TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Siltation & Habitat Alteration

In The

Caney Fork River Watershed (HUC 05130108)

Bledsoe, Cannon, Cumberland, DeKalb, Putnam, Sequatchie, Smith, Van Buren, Warren, White and Wilson Counties, Tennessee

Prepared by:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

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LIST OF ABBREVIATIONS

ARS	Agricultural Research Station
BMP	Best Management Practices
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DWPC	Division of Water Pollution Control
EPA	Environmental Protection Agency
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NHD	National Hydrography Dataset
NPS	Nonpoint Source
NPDES	National Pollutant Discharge Elimination System
NSL	National Sediment Laboratory
Rf3	Reach File v.3
RM	River Mile
RMCF	Ready Mixed Concrete Facility
SABS	Suspended and Bedded Sediments
STATSGO	State Soil and Geographic Database
SSURGO	Soil Survey Geographic Database
TDEC	Tennessee Department of Environment & Conservation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WMD	Water Management Division
WTP	Water Treatment Plant
WWTF	Wastewater Treatment Facility

SUMMARY SHEET

CANEY FORK RIVER WATERSHED (HUC 05130108)

Total Maximum Daily Load for Siltation / Habitat Alteration in Waterbodies Identified on the State of Tennessee's 2002 303(d) List

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Impaired Waterbody Information:

State: Tennessee
Counties: Bledsoe, Cannon, Cumberland, DeKalb, Putnam, Sequatchie, Smith, Van Buren, Warren, White and Wilson
Watershed: Caney Fork River (HUC 05130108)
Watershed Area: 1796.8 mi^2
Constituent of Concern: Siltation / Habitat Alteration (excess loading of sediment produced by erosional processes – see Section 3.0)
Impaired Waterbodies: 2002 303(d) List

Waterbody ID	Waterbody	RM
05130108001_0100	Snow Creek	7.6
05130108001_0200	Ferguson Branch	5.8
05130108001_0400	Rock Springs Branch	8.1
05130108002_2000	Hickman Creek	22.2
05130108024_1000	Rocky River	8.7
05130108025_0400	Hickory Valley Branch	8.2
05130108033_0310	Bradden Creek	10.7
05130108033_1000	Bee Creek	17.5
05130108036_0810	Flynn Creek	2.8
05130108036_3000	Unnamed Tributary to Caney Fork River	3.5
05130108043_0300	Blue Spring Creek	10.1
05130108045_0150	Cane Creek	12.0
05130108045_0300	Hudgens Creek	6.7
05130108045_0400	Pigeon Roost Creek	2.4
05130108045_0450	Pigeon Roost Creek	3.2
05130108045_0500	Post Oak Creek	8.3
05130108045_1000	Falling Water River	8.8
05130108048_1000	Indian Creek	31.0
05130108684_1000	Fall Creek (DeKalb)	9.8
05130108684_2000	Fall Creek (DeKalb)	6.7

Note: There are three waterbodies identified on the 2002 303(d) List as impaired due to other habitat alterations. These waterbodies were determined to be impaired due to causes other than excess sediment loading and are not addressed in this document (ref.: Section 3.0).

Designated Uses: Fish & aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in watershed also classified for domestic and/or industrial water supply.

Applicable Water Quality Standard: Most stringent narrative criteria applicable to fish & aquatic life use classification:

Biological Integrity: The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.

Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion, (b) is of the appropriate stream order specified for the bioregion and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.

Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.

Habitat: The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

TMDL Development

General Analysis Methodology:

- Analysis performed using the Watershed Characterization System Sediment Tool (based on Universal Soil Loss Equation) applied to impaired HUC-12 subwatershed areas to calculate existing sediment loads.

- Target sediment loads (lbs/acre/year) are based on the average annual sediment loads from biologically healthy watersheds (Level IV Ecoregion reference sites).

- TMDLs are expressed as the percent reduction in average annual sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate target load.

- 5% of subwatershed target loads are reserved to account for WLAs for regulated mining sites and RMCFs. Most loading from these sources are small compared to total loading.

- TSS from WWTF effluent was not considered as part of the TMDL analysis (see Sections 3.0 & 6.0).

- WLAs for Municipal Separate Storm Sewer Systems (MS4s), WLAs for NPDES regulated construction storm water discharges, and LAs for nonpoint sources are expressed as the percent reduction in average annual sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate reduced target load (target load minus 5% reserved WLAs for mining sites and RMCFs).

Critical Conditions: Methodology takes into account all flow conditions.

Seasonal Variation: Methodology addresses all seasons.

Margin of Safety (MOS): Implicit (conservative modeling assumptions).

TMDL/Allocations

TMDLs, WLAs for MS4s & Construction Storm Water Sites; LAs for Nonpoint Sources:

HUC-12 Subwatershed	Waterbody ID	Waterbody Impaired by Siltation/ Habitat Alteration	Level IV Ecoregion	TMDL (Required Overall Load Reduction)	Required Load Reduction	
					WLA (MS4s & Constr. SW)	LA (Nonpoint Sources)
				[%]	[%]	[%]
0101	05130108036_3000	UT to Caney Fork River	68a	54.5	56.8	56.8
0102	05130108036_0810	Flynn Creek	68a	46.6	49.3	49.3
0104	05130108025_0400	Hickory Valley Branch	68c	46.0	48.7	48.7
0202	05130108033_0310	Bradden Creek	68a	48.9	51.5	51.5
0203	05130108033_1000	Bee Creek	68a	24.3	28.1	28.1
0406	05130108684_1000	Fall Creek (DeKalb)	71g	67.8	69.4	69.4
	05130108684_2000	Fall Creek (DeKalb)				
0503	05130108043_0300	Blue Spring Creek	68c	62.6	64.4	64.4
0602	05130108024_1000	Rocky River	68c	45.7	48.4	48.4
0702	05130108045_0300	Hudgens Creek	71g	13.8	18.1	18.1
	05130108045_0400	Pigeon Roost Creek				
	05130108045_0450	Pigeon Roost Creek				
	05130108045_0500	Post Oak Creek				
0703	05130108045_1000	Falling Water River	71g	26.0	29.7	29.7
0704	05130108045_0150	Cane Creek	71g	48.4	51.0	51.0
0805	05130108001_0200	Ferguson Branch	71h	26.6	31.8	31.8
	05130108001_0400	Rock Springs Branch				
	05130108048_1000	Indian Creek				
0806	05130108001_0100	Snow Creek	71h	62.4	64.3	64.3
0807	05130108002_2000	Hickman Creek	71h	11.3	15.8	15.8

WLAs for Mining Sites and RMCFs:

WLAs for NPDES regulated mining sites are equal to existing permit limits for total suspended solids (TSS). There are no RMCFs located in impaired subwatersheds.

Mines Permitted to Discharge TSS and Located in Impaired Subwatersheds

HUC-12 Subwatershed (05130108__)	NPDES Permit No.	Name	Area	TSS Daily Max Limit
			[acres]	[mg/l]
0702	TN0062910	American Sand Supply Sand Processing Plant	18.00	40
0806	TN0004227	Pasminco Zinc, Inc. Elmwood Mine	158.00	30
	TN0069124	Rogers Group, Inc. Gordonsville Plant	91.01	40

TOTAL MAXIMUM DAILY LOAD (TMDL) FOR SILTATION/HABITAT ALTERATION CANEY FORK RIVER WATERSHED (HUC 05130108)

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and nonpoint sources in order to restore and maintain the quality of water resources (USEPA, 1991).

2.0 WATERSHED DESCRIPTION

The Caney Fork River Watershed (HUC 05130108) is located in Middle Tennessee (Figure 1), primarily in Bledsoe, Cannon, Cumberland, DeKalb, Putnam, Sequatchie, Smith, Van Buren, Warren, White and Wilson Counties. The Caney Fork River Watershed lies within two level III Ecoregions (Southwestern Appalachians and Interior Plateau) and contains four level IV Ecoregions as shown in Figure 2 (USEPA, 1997):

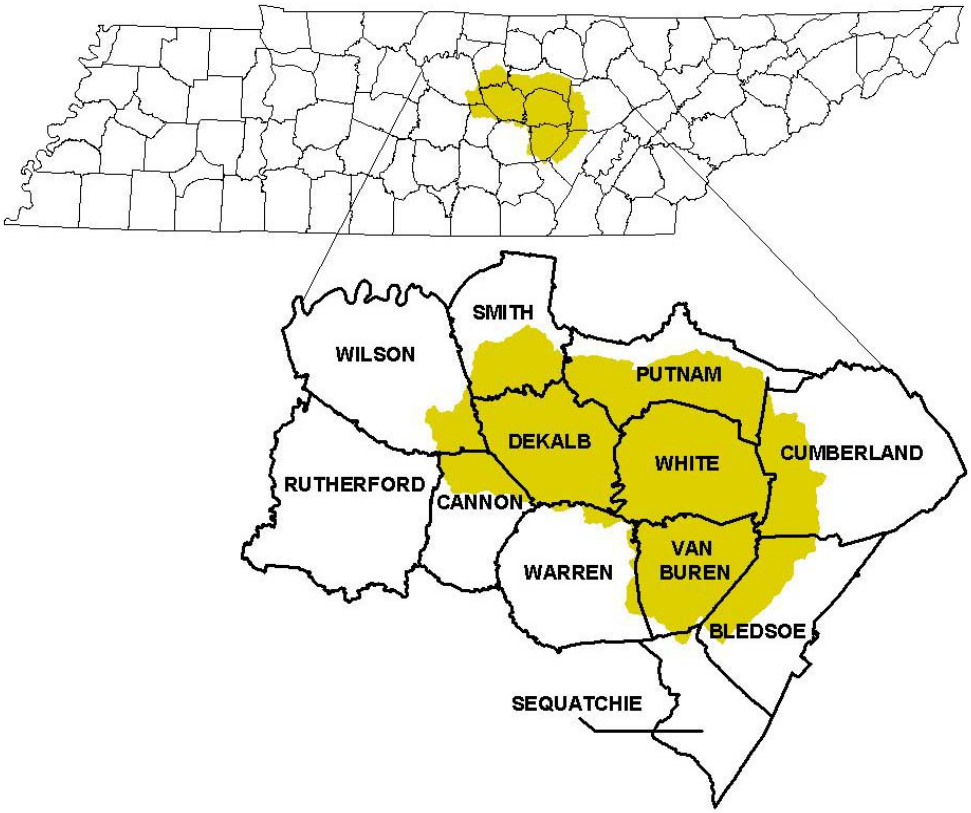
- The Cumberland Plateau's (68a) tablelands and open low mountains are about 1000 feet higher than to the west and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains or the Plateau Escarpment (68c). Elevations are generally 1200-2000 feet, with the Crab Orchard Mountains reaching over 3000 feet. Pennsylvania-age conglomerate, sandstone, siltstone, and shale is covered by mostly well-drained, acidic soils of low fertility. The region is forested, with some agriculture and coal mining activities.

- The Plateau Escarpment (68c) is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvania-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, more mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

- The Eastern Highland Rim (71g) has level terrain, with landforms characterized as tablelands of moderate relief and irregular plains. Mississippian-age limestone, chert, shale and dolomite predominate, and karst terrain sinkholes and depressions are especially noticeable between Sparta and McMinnville. Numerous springs and spring-associated fish fauna also typify the region. Natural vegetation for the region is transitional between the oak-hickory type to the west and the mixed mesophytic forests of the Appalachian ecoregions to the east. Bottomland hardwoods forests were once abundant in some areas, although much of the original bottomland forest has been inundated by several large impoundments. Barrens and former prairie areas are now mostly oak thickets or pasture and cropland.

- The Outer Nashville Basin (71h) is a heterogeneous region, with rolling and hilly topography and slightly higher elevations. The region encompasses most all of the outer areas of the generally no-cherty Mississippian-age formations, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forest with pasture and cropland are the dominant land covers. Streams are low to moderate gradient, with productive, nutrient-rich waters, resulting in algae, rooted vegetation and occasionally high densities of fish. The Nashville Basin as a whole has a distinctive fish fauna, notable for fish that avoid the region, as well as those that are present.

Figure 1 Location of the Caney Fork River Watershed



The Caney Fork River Watershed has approximately 25,887 lake acres, 2041.5 miles of streams (Rf3) and drains a total area of 1796.8 square miles. Watershed land use distribution is based on Multi-Resolution Land Characteristic (MRLC) databases derived from Landsat Thematic Mapper digital images from the period 1990-1993. Land use for the Caney Fork River Watershed is summarized in Table 1 and shown in Figure 3.

Table 1 Land Use Distribution - Caney Fork River Watershed

Land Use	Area		
	[acres]	[mi^2]	[% of watershed]
Bare Rock/Sand	7	0.01	0.00
Deciduous Forest	619,711	968.29	53.89
Emergent Herbaceous Wetlands	42	0.07	0.00
Evergreen Forest	88,323	138.00	7.68
High Intensity Commercial/Industrial/ Transportation	5,210	8.14	0.45
High Intensity Residential	1,021	1.59	0.09
Low Intensity Residential	7,362	11.50	0.64
Mixed Forest	150,871	235.73	13.12
Open Water	18,663	29.16	1.62
Other Grasses (Urban/Recreational)	7,775	12.15	0.68
Pasture / Hay	185,405	289.69	16.12
Quarries/Strip Mines/Gravel Pits	532	0.83	0.05
Row Crops	57,498	89.84	5.00
Transitional	4,742	7.41	0.41
Woody Wetlands	2,806	4.38	0.24
Total	**1,149,968**	**1,796.81**	**100.00**

