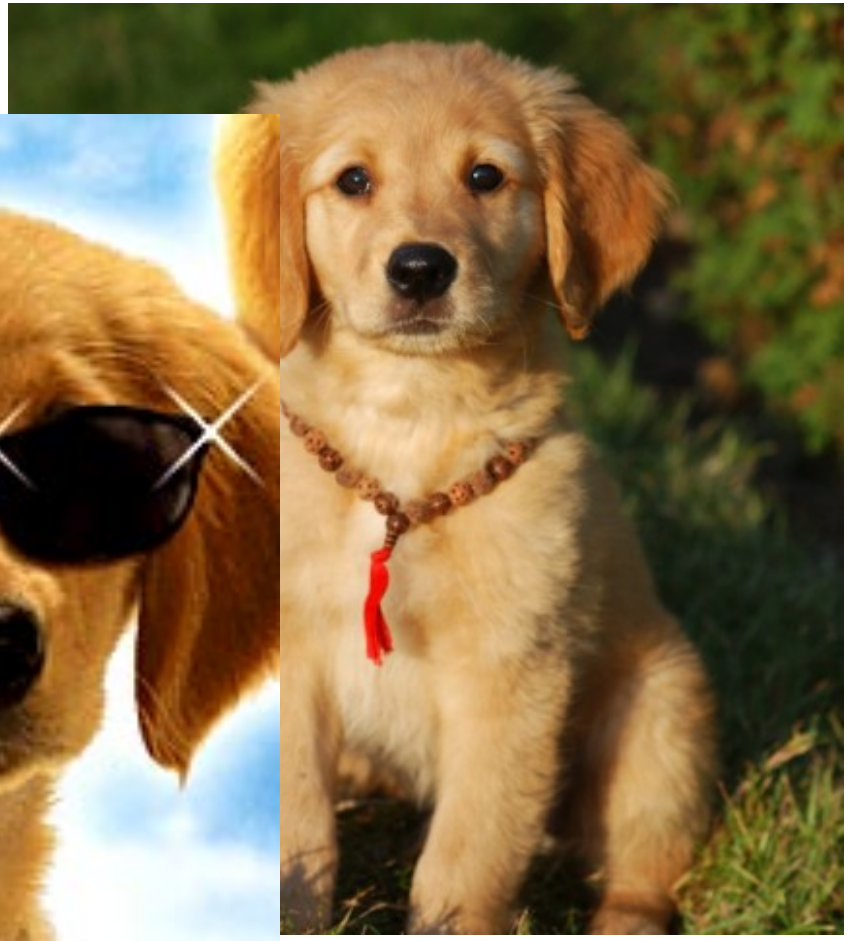
Department of
Environment &
Conservation

Aligning Policy, Practice, and Agencies: Moving From Ratios to Function Lift

Vena Jones August 15, 2018



2004 TN Stream Mitigation Guidelines

- Ratio Based
  - Language focuses on projects that re-establish maximum **biological**, **chemical**, and **physical** integrity to resource
  - Describes **activity based crediting-pattern, profile, and dimension**

- Narrative Criteria
  - Does not require baseline information
  - Subjective
  - Creates **crediting drift**

  - TDEC uses to also inform on ratios for debits

2012 Draft Stream Mitigation Guidelines

Realized deficiencies in the 2004 mitigation guidelines; qualitative/subjective and crediting drift

- Wanted to be consistent with USACE requirements
- Wanted to align state guidelines with the 2008 Final Rule to the extent practical for TN
- Wanted to establish **functional lift**
- Move away from linear footage/ratio based system

Shortcomings

- Received significant comment on efficacy of functional assessment parameters and methods
- Division lacked capacity to create a robust functional assessment

TDEC Steps to Policy Change (2013)

- ID problem- uncertainty, credit drift, does not meet federal rule
- Engage our stakeholders
- Evaluate potential assessment methods
- Establish parallel pathways
  - Education and outreach
  - Incremental and iterative document development
  - Data gathering
  - Tool development
  - Tools to Policy

