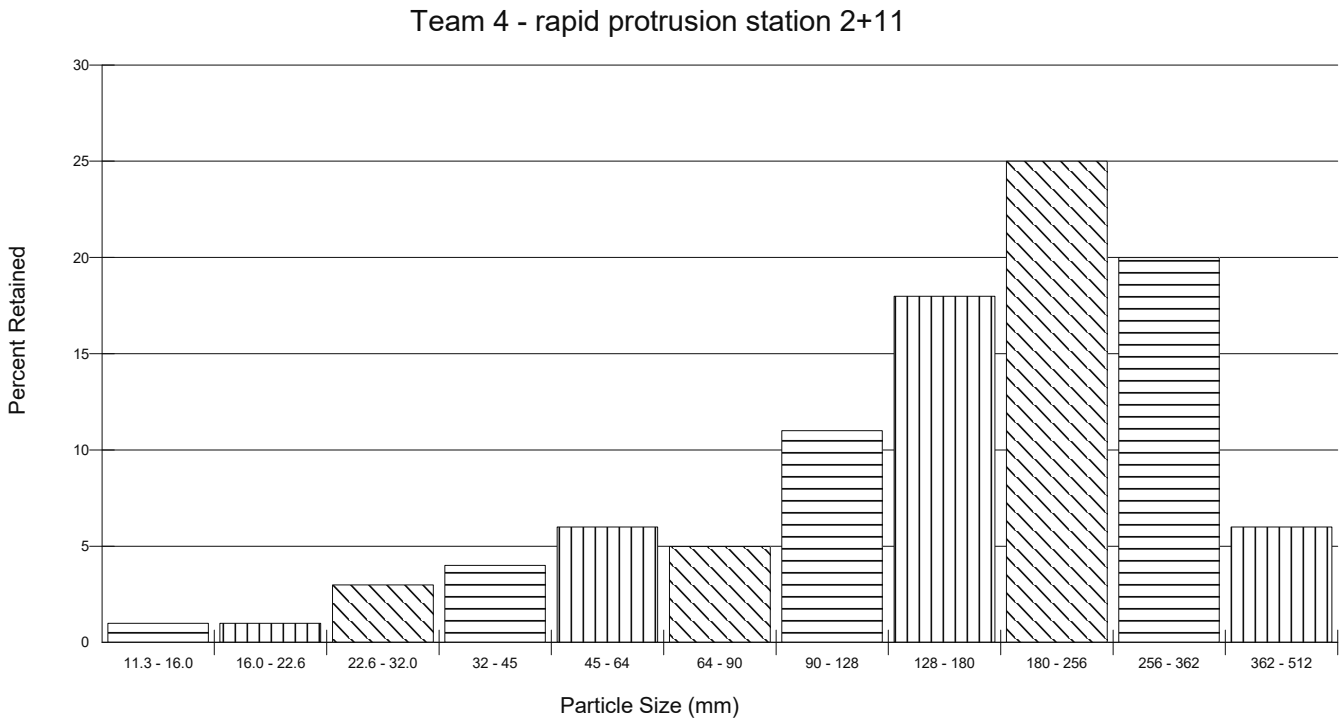

Team 4 - active rapid pebble station 1+02
Percent Finer
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Particle Size (mm)

