Benefits from Stream Restoration Protocols

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NATIONAL COVERAGE - LOCAL FOCUS

Founded in Baton Rouge in 2007, RES is the nation's leading provider of ecological and water resource solutions.

RES creates solutions to support economic development and long-term environmental sustainability.

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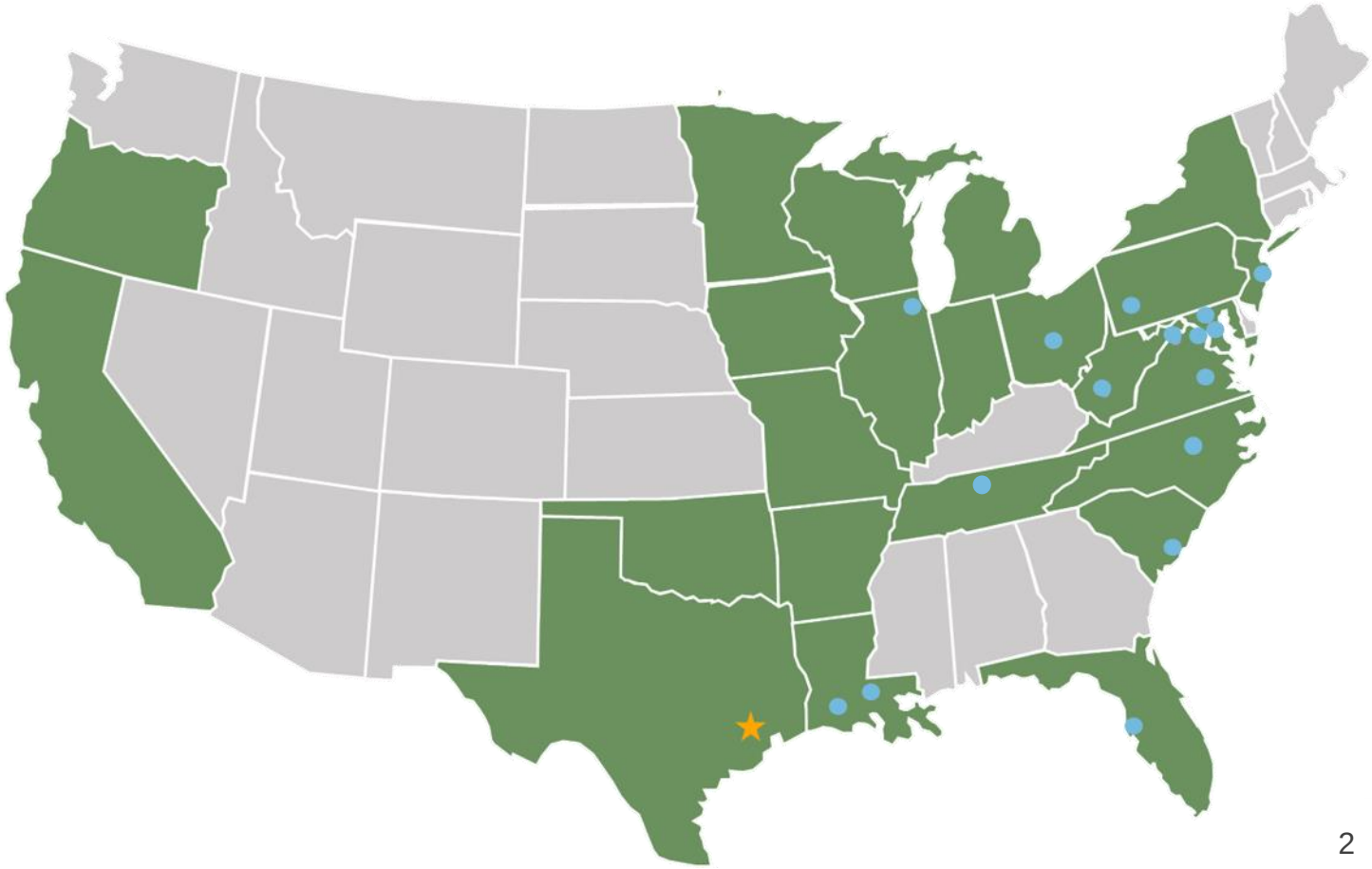
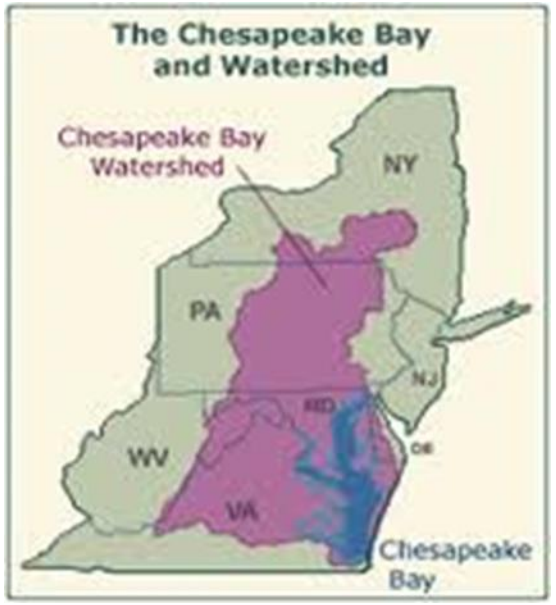


WATERSHED POLLUTION DIET

- TMDL Goal to meet reductions by 2025
- 60% of Actions in place by 2017
- Phase III WIP to be developed by 2017
- Nitrogen, Phosphorous, and Sediment
- DE, MD, NY, D.C., PA, WV, and VA



EPA Estimate of Stream and Wetland Restoration Projects to be Significant Strategy to Achieve Reductions:

3,096,922 linear feet or 587 restoration miles 2014 – 2025

92,228 wetland acres

Total Reductions:

25% N

24% P

20% Sediment

Tracking:

Local TMDL Action Plans

DEQ

Bayfast

STREAM RESTORATION PROTOCOLS

The Chesapeake Bay TMDL has set load reduction goals for TN, TP and TSS for each MS4 permittee in the watershed.