Figure 2 Level IV Ecoregions in the Caney Fork River Watershed

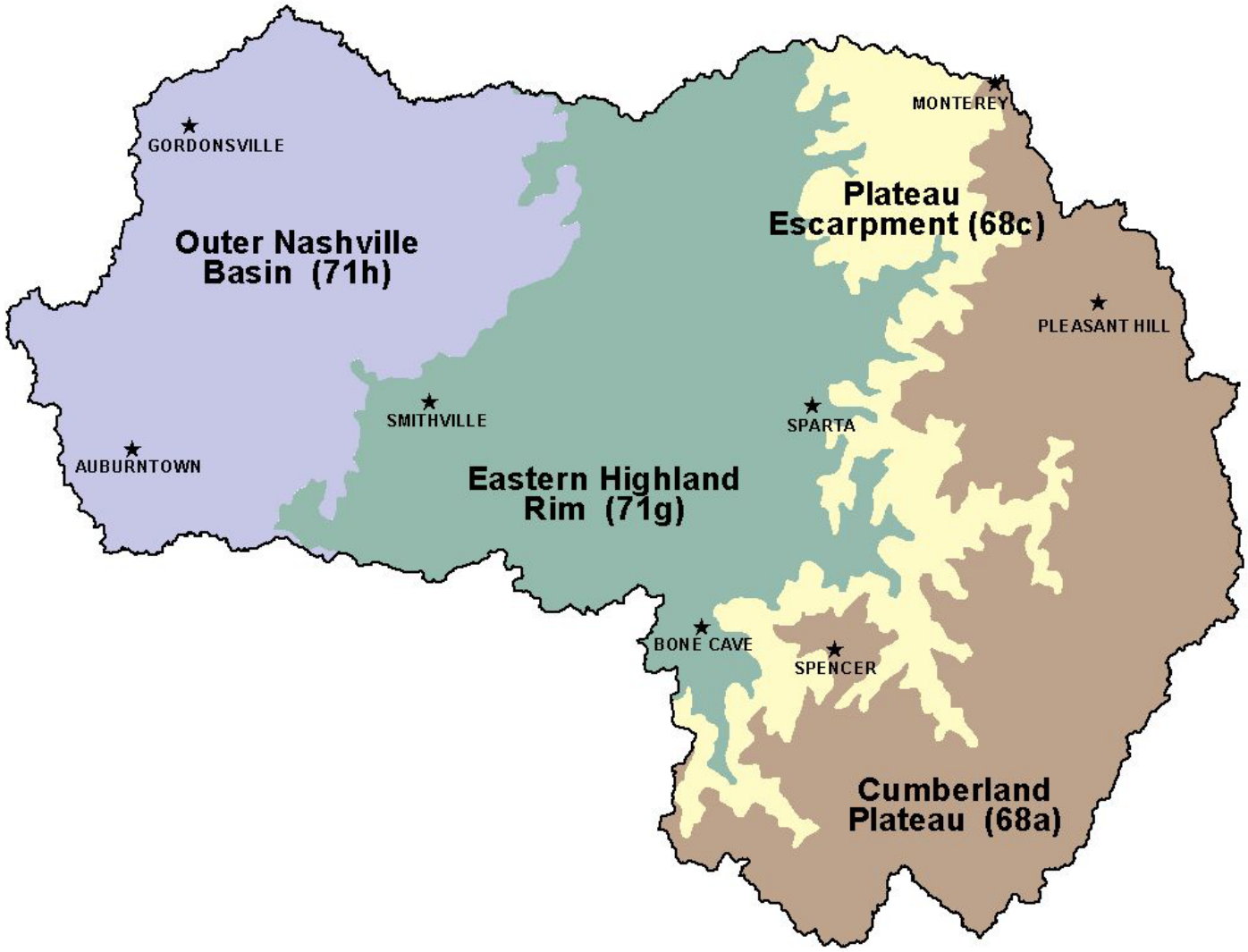
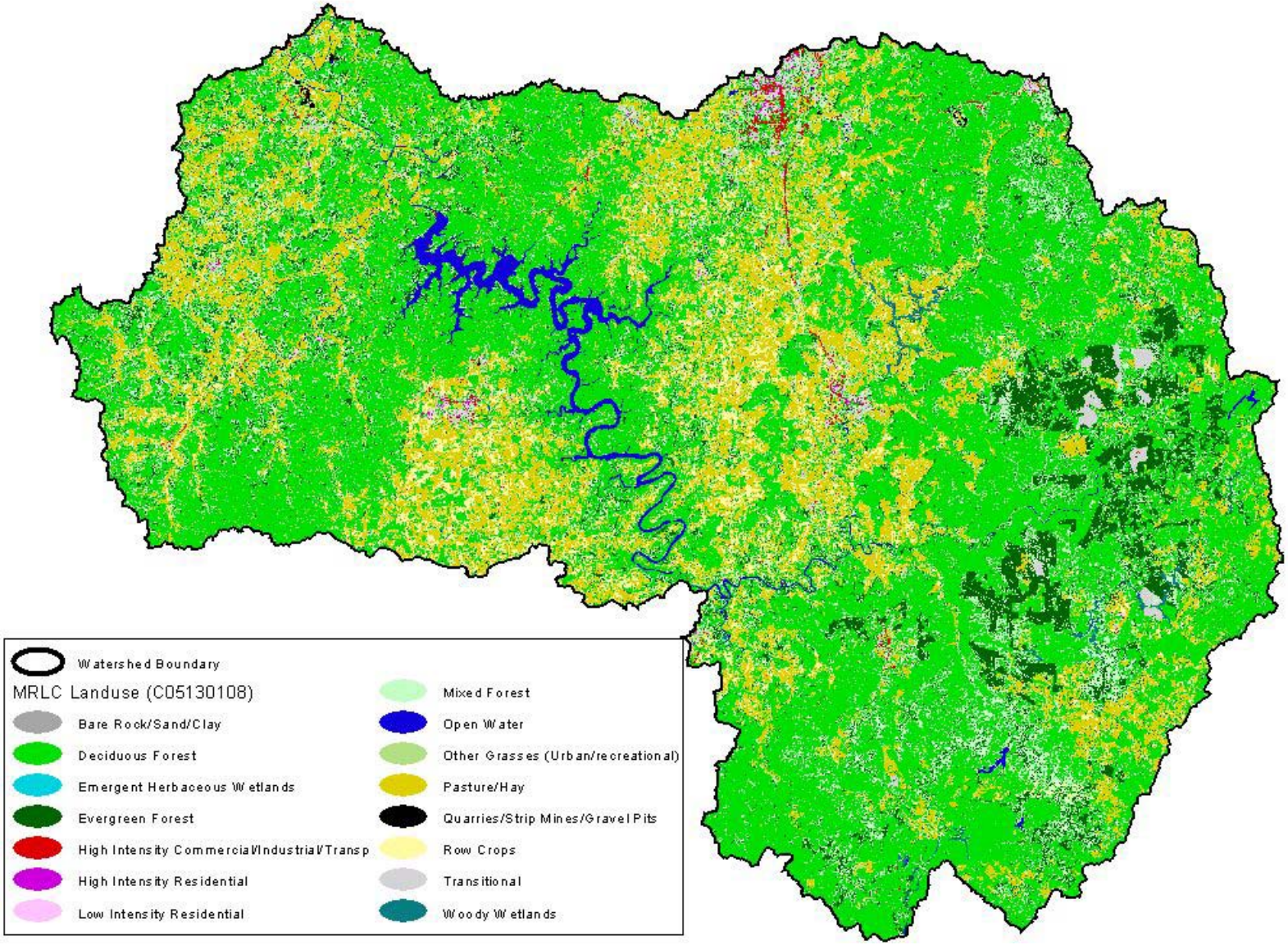


Figure 3 MRLC Land Use in the Caney Fork River Watershed



3.0 PROBLEM DEFINITION

The State of Tennessee's final 2002 303(d) List was approved by the U.S. Environmental Protection Agency (EPA), Region IV in January, 2004 (TDEC, 2004). The list identified a number of waterbodies in the Caney Fork River watershed as not fully supporting designated use classifications due, in part, to siltation and/or habitat alteration associated with agriculture, urban runoff, land development, and bank modification. These waterbodies are summarized in Table 2 and shown in Figure 4. The designated use classifications for the Caney Fork River and its tributaries include fish and aquatic life, irrigation, livestock watering & wildlife and recreation. Some waterbodies in the watershed are also classified for industrial water supply and/or domestic water supply.

A description of the stream assessment process in Tennessee can be found in *2004 305(b) Report, The Status of Water Quality in Tennessee* (TDEC, 2004a). This document states that "biological surveys using macroinvertebrates as the indicator organisms are the preferred method for assessing support of the fish & aquatic life designated use." The waterbody segments listed in Table 2 were assessed as impaired based primarily on biological surveys. The results of these assessment surveys are summarized in Table 3. The assessment information presented is excerpted from the EPA/TDEC Assessment Database (ADB) and is referenced to the waterbody IDs in Table 2. Assessment Database information may be accessed at:

http://gwidc.memphis.edu/website/dwpc/

A typical example of a stream assessment (Snow Creek) is shown in Appendix A.

Siltation is the process by which sediments are transported by moving water and deposited on the bottom of stream, river, and lake beds. Sediment is created by the weathering of host rock and delivered to stream channels through various erosional processes, including sheetwash, gully and rill erosion, wind, landslides, dry gravel, and human excavation. In addition, sediments are often produced as a result of stream channel and bank erosion and channel disturbance. Movement of eroded sediments downslope from their points of origin into stream channels and through stream systems is influenced by multiple interacting factors (USEPA, 1999).

Siltation (sedimentation) is the most frequently cited cause of waterbody impairment in Tennessee, impacting over 5,743 miles of streams and rivers (TDEC, 2004a). Unlike many chemical pollutants, sediments are typically present in waterbodies in natural or background amounts and are essential to normal ecological function. Excessive sediment loading, however, is a major ecosystem stressor that can adversely impact biota, either directly or through changes to physical habitat.

Excessive sediment loading has a number of adverse effects on fish & aquatic life in surface waters. As stated in excerpts from *Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Draft* (USEPA, 2003):

> In streams and rivers, fine inorganic sediments, especially silts and clays, affect the habitat for macroinvertebrates and fish spawning, as well as fish rearing and feeding behavior. Larger sands and gravels can scour diatoms and cause burying of invertebrates, whereas suspended sediment affects the light available for photosynthesis by plants and visual capacity of animals.

> Sedimentation alters the structure of the invertebrate community by causing a shift in proportions from one functional group to another. Sedimentation can lead to embeddedness, which blocks critical macroinvertebrate habitat by filling in the interstices of the cobble and other hard substrate on the stream bottom. As deposited sediment increases, changes in invertebrate community structure and diversity occur.
>
> Invertebrate drift is directly affected by increased suspended sediment load in freshwater streams. These changes generally involve a shift in dominance from ephemeroptera, plecoptera and trichoptera (EPT) taxa to other less pollution-sensitive species that can cope with sedimentation. Increases in sediment deposition that affect the growth, abundance, or species composition of the periphytic (attached) algal community will also have an effect on the macroinvertebrate grazers that feed predominantly on periphyton. ……. Effects on aquatic individuals, populations, and communities are expressed through alterations in local food webs and habitat. When sedimentation exceeds certain thresholds, ensuing effects will likely involve decline of the existing aquatic invertebrate community and subsequent colonization by pioneer species.

Historically, waterbodies in Tennessee have been assessed as not fully supporting designated uses due to siltation when the impairment was determined to be the result of excess loading of the inorganic sediment produced by erosional processes. In cases where impairment was determined to be caused by excess loading of the primarily organic particulate material found in sewage treatment plant (STP) effluent, the cause of pollution was listed as total suspended solids (TSS) or organic enrichment. In consideration of this practice, this document presents the details of TMDL development for waterbodies in the Caney Fork watershed listed as impaired due to siltation (excess inorganic sediment produced by erosional processes) and/or appropriate cases of habitat alteration. The TSS in STP effluent is considered to be a distinctly different pollutant and, therefore, is not used for sediment loading calculations.

Note: Table 2 lists all of the waterbodies in the Caney Fork River watershed that appear on the 2002 303(d) List as impaired due to siltation and/or habitat alteration. Although listing habitat alteration as a cause of pollution, Fall Creek (TN05130108027_0600), Piney Creek (TN05130108027_0700), and Dry Fork (TN05130108027_0850) were determined to be impaired for reasons other than excess sediment loading. Therefore, <u>TMDL development for these waterbodies will not be addressed in this document.</u>

Table 2 2002 303(d) List - Stream Impairment Due to Siltation/Habitat Alteration in the Caney Fork River Watershed

Waterbody Segment ID	Waterbody Segment Name	RM Partially Supporting	RM Not Supporting	Cause (Pollutant)	Source (Pollutant)
05130108001_0100	Snow Creek	7.6		Siltation Other Habitat Alterations	Pasture Grazing Removal of Riparian Vegetation
05130108001_0200	Ferguson Branch	5.8		Siltation Other Habitat Alterations	Removal of Riparian Vegetation
05130108001_0400	Rock Springs Branch	8.1		Siltation Other Habitat Alterations	Livestock in Stream Removal of Riparian Vegetation
05130108002_2000	Hickman Creek	22.2		Organic Enrichment/Low DO Other Habitat Alterations	Minor Municipal Point Source Grazing Related Sources
05130108024_1000	Rocky River	8.7		Siltation	Hwy/Road/Bridge Construction
05130108025_0400	Hickory Valley Branch	8.2		Organic Enrichment/Low DO Other Habitat Alterations	Pasture Grazing Removal of Riparian Vegetation
05130108027_0600	Fall Creek (Van Buren) *	0.5		Flow Alteration/Other Habitat Alterations/Iron	Upstream Impoundment
05130108027_0700	Piney Creek *	28.8		Metals/PH/Other Habitat Alteration	Abandoned Mining
05130108027_0850	Dry Fork *		16.7	Metals/PH/ Other Habitat Alteration	Abandoned Mining
05130108033_0310	Bradden Creek		10.7	Organic Enrichment/Low DO Other Habitat Alterations	Pasture Grazing Removal of Riparian Vegetation
05130108033_1000	Bee Creek	17.5		Siltation Other Habitat Alterations	Crop Related Sources Bank Modification/Destabilization
05130108036_0810	Flynn Creek	2.8		Siltation	Source Undetermined

Table 2 (cont.) 2002 303(d) List - Stream Impairment Due to Siltation/Habitat Alteration in the Caney Fork River Watershed

Waterbody Segment ID	Waterbody Segment Name	RM Partially Supporting	RM Not Supporting	Cause (Pollutant)	Source (Pollutant)
05130108036_3000	Unnamed Tributary to Caney Fork River	3.5		Other Habitat Alterations	Livestock in Stream Upstream Impoundment
05130108043_0300	Blue Spring Creek	10.1		Siltation	Bank Modification/Destabilization
05130108045_0150	Cane Creek	12.0		Other Habitat Alterations	Livestock in Stream Removal of Riparian Vegetation
05130108045_0300	Hudgens Creek	6.7		Other Habitat Alterations	Urban Runoff/Storm Sewers Hydromodification
05130108045_0400	Pigeon Roost Creek		2.4	Nutrients/Other Habitat Alterations/Pathogens	Major Municipal Point Source Urban Runoff/Storm Sewers Hydromodification
05130108045_0450	Pigeon Roost Creek	3.2		Nutrients/Other Habitat Alterations/Pathogens	Urban Runoff/Storm Sewers Hydromodification
05130108045_0500	Post Oak Creek	8.3		Siltation Other Habitat Alterations	Grazing Related Sources Removal of Riparian Vegetation
05130108045_1000	Falling Water River	8.8		Siltation	Agriculture
05130108048_1000	Indian Creek	31.0		Siltation Other Habitat Alterations	Dredging (gravel) Highway Maintenance/Runoff
05130108684_1000	Fall Creek (DeKalb)		9.8	Siltation/Organic Enrichment/Low DO/ Pathogens/Other Habitat Alterations	Major Municipal Point Source Upstream Impoundment
05130108684_2000	Fall Creek (DeKalb)	6.7		Other Habitat Alterations	Urban Runoff/Storm Sewers Hydromodification Removal of Riparian Vegetation

* The habitat alteration impairment of these waterbodies was determined to be related to factors other than excessive sediment loading. TMDLs for these waterbodies will be addressed in a separate document.