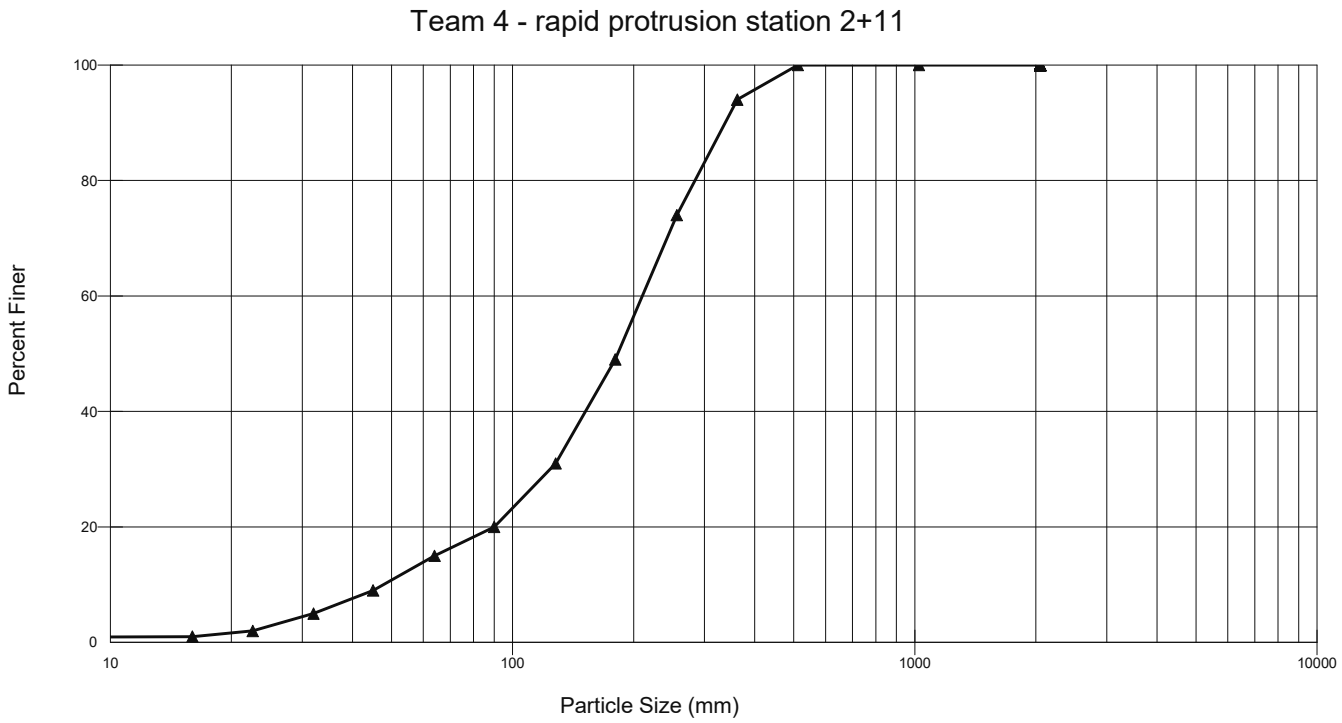

Team 4 - active rapid pebble station 2+11
Percent Retained
20
15
10
5
0
0.125 - 0.25
1.0 - 2.0
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
Bedrock
Particle Size (mm)