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

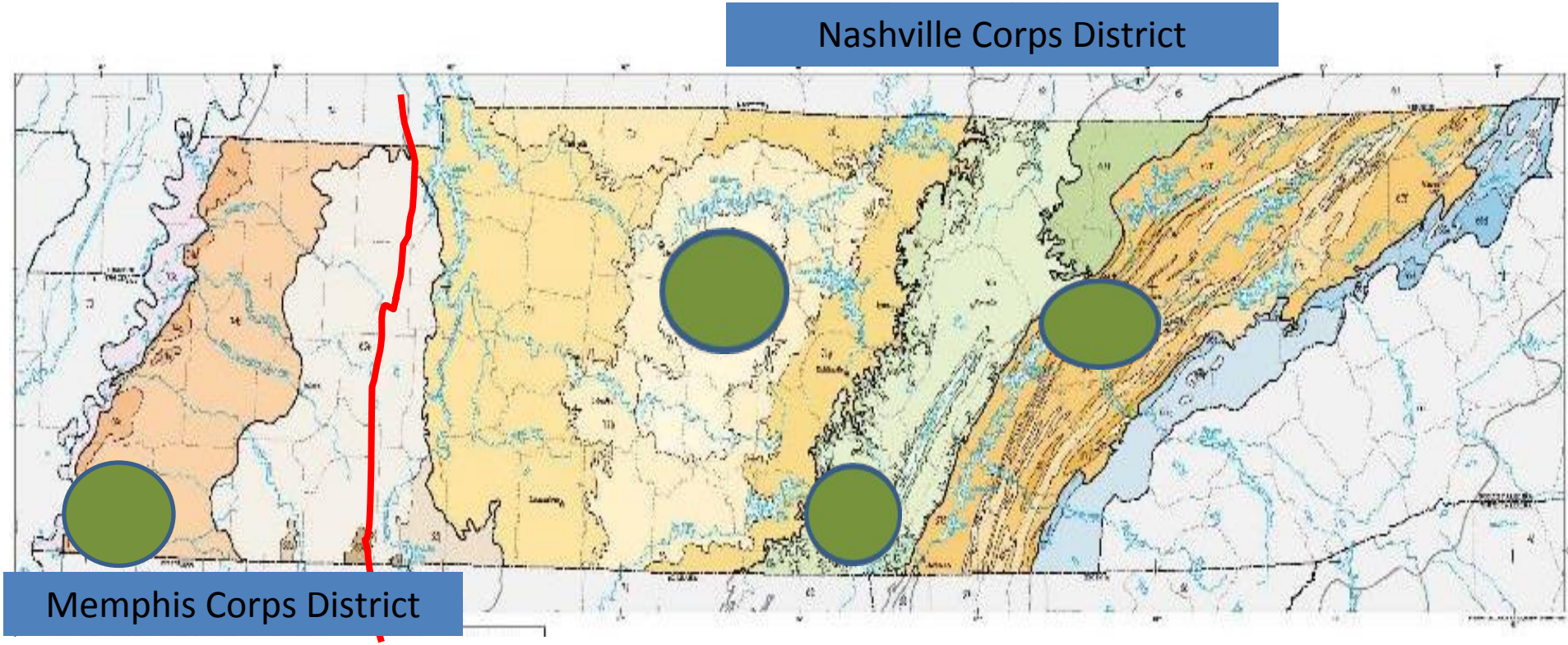
NRCS

U.S. FISH & WILDLIFE SERVICE

TVA

TENNESSEE WILDLIFE RESOURCES AGENCY

Corps Districts in Tennessee



Broad-based Collaboration 2014

- Stakeholdering
- Provide opportunity for wide ranging feedback
- NGOs
- Consultants
- All IRT agencies
- EPA
- Universities
- MS4s
- Citizens

- Important to have transparent, predictable, and repeatable processes for credits AND debits

Establishing Pathway (2014)

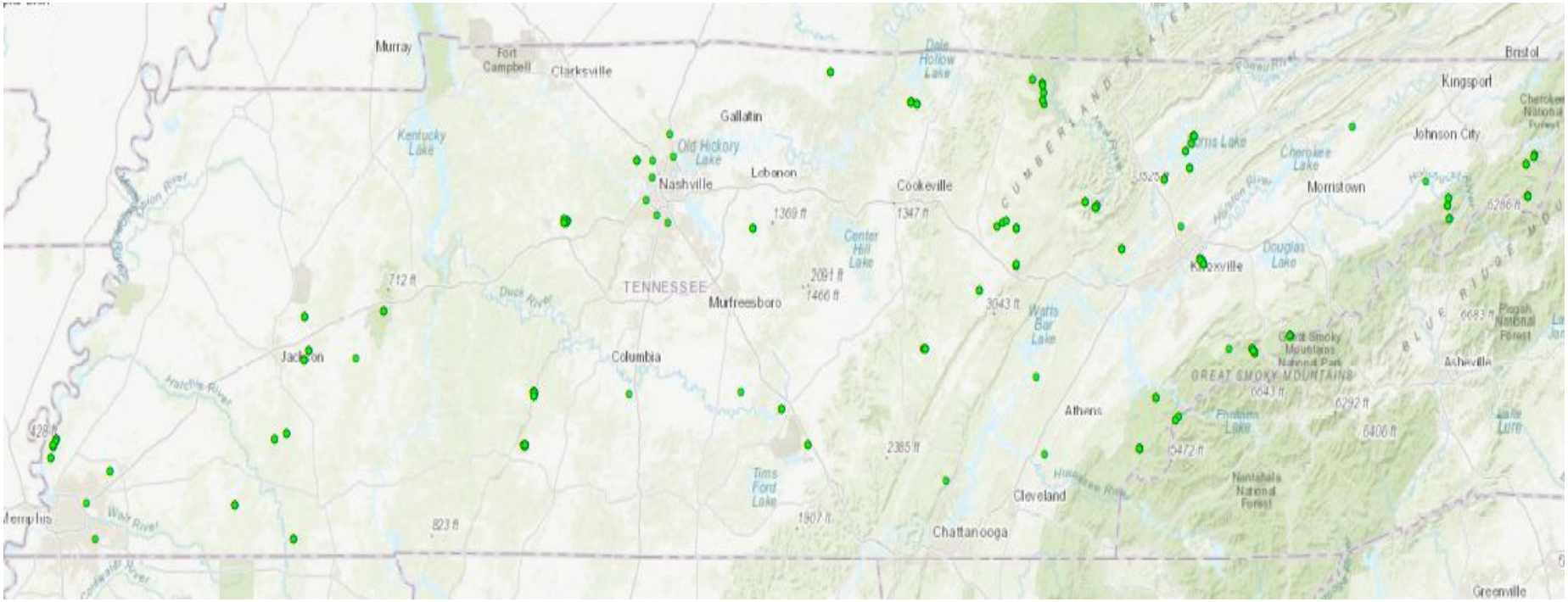
- *Measurable. Transparent. Predictable. Repeatable*
- Partner with USACE and IRT to develop/adopt functional assessment guidance tools
- Based on known stream functions
- Inherent relationships in stream channel metrics
- Incorporate TDEC biological and water quality data
- Regionalize as information becomes available

