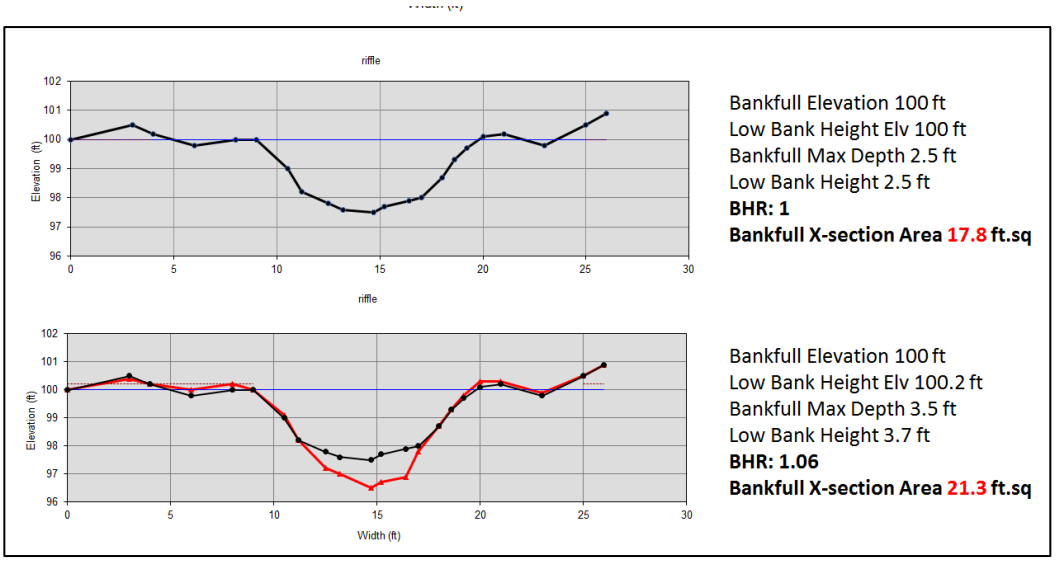
Monitoring Channel Change in DMS Mitigation Projects (Effective 2019)
(Bank Height Ratio, Low Top of Bank Cross Sectional Area and Max Depth)

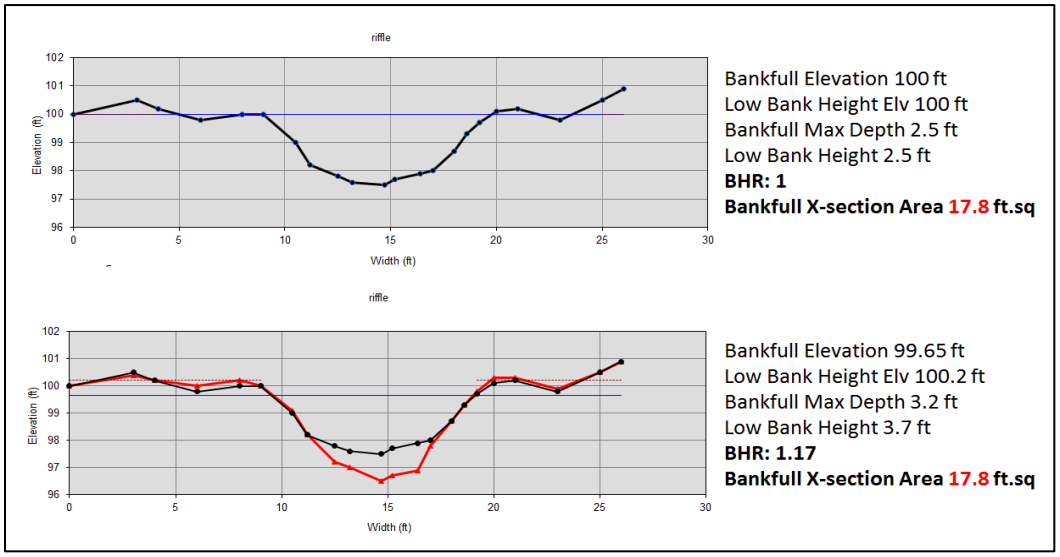
The following describes the parameters required and their calculation methods for monitoring channel change in DMS mitigation projects. The methods and parameters were finalized in 2019 and were the result of a consensus from a technical workgroup comprised of members of the IRT, DMS, and the provider community to address inconsistencies in the BHR calculation and the channel features used to track channel depth and cross sectional area. The standardization of the parameters and their calculation methods will improve the consistency and accuracy of monitoring channel change to include the maintenance of floodplain connection.

