Tennessee Stream Mitigation Guidelines

- **Historically, credits and debits were *ratio-based.***
  - *Debits*
    - *Riprap: 0.75:1 ratio*
      - *E.g., 100 ft riprap = 75 debits owed*
    - *Encapsulation: 1:1 ratio*
      - *E.g., 100 ft pipe = 100 debits owed*
  - *Credits*
    - *Ratios range from 1:1 to 60:1*
      - *E.g., 1,000 ft restoration = 667 credits generated*
      - *E.g., 1,000 ft preservation = 17 credits generated*

Stream Function Collaboration

- 2013 TDEC EPA Grant
- IRT Resource Agency Stream Functional Pyramid Framework Workshops
- Gather ecological success criteria and build regionalized quantification tool
- Stakeholder Stream Quantification Tool Review Committee
- Public Notice of Guidance
- 2018 ARAP Rule Revisions
- 2019 Mitigation Guidelines
- 2019 ARAP Rule Revisions Effective

2019 TN SQT and Debit Tool

- **Credits and debits calculated as *functional feet***
  - Debit calculations based on *existing resource value* and *proposed impacts*
  - Credit calculations based on *existing* and *proposed resource value*

Summary of Existing Conditions	
Reach ID	ECS
STR1R1	0.56
STR2R1	0.57
STR3R1	0.56
STR4R1	0.64
STR5R1	0.66
STR6R1	0.63
STR7R1	0.57
STR8R1	0.63
STR9R1	0.62

FUNCTIONAL LIFT SUMMARY	
Exisiting Condition Score (ECS)	0.33
Proposed Condition Score (PCS)	0.34
Change in Functional Condition (PCS - ECS)	0.01
Existing Stream Length (feet)	254
Proposed Stream Length (feet)	420.9
Additional Stream Length (feet)	166.9
Existing Stream Functional Feet (FF)	84
Proposed Stream Functional Feet (FF)	143
Functional Lift (Proposed FF - Existing FF)	59

MITIGATION SUMMARY	
59	Credits

Date:

Impact Severity Tiers	Impact Factors	Percent Functional Loss
Tier 0	1.00	0%
Tier 1	0.89	11%
Tier 2	0.8	20%
Tier 3	0.52	48%
Tier 4	0.32	68%
Tier 5	0.12	88%
Tier 6	0.00	100%

Increased Mitigation Needs & Costs

- **Credit currency**
  - Owe similar mitigation, but produce less credits
- **Reduces debits owed**
  - Up to 40% reduction
- **Reduces credit production**
  - 50-80% reduction in credits produced by banks
  - East TN bank expected to produce 18,021 ratio-based credits and 5,287 functional feet.
- **Increased mitigation costs**
  - Increased cost per credit purchased; credit prices expected to at least double
  - Increased cost for data collection pre- and post-project

Time Intensive Data Collection

Reach ID:	STR9R1	Drainage Area (sqmi):	0.0062			Upstream Latitude:	35.225207
Existing Stream Type:	C	Existing Bed Material:	Sand	Data Collection Season:		Upstream Longitude:	-89.366487
Reference Stream Type:	C	Existing Stream Slope (%):	2	Macro Collection Method:		Downstream Latitude:	
Ecoregion:	74b	Flow Type:	Perennial/Intermittent	Valley Type:	Unconfined Alluvial	Downstream Longitude:	