Data gathering and analysis (2015)

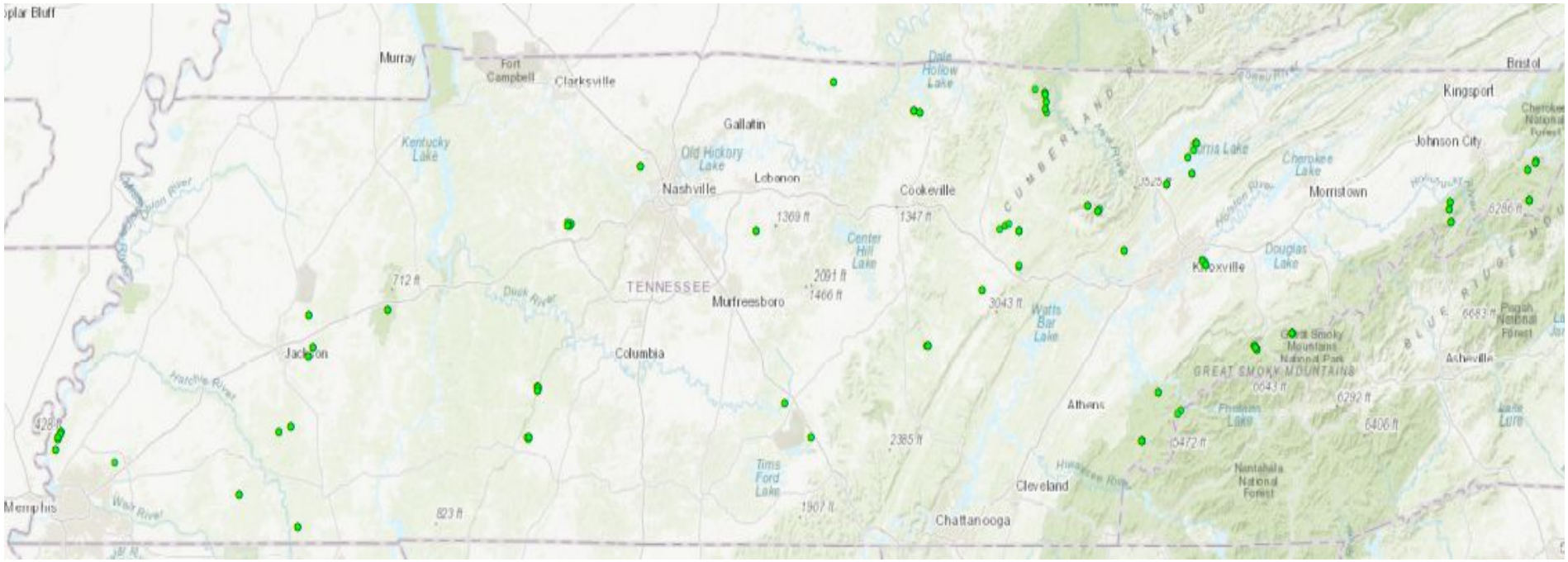
- Ecoregion based
- Regional Curves
- Bedform Diversity
- Large Woody Debris
- Riparian vegetation
- Biology
- Water Quality
- Ecogeomorphological Reference Sites

- Review 35 established compensatory mitigation sites with the TN SQT
- Riparian vegetation species composition