The updated methodology applies the as-built bankfull cross-sectional area to each successive annual survey of riffle cross sections. For example, if the As-built cross-sectional area is 10 ft^2 a line should be drawn on each resurvey of the cross section each monitoring year to reflect the elevation that encompasses 10 ft^2 of area below it. This line will be considered the bankfull elevation for that year and the ratio will be calculated with the height from the low top of bank to the thalweg in the numerator and the height from that years bankfull elevation to the thalweg in the denominator (see examples below). For years that exhibit deposition in the channel this may yield ratios that are less than 1 and should be calculated. This calculation should be applied beginning in the 2019 monitoring reports and used thereafter. Calculations from monitoring reports prior to 2019 do not need to be recalculated.

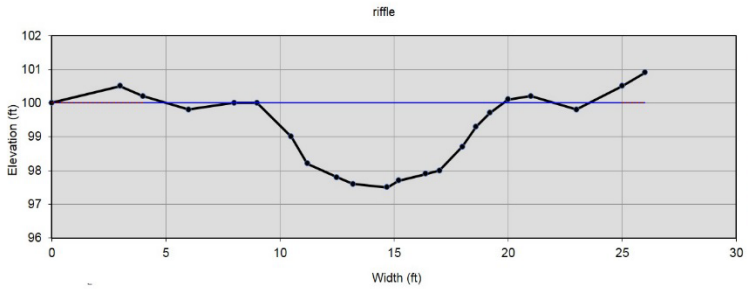
Additionally, the Low Top of Bank (LTOB) depth and XSA is now required and must be added to the monitoring data table for all cross sections. The Excel data table at the end of this document includes the parameters required for reporting.



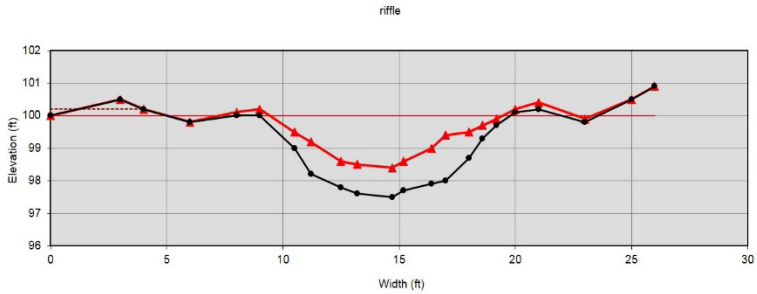
Old Methodology
Fixed AB Bankfull Elevation
Degradation Example



New Methodology
Fixed AB Bankfull Area
Degradation Example

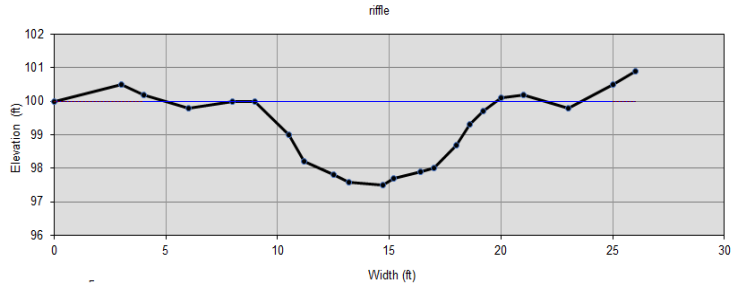


Bankfull Elevation 100 ft
Low Bank Height Elv 100 ft
Bankfull Max Depth 2.5 ft
Low Bank Height 2.5 ft
BHR: 1
Bankfull X-section Area 17.8 ft.sq

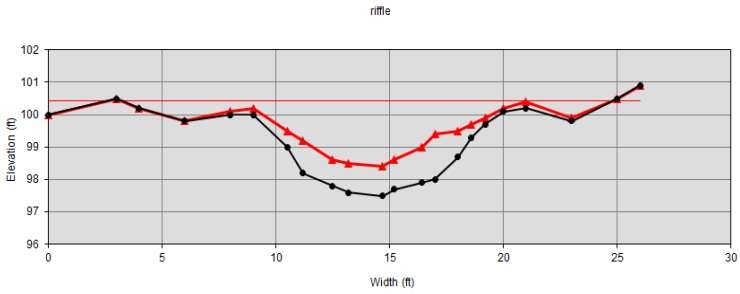


Bankfull Elevation 100 ft
Low Bank Height Elv 100.2 ft
Bankfull Max Depth 1.6 ft
Low Bank Height 1.8 ft
BHR: 1.1
Bankfull X-section Area 9.4 ft.sq