Figure 4 Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the 2002 303(d) List)

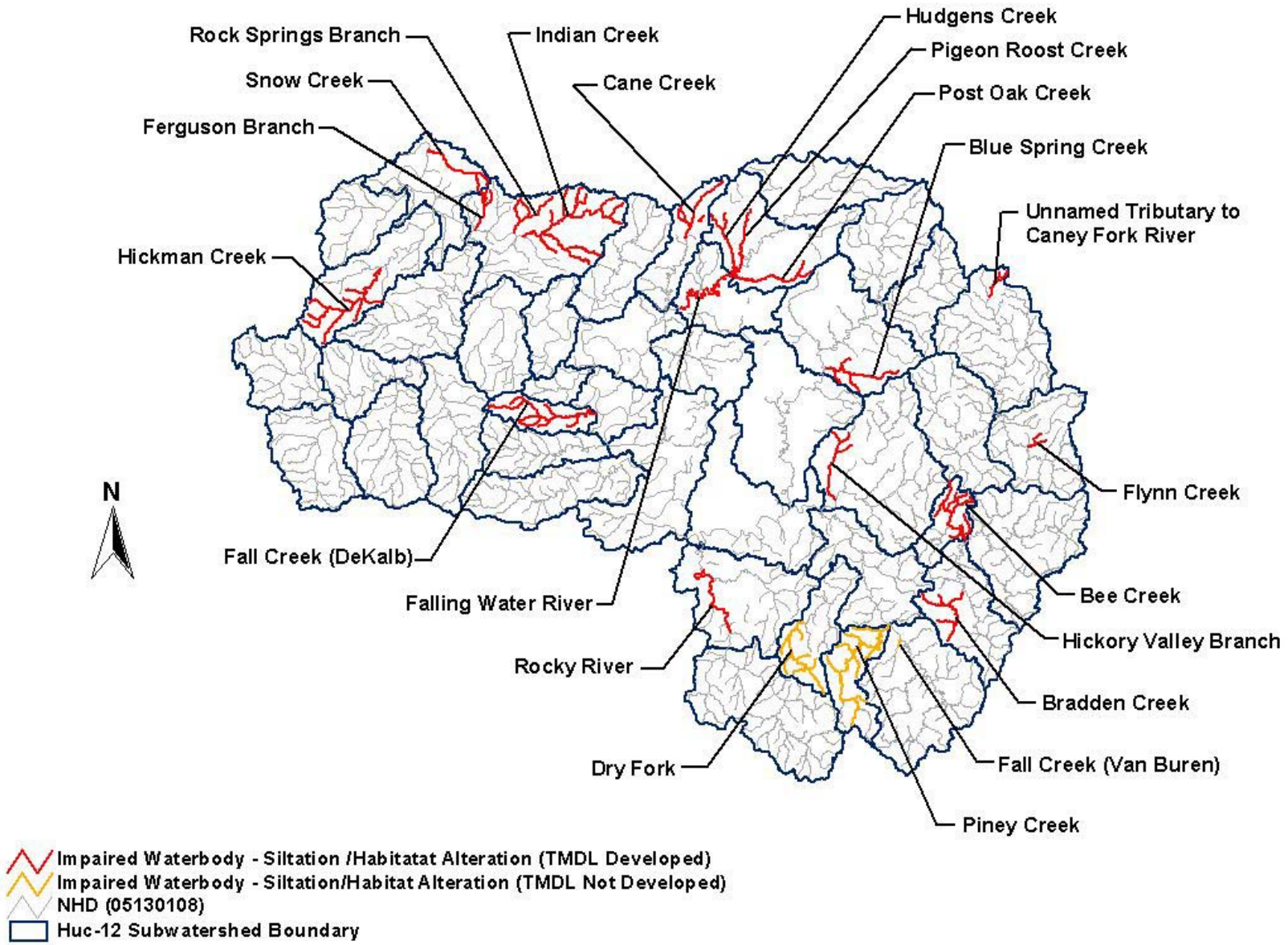


Table 3 Water Quality Assessment of Waterbodies Impaired Due to Siltation/Habitat Alteration

Waterbody Segment ID	Waterbody Segment Name	Cause	Source	Comments
05130108001_0100	Snow Creek	Siltation Other Habitat Alterations	Pasture Grazing/Removal of Riparian Vegetation	TDEC biological survey mile 1.4 in 1998. 4 EPT families.
05130108001_0200	Ferguson Branch	Siltation Other Habitat Alterations	Removal of Riparian Vegetation	TDEC biological assessment at 0.8 in 1998. Zero ETP families.
05130108001_0400	Rock Springs Branch	Siltation Other Habitat Alterations	Livestock in Stream/Removal of Riparian Vegetation	TDEC biological assessment at mile 1.1. 1 EPT families.
05130108002_2000	Hickman Creek (Brush Ck. to headwaters)	Organic Enrichment/Low DO/Other Habitat Alterations	Minor Municipal Point Source Grazing Related Sources	TDEC biological survey at mile 12.8 in 1998. 5 EPT families.
05130108024_1000	Rocky River (Caney Fk. to Norton Spring)	Siltation	Hwy/Road/Bridge Construction	TDEC biological survey at mile 9.2. 3 EPT families.
05130108025_0400	Hickory Valley Branch	Organic Enrichment/Low DO/Other Habitat Alterations	Pasture Grazing/Removal of Riparian Vegetation	TDEC biological survey at mile 0.3. General lack of EPT families noted.
05130108033_0310	Bradden Creek	Organic Enrichment/Low DO/Other Habitat Alterations	Pasture Grazing/Removal of Riparian Vegetation	TDEC biological survey at mile 0.8 and 3.4. Zero EPTs at either site.
05130108033_1000	Bee Creek (Caney Fork River to Glade Ck.)	Siltation Other Habitat Alterations	Crop Related Sources/Bank Modification/Destabilization	TDEC biological survey at mile 15.1. 4 EPT families.
05130108036_0810	Flynn Creek	Siltation	Source Undetermined	TDEC biological survey at mile 0.1. General absence of EPT families.
05130108036_3000	Unnamed Tributary to Caney Fork River	Other Habitat Alterations	Livestock in Stream Upstream Impoundment	TDEC biological survey at mile 0.2.
05130108043_0300	Blue Spring Creek	Siltation	Bank Modification/Destabilization	TDEC biological site at mile 0.1. Zero EPTs documented.
05130108045_0150	Cane Creek (Lee Seminary Road to headwaters)	Other Habitat Alterations	Livestock in Stream/Removal of Riparian Vegetation	TDEC biological survey at mile 11.8. 2 EPT families.
05130108045_0300	Hudgens Creek	Other Habitat Alterations	Urban Runoff/Storm Sewers Hydromodification	TDEC biological survey at mile 0.7. 4 EPT families.

Table 3 (Cont.) Water Quality Assessment of Waterbodies Impaired Due to Siltation/Habitat Alteration

Waterbody Segment ID	Waterbody Segment Name	Cause	Source	Comments
05130108045_0400	Pigeon Roost Creek (Falling Water River to Cookeville STP outfall)	Nutrients/Other Habitat Alterations/Pathogens	Major Municipal Point Source/Urban Runoff/Storm Sewers/ Hydromodification	TDEC biological surveys at mile 1.3. Water has an odor and algae growth is excessive. NO2+NO3 of 2.55 on 3/8/99 and 5.82 on 11/13/98. 1999 and 2000 Tenn. Tech biorecon surveys just d/s of STP outfall. 1 EPT in 11/00.
05130108045_0450	Pigeon Roost Creek (Cookeville STP outfall to cave at mile 5.6 where creek emerges from underground)	Nutrients/Other Habitat Alterations/Pathogens	Urban Runoff/Storm Sewers Hydromodification	TDEC biological & chemical sampling above STP. Fecal & nutrients elevated. 1999 and 2000 Tenn. Tech biorecon surveys just u/s of STP outfall at mile 2.5. 5 EPT, 16 total families in 5/99. 4 EPT, 23 total families in 6/00. 6 EPT, 13 total in 11/00.
05130108045_0500	Post Oak Creek	Siltation Other Habitat Alterations	Grazing Related Sources Removal of Riparian Vegetation	TDEC biological survey at mile 0.7. 4 EPT families.
05130108045_1000	Falling Water River (Center Hill embayment to Pigeon Roost Creek)	Siltation	Agriculture	Ambient monitoring station at mile 10.5. Biological survey at mile 18.0. 6 EPT families. COE performed biological survey at mile 18 in 1996. 11 EPT genera documented,
05130108048_1000	Indian Creek	Siltation Other Habitat Alterations	Dredging (gravel) Highway Maintenance / Runoff	TDEC biological surveys a miles 1.0 & 4.8. 4 EPT families at mile 1.0. Much evidence of gravel dredging.
05130108684_1000	Fall Creek (DeKalb) (Lower Fall Creek from embayment to and including Calverts Lake)	Siltation/Organic Enrichment/Low DO/Pathogens/Other Habitat Alterations	Major Municipal Point Source Upstream Impoundment	TDEC biological survey at mile 4.7. 2 EPT families. COE performed biological survey in 1996 at mile 5.4. 18 EPT genera documented.
05130108684_2000	Fall Creek (DeKalb) (Calvert's Lake to headwaters)	Other Habitat Alterations	Urban Runoff/Storm Sewers/ Hydromodification/Removal of Riparian Vegetation	TDEC biological survey at 7.0. 5 EPT families

4.0 TARGET IDENTIFICATION

Several narrative criteria, applicable to siltation/habitat alteration, are established in *Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-3 General Water Quality Criteria, January, 2004* (TDEC, 2004b):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.
>
> Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion, (b) is of the appropriate stream order specified for the bioregion and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.
>
> Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.
>
> Habitat - The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

These TMDLs are being established to attain full support of the fish and aquatic life designated use classification. TMDLs established to protect fish and aquatic life will protect all other use classifications for the identified waterbodies from adverse alteration due to sediment loading.

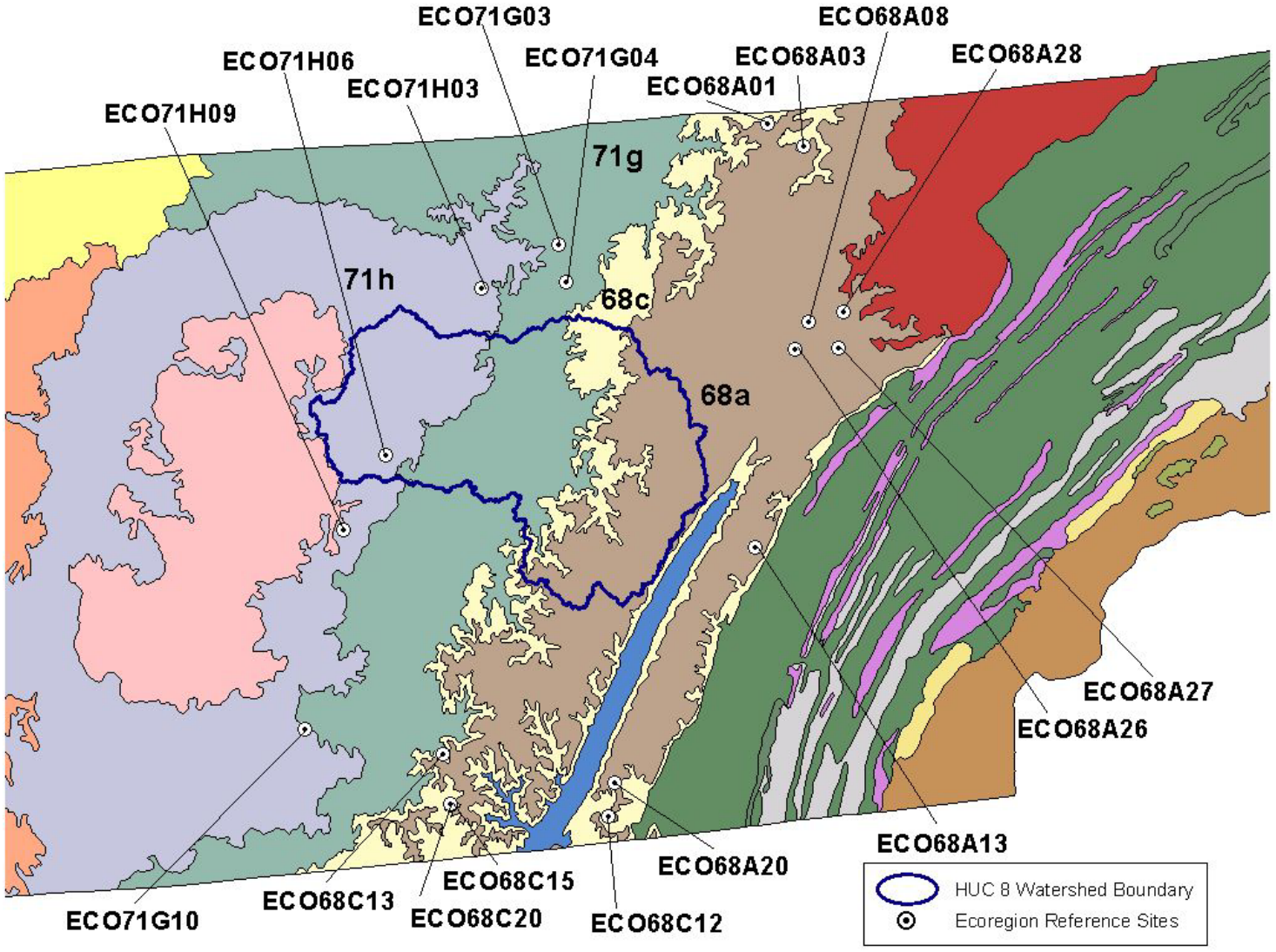
In order for a TMDL to be established, a numeric "target" protective of the uses of the water must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where State regulation does not provide a numeric water quality criteria, as in the case of siltation/habitat alteration, a numeric interpretation of the narrative water quality standard must be determined. For the purpose of these TMDLs, the average annual sediment loading in lbs/acre/yr, from a biologically healthy watershed, located within the same Level IV ecoregion as the impaired watershed, is determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. Biologically healthy watersheds were identified from the State's ecoregion reference sites. These ecoregion reference sites have similar characteristics and conditions as the majority of streams within that ecoregion. Detailed information regarding Tennessee ecoregion reference sites can be found in *Tennessee Ecoregion Project, 1994-1999* (TDEC, 2000). In general, land use in ecoregion reference watersheds contain less pasture, cropland, and urban areas, and more forested areas compared to the impaired watersheds. The biologically healthy (reference) watersheds are considered the "least impacted" in an ecoregion and, as such, sediment loading from these watersheds may serve as an appropriate target for the TMDL.