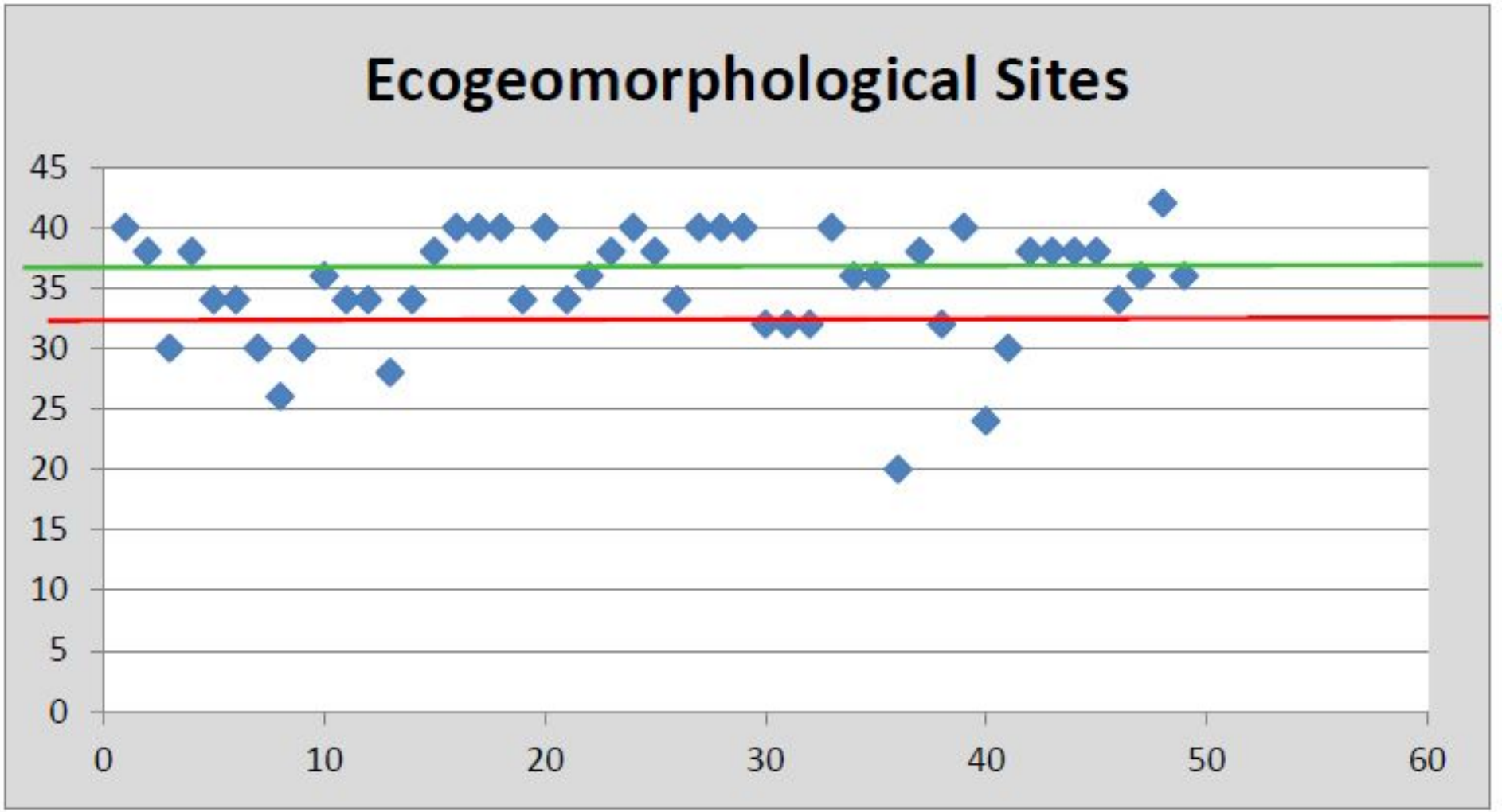
All Sites (115)



GeoMorph Sites (92)



49 geomorph sites assessed for biology and WQ; 6 not supporting (FAR/NF) , 43 fully supporting; 11 (high FAR) , 32 functioning are fully



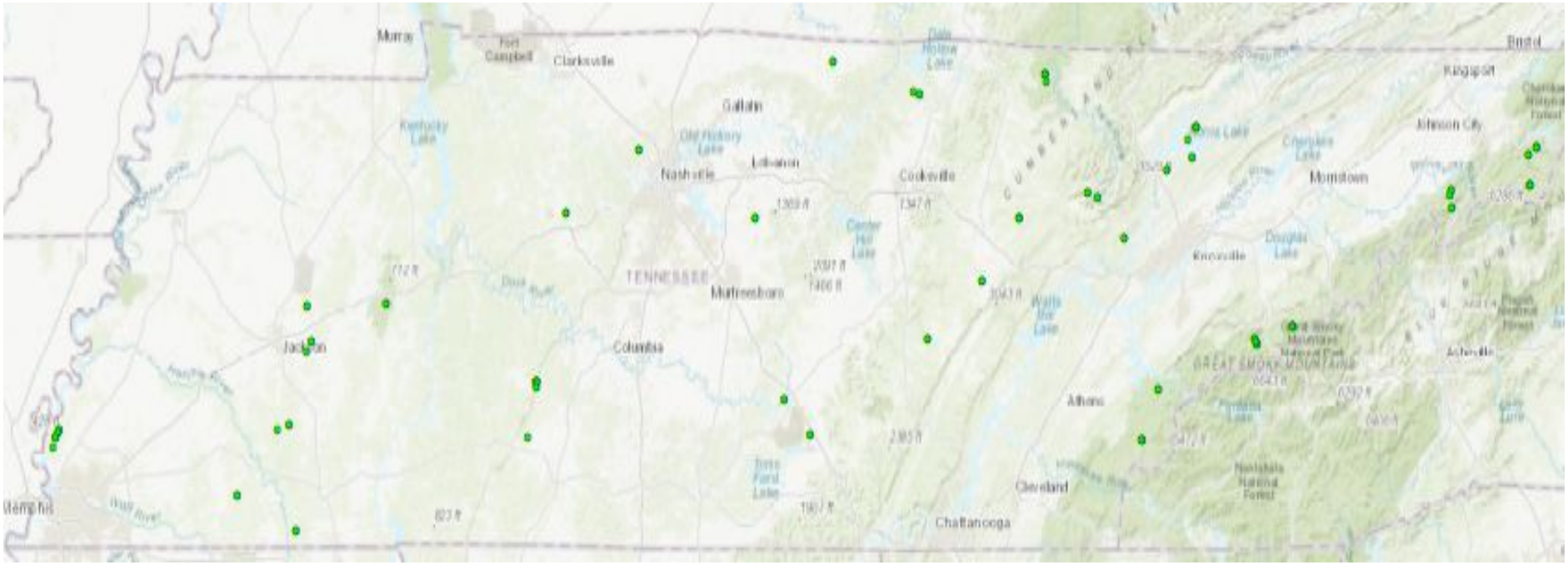
Broad Based Collaboration

- Mitigation Assessment Team (MAT)
  - Internal working group of IRT
  - TDEC, USACE, & EPA
- MAT broken into parameter driven mini teams
  - Review and analyze existing data
  - Research and gather new data
  - Incorporate TN specific data into performance curves from Stream Quantification Tool
- Stream Design Review Group
- All members of IRT

