

Process-based Modeling and Measurement of Streambank Retreat in a NC Piedmont Stream

Division of Mitigation Services (DMS)

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Department of Environmental Quality



EcoStream 2018

Bank Retreat: Consistent Questions Related to Restoration Projects

Pre and post construction
Why?
How much?
Local or Systemic?
Long-term or Short-term
Effect?

Need to understand



Department of Environmental Quality



EcoStream 2018

Bank Stability and Toe Erosion Model (BSTEM)

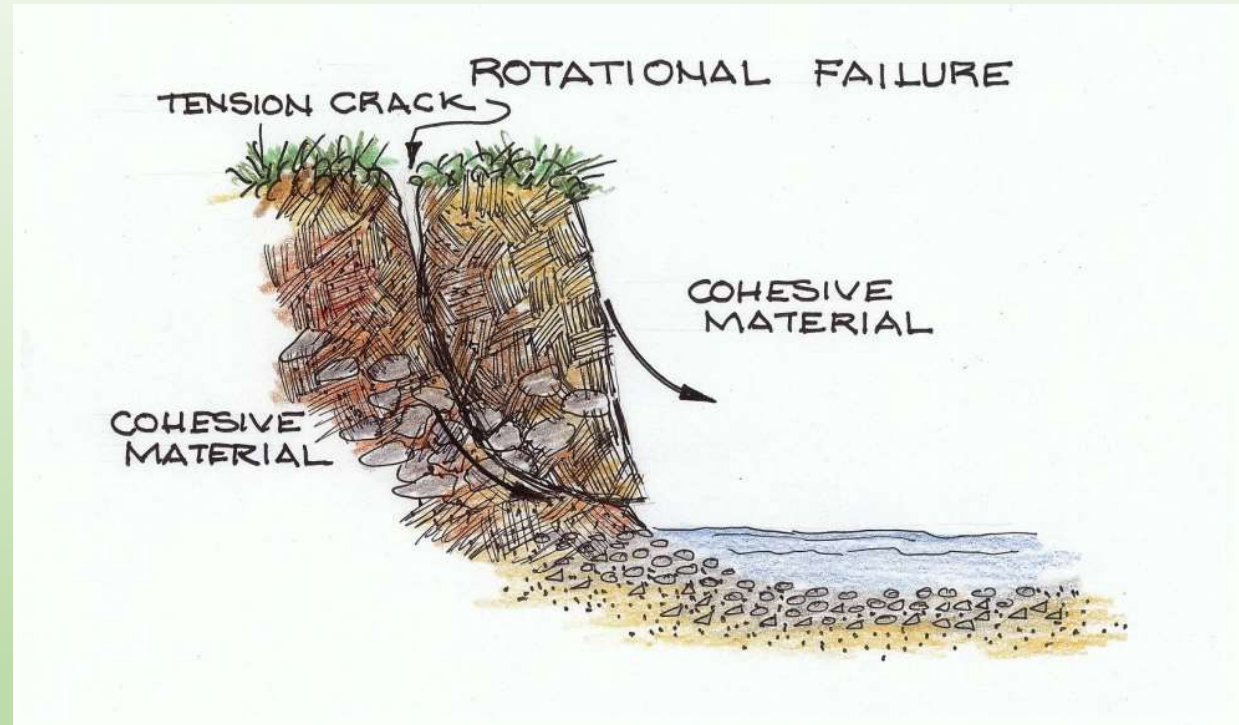
Process-Based

Fluvial and Geotechnical

Physical properties of streambank

Considers variable GW and surface flows over time

Quantifies area and volume



Reckendorf & Associates 2006

Ultimate Goal:

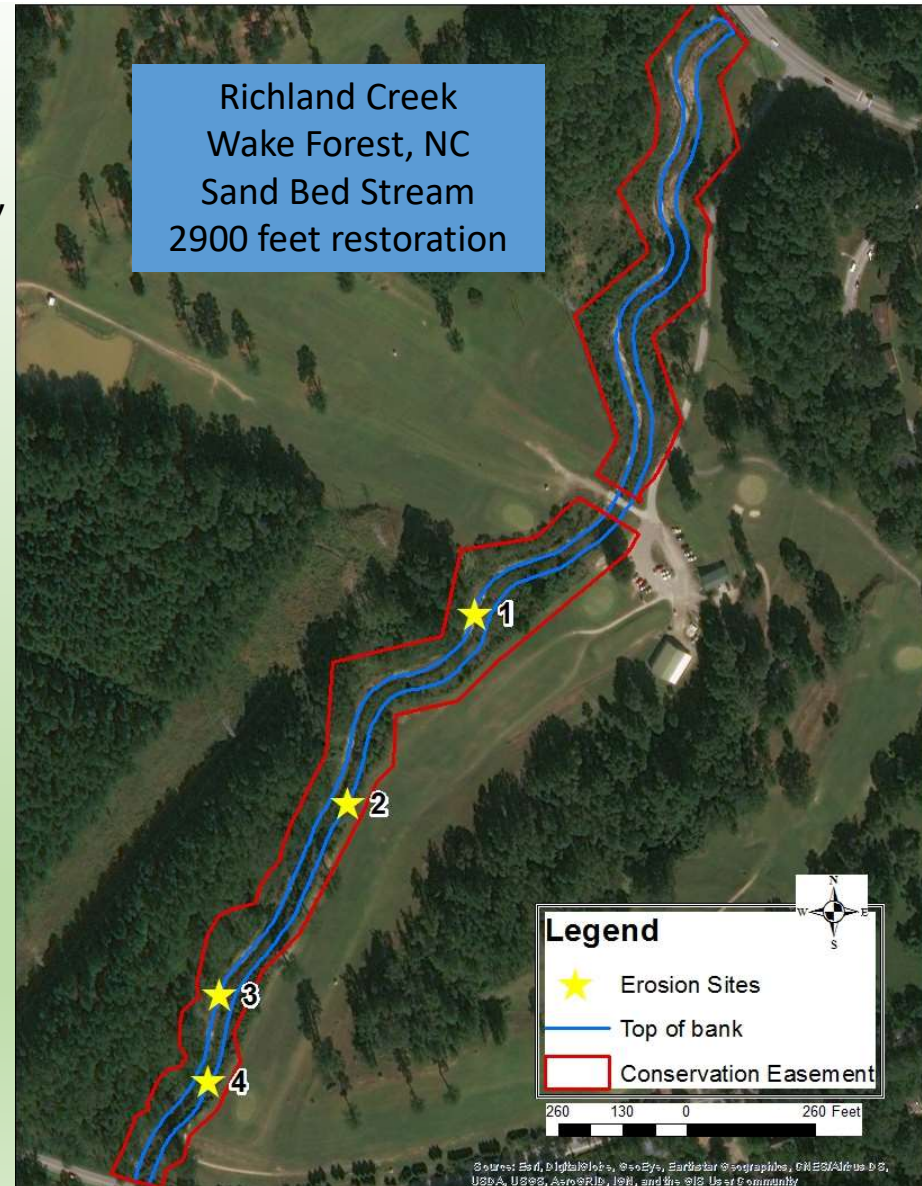
Calibrate and regionalize BSTEM for ease of application in the NC Piedmont

Test the effectiveness of the processed-based BSTEM in predicting erosion rates

Expand modeling efforts to account for bank erosion and sediment transport processes

Test Site and Methods

- Completed 5 3D terrestrial laser scans from Oct 2017 – July 2018
 - 1 base, 4 at least $.66Q_e$
- Estimated erosion and deposition
- Modeled bank retreat – BSTEM (static)
 - Jet Erosion Test (JET) to measure τ_c and K for each bank
 - Soil samples - moisture content, bulk density
 - Compared measured to modeled