Old Methodology
Fixed AB Bankfull
Elevation
Aggradational Example



Bankfull Elevation 100 ft
Low Bank Height Elv 100 ft
Bankfull Max Depth 2.5 ft
Low Bank Height 2.5 ft
BHR: 1
Bankfull X-section Area 17.8 ft.sq



Bankfull Elevation 100.4 ft
Low Bank Height Elv 100.2 ft
Bankfull Max Depth 2.0 ft
Low Bank Height 1.8 ft
BHR: 0.9
Bankfull X-section Area 17.8 ft.sq

New Methodology
Fixed AB Bankfull
Area
Aggradational Example

Monitoring Data - Cross Section Morphology Monitoring Summary

Project Name/Number Segment/Reach: Reach 1-4

	Cross Section 1 (Pool - Reach 3)							Cross Section 2 (Riffle - Reach 3)							Cross Section 3 (Riffle - Reach 4)							Cross Section 4 (Pool - Reach 4)							Cross Section 5 (Pool - Reach 2)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area								36.40	36.36	36.55	36.42				34.50	34.34	34.60	34.62																	
Bank Height Ratio_Based on AB Bankfull[1] Area								1.00	1.00	0.77	0.88				1.00	1.14	0.77	0.65																	
Thalweg Elevation	36.33	37.05	37.54	38.25				35.55	35.44	35.52	35.51				33.76	32.88	33.96	34.06				33.00	32.92	32.90	33.20				34.56	34.77	34.89	35.19			
LTOB[2] Elevation	37.57	37.52	38.05	38.65				36.40	36.36	36.31	36.31				34.50	34.55	34.45	34.42				33.60	33.64	33.60	33.75				35.46	35.42	35.44	36.15			
LTOB[2] Max Depth (ft)	1.24	0.47	0.51	0.40				0.85	0.92	0.79	0.80				0.74	1.67	0.49	0.36				0.60	0.72	0.70	0.55				0.90	0.65	0.55	0.96			
LTOB[2] Cross Sectional Area (ft^2)	3.90	1.50	1.40	1.80				7.07	7.07	2.90	5.60				3.17	4.40	2.00	1.70				3.19	2.30	1.80	2.50				3.70	4.90	2.00	3.40			

	Cross Section 6 (Riffle - Reach 2)							Cross Section 7 (Pool - Reach 1)							Cross Section 8 (Riffle - Reach 1)							Cross Section 9 (Pool - Reach 1)							Cross Section 10 (Riffle - Reach 1)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	36.53	37.13	37.75	37.84											37.91	37.90	37.97	37.93											40.26	40.22	40.27	40.28			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.63	0.47	0.74											1.00	1.30	1.09	0.88											1.00	1.13	1.04	1.00			
Thalweg Elevation	35.67	36.57	36.97	37.01				35.91	35.87	35.70	35.96				37.40	37.41	37.33	37.44				38.41	38.32	38.05	38.43				39.86	39.77	39.82	39.87			
LTOB[2] Elevation	36.53	36.92	37.34	37.62				36.56	36.66	36.25	36.70				37.91	38.05	38.03	37.87				39.00	39.03	39.21	39.05				40.26	40.28	40.29	40.28			
LTOB[2] Max Depth (ft)	0.86	0.35	0.37	0.61				0.65	0.79	0.55	0.74				0.51	0.64	0.70	0.43				0.59	0.71	1.16	0.62				0.40	0.51	0.47	0.41			
LTOB[2] Cross Sectional Area (ft^2)	5.25	2.82	1.60	2.66				2.30	3.10	2.30	3.20				4.28	7.20	5.01	3.80				2.20	2.40	5.20	2.40				2.40	3.30	2.90	2.40			

	Cross Section 11 (Confluence - Reach 1)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	33.42	33.44	33.49	33.52			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.84	0.73	0.71			
Thalweg Elevation	32.51	31.91	32.56	32.58			
LTOB[2] Elevation	33.42	33.19	33.24	33.25			
LTOB[2] Max Depth (ft)	0.91	1.28	0.68	0.67			
LTOB[2] Cross Sectional Area (ft^2)	22.54	14.68	14.13	13.85			

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - **Bank Height Ratio (BHR)** takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.

2 - **LTOB Area and Max depth -** These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.