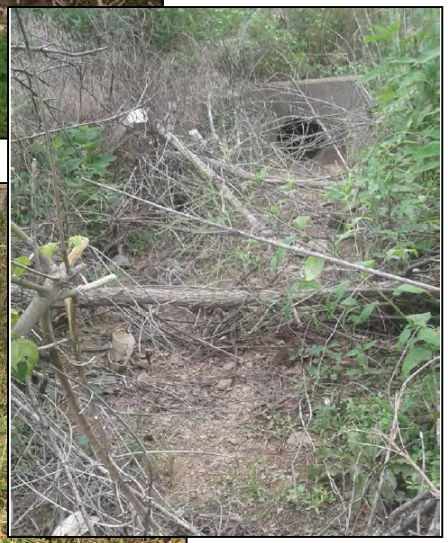
EXISTING CONDITION ASSESSMENT					Roll Up Scoring			
Functional Category	Function-Based Parameters	Measurement Method	Field Value	Index Value	Parameter	Category	Category	ECS
Hydrology	Catchment Hydrology	Watershed Land Use Runoff Score	0.2	0.21	0.21	0.51	Functioning At Risk	0.62
	Reach Runoff	Stormwater Infiltration		0.80	0.80			
Hydraulics	Floodplain Connectivity	Bank Height Ratio	5.3	0.00	0.40	0.40	Functioning At Risk	
		Entrenchment Ratio		0.80				
Geomorphology	Large Woody Debris	Large Woody Debris Index			0.23	0.58	Functioning At Risk	
		# Pieces	3	0.23				
	Lateral Migration	Erosion Rate (ft/yr)			0.53			
		Dominant BEHI/NBS		0.80				
		Percent Streambank Erosion (%)	60	0.00				
		Percent Armoring (%)		0.80				
	Riparian Vegetation	Left - Average Diameter at Breast Height (DBH; in)	6	0.65	0.53			
		Right - Average DBH (in)	6	0.65				
		Left - Buffer Width (feet)		0.80				
		Right - Buffer Width (feet)		0.80				
		Left - Tree Density (#/acre)		0.80				
		Right - Tree Density (#/acre)		0.80				
		Left - Native Herbaceous Cover (%)	20	0.27				
		Right - Native Herbaceous Cover (%)	20	0.27				
		Left - Native Shrub Cover (%)	10	0.14				
		Right - Native Shrub Cover (%)	10	0.14				
	Bed Material Characterization	Size Class Pebble Count Analyzer (p-value)						
	Bed Form Diversity	Pool Spacing Ratio		0.80	0.80			
		Pool Depth Ratio		0.80				
		Percent Riffle (%)		0.80				
		Aggradation Ratio						
	Plan Form	Sinuosity		0.80	0.80			
Physicochemical	Bacteria	E. Coli (Cfu/100 mL)		0.80	0.80	0.80	Functioning	
	Organic Enrichment	Percent Nutrient Tolerant Macroinvertebrates (%)						
	Nitrogen	Nitrate-Nitrite (mg/L)		0.80	0.80			
	Phosphorus	Total Phosphorus (mg/L)		0.80	0.80			
Biology	Macroinvertebrates	Tennessee Macroinvertebrate Index		0.80	0.80	0.80	Functioning	
		Percent Clingers (%)						
		Percent EPT - Cheumatopsyche (%)						
		Percent Oligochaeta and Chironomidae (%)						
	Fish	Native Fish Score Index						
		Catch per Unit Effort Score						

Time Intensive Data Collection

- **Increases data collection time**
  - 30+ metrics can be measured:
  - Watershed Land Use Runoff Score, Stormwater Infiltration, Bank Height Ratio, Entrenchment Ratio, Large Woody Debris Index, # Woody Debris Pieces, Erosion Rate, Dominant BEHI/NBS, % Streambank Erosion, % Armoring, Buffer Widths, Average Diameter, Tree Density, Native Shrub Cover, Size Class Pebble Count Analyzer, Pool-Pool Spacing Ratio, Percent Riffle, Aggradation Ratio, Sinuosity, E. Coli, Percent Nutrient Tolerant Macros, Nitrate-Nitrite, Total Phosphorus, Macroinvertebrate Index, Percent Clingers, Percent EPT – Chironomidae, Native Fish Score Index, Catch per Unit Effort Score

Time Intensive Data Collection

- **Increases data collection time**
  - Current process requires ~45 min per stream
  - New guidance will require 4-6 hours per stream reach
    - Streams must be broken into separate reaches
    - E.g., upstream of culvert and downstream of culvert



Implementation

- Transition/Grandfather Periods
- Training
- Implementation Plan
  - When use tool
  - Which metrics to measure
  - When use default values
- Request approval for other qualitative and quantitative methodology (Missouri, Savannah)
- Review Mitigation Contracts
- Review Pre-Purchased Advanced Credits
- Opportunities to balance lift and loss on projects