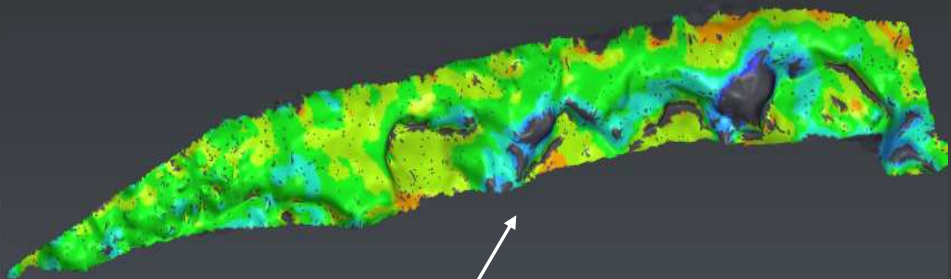
May 2017

Richland Creek Bank 3



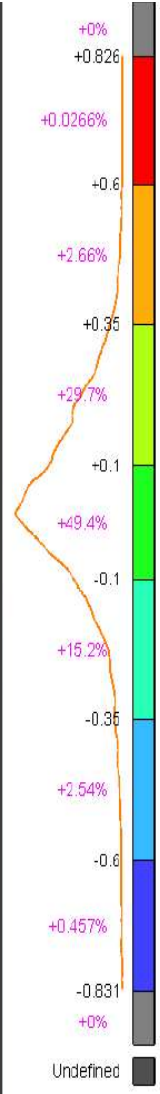
May 2017

Richland Creek Bank 3 Scan 1 – Scan 5

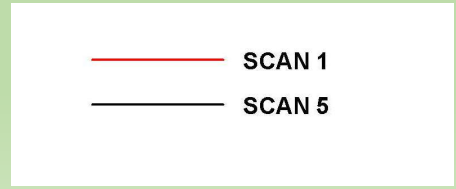
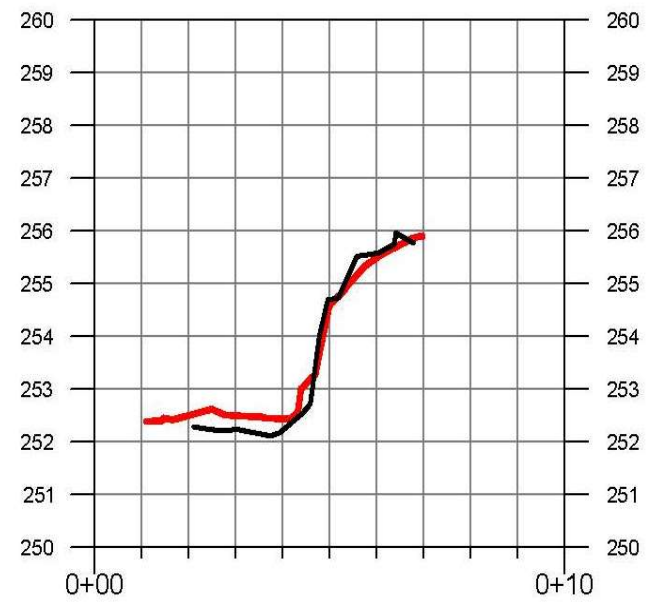