In 2014, an expert panel completed a multiple year effort to establish protocols that MS4 permitees could use to calculate load reductions from stream restoration projects.

The Expert Panel Identified three main protocols for load reduction.

THREE MAIN GOALS FOR LOAD REDUCTION

- **PROTOCOL 1 - PREVENTED SEDIMENT**: This protocol determined the load reduction from reducing bank erosion. The protocol is based on bank erosion hazard index/near bank stress methods. This protocol focus on preventing future loads from the existing channel.
- **PROTOCOL 2 – DENITRIFICATION**: The removal of water column nitrate during baseflow through increasing in-channel de-nitrification. This is the only protocol that solely targets nitrogen, and could be treat-n-load generated upstream of the restoration reach.
- **PROTOCOL 3 – FLOODPLAIN CONNECTION**: This protocol estimates the pollutant removal achieved through storm flows flowing through a vegetated floodplain. This protocol treats pollutant load generated upstream of the restored reach.

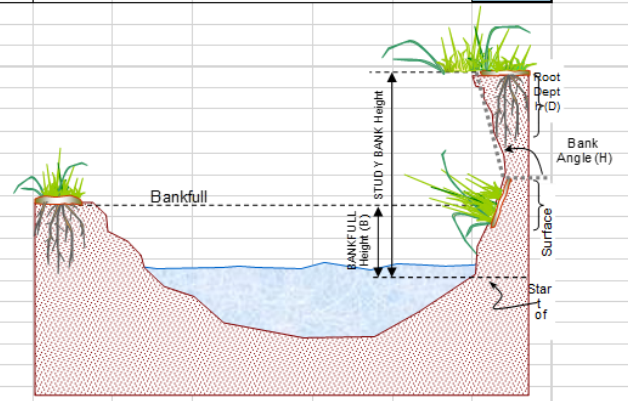
PROTOCOL 1 - BEHI

BEHI DATA COLLECTION APPLICATIONS

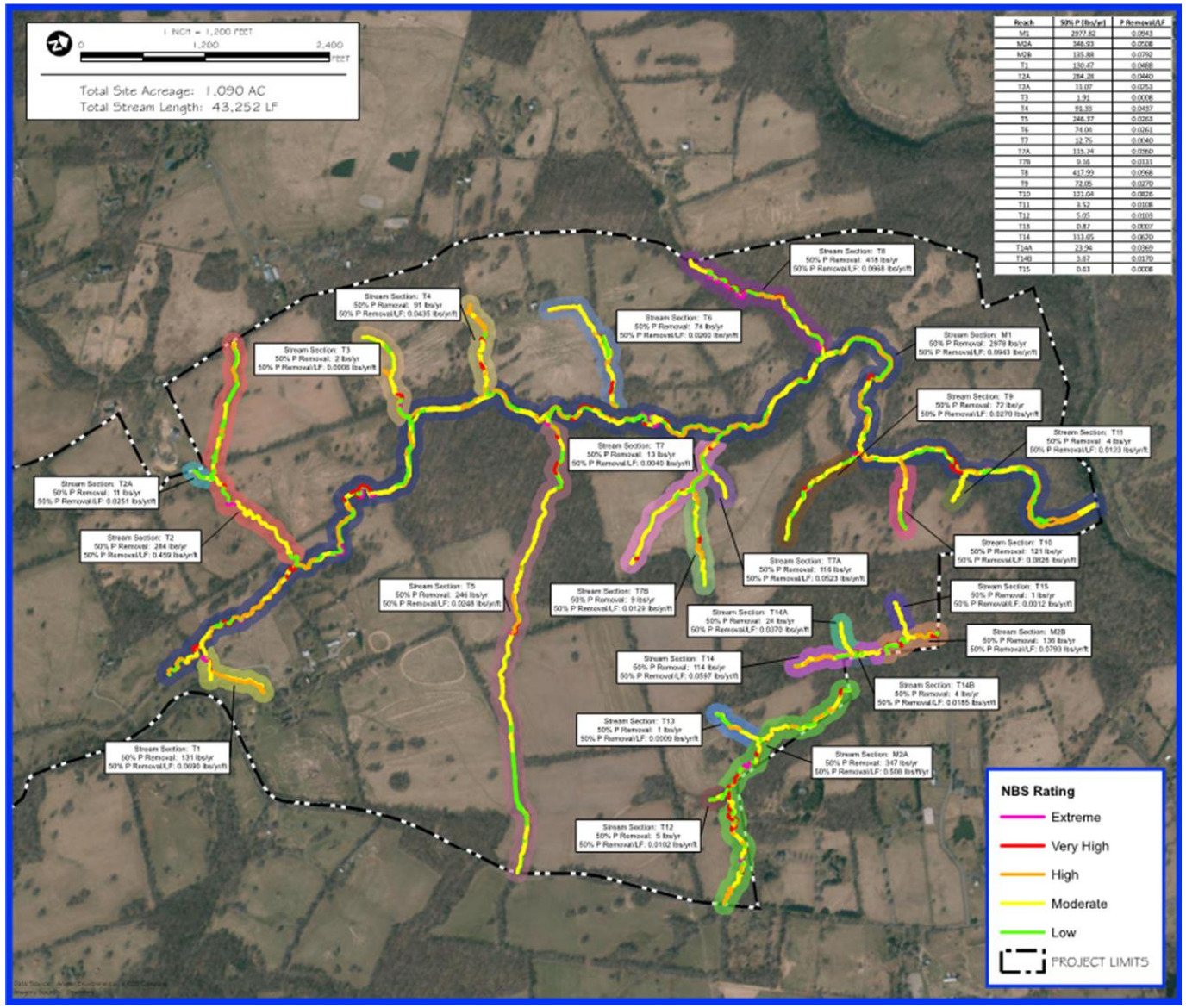
104R	R	8.0	1.5	2.0	25	65	25		37.57207
Smithwick				Location:	Loudoun County, Virginia				
104R				Observers:	BS and JA				
	Stream Type:			Valley Type:					
				Study Bank Height / Bankfull Height (C)				BEHI Score (Fig. 3-7)	
	Study Bank Height (ft) =	8.00 (A)	Bankfull Height (ft) =	1.50 (B)	(A) / (B) =	5.33 (C)		10.0	
				Root Depth / Study Bank Height (E)					
	Root Depth (ft) =	2.00 (D)	Study Bank Height (ft) =	8.00 (A)	(D) / (A) =	0.25 (E)		6.5	
				Weighted Root Density (G)					
			Root Density as % =	25% (F)	(F) x (E) =	0.0625 (G)		9.3	
					Bank Angle (H)				
					Bank Angle as *Degrees* =	65 (H)		4.4	
					Surface Protection (I)				
					Surface Protection as % =	25% (I)		6.5	