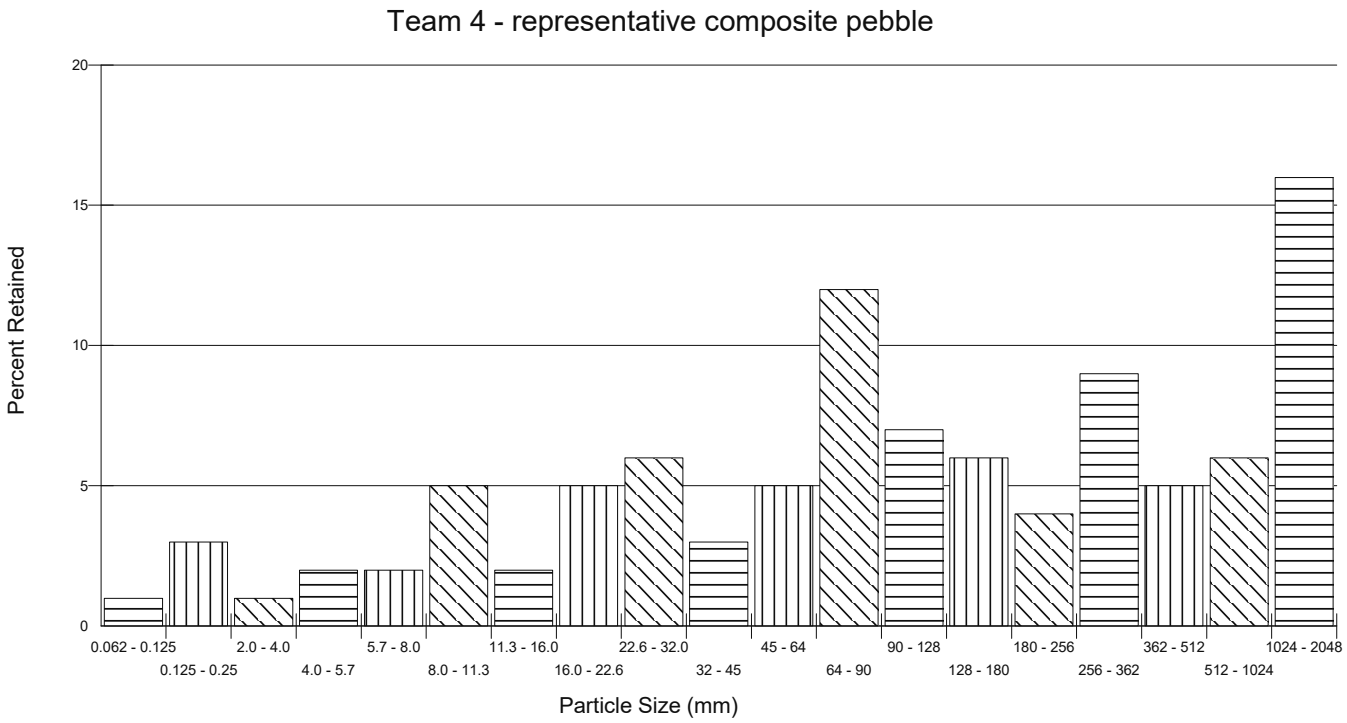

Team 4 - active rapid pebble station 2+11
Percent Finer
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Particle Size (mm)

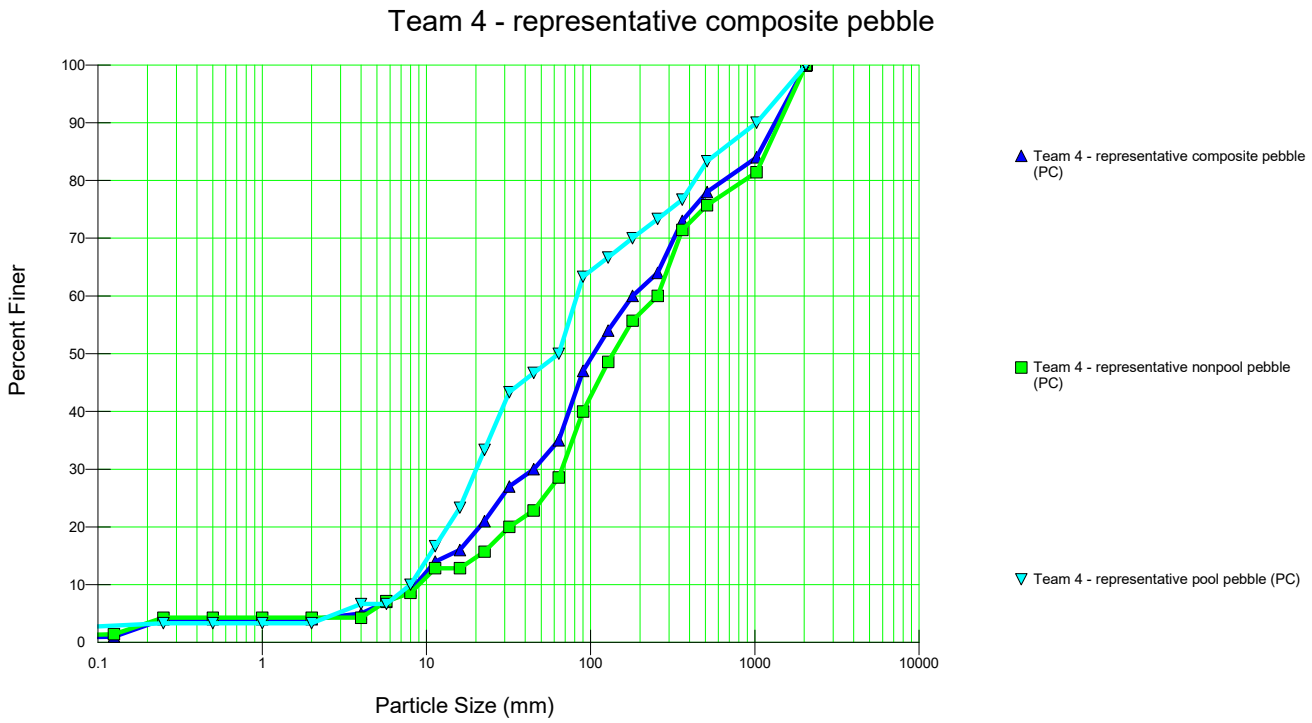

Team 4 - rapid protrusion station 1+02
Percent Retained
30
25
20
15
10
5
0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
Particle Size (mm)


Team 4 - rapid protrusion station 1+02
Percent Finer
100
80
60
40
20
0
10
100
1000
10000
Particle Size (mm)


Team 4 - rapid protrusion station 2+11
Percent Retained
30
25
20
15
10
5
0
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
Particle Size (mm)