Using the methodology described in Appendix B, the Watershed Characterization System (WCS) Sediment Tool was used to calculate the average annual sediment load for each of the biologically healthy (reference) watersheds in Level IV ecoregions 68a, 68c, 71g, and 71h. The geometric mean of the average annual sediment loads of the reference watersheds in each Level IV ecoregion was selected as the most appropriate target for that ecoregion. Since the impairment of biological integrity due to sediment build-up is generally a long-term process, using an average annual load is considered appropriate. The average annual sediment loads for reference sites and corresponding TMDL target values for Level IV ecoregions 68a, 68c, 71g, and 71h are summarized in Table 4. Reference site locations are shown in Figure 5.

Table 4 Average Annual Sediment Loads of Level IV Ecoregion Reference Sites

Level IV Ecoregion	Reference Site	Stream	Drainage Area	Average Annual Sediment Load
			(acres)	[lbs/acre/year]
68a	ECO68A01	Rock Creek	3,717	41.8
	ECO68A03	Laurel Fork	10,827	86.3
	ECO68A08	Clear Creek	98,904	159.1
	ECO68A13	Piney Creek	8,946	156.1
	ECO68A20	Mullens Creek	7,388	122.1
	ECO68A26	Daddy's Creek	39,923	367.1
	ECO68A27	Island Creek	11,836	179.3
	ECO68A28	Rock Creek	16,036	104.4
		Geometric Mean (Target Load)		**128.7**
68c	ECO68C12	Ellis Gap Branch	810	91.6
	ECO68C13	Mud Creek	2,627	233.3
	ECO68C15	Crow Creek	14,106	223.8
	ECO68C20	Crow Creek	12,617	183.8
		Geometric Mean (Target Load)		**172.3**
71g	ECO71G03	Flat Creek	14,146	340.0
	ECO71G04	Spring Creek	17,090	496.3
	ECO71G10	Hurricane Creek	3,565	269.3
		Geometric Mean (Target Load)		**356.9**
71h	ECO71H03	Flynn Creek	8,318	735.7
	ECO71H06	Clear Fk. Creek	8,778	559.3
	ECO71H09	Carson Fork	7,934	518.6
		Geometric Mean (Target Load)		**597.7**

Figure 5 Reference Sites in Level IV Ecoregions 68a, 68c, 71g, & 71h



Note: Ecoregion reference sites are continually reviewed, with sites added or deleted as circumstances warrant. The stations shown were determined as ecoregion reference sites as of June 3, 2003.

5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Using the methodology described in Appendix B, the WCS Sediment Tool was used to determine the average annual sediment load, due to precipitation based sources, for all HUC-12 subwatersheds in the Caney Fork River watershed (Figure 6). Existing precipitation based sediment loads for subwatersheds with waterbodies listed on the 2002 303(d) List as impaired for siltation/habitat alteration are summarized in Table 5.

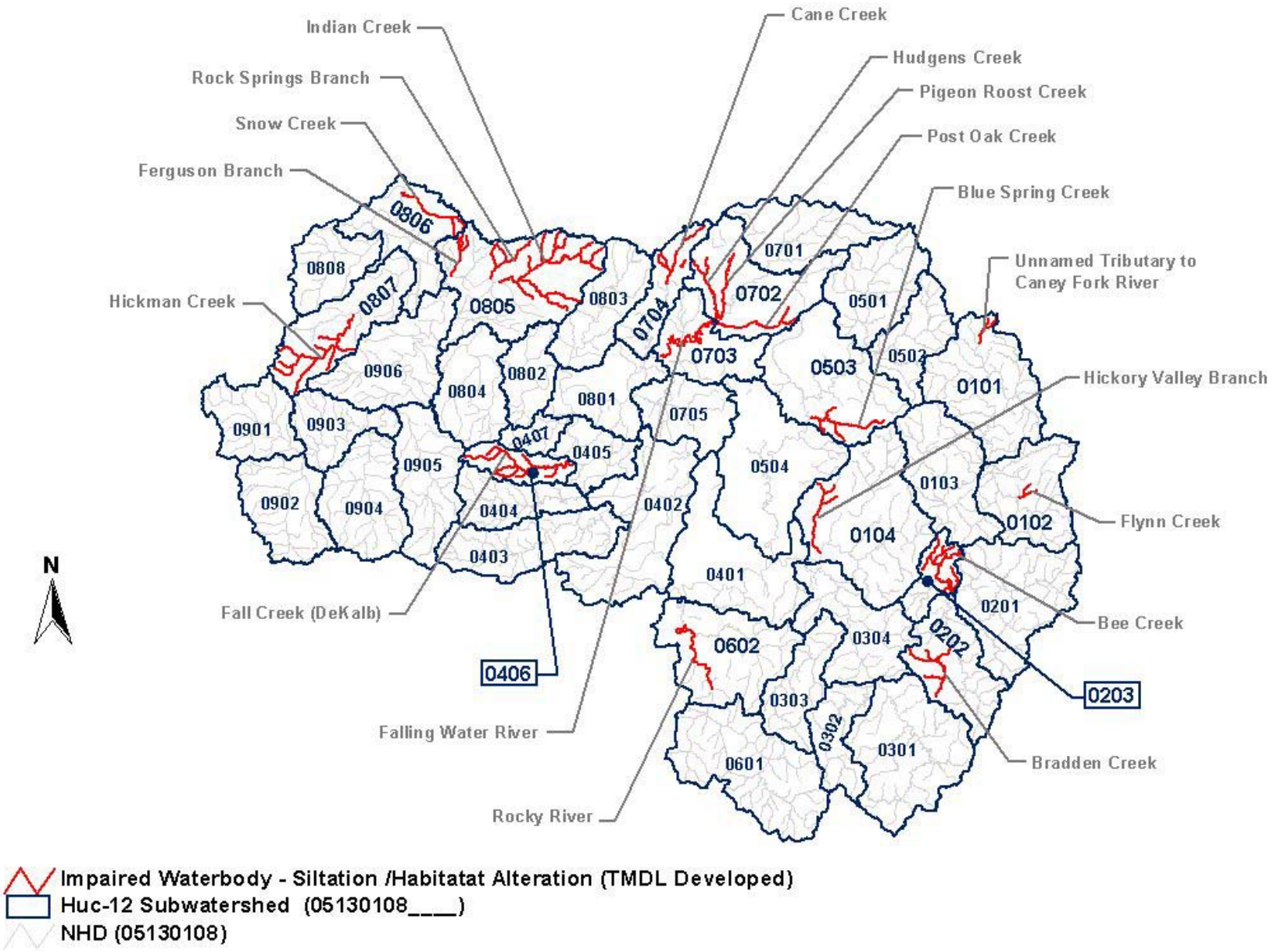
Table 5 Existing Sediment Loads in Subwatersheds With Impaired Waterbodies

Huc-12 Subwatershed (05130108____)	Level IV Ecoregion	Existing Sediment Load
		[lbs/ac/yr]
0101	68a	283
0102	68a	241
0104	68c	319
0202	68a	252
0203	68a	170
0406	71g	1,109
0503	68c	460
0602	68c	317
0702	71g	415
0703	71g	482
0704	71g	692
0805	71h	555
0806	71h	1,590
0807	71h	675

6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of siltation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Regulated point sources include: 1) municipal and industrial wastewater treatment facilities (WWTFs); 2) storm water discharges associated with industrial activity (which includes construction activities); and 3) certain discharges from Municipal Separate Storm Sewer Systems (MS4s). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES-regulated point sources. For the purposes of these TMDLs, all sources of sediment loading not regulated by NPDES are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

Figure 6 Caney Fork River Watershed – HUC-12 Subwatershed Boundaries



6.1 Point Sources

6.1.1 NPDES-Regulated Municipal and Industrial Wastewater Treatment Facilities

As stated in Section 3.0, the TSS component of WWTF discharges is generally composed of primarily organic material and is considered to be different in nature than the sediments produced from erosional processes. Therefore, TSS discharges from WWTFs are not included in the TMDLs developed for this document.

6.1.2 NPDES Regulated Ready Mixed Concrete Facilities

Discharges from regulated Ready Mixed Concrete Facilities (RMCFs) may contribute sediment to surface waters as TSS discharges (TSS discharged from RMCFs is composed of primarily inorganic material and is therefore included as a source for TMDL development). Most of these facilities obtain coverage under NPDES Permit No. TNG110000, *General NPDES Permit for Discharges of Storm Water Runoff and Process Wastewater Associated With Ready Mixed Concrete Facilities (TDEC, 2003)*. This permit establishes a daily maximum TSS concentration limit of 50 mg/l on process wastewater effluent and specifies monitoring procedures for storm water. Facilities are also required to develop and implement storm water pollution prevention plans (SWPPPs). Discharges from RMCFs are generally intermittent, and contribute a small portion of total sediment loading to HUC-12 subwatersheds (ref.: Appendix D). In some cases, for discharges into impaired waters documented on the 303(d) List, sites may be required to obtain coverage under an individual NPDES permit. There is only one permitted RMCF in the Caney Fork River watershed and it is not located in an impaired subwatershed.

6.1.3 NPDES Regulated Mining Sites

Discharges from regulated mining activities may also contribute sediment to surface waters as TSS (TSS discharged from mining sites is composed of primarily inorganic material and is therefore included as a source for TMDL development). Discharges from active mines may result from dewatering operations and/or in response to storm events, whereas discharges from permitted inactive mines are only in response to storm events. Inactive sites with successful surface reclamation contribute relatively little solids loading. There are 17 mining sites permitted to discharge TSS in the Caney Fork River Watershed (as of September 1, 2004). Three of these 17 permitted mining sites are located in impaired subwatersheds. These three sites are shown in Figure 7 and permit limits are summarized in Table 6. Sediment loads (as TSS) to waterbodies from mining site discharges are very small in relation to total sediment loading (ref.: Appendix D).

Figure 7 NPDES Regulated Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds

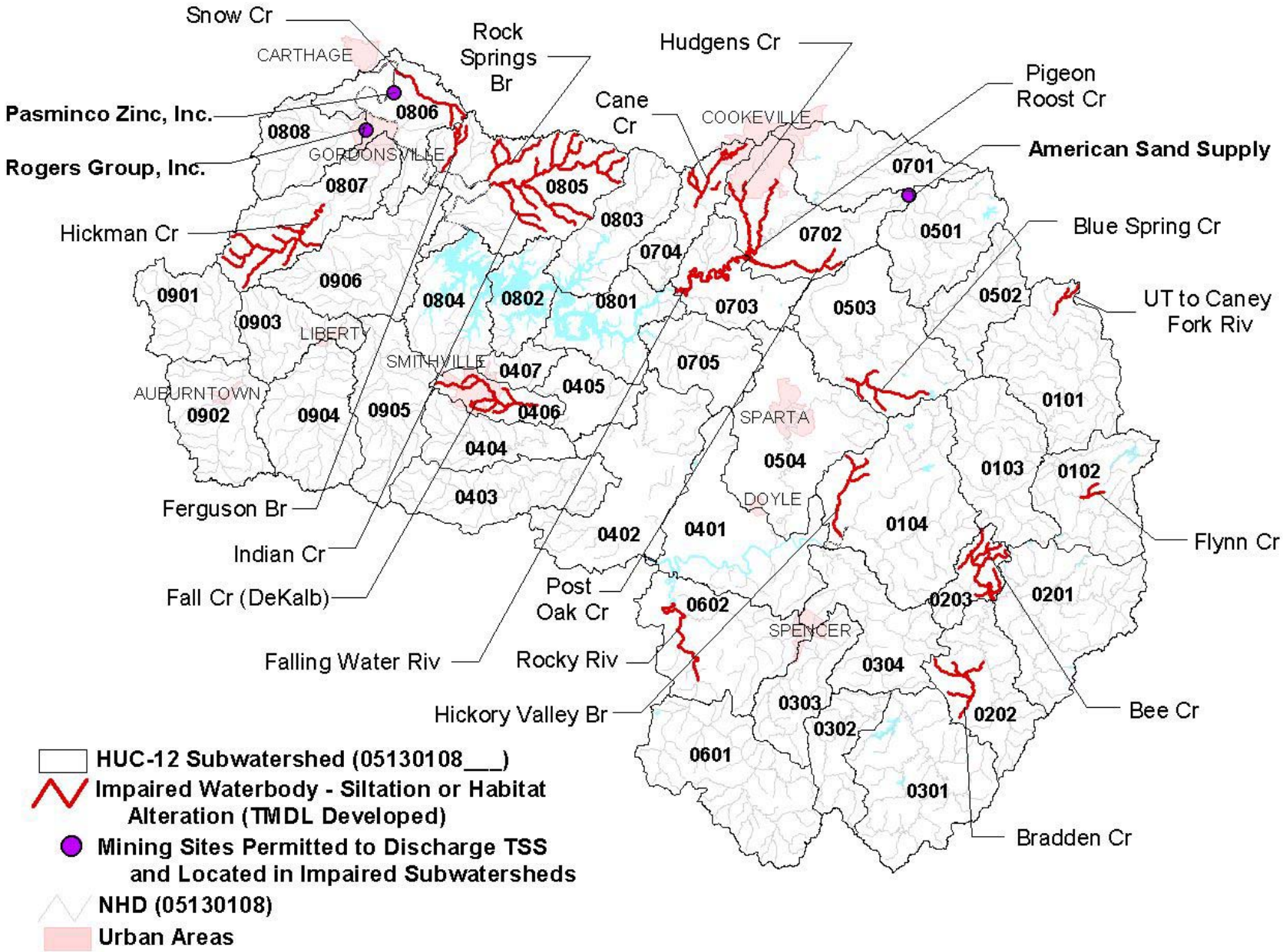


Table 6 NPDES Regulated Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds

HUC-12 Subwatershed (05130108__)	NPDES Permit No.	Name	Area [acres]	TSS Daily Max Limit [mg/l]
0702	TN0062910	American Sand Supply Sand Processing Plant	18.00	40
0806	TN0004227	Pasminco Zinc, Inc. Elmwood Mine	158.00	30
	TN0069124	Rogers Group, Inc. Gordonsville Plant	91.01	40