Bank Material Adjustment:		
Bedrock (Overall Very Low BEHI)	Bank Material Adjustment	0
Boulders (Overall Low BEHI)		
Cobble (Subtract 10 points if uniform medium to large cobble)		
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)	Stratification Adjustment: Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	0
Sand (Add 10 points)		
Silt/Clay (no adjustment)		

Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	HIGH 36.6
10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50		

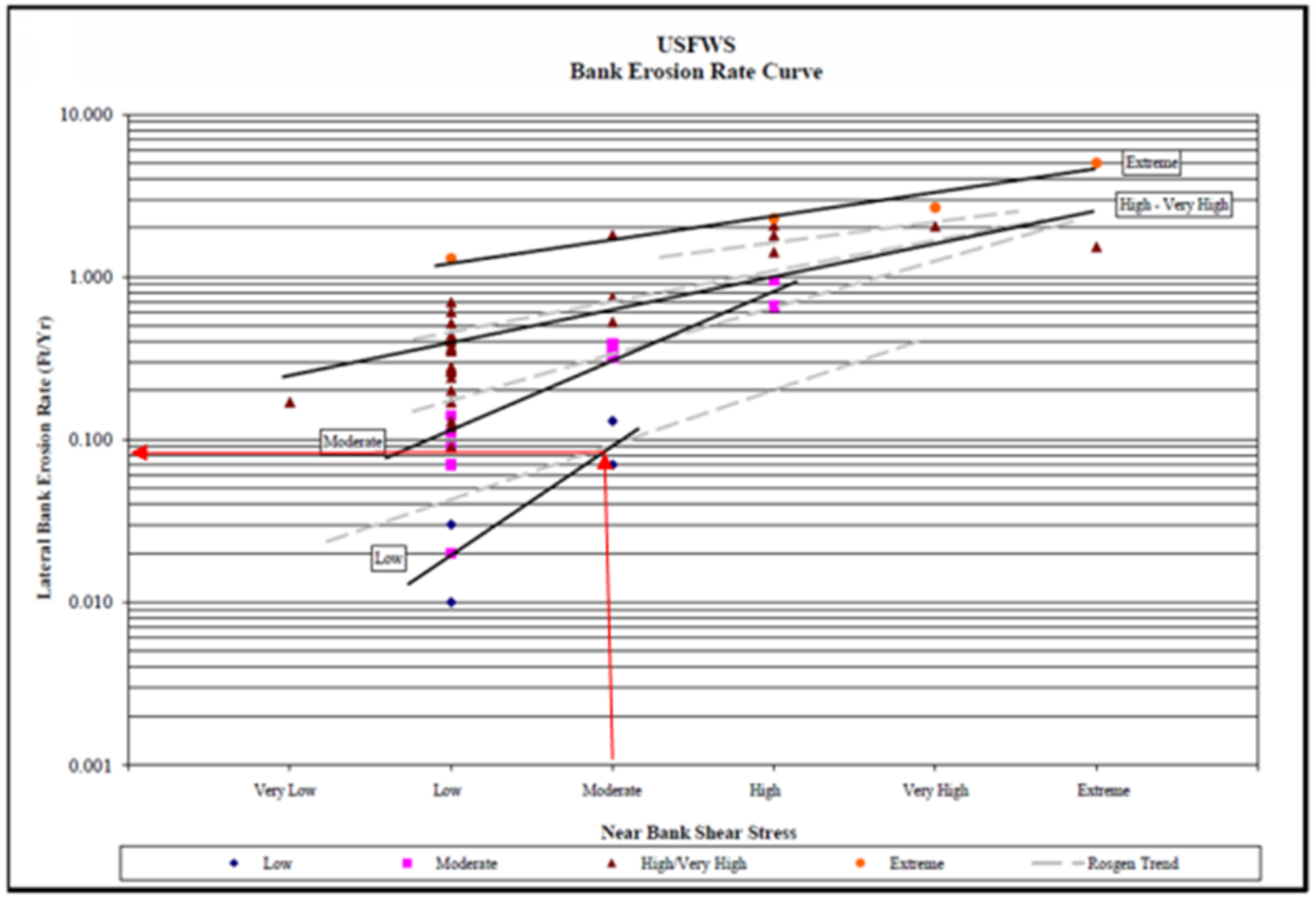


PROTOCOL 1 – BEHI DATA COLLECTION



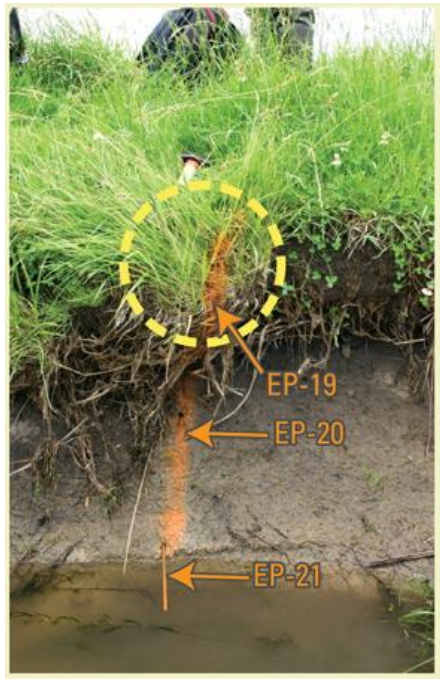
PROTOCOL 1 - REGIONAL EROSION CURVES

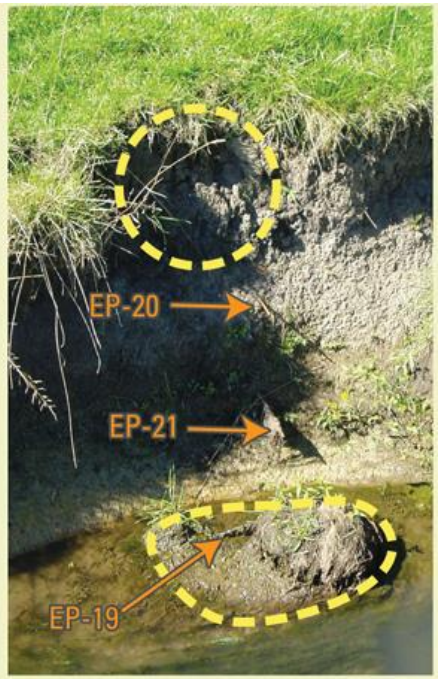
BEHI	NBS			BEHI/NBS	
Very Low	Very Low	0.04		Very LowVery Low	0.04
	Low	0.02		Very LowLow	0.02
	Moderate	0.07		Very LowModerate	0.07
	High	0.43		Very LowHigh	0.43
	Very High	2		Very LowVery High	2
	Extreme	10		Very LowExtreme	10
Low	Very Low	0.04		LowVery Low	0.04