Team 4 - rapid protrusion station 2+11
Percent Finer
100
80
60
40
20
0
10
100
1000
10000
Particle Size (mm)


Team 4 - representative composite pebble
Percent Retained
20
15
10
5
0
0.062 - 0.125
0.125 - 0.25
2.0 - 4.0
4.0 - 5.7
5.7 - 8.0
8.0 - 11.3
11.3 - 16.0
16.0 - 22.6
22.6 - 32.0
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
Particle Size (mm)


Team 4 - representative composite pebble
Percent Finer
Particle Size (mm)
100
90
80
70
60
50
40
30
20
10
0
0.1
1
10
100
1000
10000
Team 4 - representative composite pebble (PC)
Team 4 - representative nonpool pebble (PC)
Team 4 - representative pool pebble (PC)

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

| | | | | | |
|---|---|---|---|---|---|
| Stream: | **Sharman's River is great, Reach - Team 4 Day 1 Cross Sections** | | | | |
| Basin: | | Drainage Area: | **2304** acres | **3.6** | $mi^2$ |
| Location: | | | | | |
| Twp.&Rge: **;** | | Sec.&Qtr.: **;** | | | |
| Cross-Section Monuments (Lat./Long.): | **0 Lat / 0 Long** | | | Date: | **04/17/18** |
| Observers: | **Team 4** | | | Valley Type: | C-CO-U |

| | | |
|---|---|---|
| **Bankfull WIDTH ($W_{bkf}$)**<br>WIDTH of the stream channel at bankfull stage elevation, in a riffle section. | **22.1** | ft |
| **Bankfull DEPTH ($d_{bkf}$)**<br>Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$). | **1.39** | ft |
| **Bankfull X-Section AREA ($A_{bkf}$)**<br>AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. | **30.79** | $ft^2$ |
| **Width/Depth Ratio ($W_{bkf} / d_{bkf}$)**<br>Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. | **15.9** | ft/ft |
| **Maximum DEPTH ($d_{mbkf}$)**<br>Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and Thalweg elevations, in a riffle section. | **2.25** | ft |
| **WIDTH of Flood-Prone Area ($W_{fpa}$)**<br>Twice maximum DEPTH, or (2 x $d_{mbkf}$) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section. | **37.68** | ft |
| **Entrenchment Ratio (ER)**<br>The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH ($W_{fpa} / W_{bkf}$) (riffle section). | **1.7** | ft/ft |
| **Channel Materials (Particle Size Index ) $D_{50}$**<br>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. | **106.29** | mm |
| **Water Surface SLOPE (S)**<br>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. | **0.0375** | ft/ft |
| **Channel SINUOSITY (k)**<br>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). | **1.13** | |

***Stream Type*** **B 3/1** (See **Figure 2-14**)

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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: | Sharman's River is great | Location: | Reach - Team 4 Day 1 Cross Sections |
| Date: | | Stream Type: | B3 |
| Valley Type: | C-CO-US | | |
| Observers: | Team 4 | HUC: | |

| INPUT VARIABLES | | | OUTPUT VARIABLES | | |
|---|---|---|---|---|---|
| Bankfull Riffle Cross-Sectional AREA | 42.98 | $A_{bkf}$ ($ft^2$) | Bankfull Riffle Mean DEPTH | 1.54 | $d_{bkf}$ (ft) |
| Bankfull Riffle WIDTH | 27.90 | $W_{bkf}$ (ft) | Wetted PERIMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$ | 29.74 | $W_p$ (ft) |
| $D_{84}$ at Riffle | 266.60 | Dia. (mm) | $D_{84}$ (mm) / 304.8 | 0.87 | $D_{84}$ (ft) |
| Bankfull SLOPE | 0.0375 | $S_{bkf}$ (ft / ft) | Hydraulic RADIUS $A_{bkf} / W_p$ | 1.45 | R (ft) |
| Gravitational Acceleration | 32.2 | g ($ft / sec^2$) | Relative Roughness R(ft) / $D_{84}$ (ft) | 1.66 | R / $D_{84}$ |
| Drainage Area | 3.6 | DA ($mi^2$) | Shear Velocity $u^* = (gRS)^{½}$ | 1.323 | u* (ft/sec) |