6.1.4 NPDES-Regulated Construction Activities

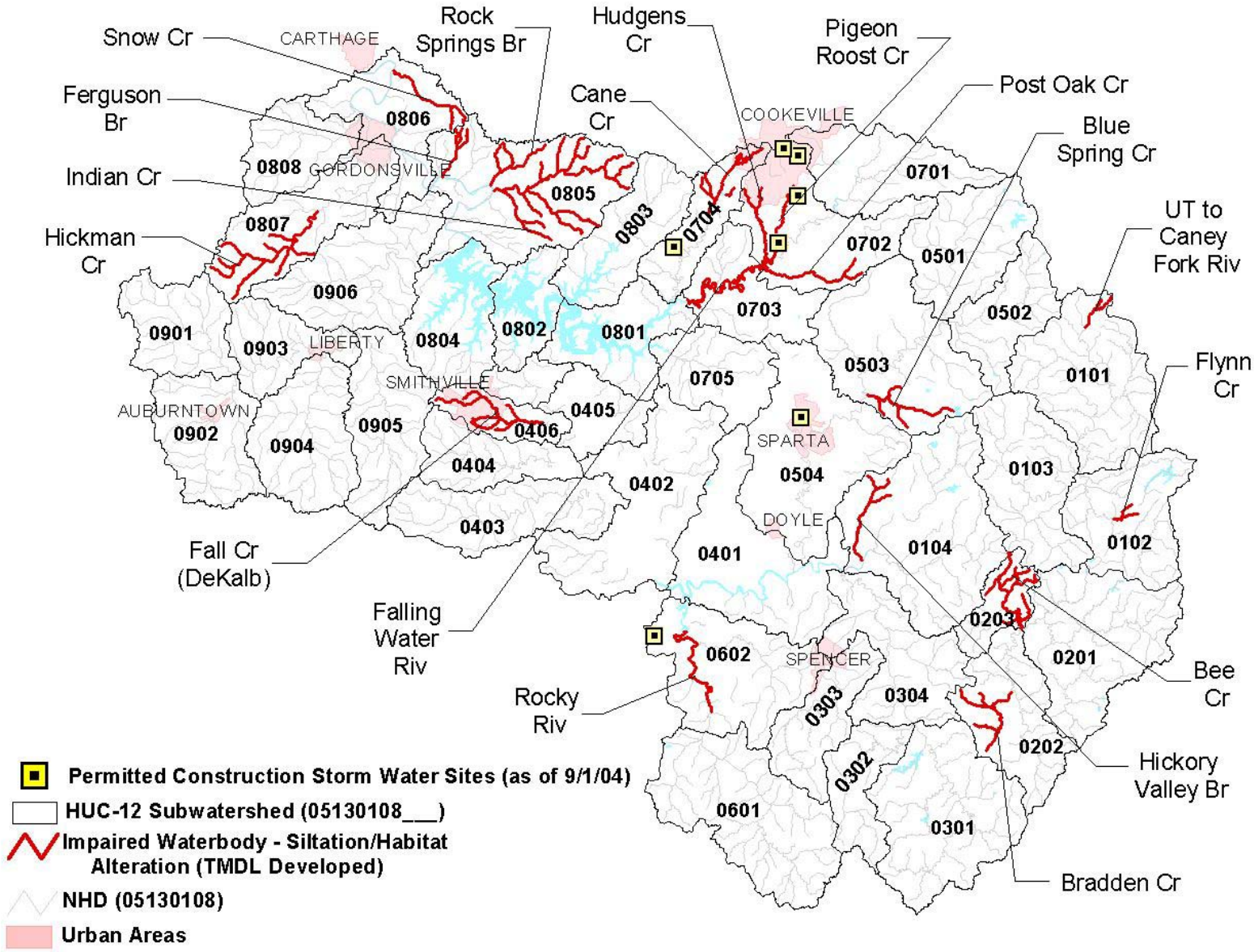
Discharges from NPDES-regulated construction activities are considered point sources of sediment loading to surface waters and occur in response to storm events. Currently, discharges of storm water from construction activities disturbing an area of one acre or more must be authorized by an NPDES permit. Most of these construction sites obtain coverage under NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2000a). The permit requires the development and implementation of a SWPPP to minimize the discharge of pollutants to surface waters and prohibits discharges that would result in the violation of a State water quality criteria. Additional requirements are specified for discharges into impaired waterbodies documented on the 303(d) List, and, in some cases, sites may be required to obtain coverage under an individual NPDES permit. Since construction activities at a site are of a temporary, relatively short-term nature, the number of construction sites covered by the general permit at any instant of time varies. In the Caney Fork River watershed, there were seven permitted active construction sites on September 1, 2004 (ref.: Figure 8).

6.1.5 NPDES-Regulated Municipal Separate Storm Sewer Systems

Municipal separate storm sewer systems (MS4s) may also discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches and storm drains. These systems convey urban runoff from surfaces such as bare soil and wash-off of accumulated street dust and litter from impervious surfaces during rain events. Large and medium MS4s serving populations greater than 100,000 people are required to obtain an NPDES storm water permit. At present, there are no MS4s of this size in the Caney Fork River Watershed. As of March 2003, small MS4s serving urbanized areas, or having the potential to exceed instream water quality standards, are required to obtain coverage under the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2002). An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile. The City of Cookeville (TNS075256) and Wilson County (TNS075809) are covered under Phase II of the NPDES Storm Water Program. Both Notices of Coverage (NOCs) were issued July 3, 2003, became effective July 7, 2003 and expire February 26, 2008. The Tennessee Department of Transportation (TDOT) is also being issued an MS4 permit (TNS077585, target public notice 7/5/2004) for State roads in urban areas. Information regarding storm water permitting in Tennessee may be obtained from the TDEC website at:

http://www.state.tn.us/environment/wpc/stormh2o/.

Figure 8 Location of NPDES Permitted Construction Sites in the Caney Fork River Watershed



6.2 Nonpoint Sources

Nonpoint sources account for the vast majority of sediment loading to surface waters. These sources include:

- Natural erosion occurring from the weathering of soils, rocks, and uncultivated land; geological abrasion; and other natural phenomena.

- Erosion from agricultural activities can be a major source of sedimentation due to the large land area involved and the land-disturbing effects of cultivation. Grazing livestock can leave areas of ground with little vegetative cover. Unconfined animals with direct access to streams can cause streambank damage.

- Urban erosion from bare soil areas under construction and washoff of accumulated street dust and litter from impervious surfaces.

- Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The actual road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or “turn-outs” from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion. Exposed soils, high runoff velocities and volumes, and poor road compaction all increase the potential for erosion

- Runoff from abandoned mines may be significant sources of solids loading. Mining activities typically involve removal of vegetation, displacement of soils, and other significant land disturbing activities.

- Soil erosion from forested land that occurs during timber harvesting and reforestation activities. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Established forest areas produce very little soil erosion.

For the listed waterbodies within the Caney Fork River Watershed, the primary sources of nonpoint sediment loading come from agriculture, roadways, and urban sources.

7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOADS

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations) and an

appropriate margin of safety (MOS) which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity or other appropriate measure.

TMDL analyses are performed on a 12-digit hydrologic unit area (HUC-12) basis for subwatersheds containing waterbodies identified as impaired due to siltation or habitat alteration on the 2002 303(d) List. HUC-12 subwatershed boundaries are shown in Figure 6.

7.1. Analysis Methodology

Sediment analysis for watersheds can be conducted using methods ranging from simple, gross estimates to complex dynamic loading and receiving water models. The choice of methodology is dependent on a number of factors that include watershed size, type of impairment, type and quantity of data available, resources available, time, and cost. In consideration of these factors, the procedure outlined in Section 7.1.1 was selected as the most appropriate for first phase sediment TMDLs in the Caney Fork River watershed. This procedure was modified as noted in Section 7.1.2 for subwatershed 051301080805.

7.1.1 WCS Sediment Tool

Sediment loading analysis for waterbodies impaired due to siltation/habitat alteration in the Caney Fork River watershed was accomplished using the Watershed Characterization System (WCS) Sediment Tool. This ArcView geographic information system (GIS) based model is described in Appendix B and was utilized according to the following procedure:

- The Watershed Characterization System (WCS) Sediment Tool was used to determine sediment loading to Level IV ecoregion reference site watersheds. These are considered to be biologically healthy watersheds. The average annual sediment loads in lbs/acre/year of these reference watersheds serve as target values for Caney Fork River watershed sediment TMDLs.

- The Sediment Tool was also used to determine the existing average annual sediment loads of impaired subwatersheds located in the Caney Fork River watershed. Impaired subwatersheds are defined as 12-digit HUCs containing one or more waterbodies identified as impaired due to siltation/habitat alteration on the State's 2002 303(d) List (ref.: Figure 4).

- The existing average annual sediment load of each impaired HUC-12 subwatershed was compared to the average annual load of the appropriate reference (biologically healthy) watershed and an <u>overall</u> required percent reduction in loading calculated. For each impaired HUC-12 subwatershed, the TMDL is equal to this <u>overall</u> required reduction:

$$TMDL = \frac{(\text{Existing Load}) - (\text{Target Load})}{(\text{Existing Load})} \times 100$$

Although the Sediment Tool uses the best road, elevation, and land use GIS coverages available, the resulting average annual sediment loads should not be interpreted as an absolute value. The calculated loading reductions, however, are considered to be valid since they are based on the relative comparison of loads calculated using the same methodology.

- In each impaired subwatershed, 5% of the ecoregion-based target load was reserved to account for WLAs for NPDES permitted mining sites and RMCFs. The existing loads from these facilities were determined to be less than the five percent reserved in each impaired HUC-12 subwatershed. Any difference between these existing loads and the 5% reserved load provide for future growth and additional MOS (ref.: Appendix D).

- For each impaired HUC-12 subwatershed, WLAs for construction storm water sites, WLAs for MS4s, and LAs for nonpoint sources were considered to be the percent load reduction required to decrease the existing annual average sediment load to a level equal to 95% of the target value.

$$WLA_{Const.SW} = WLA_{MS4} = LA = \frac{\text{(Existing Load)} - [(.95)\ \text{(Target Load)}]}{\text{(Existing Load)}} \times 100$$

- TMDLs, WLAs for construction storm water sites and MS4s, and LAs are expressed as a percent reduction in average annual sediment loading. WLAs for mining sites and RMCFs are equal to loads authorized by their existing permits. Since sediment loading from these facilities are small with respect to storm water induced sediment loading, further reductions were not considered warranted (ref.: Appendix D).

  It is considered that the reduction of sediment loading as specified by WLAs and LAs in impaired watersheds will result in the attainment of fully supporting status for all designated use classifications, with respect to siltation/habitat alteration. According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

Details of the analysis methodology are more fully described in Appendix B. This approach is recognized as an acceptable alternative to a maximum allowable mass load per day in the *Protocol for Developing Sediment TMDLs* (USEPA, 1999).

7.1.2 Sediment Tool Analysis Anomalies

There is one HUC-12 subwatershed in the Caney Fork River watershed that has been assessed (primarily on the basis of biological surveys as stated in Section 3.0) as impaired due to siltation or habitat alteration, for which the results of the Sediment Tool based analysis indicate that the existing sediment load is smaller than the target load. This subwatershed is:

051301080805 (Ferguson Branch, Indian Creek, & Rock Springs Branch)

This subwatershed requires a more thorough investigation to determine site-specific causes of impairment. A detailed analysis is presented in Appendix F. In consideration, however, of the assessment of waterbodies in these subwatersheds as impaired due to siltation or habitat alteration, TMDLs, WLAs for construction storm water sites, WLAs for MS4s, and LAs for nonpoint

sources were assigned based on the predominant Level IV ecoregion in each HUC-12 subwatershed using the following procedure:

- Assigned TMDLs were determined to be equal to the geometric mean of the overall required load reductions (TMDLs) of other impaired HUC-12 subwatersheds predominantly in the same Level IV ecoregion.

- Assigned WLAs for construction storm water, WLAs for MS4s, and LAs for nonpoint sources for the subwatersheds were determined to be equal to the geometric mean of the WLA & LA load reductions of other impaired HUC-12 subwatersheds predominantly in the same Level IV ecoregion.

7.2 TMDLs for Impaired Subwatersheds

Sediment TMDLs for subwatersheds containing waterbodies identified as impaired for siltation/habitat alteration are summarized in Table 7. The determination of assigned TMDLs for HUC-12 subwatersheds where the Sediment Tool analysis resulted in existing loads lower than target loads are shown in Table 8.

Table 7 Sediment TMDLs for Subwatersheds with Waterbodies Impaired for Siltation/Habitat Alteration

HUC-12 Subwatershed	Waterbody ID	Waterbody Impaired by Siltation/ Habitat Alteration	Level IV Ecoregion	Existing Sediment Load	Target Load	TMDL (Required Overall Load Reduction)
				[lbs/ac/yr]	[lbs/ac/yr]	[%]
0101	05130108036_3000	UT to Caney Fork River	68a	283	128.7	54.5
0102	05130108036_0810	Flynn Creek	68a	241	128.7	46.6
0104	05130108025_0400	Hickory Valley Branch	68c	319	172.2	46.0
0202	05130108033_0310	Bradden Creek	68a	252	128.7	48.9
0203	05130108033_1000	Bee Creek	68a	170	128.7	24.3
0406	05130108684_1000	Fall Creek (DeKalb)	71g	1,109	356.9	67.8
	05130108684_2000	Fall Creek (DeKalb)				
0503	05130108043_0300	Blue Spring Creek	68c	460	172.2	62.6
0602	05130108024_1000	Rocky River	68c	317	172.2	45.7
0702	05130108045_0300	Hudgens Creek	71g	414	356.9	13.8
	05130108045_0400	Pigeon Roost Creek				
	05130108045_0450	Pigeon Roost Creek				
	05130108045_0500	Post Oak Creek				
0703	05130108045_1000	Falling Water River	71g	482	356.9	26.0
0704	05130108045_0150	Cane Creek	71g	692	356.9	48.4
0805	05130108001_0200	Ferguson Branch	71h	555	597.6	26.6 *
	05130108001_0400	Rock Springs Branch				
	05130108048_1000	Indian Creek				
0806	05130108001_0100	Snow Creek	71h	1,589	597.6	62.4
0807	05130108002_2000	Hickman Creek	71h	674	597.6	11.3

* Assigned TMDL . Ref.: Section 7.1.2 & Table 8.

Table 8 Determination of Assigned TMDLs for Subwatershed 051301080805

Level IV Ecoregion	Impaired HUC-12 Subwatershed	Required Load Reduction		
		TMDL (Overall)	WLAs (Construction SW & MS4s)	LAs (Nonpoint Sources)
		[%]	[%]	[%]
71h	0806	62.4	64.3	64.3
	0807	11.3	15.8	15.8
	Geometric Mean	**26.6**	**31.8**	**31.8**

Note: WLAs for construction storm water, WLAs for MS4s, & LAs for nonpoint sources are based on the information in Sections 7.3.3, 7.3.4, & 7.4 and Table 11 and are shown here for convenience.

7.3 Waste Load Allocations

7.3.1 Waste Load Allocations for NPDES Regulated Ready Mixed Concrete Facilities

There are no NPDES permitted ready mixed concrete facilities (RMCFs) located in impaired subwatersheds in the Caney Fork River watershed.

7.3.2 Waste Load Allocations for NPDES-Regulated Mining Activities

Of the 17 NPDES regulated mining sites in the Caney Fork River watershed, three are located in impaired subwatersheds (ref.: Table 6). Since sediment loading from mining sites is small (ref.: Appendix D) compared to the total loading for impaired subwatersheds, WLAs are considered to be equal to the existing permit requirements for these sites.