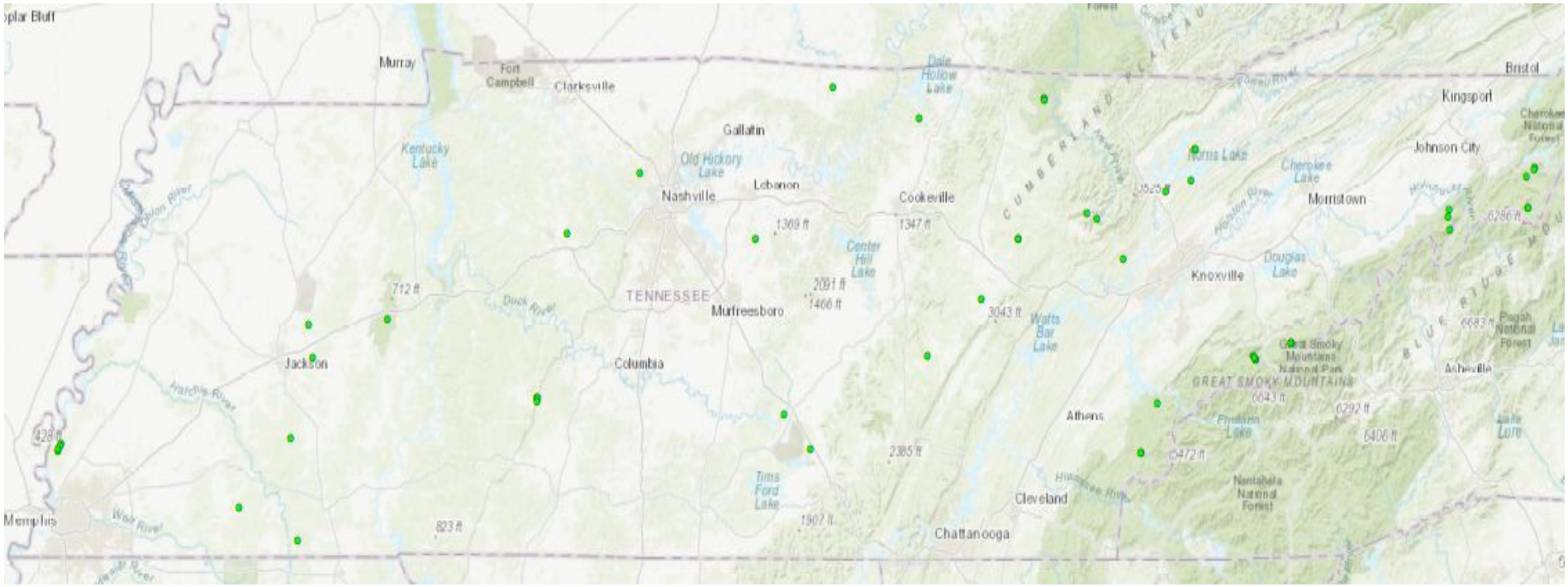
TN SQT

Hydrology	Catchment Hydrology	Watershed Land Use Runoff Score
	Reach Runoff	Stormwater Infiltration
		Concentrated Flow Points
Hydraulics	Floodplain Connectivity	Bank Height Ratio
		Entrenchment Ratio
Geomorphology	Large Woody Debris	Large Woody Debris Index
		# Pieces
	Lateral Migration	Erosion Rate (ft/yr)
		Dominant BEHI/NBS
		Percent Streambank Erosion (%)
		Percent Armoring (%)
	Riparian Vegetation	Left - Average DBH
		Right - Average DBH (in)
		Left - Buffer Width (feet)
		Right - Buffer Width (feet)
		Left - Tree Density (#/acre)
		Right - Tree Density (#/acre)
		Left - Native Herbaceous Cover (%)
		Right - Native Herbaceous Cover (%)
		Left - Native Shrub Cover (%)
		Right - Native Shrub Cover (%)
	Bed Material Characterization	Size Class Pebble Count Analyzer (p-value)
	Bed Form Diversity	Pool Spacing Ratio
		Pool Depth Ratio
		Percent Riffle (%)
		Aggradation Ratio
	Plan Form	Sinuosity
Physicochemical	Bacteria	E. Coli (Cfu/100 mL)
	Organic Enrichment	Percent Nutrient Tolerant Macroinvertebrates (%)
	Nitrogen	Nitrate-Nitrite (mg/L)
	Phosphorus	Total Phosphorus (mg/L)
Biology	Macroinvertebrates	Tennessee Macroinvertebrate Index
		Percent Clingers (%)
		Percent EPT - Cheumatopsyche (%)
		Percent Oligochaeta and Chironomidae (%)
	Fish	Native Fish Score Index
		Catch per Unit Effort Score

Biology and WQ Sampling Sites (75)



EcoMorph Sites (63)



Bridging the Gap: tools into policy

- Crediting is easy-lift is lift
- Debits
- Transitioning
- Potential to change currency AND reduce mitigation requirement
- No net loss