	Low	0.02		LowLow	0.02
	Moderate	0.07		LowModerate	0.07
	High	0.43		LowHigh	0.43
	Very High	2		LowVery High	2
	Extreme	10		LowExtreme	10
Moderate	Very Low	0.04		ModerateVery Low	0.04
	Low	0.12		ModerateLow	0.12
	Moderate	0.3		ModerateModerate	0.3
	High	1.2		ModerateHigh	1.2
	Very High	2		ModerateVery High	2
	Extreme	6		ModerateExtreme	6
High	Very Low	0.25		HighVery Low	0.25
	Low	0.4		HighLow	0.4
	Moderate	0.62		HighModerate	0.62
	High	1		HighHigh	1
	Very High	1.7		HighVery High	1.7
	Extreme	2.65		HighExtreme	2.65
Very High	Very Low	0.25		Very HighVery Low	0.25
	Low	0.4		Very HighLow	0.4
	Moderate	0.62		Very HighModerate	0.62
	High	1		Very HighHigh	1
	Very High	1.7		Very HighVery High	1.7
	Extreme	2.65		Very HighExtreme	2.65
Extreme	Very Low	0.85		ExtremeVery Low	0.85
	Low	1.25		ExtremeLow	1.25
	Moderate	1.8		ExtremeModerate	1.8
	High	2.5		ExtremeHigh	2.5
	Very High	3.5		ExtremeVery High	3.5
	Extreme	5		ExtremeExtreme	5