7.3.3 Waste Load Allocations for NPDES-Regulated Construction Activities

Construction activities disturbing one or more acres are regulated by the State's NPDES program (ref.: Section 6.1.4) and discharges from these sites must be authorized by a permit. This includes clearing, grading or excavating that results in an area of disturbance of one or more acres, and activities that result in the disturbance of less than one acre if it is part of a larger common plan of development or sale. Since these construction activities may discharge sediment to surface waters, WLAs are provided for this category of activities. WLAs are established for each subwatershed containing a waterbody identified on the 2002 303(d) List as impaired due to siltation or habitat alteration (ref.: Table 2). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading (minus the amount allocated to RMCFs and regulated mining sites (5%)) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 9).

The WLAs provided to the NPDES regulated construction activities will be implemented as Best Management Practices (BMPs), as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2000a). It is not technically feasible to incorporate numeric sediment limits into construction storm water permits at this time. WLAs should not be construed as numeric permit limits. Ambient monitoring may be required

for specific discharges to determine compliance with the TMDL for a particular segment. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs. In some cases, it may be necessary to go beyond standard practices in the application of BMPs to assure compliance with the WLA (ref.: Section 8).

7.3.4 Waste Load Allocations for NPDES-Regulated Municipal Separate Storm Sewer Systems (MS4s)

Municipal separate storm sewer systems (MS4s) are regulated by the State's NPDES program (ref.: Section 6.1.5). Since MS4s have the potential to discharge TSS to surface waters, WLAs are specified for these systems. WLAs are established for each HUC-12 subwatershed containing a waterbody identified on the 2002 303(d) List as impaired due to siltation or habitat alteration (ref.: Table 2). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for an impaired subwatershed, relative to the estimated average annual sediment loading (minus the amount allocated to RMCFs and regulated mining sites (5%)) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 9).

WLAs provided to NPDES regulated MS4s will be implemented as Best Management Practices (BMPs) as specified in Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into MS4 permits at this time. WLAs should not be construed as numeric permit limits. Ambient monitoring may be required for specific discharges to determine compliance with the TMDL for a particular segment. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs. In some cases, it may be necessary to go beyond standard practices in the application of BMPs to assure compliance with the WLA (ref.: Section 8).

7.4 Load Allocations for Nonpoint Sources

Sources of sediment loading to surface waters not covered by the NPDES program are provided a Load Allocation (LA) in these TMDLs. LAs are established for each HUC-12 subwatershed containing a waterbody identified on the 2002 303(d) List as impaired due to siltation or habitat alteration (ref.: Table 2). LAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading (minus the amount allocated to RMCFs and regulated mining sites) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 9). Properly designed and well-maintained BMPs will be necessary to assure that LAs are achieved.

Table 9 Summary of WLAs for MS4s, WLAs for Construction Storm Water Sites, & LAs for Nonpoint Sources

HUC-12 Subwatershed (05130108__)	Level IV Ecoregion	Percent Reduction in Average Annual Sediment Load	
		WLAs (Construction SW & MS4s)	LAs (Nonpoint Sources)
		[%]	[%]
0101	68a	56.8	56.8
0102	68a	49.3	49.3
0104	68c	48.7	48.7
0202	68a	51.5	51.5
0203	68a	28.1	28.1
0406	71g	69.4	69.4
0503	68c	64.4	64.4
0602	68c	48.4	48.4
0702	71g	18.1	18.1
0703	71g	29.7	29.7
0704	71g	51.0	51.0
0805	71h	31.8 *	31.8 *
0806	71h	64.3	64.3
0807	71h	15.8	15.8

* Assigned WLA or LA. Ref.: Section 7.1.2, Table 8, & Appendix F

7.5 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, an implicit MOS was incorporated through the use of conservative modeling assumptions. These include:

- Target values based on Level IV ecoregion reference sites. These sites represent the least impacted streams in the ecoregion.

- The use of the sediment delivery process that results in the most sediment transport to surface waters (ref.: Method 2 in Appendix B).

In most presently impaired subwatersheds, some amount of explicit MOS is realized due to the WLAs specified for NPDES permitted mining sites and RMCFs being less than the 5% of the target load reserved for these facilities.

7.6 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. The determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE (ref.: Appendix B). This is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

8.0 IMPLEMENTATION PLAN

8.1 Point Sources

8.1.1 NPDES Regulated Ready Mixed Concrete Facilities

There are no NPDES permitted ready mixed concrete facilities (RMCFs) located in impaired subwatersheds in the Caney Fork River Watershed.

8.1.2 NPDES Regulated Mine Sites

WLAs for mining sites located in impaired HUC-12 subwatersheds will be implemented through each site's NPDES permit. Since discharges from these facilities are small compared to the total sediment loading in impaired subwatersheds, WLAs are equal to existing permit requirements.

8.1.3 NPDES-Regulated Construction Storm Water

The WLAs provided to existing and future NPDES-regulated construction activities disturbing one acre or more will be implemented through Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y (TDEC, 2000a). It is not technically feasible to incorporate numeric sediment limits into permits for these activities at this time. WLAs should <u>not</u> be construed as numeric permit limits. This permit requires (ref.: Appendix E):

- Development and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP) that addresses erosion and sediment control.
- Good engineering and best management practices in the design, installation, and maintenance of erosion and sediment controls.
- Erosion and sediment controls must be designed to function properly in a two-year, 24-hour storm event.

In addition, a number of special requirements in the permit apply to discharges entering waterbodies that have been identified on the 303(d) List as being impaired due to siltation. These additional requirements include:

- More frequent (weekly) inspections of erosion and sediment controls.
- Inspections and the condition of erosion and sediment controls must be reported to the Division of Water Pollution Control (DWPC).
- The SWPPP must be submitted to the DWPC prior to disturbing soil at the construction site.

- In order to assure that the WLA is achieved, the application of BMPs that go beyond the typical minimum elements generally undertaken to comply with the General Permit may be necessary.

Strict compliance with the provisions of the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* can reasonably be expected to achieve reduced sediment loads to streams. The primary challenge for the reduction of sediment loading from construction sites to meet WLAs is in the effective compliance monitoring of all requirements specified in the permit and timely enforcement against construction sites not found to be in compliance with the permit.

8.1.4 NPDES-Regulated Municipal Separate Storm Sewer Systems (MS4s)

For regulated discharges from municipal separate storm sewer systems, WLAs will be implemented through Phase II MS4 permits. These permits will require the development and implementation of a Storm Water Management Plan (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards. The individual permittees will be responsible for identifying the specific BMPs to be applied to attain appropriate reduction in sediment loads. The SWMP will also include a number of programs/activities to identify sources of pollutants in municipal storm water runoff and verify SWMP effectiveness.

8.2 Nonpoint Sources

Reductions of sediment loading from nonpoint sources will be achieved using a phased and adaptive management approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in sediment loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. TMDL implementation activities will be accomplished within the framework of Tennessee's Watershed Approach (ref.: http://www.state.tn.us/environment/wpc/watershed/).

The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring, assessment, TMDLs, WLAs/LAs, and permit issuance. It relies on participation at the federal, state, local and nongovernmental levels to be successful. The *Caney Fork River Watershed Management Plan* was developed in 2003 and describes, in general, the partnerships among government agencies and stakeholder groups and the roles that each play in the effort to improve water quality in the Caney Fork River Watershed, including the reduction of pollutant loading.

Governmental agencies include:

- Natural Resources Conservation Service, http://prms.nrcs.usda.gov/prms
- USGS Water Resource Programs—Tennessee District, http://water.usgs.gov/
- U.S. Environmental Protection Agency, http://epa.gov/
- U.S. Fish and Wildlife Service, http://www.*fws.gov*, (931)-528-6481
- Tennessee Valley Authority, http://www.tva.gov
- TDEC - Division of Water Supply, http://www.state.tn.us/environment/dws,
- http://www.state.tn.us/environment/water.php
- Tennessee Department of Agriculture, http://www.state.tn.us/agriculture/
- Tennessee Wildlife Resources Agency, http://www.state.tn.us/twra/

Local stakeholder groups include:

- Caney Fork Watershed Association

With respect to the reduction of nonpoint source sediment loading and habitat alteration, government agency and stakeholders should, at a minimum, be directed to:

- Implement and maintain conservation farming, including conservation tillage, contour strips and no till farming
- Install grass buffer strips along streams
- Reduce activities within riparian areas
- Minimize road and bridge construction impacts on streams

8.3 Evaluation of TMDL Effectiveness

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. Monitoring data, ground-truthing, and source identification actions will enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be reevaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed sediment TMDLs for the Caney Fork River watershed was placed on Public Notice for a 35-day period (March 21, 2005 through April 25, 2005) and comments solicited. Per request, the comment period was extended to July 31, 2005. Steps that were taken in this regard include:

1) Notice of the proposed TMDLs was posted on the Tennessee Department of Environment and Conservation website. The notice will invite public and stakeholder comments and provide a link to a downloadable version of the TMDL document.

2) Notice of the availability of the proposed TMDLs (similar to the website announcement) was included in one of the NPDES permit Public Notice mailings.

3) A letter was sent to the Caney Fork Watershed Association advising them of the proposed sediment TMDLs and their availability on the TDEC website.

4) A draft copy of the proposed sediment TMDLs was sent to the City of Cookeville, Wilson County and Tennessee Department of Transportation (TDOT). These entities are covered by MS4 permits under the Phase II storm water regulations.

5) A public meeting was held on June 21, 2005 in Cookeville to present information regarding the proposed Caney Fork Sediment TMDLs and answer questions. The meeting was attended by nine persons representing various governmental and stakeholder groups.

6) An additional meeting was held on July 18, 2005 with the Save Our Cumberland Mountains stakeholder group to further discuss Tennessee's TMDL program and the Caney Fork Sediment TMDLs.

By the end of the extended public comment period, written comments were received from the Caney Fork Watershed Association and the Save Our Cumberland Mountains stakeholder group. These comments are included as Appendix G.

10.0 FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/

Technical questions regarding these TMDLs should be directed to the following members of the Division of Water Pollution Control staff:

Mary L. Wyatt, Watershed Management Section
e-mail: Mary.Wyatt@state.tn.us

Bruce R. Evans, P.E., Watershed Management Section
e-mail: Bruce.Evans@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
e-mail: Sherry.Wang@state.tn.us

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APPENDIX A

Example of Stream Assessment (Snow Creek)

Example of Stream Assessment – Snow Creek at RM 1.4 (6 pages)

STREAM SURVEY FORM

STREAM SURVEY INFORMATION

Support Status: (PS)

STREAM:	SNOW001.4SM Snow Crk
STREAM LOCATION:	¼ off Horse Bend Road (Snow Crk Rd?) connector to Condit Hollow Rd)
STATION NUMBER:	site establ. 10/21/98
COUNTY	Smith Co
MAJOR BASIN	CF WS
WBID#/HUC:	TN05130108001
WBID NAME:	Lower CF + TRIBS
LAT/LONG DEC:	36.231944/-85.887222
USGS QUAD:	322 NW (Gordonsville, TN)
Drainage:	C.F. (RM 2.8)
ECOLOGICAL SUBREGION:	71h (ONB) {36° 13' 55"
OBJECTIVES:	WS SS {85° 53' 14"}

ASSESSORS:	A M Goodhue
DATE:	SAT 08/24/02
TIME:	6:00 - 8:00 pm
STREAM MILE:	RM: 1.4
STREAM ORDER:	≅ 3rd (+)
ADB SEGMENT:	
3Q20:	
ELEVATION (ft):	480-500'
GAZETTEER PAGE:	p55

Field # Lower CF + TRIBS = CF001 (P)

SAMPLES COLLECTED

METERS USED: Hydrolab IV minisonde

pH	8.15 / 8.16	SU
CONDUCTIVITY	2621 / 2629	UMHOS
TEMPERATURE	23.69 / 23.69	C

Conductivity 2621 2629

DISSOLVED OXYGEN	7.21 / 7.18	PPM
TIME	6:10 / 6:15 pm	
OTHERS	3AH.	45.8% / 44.3%

Previous 48 hours Precip: UNKNOWN NONE (LITTLE) / MODERATE HEAVY FLOODING

Ambient Weather: (SUNNY) (CLOUDY) BREEZY RAIN SNOW Current Temp: 90°F (sunset)

CHEMICAL SAMPLES COLLECTED : None @ Present

Photographs : Slides Prints (Digital) (Photo #s:) #11 u/s, #12 d/s = CF001 SNO 1.4 u,d

BIOLOGICAL ASSESSMENT: (Benthics) Fish Algae Other:

Type of benthic sample: (BIORECON) SQ KICK SQ BANK DENDY SURBER OTHER:

Taxa List Attached? (Yes) / No Specimens collected ? (Y) or N Sample Log Numbers: N0208614

WATERSHED CHARACTERISTICS App. % of watershed observed: 30%

UPSTREAM SURROUNDING LAND USE: (estimated %)

PASTURE / Fields	55-65%	URBAN		RESID / Rd	2%
Row Crops	≃	INDUSTRY		OTHER	
FOREST	15-25%	MINING			

NOTES:

IMPACTS OBSERVED AND POSSIBLE SOURCES Describe causes, nature, and rate magnitude

see general land uses listed above...

PREV=10/21/98 = WS WBM (AMG) = (PS)

OVERALL ASSESSMENT & SUMMARY:

This creek had clear flow w/ high silt/sand (blanketing in areas...) also crk is incised somewhat... little to no riparian w/ crk being flanked by roads + pasturelands... @ this time no fish were observed... it should be noted conductivity = 2621/2629 (?)... there is a mild aroma to water = unidentifiable...! this creek looks similar to it's appearance 4 years ago...! EPT/OT/INT = 4/18/2 = very low numbers... Micro algae creates a slickened cobble substrate + is abundant... visually it also gives cobble substrate a darkened appearance... @ this time crk is (PS) for F+A life...