| ESTIMATION METHODS | Bankfull VELOCITY | | Bankfull DISCHARGE | |
|---|---|---|---|---|
| 1. Friction Factor / Relative Roughness $u = [ 2.83 + 5.66 * Log \{ R / D_{84} \} ] u^*$ | 5.37 | ft / sec | 230.75 | cfs |
| 2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. 2-18, 2-19) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.07 | 5.26 | ft / sec | 225.95 | cfs |
| 2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. 2-20) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.059 | 6.24 | ft / sec | 268.07 | 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 $n =$ 0.106 | 3.48 | ft / sec | 149.74 | cfs |
| 3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.) Darcy-Weisbach (Leopold, Wolman and Miller) | 5.78 | ft / sec | 248.50 | 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 = 1.5 year | 2.72 | ft / sec | 117.00 | 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 2-4a.** Morphological relations, including dimensionless ratios of river reach sites (Rosgen and Silvey, 2007; Rosgen, 2008).

Stream: **Sharman's River is great** Location: **Reach - Team 4 Day 1 Cross Sections**

Observers: **Team 4** Date: **04/17/18** Valley Type: **C-CO-US** Stream Type: **B 3/1**

**River Reach Dimension Summary Data…..1**

**Riffle Dimensions*, **, ***

| Riffle Dimensions*, **, *** | Mean | Min | Max | | Riffle Dimensions & Dimensionless Ratios**** | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Riffle Width ($W_{bkf}$) | 25 | 22.1 | 27.9 | ft | Riffle Cross-Sectional Area ($A_{bkf}$) ($ft^2$) | 36.89 | 30.79 | 42.98 |
| Mean Riffle Depth ($d_{bkf}$) | 1.47 | 1.39 | 1.54 | ft | Riffle Width/Depth Ratio ($W_{bkf}$ / $d_{bkf}$) | 17.01 | 15.90 | 18.12 |
| Maximum Riffle Depth ($d_{max}$) | 2.27 | 2.25 | 2.28 | ft | Max Riffle Depth to Mean Riffle Depth ($d_{max}$ / $d_{bkf}$) | 1.550 | 1.481 | 1.619 |
| Width of Flood-Prone Area ($W_{fpa}$) | 35.5 | 33.3 | 37.7 | ft | Entrenchment Ratio ($W_{fpa}$ / $W_{bkf}$) | 1.450 | 1.195 | 1.705 |
| Riffle Inner Berm Width ($W_{ib}$) | 0 | 0 | 0 | ft | Riffle Inner Berm Width to Riffle Width ($W_{ib}$ / $W_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Riffle Inner Berm Depth ($d_{ib}$) | 0 | 0 | 0 | ft | Riffle Inner Berm Depth to Mean Depth ($d_{ib}$ / $d_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Riffle Inner Berm Area ($A_{ib}$) | 0 | 0 | 0 | $ft^2$ | Riffle Inner Berm Area to Riffle Area ($A_{ib}$ / $A_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Riffle Inner Berm W/D Ratio ($W_{ib}$ / $d_{ib}$) | 0 | 0 | 0 | | | | | |

**Pool Dimensions*, **, ***

| Pool Dimensions*, **, *** | Mean | Min | Max | | Pool Dimensions & Dimensionless Ratios**** | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Pool Width ($W_{bkfp}$) | 30.8 | 24.1 | 37.5 | ft | Pool Width to Riffle Width ($W_{bkfp}$ / $W_{bkf}$) | 1.232 | 0.965 | 1.500 |
| Mean Pool Depth ($d_{bkfp}$) | 2.08 | 1.86 | 2.29 | ft | Mean Pool Depth to Mean Riffle Depth ($d_{bkfp}$ / $d_{bkf}$) | 1.415 | 1.265 | 1.558 |
| Pool Cross-Sectional Area ($A_{bkfp}$) | 65.3 | 44.8 | 85.9 | ft | Pool Area to Riffle Area ($A_{bkfp}$ / $A_{bkf}$) | 1.771 | 1.213 | 2.329 |
| Maximum Pool Depth ($d_{maxp}$) | 3.28 | 3.09 | 3.46 | ft | Max Pool Depth to Mean Riffle Depth ($d_{maxp}$ / $d_{bkf}$) | 2.231 | 2.102 | 2.354 |
| Pool Inner Berm Width ($W_{ibp}$) | 0 | 0 | 0 | ft | Pool Inner Berm Width to Pool Width ($W_{ibp}$ / $W_{bkfp}$) | 0.000 | 0.000 | 0.000 |
| Pool Inner Berm Depth ($d_{ibp}$) | 0 | 0 | 0 | ft | Pool Inner Berm Depth to Pool Depth ($d_{ibp}$ / $d_{bkfp}$) | 0.000 | 0.000 | 0.000 |
| Pool Inner Berm Area ($A_{ibp}$) | 0 | 0 | 0 | $ft^2$ | Pool Inner Berm Area to Pool Area ($A_{ibp}$ / $A_{bkfp}$) | 0.000 | 0.000 | 0.000 |
| Point Bar Slope ($S_{pb}$) | 0.000 | 0.000 | 0.000 | ft/ft | Pool Inner Berm Width/Depth Ratio ($W_{ibp}$ / $d_{ibp}$) | 0.000 | 0.000 | 0.000 |