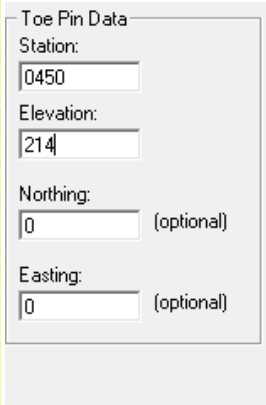


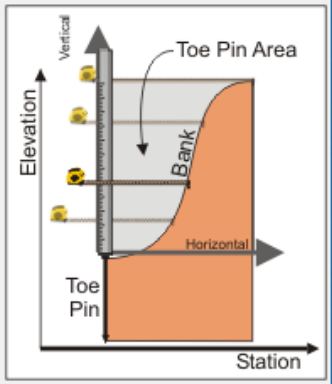
PROTOCOL 1 - BANK PINS AND BANK STABILITY MODELS

BANK PINS PROVIDE REAL SITE DATA TO VALIDATE MODELING AND REGIONAL CURVE ASSESSMENTS

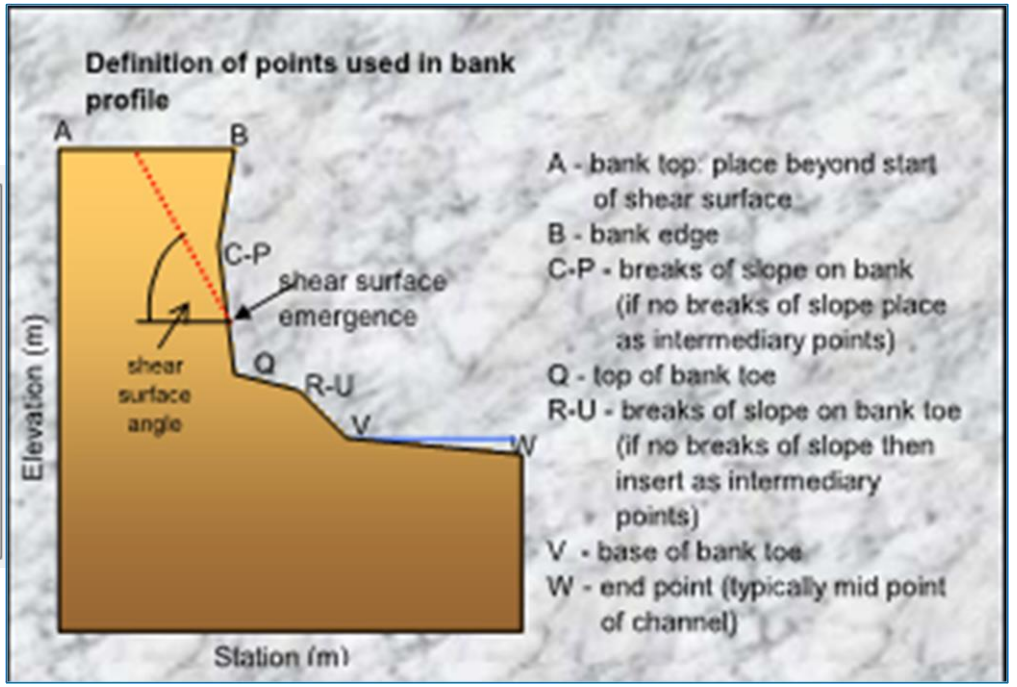