Projects in the Pipeline

GEORGIA ON MY MIND

Reach	Existing Length	Proposed Length	Extra LF	Base Ratio	Ratio for Extra LF	Total Credits for Reach	Proposed FF - Existing FF	Functional Lift Score
AB	1316	1713	397	1.5	1.1	1238.2	677	0.36
BB	1631	2220	589	1.5	1.1	1622.8	904	0.37
EB	1834	2598	764	1.5	1.1	1917.2	1032	0.35
ARB	1347	1866	519	1.5	1.1	1369.8	763	0.37
CPC	6272	7215	943	1.5	1.1	5038.6	3812	0.51
FC	986	1340	354	1.5	1.1	979.2	427	0.25
					TOTALS	12166	7615	
							AVERAGE	0.368333333

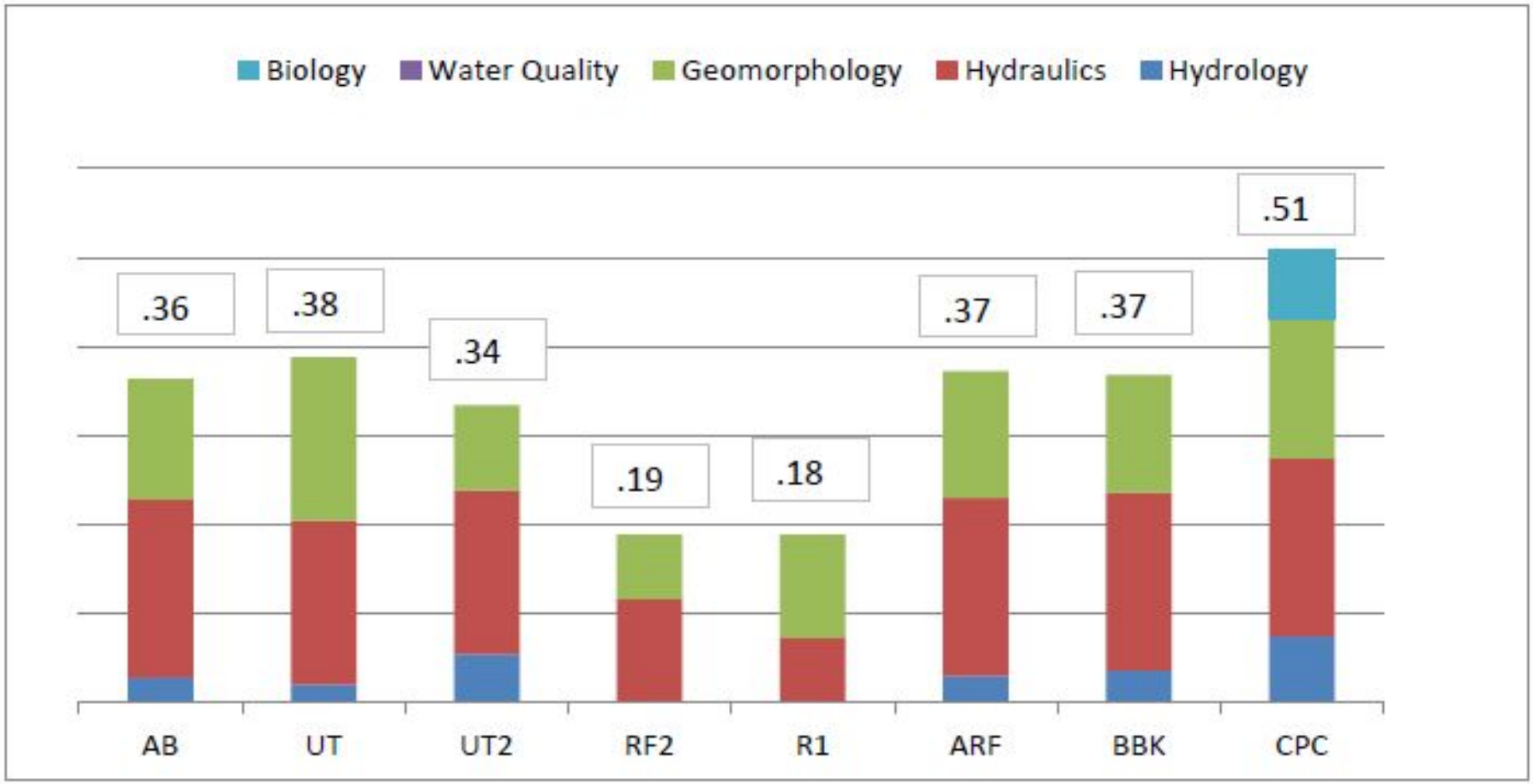
FORKS AND SPOONS

Reach	Existing Length	Proposed Length	Extra LF	Base Ratio	Ratio for Extra LF	Total Credits for Reach	Proposed FF - Existing FF	Functional Lift Score
UT1	2509	3266	757	1.5	1.1	2360.8	1309	0.38
UT2	492	841	349	1.5	1.1	645.3	321	0.34
					TOTALS	2361	1309	
							AVERAGE	0.36

RAY OF SUNSHINE

Reach	Existing Length	Proposed Length	Extra LF	Base Ratio	Ratio for Extra LF	Total Credits for Reach	Proposed FF - Existing FF	Functional Lift Score
R1	5223	5223	0	3	1.1	1741.0	940	ERRORS
R2	1887	1887	0	4	1.1	471.8	245	ERRORS
R3	2666	2666	0	3	1.1	888.7	720	0.27
R4	1025	1365	340	3	1.1	650.8	423	0.29
R5	960	1260	300	3	1.1	592.7	256	0.38
R6	2932	3628	696	3	1.1	1610.1	718	ERRORS
					TOTALS	5955	3302	
							AVERAGE	0.313333333

