Stantec

Memo

To:	Katie Dylewski	From:	Stephanie Coffman, PG
	Mobile Bay National Estuary Program		Stantec
File:	177311100	Date:	July 26, 2019

Reference: Twelve Mile Creek BANCS Assessment

INTRODUCTION

A BANCS analysis (Bank Assessment for Non-point source Consequences of Sediment [Rosgen 1996, 2001b, 2006b]) was performed to estimate the sediment load resulting from bank erosion in the Twelve Mile Creek project reach between Dickens Ferry Rd. and Foreman Rd. The BANCS model uses two erosion estimation tools to evaluate sediment production from bank erosion:

1. Bank Erosion Hazard Index (BEHI)
2. Near-Bank Stress (NBS)

BEHI evaluates streambank susceptibility to erosion, and NBS evaluates the distribution of flow energy within the stream cross section. In other words, BEHI measures the susceptibility to erosion and NBS estimates the power available during high flow events to cause erosion. An erosion rate in tons per year can be calculated by combining the results of BEHI and NBS analyses.

EXISTING CONDITION

The BANCS assessment for Twelve Mile Creek was completed by collecting BEHI and NBS data in the field and compiling data into the BANCS model in the office. BEHI analyses were only completed for banks that exhibited erosion. BEHI values in the project reach range from Low to Very High. NBS values were consistently very low throughout the reach because of the straight alignment of the existing stream. Higher NBS values were assigned for streambanks at curves in the channel alignment.

The BANCS model estimates that approximately 44 tons (~33 cubic yards) of sediment are produced by streambank erosion within the project reach under existing, unstable conditions.

RESTORED CONDITION

The objective of the restoration of the Twelve Mile Creek project reach is to reduce sediment loading to downstream reaches by stabilizing stream banks throughout the reach. Stabilizing streambanks throughout the reach will reduce the erosion susceptibility of the streambanks. As such, BEHI scores for the restored stream are expected to be less than 30 (Moderate). The “Moderate” value was selected as an appropriate post-restoration value because of the naturally steep gradient and confinement of the system might cause some erosion during the monitoring period. The restoration design planform is also aligned to not experience higher NBS values. As such, NBS values for the restored stream will be consistently very low. To estimate the bank erosion sediment load from the restored reach, a Moderate BEHI value and Very Low NBS value were applied to the proposed restoration design. This resulted in an annual sediment load of approximately 30 tons per year. This results in an approximate sediment load reduction of 14 tons per year.

It is important to note that a restored stream is not a static stream. Some erosion should be expected to occur, with the goal being a stream that does not appreciably aggrade or degrade over time. Therefore, it would be unrealistic to assume that the restored project reach would experience zero bank erosion during the monitoring period.

Reference: **Twelve Mile Creek BANCS Assessment**

Additionally, the BANCS model does not account for sediment load from upstream sources; only sediment load produced by bank erosion within the study reach was evaluated. It is assumed that the project will have zero impact on the amount of sediment being produced by overland processes and streambank erosion in the upper watershed. The Twelve Mile Creek restoration project also proposes to improve floodplain connection throughout the project reach. This improved floodplain connection will increase the frequency of floodplain inundation within a given year, which will produce a greater opportunity for suspended sediments to settle out of flood waters and be sequestered on the floodplain. This will, in turn, further reduce the among of sediment being delivered to the reach of Twelve Mile Creek downstream of Foreman Rd. It is not possible to quantify the sediment reduction from floodplain settling without substantial additional modeling, sampling, and monitoring.