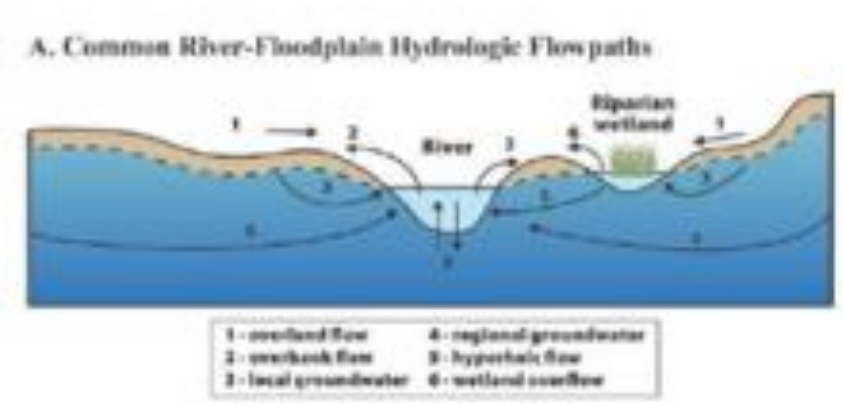


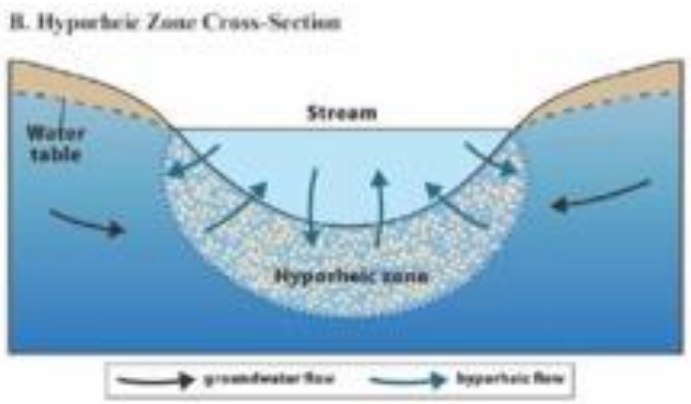


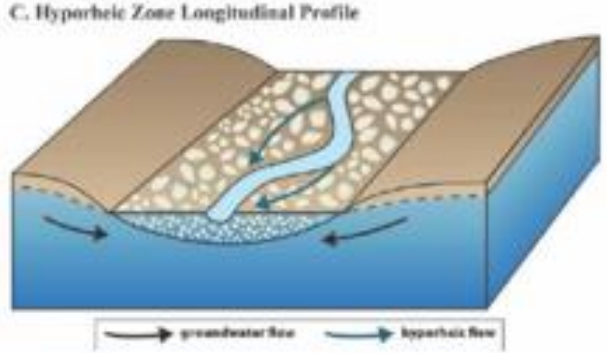
BANK STABILITY TOE EROSION MODEL (BSTEM)



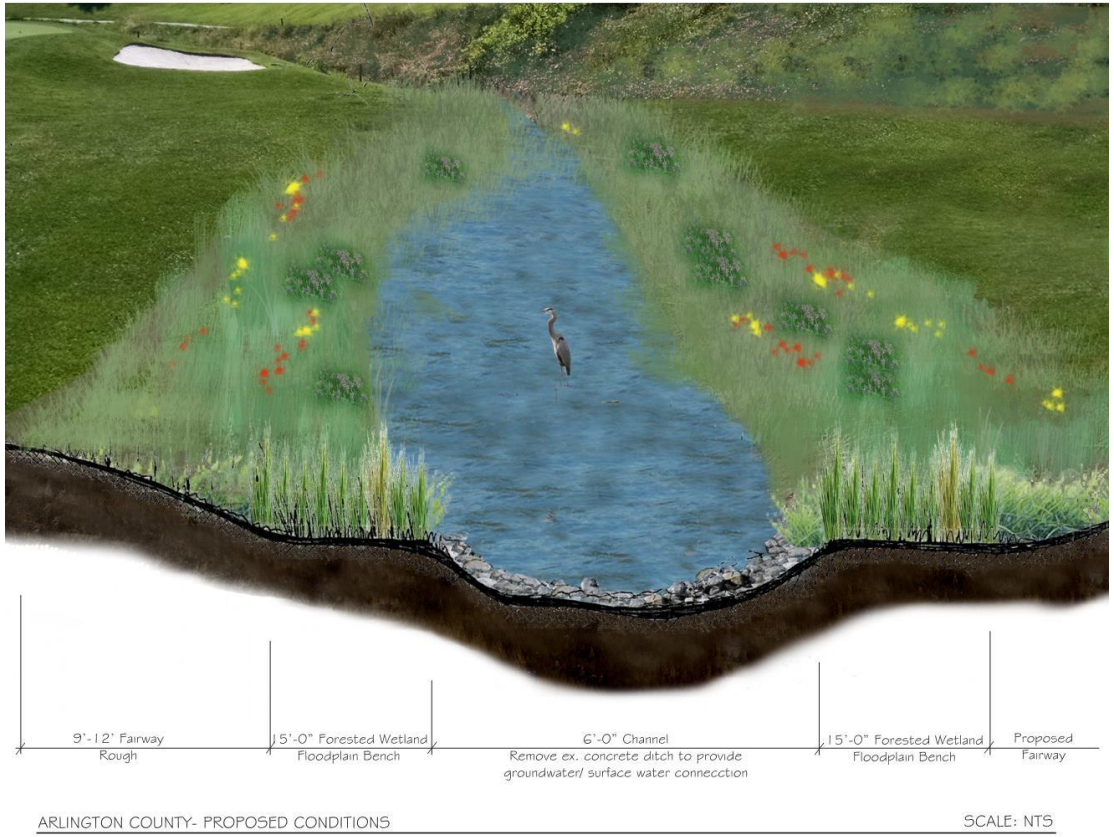
PROTOCOL 2 –SURFACE WATER AND GROUNDWATER INTERACTION AND CARBON SOURCE PRODUCTION