Proposed Lift



TN Debit Tool

- Debits will decrease
  - Proposed state rules establish existing condition
- Not all impacts are the same
- TDEC can't assess every impact site pre-impact
  - Standard Existing Condition Score (0.80)
  - Lower limit of ECS (0.40)
- Credits and debits need to be in the same currency
- Reporting and performance standards for all project types
- Biological assessments

Tier 5 –This tier represents activities that result in a significant functional loss to most if not all stream resource values. Examples include but are not limited to:

- **Pipe or 4-Sided Box Culvert:** These pipes encapsulate the stream for greater than 200 linear feet either cumulatively or individually. Includes wingwalls, any energy dissipation device, u-shaped endwalls. All components attached to the pipe structure itself. Does not include riprap. Riprap at the upstream or downstream section of a pipe is calculated using the bed and/or bank armoring descriptions by tier. These structures may affect the channel at the crossing approaches when the activity requires reshaping this zone making the stream wider and potentially deeper. This activity eliminate most stream resource values and functions including riparian vegetation, macroinvertebrates and fish communities, water quality, floodplain connectivity, natural bedforms and lateral migration and eliminates hydrologic contributions from reach runoff.

- **Channelization or Full Channel Armoring:** Affects both banks for a distance of 200 feet or greater. Channels are lined along the bed and banks with concrete, grouted riprap, or concrete articulated mats. These streams are incised and alterations most likely include channel bank and potentially bed reshaping. The bed material is not suitable substrate for aquatic colonization and these channels will most likely be maintained in their current state. Vegetation in the near buffer zone is restricted and routinely eliminated.

Tier 6 – This tier represents 100% functional loss of a stream's resource value.

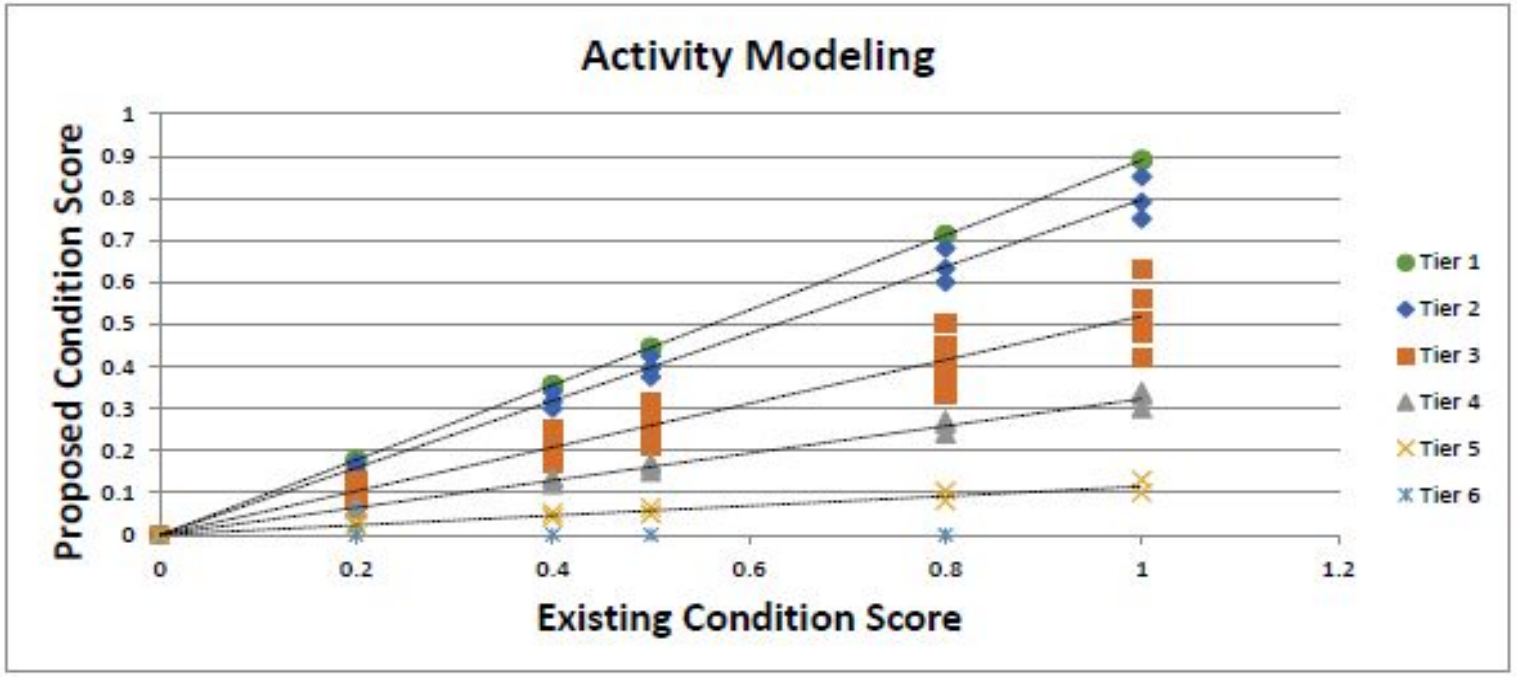
Tier	Functional Loss Description
0	No appreciable permanent loss of resource value
1	Minimal loss of resource value (stream function). Impacts to reach runoff, lateral migration and/or riparian vegetation. No appreciable impact to water quality, and macroinvertebrate and fish communities.
2	Partial loss of resource value (stream function). Impacts to reach runoff, lateral migration, bed form diversity, and riparian vegetation. No appreciable impact to water quality, and macroinvertebrate and fish communities.
3	Permanent loss of some of resource value (stream function). Impacts to reach runoff, floodplain connectivity, lateral migration, riparian vegetation, and bed form diversity. May also include impacts to large woody debris. Minor impacts to water quality and moderate impacts to macroinvertebrate and fish communities.
4	Permanent loss of most of resource value (stream function). Impacts to reach runoff, floodplain connectivity, lateral migration, riparian vegetation, , and bed form diversity. May also include impacts to plan form and/or large woody debris. Significant impacts to water quality and macroinvertebrate and fish communities.
5	Permanent loss of most of resource value (stream function). Removal of all aquatic functions except for hydrology.
6	Total and permanent loss of all resource value (stream function). Complete elimination of all stream functions. Total loss of existing and potential function.