**Run Dimensions***

| Run Dimensions* | Mean | Min | Max | | Run Dimensionless Ratios**** | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Run Width ($W_{bkfr}$) | 0 | 0 | 0 | ft | Run Width to Riffle Width ($W_{bkfr}$ / $W_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Mean Run Depth ($d_{bkfr}$) | 0 | 0 | 0 | ft | Mean Run Depth to Mean Riffle Depth ($d_{bkfr}$ / $d_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Run Cross-Sectional Area ($A_{bkfr}$) | 0 | 0 | 0 | ft | Run Area to Riffle Area ($A_{bkfr}$ / $A_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Maximum Run Depth ($d_{maxr}$) | 0 | 0 | 0 | ft | Max Run Depth to Mean Riffle Depth ($d_{maxr}$ / $d_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Run Width/Depth Ratio ($W_{bkfr}$ / $d_{bkfr}$) | 0 | 0 | 0 | ft | | | | |

**Glide Dimensions***

| Glide Dimensions* | Mean | Min | Max | | Glide Dimensions & Dimensionless Ratios**** | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Glide Width ($W_{bkfg}$) | 0 | 0 | 0 | ft | Glide Width to Riffle Width ($W_{bkfg}$ / $W_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Mean Glide Depth ($d_{bkfg}$) | 0 | 0 | 0 | ft | Mean Glide Depth to Mean Riffle Depth ($d_{bkfg}$ / $d_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Glide Cross-Sectional Area ($A_{bkfg}$) | 0 | 0 | 0 | ft | Glide Area to Riffle Area ($A_{bkfg}$ / $A_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Maximum Glide Depth ($d_{maxg}$) | 0 | 0 | 0 | ft | Max Glide Depth to Mean Riffle Depth ($d_{maxg}$ / $d_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Glide Width/Depth Ratio ($W_{bkfg}$ / $d_{bkfg}$) | 0 | 0 | 0 | ft/ft | Glide Inner Berm Width/Depth Ratio ($W_{ibg}$ / $d_{ibg}$) | 0.000 | 0.000 | 0.000 |
| Glide Inner Berm Width ($W_{ibg}$) | 0 | 0 | 0 | ft | Glide Inner Berm Width to Glide Width ($W_{ibg}$/$W_{bkfg}$) | 0.000 | 0.000 | 0.000 |
| Glide Inner Berm Depth ($d_{ibg}$) | 0 | 0 | 0 | ft | Glide Inner Berm Depth to Glide Depth ($d_{ibg}$ / $d_{bkfg}$) | 0.000 | 0.000 | 0.000 |
| Glide Inner Berm Area ($A_{ibg}$) | 0 | 0 | 0 | $ft^2$ | Glide Inner Berm Area to Glide Area ($A_{ibg}$ / $A_{bkfg}$) | 0.000 | 0.000 | 0.000 |

**Step****

| Step** | Mean | Min | Max | | Step Dimensionless Ratios**** | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Step Width ($W_{bkfs}$) | 28.9 | 26 | 31.9 | ft | Step Width to Riffle Width ($W_{bkfs}$ / $W_{bkf}$) | 1.157 | 1.039 | 1.274 |
| Mean Step Depth ($d_{bkfs}$) | 1.63 | 1.43 | 1.83 | ft | Mean Step Depth to Riffle Depth ($d_{bkfs}$ / $d_{bkf}$) | 1.109 | 0.973 | 1.245 |
| Step Cross-Sectional Area ($A_{bkfs}$) | 47.8 | 37.1 | 58.4 | ft | Step Area to Riffle Area ($A_{bkfs}$ / $A_{bkf}$) | 1.295 | 1.006 | 1.584 |
| Maximum Step Depth ($d_{maxs}$) | 2.69 | 2.6 | 2.77 | ft | Max Step Depth to Mean Riffle Depth ($d_{maxs}$ / $d_{bkf}$) | 1.830 | 1.769 | 1.884 |
| Step Width/Depth Ratio ($W_{bkfs}$ / $d_{bkfs}$) | 17.8 | 17.4 | 18.2 | | | | | |