{Note: a fairly poor Habitat score = 106}

BIORECON Score= 5	Time = 30"	Habitats = 3.8 RIFF + 0.2 Bnk + ϕ grass	
EPT Families (+ add. taxa) = 4	Total Families (+ add. taxa) = 18 (+2)	Intolerant Taxa = 2	
EPA Habitat Assessment Completed ? √	SCORE = 106	GRADIENT : (HIGH)	LOW

 revised 8-10-98

STREAM SURVEY FORM

PHYSICAL STREAM CHARACTERISTICS — Length of stream reach assessed = 1000'

SURROUNDING LAND USE (facing downstream) :

ESTIMATE %	RDB	LDB		RDB	LDB		RDB	LDB
PASTURE	15%	70-65%	URBAN			RESID.		
CROPS			INDUSTRY			ROAD	80%	20%
FOREST	5%	10-15%	MINING			OTHER		

% CANOPY COVER: Estimated: 40-70% Open(0-10) Partly Shaded(11-45) Mostly Shaded(46-80) Shaded(>80)
Measured: / U/S / D/S / LB / RB

BANK HEIGHT (m): 0.2'-8.0' **HIGH WATER MARK** (m): 8.0' (+)

SEDIMENT DEPOSITS: NONE SLIGHT MODERATE EXCESSIVE BLANKET
TYPE: SLUDGE MUD SAND SILT NONE OTHER
TURBIDITY CLEAR / SLIGHT MODERATE HIGH OPAQUE Contaminated Y or N

ALGAE PRESENT? NONE SLIGHT MODERATE CHOKING TYPE micro algae abundant.--
AQUATIC VEGET. NONE ROOTED FLOATING TYPE Minimal (water cress-like)

RAPID PERIPHYTON ASSESS : % Direct Sunlight = / % Filamentous = / Mean Thickness Rank = / % Colonizable Substrate = /

WATER QUALITY COMMENTS: (oil sheen, odor, colors, etc)
slight aroma to water (?) high silt sediment / sand--

SUBSTRATE (%) (Visual estimates)

	RIFFLE	RUN	POOL
BOULDER (> 10")	15 %	5 %	5 %
COBBLE (2.5-10")	45 %	15 %	10 %
GRAVEL (0.1-2.5")	10 %	30 %	15 %
BEDROCK	— %	— %	— %
SAND (gritty)	5 %	20 %	30 %
SILT (fine)	20 %	20 %	30 %
CLAY (slick)	— %	— %	— %
DETRITUS (CPOM)	5 %	10 %	10 %
MUCK-MUD (FPOM)	— %	— %	— %
MARL (shell frags.)	— %	— %	— %

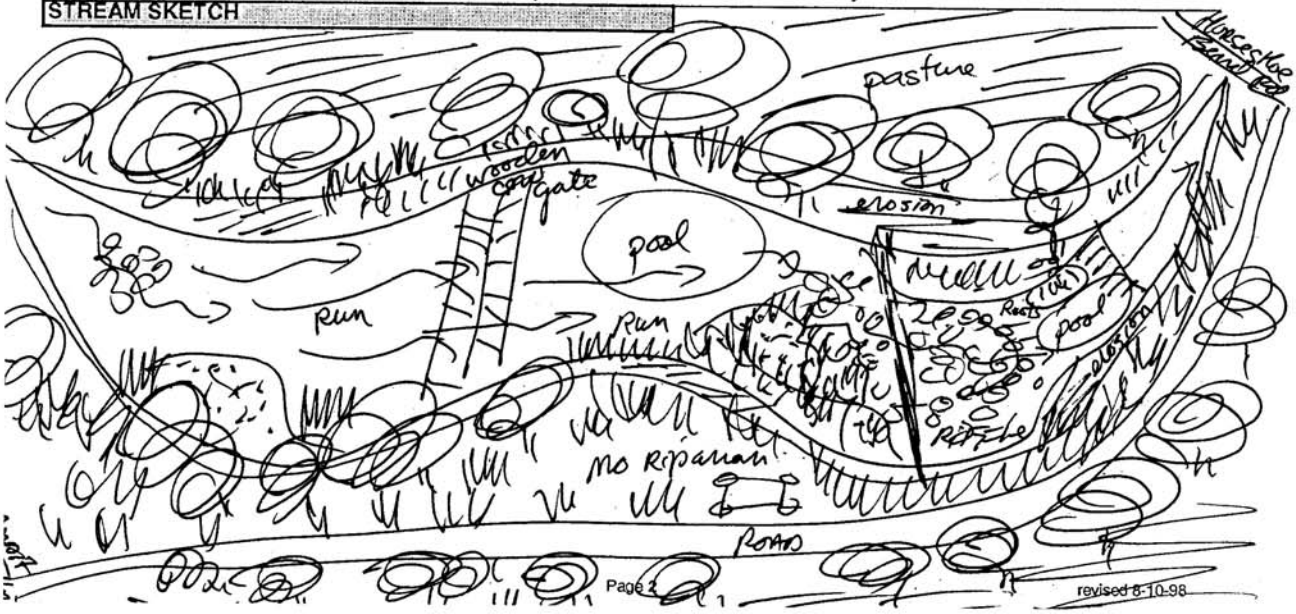
	RIFFLE	RUN	POOL
DEPTH (m)	2"-4"	4"-1.0'	1.0'-2.0'
WIDTH (m)	2'-4'	4'-8'	8'-10'
REACH LENGTH (m)	8'	15' (+)	10'

Staff Gauge/Bench Ht:
VELOCITY (FS)
FLOW (CFS)
HABITAT ASSESSMENT SCORE #: 106
RR # GP #

Gradient (sample reach): Flat Low Moderate High Cascade
Size (stream width) : 10-25' V. Small (<1.5m) Small (1.5-3m) Med (3-10m) Large (10-25m) Very Lrg (>25m)

HABITAT QUALITY COMMENTS: (bank erosion, riparian, pool/riffle variety, etc)
poor incised w/ high sediment + Bank erosion -- one area of fairly good riffle w/ cobble + minimal Bank roots -- riffle-run-pool sequence present --

STREAM SKETCH



HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Snow Ck (D)		LOCATION 45 off Horseshoe Bend Rd	
STATION # _____	RIVERMILE _____	STREAM CLASS	
LAT _____	LONG _____	RIVER BASIN CF WS	
STORET # TN001 (D)		AGENCY WPC	
INVESTIGATORS AMG			
FORM COMPLETED BY AMG	DATE TIME 08/04/02 SAT 9:40 AM (PM)	REASON FOR SURVEY WS	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 15	20 19 18 17 16	(5) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0

60

Total = 106 (See comments on SS Form & on Back)

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0

46

Total Score 106

WQ&S 4-13-01

High sediment + major riparian loss...

BIORECON FIELD SHEET

STATION NUMBER: established 10/21/98 SNQW001.4CM
STREAM NAME: Snow Crk (Q) CF001 (D)
STREAM LOCATION: off Horseshoe Bend Rd

ASSESSORS: A M Goodpasture
DATE: SAT 08/24/02 TIME 6:30 - 6:35 = 5" = collect
ECOREGION: 6:35 - 7:05 = " = pick
LOG #: N020801A

FIELD OBSERVATION OF MACROBENTHOS

Indicate estimated abundance (EA):
1 = rare (1-3 organisms) 3 = abundant (10-49 organisms)
2 = common (4-9 organisms) 4 = dominant (>50 organisms)

Time Interval	[15']	[30']	[ ]	[ ]	[ ]	[ ]
EPT	[3]	[4]	[ ]	[ ]	[ ]	[ ]
Total Taxa	[14]	[18]	[ ]	[ ]	[ ]	[ ]
	(+1)	(+2)				

Habitats Sampled:	Riffle	Macrophytes	Pool/Run Rock	Woody debris/snag	Leaf Packs	Sediment	Undercut Banks	Other
Percent habitat in reach								
# Jabs per habitat	3.8						0.2	

Taxa	EA/NO
Ephemeroptera	
Baetidae	
Heptageniidae	
Isonychia	
Caenidae	
Ephemerellidae	
Leptophlebiidae	
Trichoptera	✓
Hydropsychidae	✓ A/O
Philopotamidae	
Rhyacophilidae	
Leptoceridae	✓ R/C
Polycentropodidae	✓ R/C
Glossomatidae-like	✓ R
Plecoptera	
Leuctriform	
Perlidae	
Perlodidae	

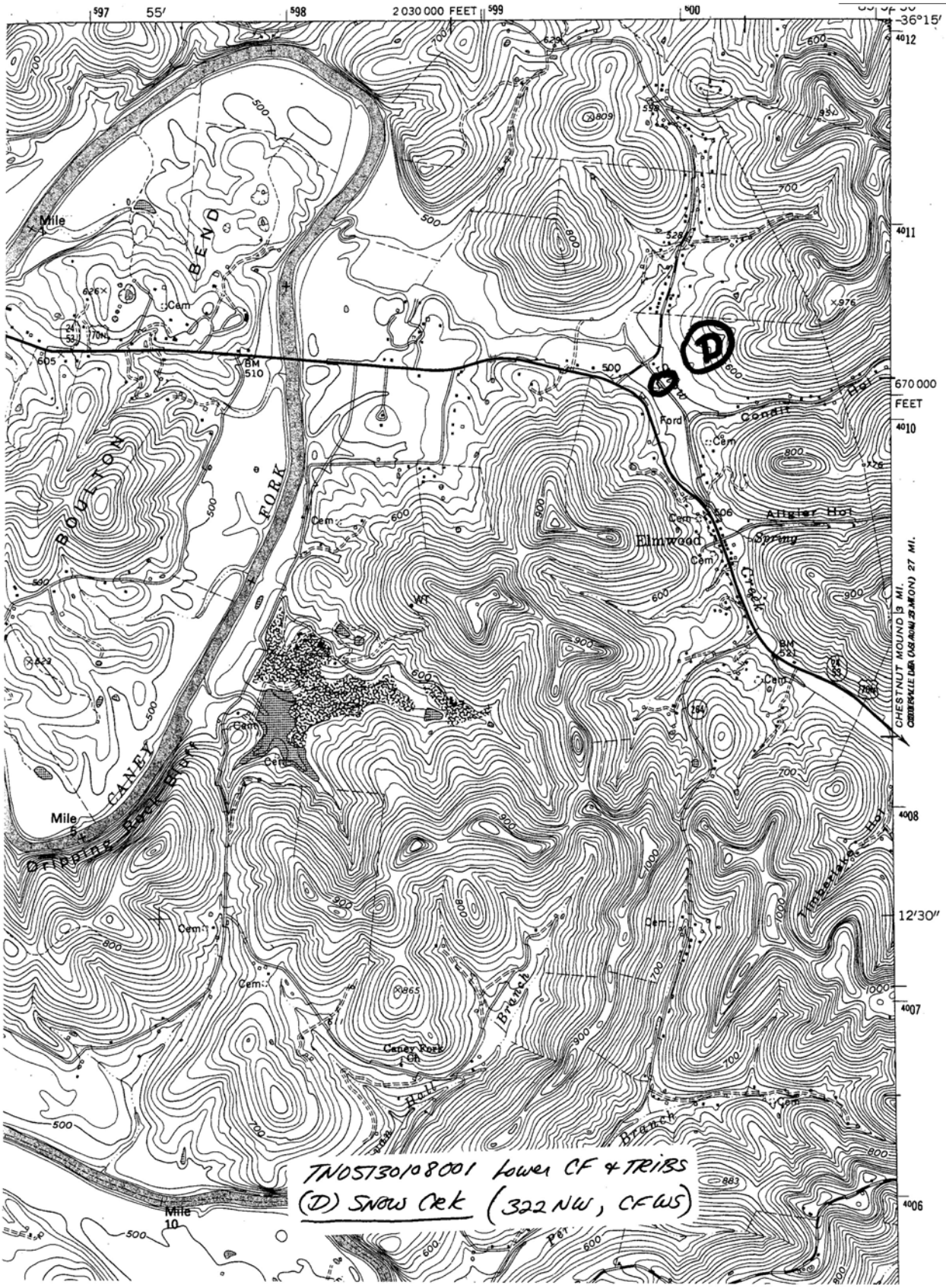
Taxa	EA/NO
Isopoda ✓	✓ D
Amphipoda	✓ C
Decapoda - Cambaridae	
Gastropoda	
Ancylidae	
Physidae	
Pleuroceridae	
Bivalvia-Corbicula	
Sphaeridae	
Diptera	✓
Cerat. ✓	✓ R
TAXA (not coll) ✓	✓ R
Simuliidae ✓	✓ R
Tabanidae	
Tipulidae	✓
Chironomidae - Red ✓	(✓) C
Non-Red ✓	✓ A/O
Tanypodinae	
Oligochaeta	
	✓
Hemiptera Corixidae ✓	✓

Taxa	EA/NO
Odonata	
Calopterygidae	
Argia	✓ R
Boyeria ✓	
Coleoptera	✓
Elmidae ✓	✓ C
(TAXA2) Elmidae	(✓) R
Haliplidae ✓	✓ R
Psephenidae ✓	✓ C/A I
Dryopidae	
Oystriidae ✓	✓ R
Lepidoptera	
Megaloptera - Sialidae ✓	✓ R
Corydalidae	
OTHER	
	✓
Porifera (sponges)	
Hydracarina (mites)	✓ R
Platyhelminthes (flatworms)	
Hirudinea (leeches)	

TAXA RICHNESS	18 (23)
# OF EPT	4 ✓
# OF INTOLERANTS (1-3)	2 ✓

NOTES: High sediment, crk incised, ... Micro algae = slick substrate (darkened color ...)

7IH = .5


2 030 000 FEET
36°15'
12'30"
670 000 FEET
Mile 1
Mile 5
Mile 10
BOULTON BEND
FORK
CANEY
Elmwood
Alligator Hot Spring
Creek
Ford
Cem
BM 510
BM 521
CHESTNUT MOUND 9 MI.
TN05130108001 Lower CF & TRIBS
(D) SNOW Crk (322 NW, CFWS)

APPENDIX B

Watershed Sediment Loading Model

WATERSHED SEDIMENT LOADING MODEL

Determination of target average annual sediment loading values for reference watersheds and the sediment loading analysis of waterbodies impaired for siltation/habitat alteration was accomplished utilizing the Watershed Characterization System (WCS) Sediment Tool (v. 2.6). WCS is an ArcView geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. WCS consists of an initial set of spatial and tabular watershed data, stored in a database, and allows the incorporation of additional data when available. It provides a number of reporting tools and data management utilities to allow users to analyze and summarize data. Program extensions, such as the sediment tool, expand the functionality of WCS to include modeling and other more rigorous forms of data analysis (USEPA, 2001).

Sediment Analysis

The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network. The following tasks can be performed:

- Estimate extent and distribution of potential soil erosion in the watershed.
- Estimate potential sediment delivery to receiving waterbodies.
- Evaluate effects of land use, BMPs, and road network on erosion and sediment delivery.

The Sediment Tool can also be used to evaluate different scenarios, such as the effects of changing land uses and implementation of BMPs, by the adjustment of certain input parameters. Parameters that may be adjusted include:

- Conservation management and erosion control practices
- Changes in land use
- Implementation of Best Management Practices (BMPs)
- Addition/Deletion of roads

Sediment analyses can be performed for single or multiple watersheds.

Universal Soil Loss Equation

Erosion potential is based on the Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith. It has been the most widely accepted and utilized soil loss equation for over 30 years. The USLE is a method to predict the average annual soil loss on a field slope based on rainfall pattern, soil type, topography, crop system, and management practices. The USLE only predicts the amount of soil loss resulting from sheet or rill erosion on a single slope and does not account for soil losses that might occur from gully, wind, or tillage erosion. Designed as a model for use with certain cropping and management systems, it is also applicable to non-agricultural situations (OMAFRA, 2000). While the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a specific storm. Based on its long history of use and wide acceptance by the forestry and agricultural communities, the USLE was considered to be an

adequate tool for estimating the relative long-term average annual soil erosion of watersheds and evaluating the effects of land use changes and implementation of BMP measures.