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Attachment: BANCS Worksheets

Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Stream:	**Twelve Mile Ck - Existing**			Location: **Left Bank**			
Graph Used:	**Colorado**	Total Stream Length (ft): **1850**				Date:	
Observers:	**D. Coffman**		Valley Type: **Unconfined Alluvial**			Stream Type:	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Station (ft)	**BEHI rating (Worksheet 3-11) (adjective)**	**NBS rating (Worksheet 3-12) (adjective)**	**Bank erosion rate (Figure 3-9 or 3-10) (ft/yr)**	**Length of bank (ft)**	**Study bank height (ft)**	**Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)**	**Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}**
1. **10+80 - 11+30**				**50.0**	**5.0**		
2. **11+30 - 11+90**				**60.0**	**5.0**		
3. **11+90 - 12+40**	**MODERATE**	**VERY LOW**	**0.092**	**50.0**	**6.0**	**27.66**	**0.02663**
4. **12+40 - 13+00**	**HIGH**	**VERY LOW**	**0.165**	**60.0**	**5.0**	**49.56**	**0.03977**
5. **13+00 - 13+55**	**MODERATE**	**VERY LOW**	**0.092**	**55.0**	**5.0**	**25.35**	**0.02219**
6. **13+55 - 14+00**				**65.0**	**4.0**		
7. **15+00 - 15+45**				**45.0**	**3.0**		
8. **15+45 - 15+85**	**HIGH**	**VERY LOW**	**0.165**	**40.0**	**3.0**	**19.83**	**0.02386**
9. **15+85 - 16+15**	**LOW**	**VERY LOW**	**0.017**	**30.0**	**4.0**	**2.05**	**0.00329**
10. **16+15 - 16+50**	**MODERATE**	**VERY LOW**	**0.092**	**35.0**	**4.0**	**12.91**	**0.01776**
11. **16+50 - 17+30**	**HIGH**	**VERY LOW**	**0.165**	**80.0**	**3.0**	**39.65**	**0.02386**
12. **17+80 - 18+00**	**HIGH**	**VERY LOW**	**0.165**	**20.0**	**3.0**	**9.91**	**0.02386**
13. **18+45 - 18+60**	**VERY HIGH**	**VERY HIGH**	**0.872**	**15.0**	**3.0**	**39.24**	**0.12596**
14. **20+60 - 21+10**	**HIGH**	**VERY LOW**	**0.165**	**50.0**	**6.0**	**49.56**	**0.04773**
15. **22+00 - 22+70**				**70.0**	**4.0**		
16. **24+40 - 25+25**				**85.0**	**3.0**		
Sum erosion subtotals in Column (7) for each BEHI/NBS combination					**Total Erosion (ft^3/yr)**	**275.73**	
Convert erosion in ft^3/yr to yds^3/yr {divide Total Erosion (ft^3/yr) by 27}					**Total Erosion (yds^3/yr)**	**10.21**	
Convert erosion in yds^3/yr to tons/yr {multiply Total Erosion (yds^3/yr) by 1.3}					**Total Erosion (tons/yr)**	**13.28**	
Calculate erosion per unit length of channel {divide Total Erosion (tons/yr) by total length of stream (ft) surveyed}					**Unit Erosion Rate (tons/yr/ft)**	**0.0072**	

Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Stream: **Twelve Mile Ck - Existing**				Location: **Right Bank**			
Graph Used: **Colorado**		Total Stream Length (ft): **1850**				Date:	
Observers: **D. Coffman**			Valley Type: **Unconfined Alluvial**			Stream Type:	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Station (ft)	**BEHI rating (Worksheet 3-11) (adjective)**	**NBS rating (Worksheet 3-12) (adjective)**	**Bank erosion rate (Figure 3-9 or 3-10) (ft/yr)**	**Length of bank (ft)**	**Study bank height (ft)**	**Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)**	**Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}**
1. **10+80 - 11+30**	**HIGH**	**VERY LOW**	**0.165**	**50.0**	**4.0**	**33.04**	**0.03182**
2. **11+30 - 11+90**	**MODERATE**	**VERY LOW**	**0.092**	**60.0**	**4.0**	**22.13**	**0.01776**
3. **11+90 - 12+40**	**MODERATE**	**VERY LOW**	**0.092**	**50.0**	**6.0**	**27.66**	**0.02663**
4. **12+40 - 13+00**	**HIGH**	**VERY LOW**	**0.165**	**60.0**	**6.0**	**59.48**	**0.04773**
5. **13+00 - 13+55**	**MODERATE**	**VERY HIGH**	**0.697**	**55.0**	**5.0**	**191.66**	**0.16778**
6. **13+55 - 14+00**	**HIGH**	**VERY LOW**	**0.165**	**65.0**	**4.0**	**42.96**	**0.03182**
7. **15+00 - 15+45**	**HIGH**	**VERY LOW**	**0.165**	**45.0**	**4.0**	**29.74**	**0.03182**
8. **15+45 - 15+85**	**HIGH**	**VERY LOW**	**0.165**	**40.0**	**3.0**	**19.83**	**0.02386**
9. **15+85 - 16+15**	**MODERATE**	**VERY LOW**	**0.092**	**30.0**	**4.0**	**11.06**	**0.01776**
10. **16+15 - 16+50**	**MODERATE**	**VERY LOW**	**0.092**	**35.0**	**3.0**	**9.68**	**0.01332**
11. **16+50 - 17+30**	**HIGH**	**VERY LOW**	**0.165**	**80.0**	**3.0**	**39.65**	**0.02386**
12. **17+80 - 18+00**	**HIGH**	**VERY LOW**	**0.165**	**20.0**	**3.0**	**9.91**	**0.02386**
13. **18+45 - 18+60**	**HIGH**	**VERY HIGH**	**0.575**	**15.0**	**3.0**	**25.89**	**0.08310**
14. **20+60 - 21+10**	**HIGH**	**VERY LOW**	**0.165**	**50.0**	**4.0**	**33.04**	**0.03182**
15. **22+00 - 22+70**	**MODERATE**	**VERY LOW**	**0.092**	**70.0**	**3.0**	**19.36**	**0.01332**
16. **24+40 - 25+25**	**HIGH**	**VERY LOW**	**0.165**	**85.0**	**4.0**	**56.17**	**0.03182**
Sum erosion subtotals in Column (7) for each BEHI/NBS combination					**Total Erosion (ft^3/yr)**	**631.25**	
Convert erosion in ft^3/yr to yds^3/yr {divide Total Erosion (ft^3/yr) by 27}					**Total Erosion (yds^3/yr)**	**23.38**	
Convert erosion in yds^3/yr to tons/yr {multiply Total Erosion (yds^3/yr) by 1.3}					**Total Erosion (tons/yr)**	**30.39**	
Calculate erosion per unit length of channel {divide Total Erosion (tons/yr) by total length of stream (ft) surveyed}					**Unit Erosion Rate (tons/yr/ft)**	**0.0164**	

Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.

Stream: **Twelve Mile Ck - Existing**				Location: **Restored - LT/RT**			
Graph Used: **Colorado**		Total Stream Length (ft): **1850**				Date:	
Observers: **D. Coffman**			Valley Type: **Unconfined Alluvial**			Stream Type:	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Station (ft)	**BEHI rating (Worksheet 3-11) (adjective)**	**NBS rating (Worksheet 3-12) (adjective)**	**Bank erosion rate (Figure 3-9 or 3-10) (ft/yr)**	**Length of bank (ft)**	**Study bank height (ft)**	**Erosion subtotal [(4)×(5)×(6)] (ft^3/yr)**	**Erosion Rate (tons/yr/ft) {[(7)/27] × 1.3 / (5)}**
1. **20+00 - 29+34**	**MODERATE**	**VERY LOW**	**0.092**	**934.0**	**2.1**	**180.83**	**0.00932**
2. **29+34 - 38+50**	**MODERATE**	**VERY LOW**	**0.092**	**916.0**	**1.6**	**135.12**	**0.00710**
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Sum erosion subtotals in Column (7) for each BEHI/NBS combination					**Total Erosion (ft^3/yr)**	**315.95**	
Convert erosion in ft^3/yr to yds^3/yr {divide Total Erosion (ft^3/yr) by 27}					**Total Erosion (yds^3/yr)**	**11.70**	
Convert erosion in yds^3/yr to tons/yr {multiply Total Erosion (yds^3/yr) by 1.3}					**Total Erosion (tons/yr)**	**15.21**	**Total 30.42 for Both Banks**
Calculate erosion per unit length of channel {divide Total Erosion (tons/yr) by total length of stream (ft) surveyed}					**Unit Erosion Rate (tons/yr/ft)**	**0.0082**	