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	80%
Tier 6	0.00	100%

Proposed Impact Factors and Activity Modeling:

graph represents combined data from modeling individual activities and the impact these actions have on stream resources. Table establishes tier, functional loss and the impact factor used to determine debits.

The Impact Factors were developed from linear regression equations of modeled impact scenarios using a simplified version of the SQT. Each impact type was described in detail and evaluated for stream resource values loss by the proposed activities. Using a simplified SQT, an individual impact factor was developed for each impact type. These types were grouped based on % functional loss (in clusters) and graphed in "tiers". A trendline was drawn and the slope of that line became the combined impact factor representing all activities within a given tier.



Name:
Date:

TN SQT DEBIT TOOL v1.0

DRAFT DELIBERATIVE,
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Project ID:

Users Input Values
Users select values from a pull-down menu

Stream	Reach ID	Existing Length	ECS	Proposed Length	Impact Severity Tier	PCS	Change in FF
STR-1	Box culvert	26	0.8	26	Tier 5	0.10	-18.2
	riprap	65	0.8	65	Tier 3	0.42	-24.7
STR-2	Box culvert	142	0.8	142	Tier 5	0.10	-99.4
	riprap	42	0.8	42	Tier 3	0.42	-16.0
STR-3	Fill	221	0.8	221	Tier 6	0.00	-176.8
					Tier 6	0.00	0.0
					Tier 5	0.00	0.0
					Tier 4	0.00	0.0
					Tier 5	0.00	0.0
					Tier 5	0.00	0.0
					Tier 0	0.00	0.0
					Tier 0	0.00	0.0
					Tier 1	0.00	0.0
					Tier 2	0.00	0.0
					Tier 3	0.00	0.0
					Tier 4	0.00	0.0
					Tier 5	0.00	0.0
					Tier 6	0.00	0.0
					Tier 5	0.00	0.0
					Tier 4	0.00	0.0
					Tier 3	0.00	0.0
					Tier 2	0.00	0.0
					Tier 1	0.00	0.0
					Tier 0	0.00	0.0
					Tier 1	0.00	0.0
					Tier 2	0.00	0.0

Total Functional Loss: -335.1 FF

Name:
Date:

TN SQT DEBIT TOOL v1.0

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Project ID:

Users Input Values
Users select values from a pull-down menu

Stream	Reach ID	Existing Length	ECS	Proposed Length	Impact Severity Tier	PCS	Change in FF
STR-1	Box culvert	26	0.4	26	Tier 5	0.05	-9.1
	riprap	65	0.4	65	Tier 3	0.21	-12.4
STR-2	Box culvert	142	0.4	142	Tier 5	0.05	-49.7
	riprap	42	0.4	42	Tier 3	0.21	-8.0
STR-3	Fill	221	0.4	221	Tier 6	0.00	-88.4
					Tier 6	0.00	0.0
					Tier 5	0.00	0.0
					Tier 4	0.00	0.0
					Tier 5	0.00	0.0
					Tier 5	0.00	0.0
					Tier 0	0.00	0.0
					Tier 0	0.00	0.0
					Tier 1	0.00	0.0
					Tier 2	0.00	0.0
					Tier 3	0.00	0.0
					Tier 4	0.00	0.0
					Tier 5	0.00	0.0
					Tier 6	0.00	0.0
					Tier 5	0.00	0.0
					Tier 4	0.00	0.0
					Tier 3	0.00	0.0
					Tier 2	0.00	0.0
					Tier 1	0.00	0.0
					Tier 0	0.00	0.0
					Tier 1	0.00	0.0
					Tier 2	0.00	0.0

Total Functional Loss: -167.5 FF

Comparison of Permitted to Proposed

DEBITS			
2004 Standard	Draft 2018		
	ECS 0.80	ECS 0.50	ECS 0.40
1140	588.64	367.98	293.32
461	325.8	204	162.9
2285	1643.3	1031.68	821.75
310	240	150	120
496	294.5	184.5	147.2

Moving to a Draft TN Mitigation Guidelines

- Use TN SQT to assess established and proposed mitigation sites and compare to 2004 guidelines
- Use TN SQT to assess permitted impacts and compare debits
- MOU with USACE
- Draft Mitigation Guidelines- AUGUST 2018
  - TN Debit Tool
  - TN SQT
  - 3 User Manuals
- TRANSITION TRANSITION TRANSITION

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