*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: **Sharman's River is great** | | Location: **Reach - Team 4 Day 1 Cross Sections** | |
| Observers: **Team 4** | Date: **04/17/18** | Valley Type: **C-CO-US** | Stream Type: **B 3/1** |

**Hydraulics** — **River Reach Summary Data…..2**

| | | | | | |
|---|---|---|---|---|---|
| Streamflow: Estimated Mean Velocity at Bankfull Stage ($u_{bkf}$) | 4.51 | ft/sec | Estimation Method | U/U* | |
| Streamflow: Estimated Discharge at Bankfull Stage ($Q_{bkf}$) | 138.98 | cfs | Drainage Area | 3.6 | $mi^2$ |

**Channel Pattern**

| Geometry | Mean | Min | Max | | Dimensionless Geometry Ratios | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Linear Wavelength ($\lambda$) | 0 | 0 | 0 | ft | Linear Wavelength to Riffle Width ($\lambda$ / $W_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Stream Meander Length ($L_m$) | 0 | 0 | 0 | ft | Stream Meander Length Ratio ($L_m$ / $W_{bkf}$) | 0.000 | 0.000 | 0.000 |
| Radius of Curvature ($R_c$) | 120 | 110 | 130 | ft | Radius of Curvature to Riffle Width ($R_c$ / $W_{bkf}$) | 4.800 | 4.400 | 5.200 |
| Belt Width ($W_{blt}$) | 125 | 0 | 0 | ft | Meander Width Ratio ($W_{blt}$ / $W_{bkf}$) | 5.000 | 0.000 | 0.000 |
| Arc Length ($L_a$) | 132 | 0 | 0 | ft | Arc Length to Riffle Width ($L_a$ / $W_{bkf}$) | 5.280 | 0.000 | 0.000 |
| Riffle Length ($L_r$) | 15 | 12 | 24 | ft | Riffle Length to Riffle Width ($L_r$ / $W_{bkf}$) | 0.600 | 0.480 | 0.960 |
| Individual Pool Length ($L_p$) | 9 | 5 | 13 | ft | Individual Pool Length to Riffle Width ($L_p$ / $W_{bkf}$) | 0.360 | 0.200 | 0.520 |
| Pool to Pool Spacing ($P_s$) | 48.8 | 26 | 106 | ft | Pool to Pool Spacing to Riffle Width ($P_s$ / $W_{bkf}$) | 1.952 | 1.040 | 4.240 |

**Channel Profile**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Valley Slope ($S_{val}$) | 0.0424 | ft/ft | Average Water Surface Slope (S) | 0.0375 | ft/ft | Sinuosity ($S_{val}$ / S) | 1.13 |
| Stream Length (SL) | 260 | ft | Valley Length (VL) | 230 | ft | Sinuosity (SL / VL) | 1.13 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Low Bank Height (LBH) | start | 0 | ft | Max Depth ($d_{max}$) | start | 0 | ft | Bank-Height Ratio (BHR) (LBH / $d_{max}$) start |
| | end | 0 | ft | | end | 0 | ft | end |

| Facet Slopes | Mean | Min | Max | | Dimensionless Facet Slope Ratios | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Riffle Slope ($S_{rif}$) | 0.033 | 0.026 | 0.049 | ft/ft | Riffle Slope to Average Water Surface Slope ($S_{rif}$ / S) | 0.883 | 0.689 | 1.311 |
| Run Slope ($S_{run}$) | 0.000 | 0.000 | 0.000 | ft/ft | Run Slope to Average Water Surface Slope ($S_{run}$ / S) | 0.000 | 0.000 | 0.000 |
| Pool Slope ($S_p$) | 0.010 | 0.000 | 0.019 | ft/ft | Pool Slope to Average Water Surface Slope ($S_p$ / S) | 0.276 | 0.000 | 0.504 |
| Glide Slope ($S_g$) | 0.000 | 0.000 | 0.000 | ft/ft | Glide Slope to Average Water Surface Slope ($S_g$ / S) | 0.000 | 0.000 | 0.000 |
| Step Slope ($S_s$) | 0.100 | 0.097 | 0.107 | ft/ft | Step Slope to Average Water Surface Slope ($S_s$ / S) | 2.674 | 2.578 | 2.845 |