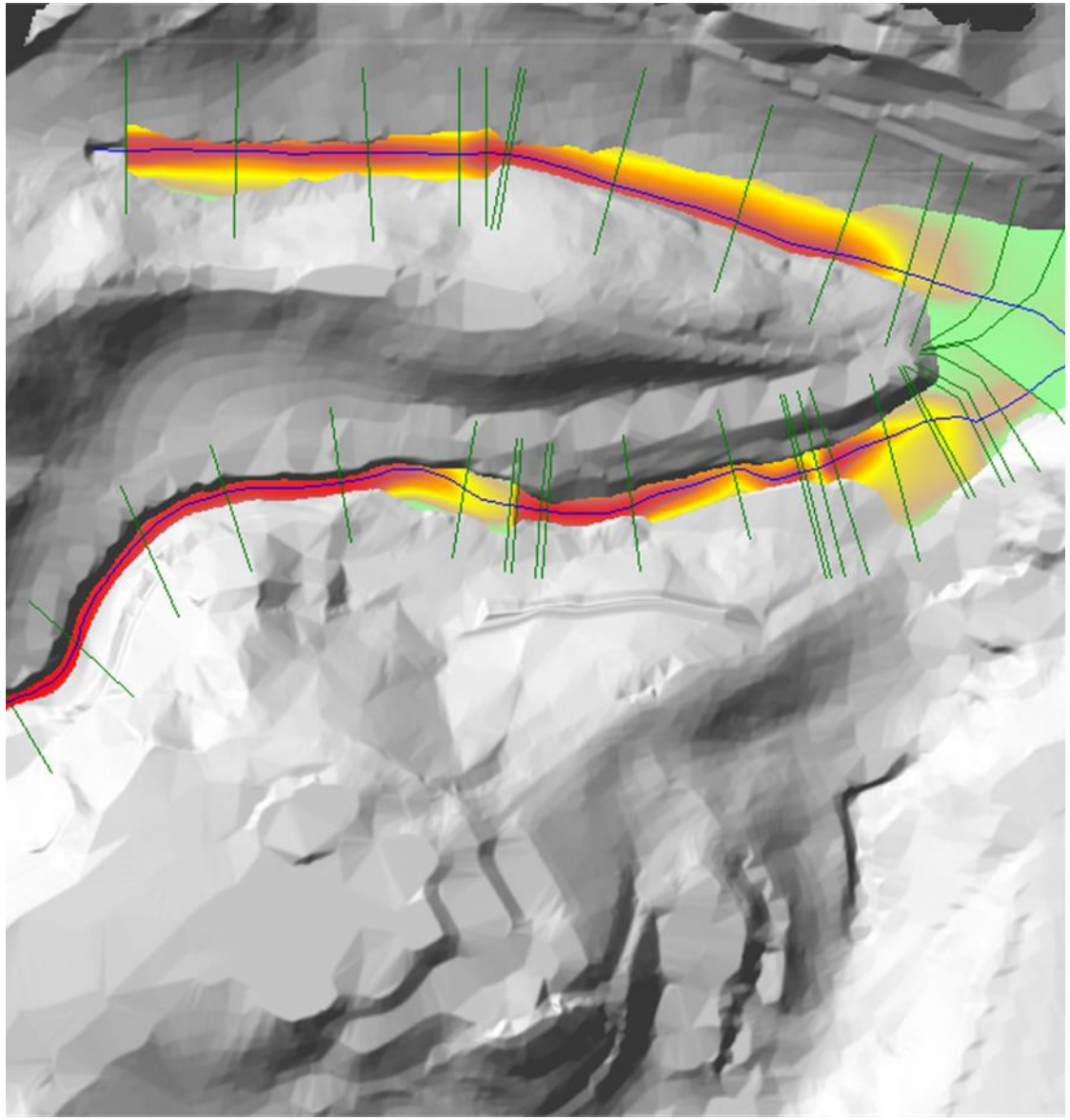


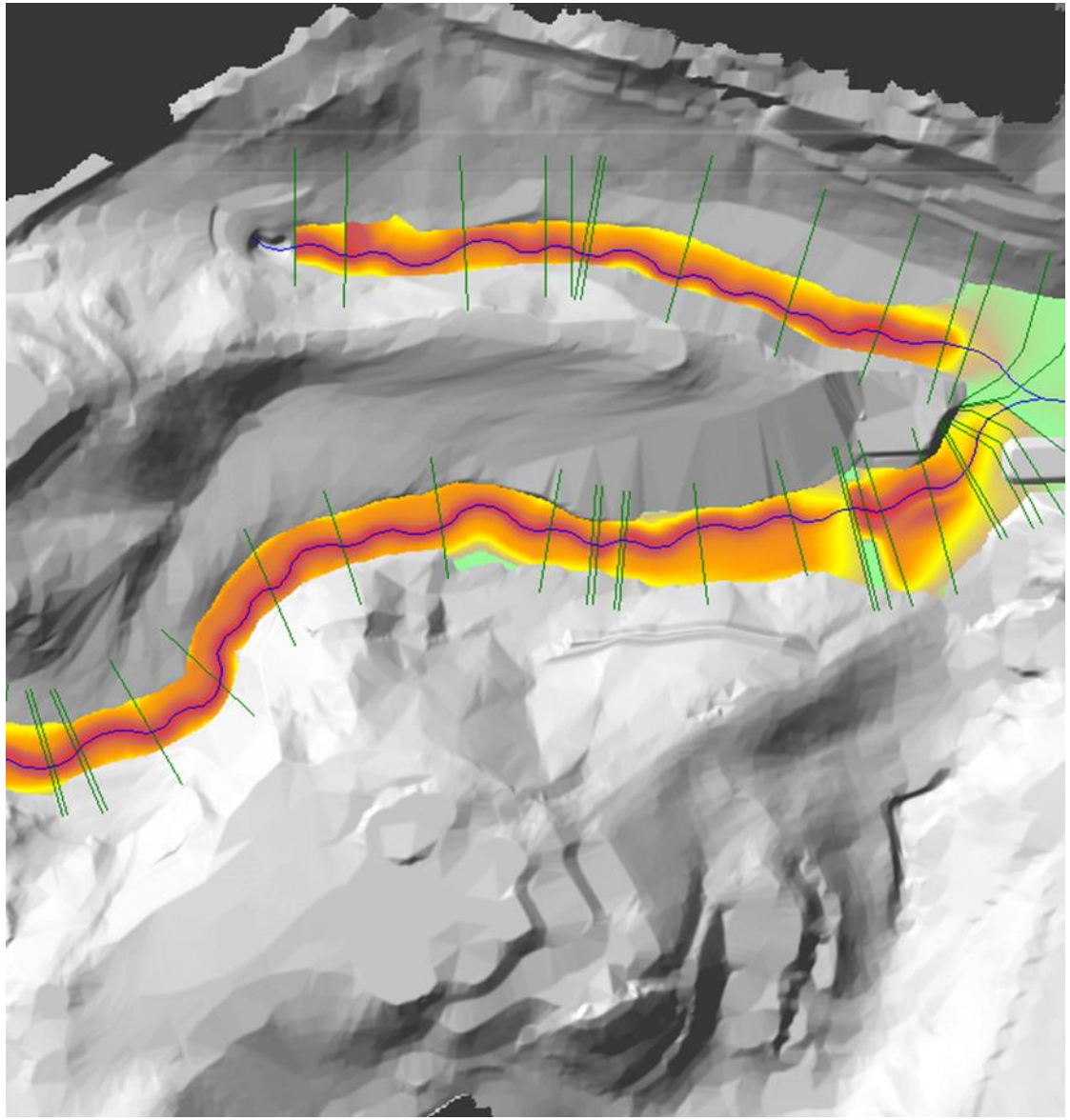
PROTOCOL 2 –SURFACE WATER AND GROUNDWATER INTERACTION – DAYLIGHTING STREAMS



PROTOCOL 3 – FLOODPLAIN RECONNECTION AND RE-ESTABLISHMENT FO FLOODPLAIN WETLANDS

PROTOCOL 3 – FLOODPLAIN RECONNECTION AND 2-D MODELING

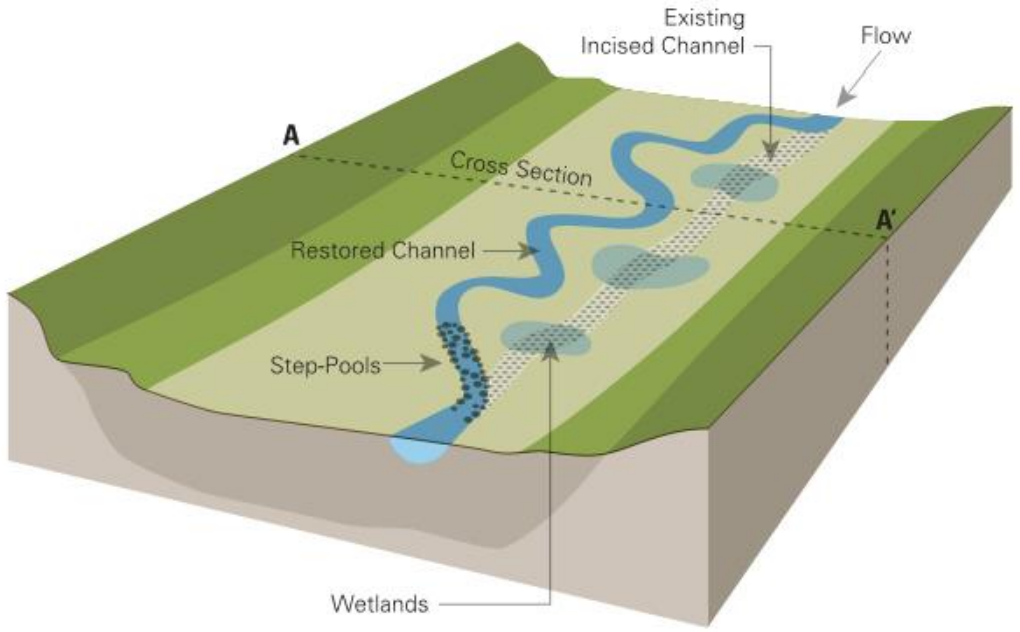




STREAM RESTORATION PROTOCOLS HAVE PLACED GREATER FOCUS ON FUNCTIONAL LIFT

Functional Lift

- **Hydrology**
  - Groundwater connection
- **Hydraulics**
  - Decreasing shear stress
  - Floodplain connection
  - Increase surface roughness with woody debris and vegetation
- **Morphology**
  - Stable stream plan form, bed form, and dimension
- **Water Quality**
  - By reconnecting the surface water and groundwater connection and providing frequen floodplain connection for sediment deposition
- **Improve Ecology**
  - Connection to cooler groundwater
  - Woody material for carbon source
  - Riffle bed form for benthic habitat



STREAM RESTORATION PROTOCOLS HAVE PLACED TREMENDOUS VALUE ON RESTORATION OF AGRICULTURAL STREAMS

- High eroded stream banks
- Lack of vegetative buffers
- Direct nutrient impact
- Disconnected floodplains
- Removal of legacy sediments

SUCCESS OF TURN KEY TMDL SOLUTIONS

Key Benefits:

- Applicable to all forms of environmental compensation (wetlands, streams, nutrients, species, habitats, buffers, forests)
- Cost savings through scale and integration
- Fixed pricing and flexible payment schedule
- Reduced administrative and internal overhead costs
- Guaranteed performance bonding
- Customized solution tailored to unique project circumstances

The $2.13 million project will restore around 6,200 feet of Cattail Creek over the next two years as the county attempts to meet state requirements to tackle stormwater runoff by 2019.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