Water level

Erosion = 0.3 m³
Deposition = 2.0 m³



PROFILE 3





October 2017

Richland Creek
Bank 4

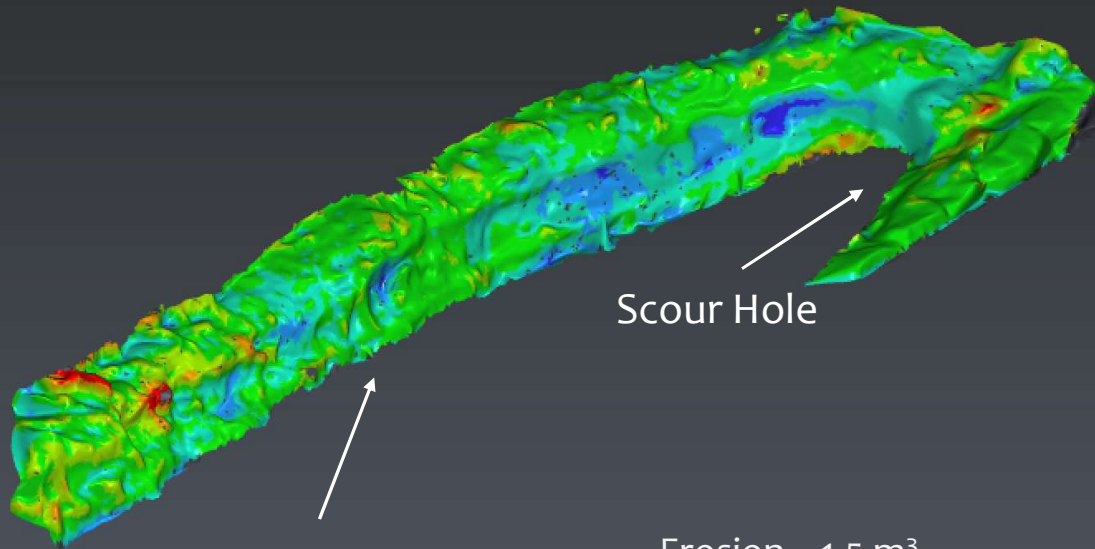


August 2018

Department of Environmental Quality



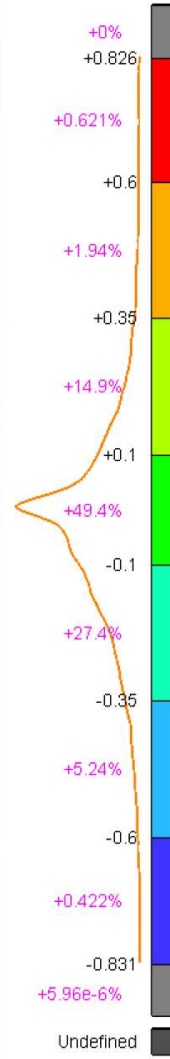
Richland Creek Bank 4 Scan 1 – Scan 5



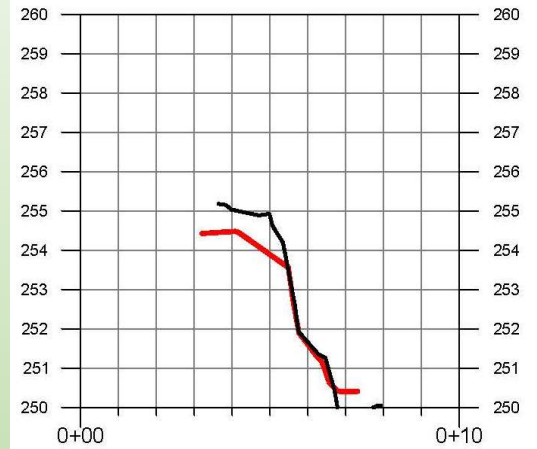
Scour Hole

Water level

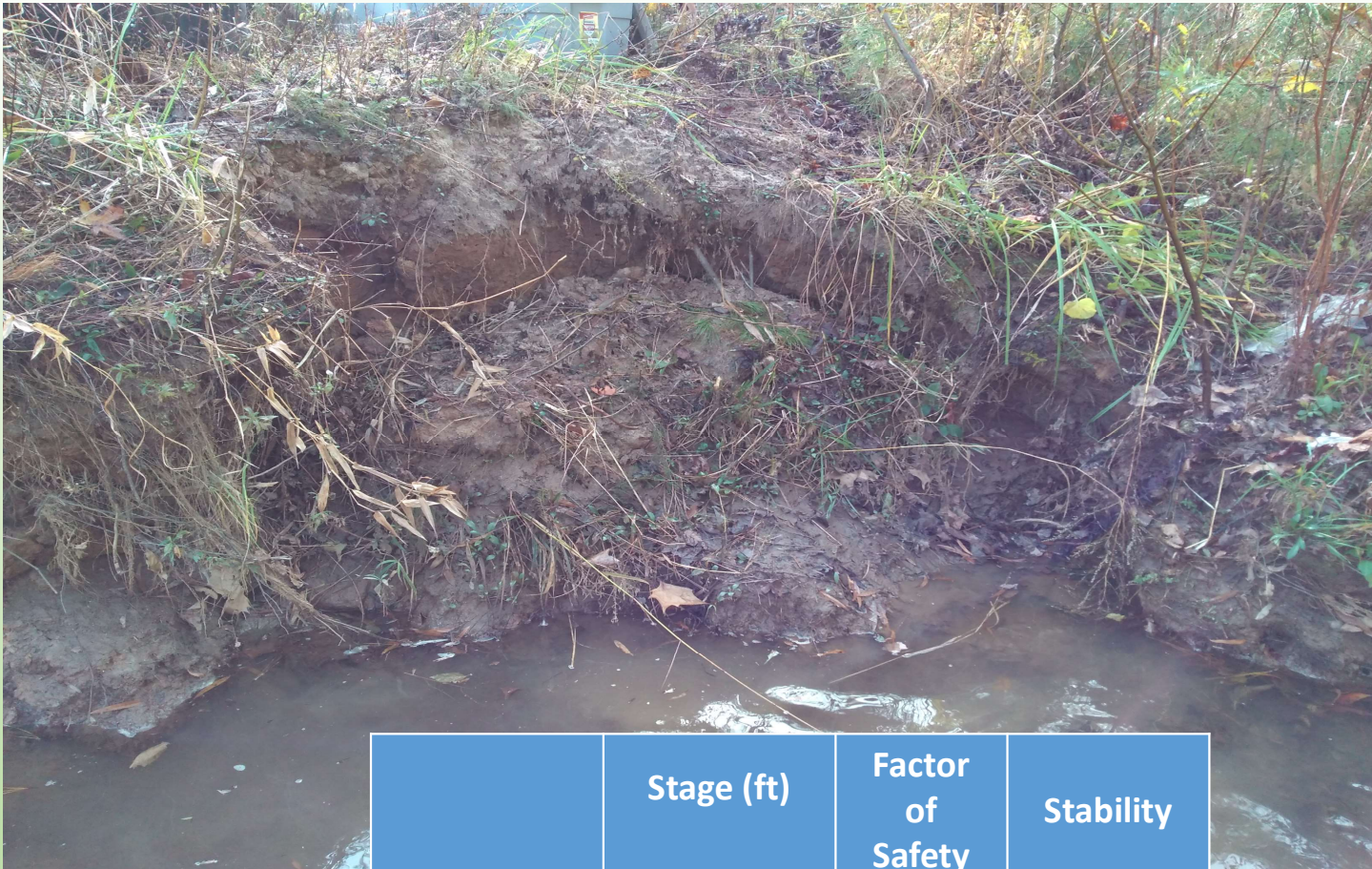
Erosion = 1.5 m³
Deposition = 1.0 m³



PROFILE 3



— SCAN 1
— SCAN 5



	Stage (ft)	Factor of Safety	Stability
Bank 3	2.3 ($.66Q_e$)	0.35	Unstable
Bank 4	2.8 ($.66Q_e$)	0.13	Unstable

Next Steps...

- Expand research sites
- Measure additional τ_c and K bank sites
- Model Richland Creek as-built geometry
 - Dynamic BSTEM - 1D
 - HEC-RAS + BSTEM – 1D
 - Sedimentation and River Hydraulics (SHR- 2D)
- Understand the limitations of the different models
- Develop tools for general use

We hope to...

- Build knowledge and understanding about bank erosion processes
- Potential for accurate existing condition assessments to inform need
- Set baseline for functional framework
- Set restoration/mitigation expectations and describe uncertainty analysis

<https://deq.nc.gov/about/divisions/mitigation-services/dms-science-data>

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