| Max Depths[a] | Mean | Min | Max | | Dimensionless Depth Ratios | Mean | Min | Max |
|---|---|---|---|---|---|---|---|---|
| Max Riffle Depth ($d_{maxrif}$) | 2.41 | 2.29 | 2.53 | ft | Max Riffle Depth to Mean Riffle Depth ($d_{maxrif}$ / $d_{bkf}$) | 1.64 | 1.558 | 1.72 |
| Max Run Depth ($d_{maxrun}$) | 0 | 0 | 0 | ft | Max Run Depth to Mean Riffle Depth ($d_{maxrun}$ / $d_{bkf}$) | 0 | 0 | 0 |
| Max Pool Depth ($d_{maxp}$) | 3.3 | 2.65 | 3.75 | ft | Max Pool Depth to Mean Riffle Depth ($d_{maxp}$ / $d_{bkf}$) | 2.24 | 1.803 | 2.55 |
| Max Glide Depth ($d_{maxg}$) | 0 | 0 | 0 | ft | Max Glide Depth to Mean Riffle Depth ($d_{maxg}$ / $d_{bkf}$) | 0 | 0 | 0 |
| Max Step Depth ($d_{maxs}$) | 2.1 | 1.5 | 2.55 | ft | Max Step Depth to Mean Riffle Depth ($d_{maxs}$ / $d_{bkf}$) | 1.43 | 1.02 | 1.73 |

**Channel Materials**

| | Reach[b] | Riffle[c] | Bar | | Reach[b] | Riffle[c] | Bar | Protrusion Height[d] | |
|---|---|---|---|---|---|---|---|---|---|
| % Silt/Clay | 0 | 0 | | $D_{16}$ | 16 | 45 | | 69.2 | mm |
| % Sand | 4 | 2 | | $D_{35}$ | 64 | 111.11 | | 139.56 | mm |
| % Gravel | 31 | 19 | | $D_{50}$ | 106.29 | 201.71 | | 183.04 | mm |
| % Cobble | 29 | 39 | | $D_{84}$ | 1024 | 1325.18 | | 309 | mm |
| % Boulder | 36 | 36 | | $D_{95}$ | 1728 | 1987.76 | | 387 | mm |
| % Bedrock | 0 | 4 | | $D_{100}$ | 2047.99 | Bedrock | | 512 | 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 (*First Field Day*).

Stream: Sharrman's Creek Location: Washington County, MD

Observers: TEAM 4 Stream Type: B3/1 Landscape Type: C-CO-US Date: April 17, 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 | | | | Mean | | | | |
| | Min. | | | | Min. | | | | |
| | Max. | | | | Max. | | | | |
| 2. Contraction Scour Pool (CSP) | Mean | 3.50 | 2.38 | | Mean | 0.158 | ~~0.921~~ | | 1.54 |
| | Min. | 1.00 | 1.55 | | Min. | 0.045 | ~~0.324~~ | | 1.00 |
| | Max. | 6.00 | 3.10 | | Max. | 0.271 | ~~1.439~~ | | 2.01 |
| 3. Step/Pool (SP) | Mean | 4.95 | 2.57 | | Mean | 0.224 | ~~1.057~~ | | 1.67 |
| | Min. | 1.50 | 1.90 | | Min. | 0.068 | ~~0.575~~ | | 1.23 |
| | Max. | 13.00 | 3.60 | | Max. | 0.588 | ~~1.798~~ | | 2.34 |
| 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 | 2.27 | 1.92 | | Mean | 0.103 | ~~0.589~~ | | 1.25 |
| | Min. | 1.00 | 1.40 | | Min. | 0.045 | ~~0.216~~ | | 0.91 |
| | Max. | 5.00 | 2.30 | | Max. | 0.226 | ~~0.935~~ | | 1.56 |
| 7. Lateral Protrusion Pool (LPP) | Mean | 4.50 | 2.03 | | Mean | 0.204 | ~~0.741~~ | | 1.38 |
| | Min. | 4.50 | 2.10 | | Min. | 0.204 | ~~0.719~~ | | 1.36 |
| | Max. | 4.50 | 2.05 | | Max. | 0.204 | ~~0.755~~ | | 1.39 |
| 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. | | | | |

check matrices w/ longpro

step pools look right ✓

also longer than step pools (currently less thought) X

too shallow

"we hate antiques"

converging should be deeper than step pool

pocket pool ≠ is

pool pool-to-pool spacing seems

match longpro + XS data sets

*underestimating pool lengths (count)



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