Soil loss from sheet and rill erosion is primarily due to detachment of soil particles during rain events. It is the cause of the majority of soil loss for lands associated with crop production, grazing areas, construction sites, mine sites, logging areas and unpaved roads. In the USLE, five major factors are used to calculate the soil loss for a given area. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion in that area. The USLE for estimating average annual soil erosion is expressed as:

$$A = R \times K \times LS \times C \times P$$

where:

A = average annual soil loss in tons per acre
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor - L is for slope length and S is for slope
C = crop/vegetation & management factor
P = conservation practice factor

Evaluating the factors in USLE:

R - Rainfall Erosivity Index

The rainfall erosivity index describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. This index varies with geography.

K - Soil Erodibility Factor

This factor quantifies the cohesive or bonding character of the soil and its ability to resist detachment and transport during a rainfall event. The soil erodibility factor is a function of soil type.

LS - Topographic Factor

The topographic factor represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. For convenience L and S are frequently lumped into a single term.

C – Crop/Vegetation & Management Factor

The crop/vegetation and management factor represents the effect that ground cover conditions, soil conditions and general management practices have on soil erosion. It is the most computationally complicated of USLE factors and incorporates the effects of: tillage management, crop type, cropping history (rotation), and crop yield.

P - Conservation Practice Factor

The conservation practice factor represents the effects on erosion of Best Management Practices (BMPs) such as contour farming, strip cropping and terracing.

Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE, are provided by the Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) 1994. The

NRI database contains information of the status, condition, and trend of soil, water, and related resources collected from approximately 800,000 sampling points across the country.
The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil lost in the field that is eventually delivered to the stream depends on several factors. These include, the distance of the source area from the stream, the size of the drainage area, and the intensity and frequency of rainfall. Soil losses along the riparian areas will be delivered into the stream with runoff-producing rainfall.

Sediment Modeling Methodology

Using WCS and the Sediment Tool, average annual sediment loading to surface waters was modeled according to the following procedures:

1. A WCS project was set up for the watershed that is the subject of these TMDLs. Additional data layers required for sediment analysis were generated or imported into the project. These included:

   DEM (grid) – The Digital Elevation Model (DEM) layers that come with the basic WCS distribution system are shapefiles of coarse resolution (300x300m). A higher resolution DEM grid layer (30x30m) is required. The National Elevation Dataset (NED) is available from the USGS website and the coverage for the watershed (8-digit HUC) was imported into the project.

   Road – A road layer is needed as a shape file and requires additional attributes such as road type, road practice, and presence of side ditches. If these attributes are not provided, the Sediment Tool automatically assigns default values: road type - secondary paved roads, side ditches present and no road practices. This data layer was obtained from ESRI for areas in the watershed.

   Soil – The SSURGO (1:24k) soil data may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database is not available, the system uses the STATSGO Soil data (1:250k) by default.

   MRLC Land Use – The Multi-Resolution Land Characteristic (MRLC) data set for the watershed is provided with the WCS package, but must be imported into the project.

2. Using WCS, the entire watershed was delineated into subwatersheds corresponding to USGS 12-digit Hydrologic Unit Codes (HUCs). These delineations are shown in Figure 6. Land use distribution for the impaired subwatersheds is summarized in Appendix C. All of the sediment analyses were performed on the basis of these drainage areas.

The following steps are accomplished using the WCS Sediment Tool:

3. For a selected watershed or subwatershed, a sediment project is set up in a new view that contains the data layers that will be subsequently used to calculate erosion and sediment delivery.

4. A stream grid for each delineated subwatershed was created by etching a stream coverage, based on Reach File v. 3 (Rf3) or National Hydrography Dataset (NHD), to the DEM grid.
5. For each 30 by 30 meter grid cell within the subwatershed, the Sediment Tool calculates the potential erosion using the USLE based on the specific cell characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:

   - Distance-based equation (Sun and McNulty 1998)
     Mad = M * (1-0.97 * D/L)
     where: Mad = mass moved (tons/acre/yr)
     M = sediment mass eroded (ton)
     D = least cost distance from a cell to the nearest stream grid (ft)
     L = maximum distance the sediment may travel (ft)

   - Distance Slope-based equation (Yagow et al. 1998)
     DR = exp(-0.4233 * L * So)
     So = exp (-16.1 * r/L+ 0.057)) - 0.6
     where: DR = sediment delivery ratio
     L = distance to the stream (m)
     r = relief to the stream (m)

   - Area-based equation (USDASCS 1983)
     $DR = 0.417762 * A^{(-0.134958)} - 1.27097, \quad DR <= 1.0$
     where: DR = sediment delivery ratio
     A = area (sq miles)

   - WEEP-based regression equation (Swift 2000)
     $Z = 0.9004 - 0.1341 * X^2 + X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$
     where: Z = percent of source sediment passing to the next grid cell
     X = cumulative distance down slope (X > 0)
     Y = percent slope in the grid cell (Y > 0)

   The distance slope based equation (Yagow et al. 1998) was selected to simulate sediment delivery in the Caney Fork River Watershed.

6. The total sediment delivered upstream of each subwatershed "pour point" is calculated. The sediment analysis provides the calculations for six new parameters:

   - Source Erosion – estimated erosion from each grid cell due to the land cover
   - Road Erosion – estimated erosion from each grid cell representing a road
   - Composite Erosion – composite of the source and road erosion layers
   - Source Sediment – estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery)
   - Road Sediment – estimated fraction of the road erosion from each grid cell that reaches the stream
   - Composite Sediment – composite of the source and erosion sediment layers

The sediment delivery can be calculated based on the composite sediment, road sediment, or source sediment layer. The sources of sediment by each land use type is determined showing the types of land use, the acres of each type of land use, and the tons of sediment estimated to be generated from each land use.

7. For each subwatershed of interest, the resultant sediment load calculation is expressed as a long-term average annual soil loss expressed in pounds per year calculated for the rainfall erosivity index (R). This statistic is calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30-minute intensity.

   Calculated erosion, sediment loads delivered to surface waters, and unit loads (per unit area) for subwatersheds that contain waterbodies documented on the 2002 303(d) List as impaired for siltation and/or habitat alteration are summarized in Tables B-1, B-2 and B-3, respectively.

Table B-1 Calculated Erosion - Subwatersheds With Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130108__)	EROSION				
	Source [tons/yr]	Road [tons/yr]	Total [tons/yr]	%Source	%Road
0101	5872	7787	13659	43.0	57.0
0102	2252	5162	7414	30.4	69.6
0104	10249	11058	21307	48.1	51.9
0202	5255	4788	10043	52.3	47.7
0203	322	1681	2002	16.1	83.9
0406	12305	2910	15215	80.9	19.1
0503	15361	8288	23650	65.0	35.0
0602	14842	6940	21782	68.1	31.9
0702	15808	11958	27766	56.9	43.1
0703	16740	4997	21737	77.0	23.0
0704	11609	4339	15948	72.8	27.2
0805	10810	19237	30046	36.0	64.0
0806	31558	9511	41068	76.8	23.2
0807	16623	7292	23915	69.5	30.5

Table B-2 Calculated Sediment Delivery to Surface Waters - Subwatersheds with Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130108__)	SEDIMENT				
	Source [tons/yr]	Road [tons/yr]	Total [tons/yr]	%Source	%Road
0101	1987	3316	5303	37.5	62.5
0102	927	2313	3239	28.6	71.4
0104	3325	4704	8029	41.4	58.6
0202	1433	1815	3248	44.1	55.9
0203	123	707	830	14.8	85.2
0406	4537	1120	5657	80.2	19.8
0503	5882	3525	9408	62.5	37.5
0602	3123	2488	5611	55.7	44.3
0702	3584	3401	6985	51.3	48.7
0703	3662	1291	4953	73.9	26.1
0704	3588	1798	5386	66.6	33.4
0805	4325	8299	12624	34.3	65.7
0806	14708	4594	19303	76.2	23.8
0807	6058	3602	9660	62.7	37.3

Table B-3 Unit Loads - Subwatersheds With Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130108__)	UNIT LOADS		
	Erosion	Sediment	
	[tons/ac/yr]	[tons/ac/yr]	[lbs/ac/yr]
0101	0.364	0.142	283
0102	0.276	0.121	241
0104	0.423	0.159	319
0202	0.389	0.126	252
0203	0.205	0.085	170
0406	1.492	0.555	1109
0503	0.578	0.230	460
0602	0.616	0.159	317
0702	0.824	0.207	414
0703	1.057	0.241	482
0704	1.024	0.346	692
0805	0.660	0.277	555
0806	1.691	0.795	1589
0807	0.834	0.337	674

APPENDIX C

MRLC Land Use of Impaired Subwatersheds & Ecoregion Reference Site Drainage Areas

Table C-1 Caney Fork River Watershed – Impaired Subwatershed Land Use Distribution

Land Use	Subwatershed (05130108___)									
	0101		0102		0104		0202		0203	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay										
Deciduous Forest	20972	56.0	15203	56.6	29121	57.9	11086	42.9	5377	55.0
Emergent Herbaceous Wetlands			0	0.0			5	0.0		
Evergreen Forest	4922	13.1	5198	19.4	8718	17.3	2454	9.5	2666	27.3
High Intensity Commercial/Industrial/Transportation	35	0.1	19	0.1	17	0.0	32	0.1	2	0.0
High Intensity Residential	0	0.0			1	0.0	3	0.0		
Low Intensity Residential	150	0.4	32	0.1	36	0.1	26	0.1	1	0.0
Mixed Forest	5257	14.0	3310	12.3	5806	11.5	4837	18.7	1516	15.5
Open Water	24	0.1	259	1.0	156	0.3	55	0.2	1	0.0
Other Grasses (Urban/Recreational)	114	0.3	8	0.0	29	0.1	32	0.1		
Pasture/Hay	4669	12.5	2290	8.5	4984	9.9	6039	23.4	167	1.7
Quarries/Strip Mines/Gravel Pits										
Row Crops	589	1.6	173	0.6	841	1.7	865	3.3	0	0.0
Transitional	725	1.9	259	1.0	619	1.2	32	0.1	47	0.5
Woody Wetlands			105	0.4			347	1.3		
Total	**37456**	**100.0**	**26856**	**100.0**	**50328**	**100.0**	**25815**	**100.0**	**9777**	**100.0**

Table C-1 (cont.) Caney Fork River Watershed – Impaired Subwatershed Land Use Distribution

Land Use	Subwatershed (05130108___)									
	0406		0503		0602		0702		0703	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay					0	0.0			3	0.0
Deciduous Forest	3086	30.3	24660	60.3	21707	61.4	14283	42.4	6694	32.6
Emergent Herbaceous Wetlands			8	0.0	1	0.0				
Evergreen Forest	290	2.8	1396	3.4	1591	4.5	1295	3.8	845	4.1
High Intensity Commercial/Industrial/Transportation	228	2.2	46	0.1	142	0.4	1600	4.7	172	0.8
High Intensity Residential	169	1.7	1	0.0	24	0.1	326	1.0	12	0.1
Low Intensity Residential	552	5.4	113	0.3	183	0.5	1493	4.4	283	1.4
Mixed Forest	1052	10.3	4292	10.5	3972	11.2	4087	12.1	2532	12.3
Open Water	194	1.9	67	0.2	189	0.5	18	0.1	58	0.3
Other Grasses (Urban/Recreational)	407	4.0	107	0.3	194	0.5	1496	4.4	563	2.7
Pasture/Hay	2719	26.7	7470	18.3	5204	14.7	7433	22.1	6247	30.4
Quarries/Strip Mines/Gravel Pits	19	0.2					44	0.1		
Row Crops	1475	14.5	1649	4.0	2100	5.9	1624	4.8	3154	15.3
Transitional	6	0.1	1	0.0	7	0.0	1	0.0		
Woody Wetlands			1104	2.7	39	0.1				
Total	**10197**	**100.0**	**40914**	**100.0**	**35353**	**100.0**	**33699**	**100.0**	**20563**	**100.0**

Table C-1 (cont.) Caney Fork River Watershed – Impaired Subwatershed Land Use Distribution

Land Use	Subwatershed (05130108___)							
	0704		0805		0806		0807	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay								
Deciduous Forest	4215	27.1	30731	67.6	12173	50.1	8514	29.7
Emergent Herbaceous Wetlands								
Evergreen Forest	518	3.3	2738	6.0	1543	6.4	2413	8.4
High Intensity Commercial/Industrial/Transportation	139	0.9	207	0.5	96	0.4	91	0.3
High Intensity Residential	70	0.5			2	0.0	28	0.1
Low Intensity Residential	498	3.2	106	0.2	105	0.4	291	1.0
Mixed Forest	1807	11.6	6056	13.3	3880	16.0	5926	20.7
Open Water	66	0.4	275	0.6	354	1.5	2	0.0
Other Grasses (Urban/Recreational)	497	3.2	101	0.2	211	0.9	303	1.1
Pasture/Hay	5852	37.6	4792	10.5	4689	19.3	9367	32.7
Quarries/Strip Mines/Gravel Pits					276	1.1		
Row Crops	1891	12.1	472	1.0	956	3.9	1701	5.9
Transitional	10	0.1						
Woody Wetlands								
Total	**15563**	**100.0**	**45479**	**100.0**	**24284**	**100.0**	**28638**	**100.0**

Table C-2 Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Land Use	Ecosite Subwatershed											
	Eco68a01		Eco68a03		Eco68a08		Eco68a13		Eco68a20		Eco68a26	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	1427.0	38.4	3536.0	32.7	46284.0	46.8	4070.0	45.5	4550.0	61.6	20301.0	50.9
Emergent Herbaceous Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	921.0	24.8	3011.0	27.8	15790.0	16.0	2365.0	26.4	519.0	7.0	6396.0	16.0
High Intensity Commercial/ Industrial / Transportation	0.0	0.0	2.0	0.0	176.0	0.2	0.0	0.0	3.0	0.0	136.0	0.3
High Intensity Residential	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Low Intensity Residential	0.0	0.0	11.0	0.1	258.0	0.3	1.0	0.0	25.0	0.3	107.0	0.3
Mixed Forest	1369.0	36.8	3977.0	36.7	24815.0	25.1	942.0	10.5	2217.0	30.0	10817.0	27.1
Open Water	0.0	0.0	0.0	0.0	73.0	0.1	9.0	0.1	0.0	0.0	182.0	0.5
Other Grasses (Urban/ Recreational)	0.0	0.0	3.0	0.0	236.0	0.2	0.0	0.0	10.0	0.1	201.0	0.5
Pasture / Hay	0.0	0.0	259.0	2.4	9207.0	9.3	501.0	5.6	9.0	0.1	1317.0	3.3
Quarries / Strip Mines/ Gravel Pits	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.0	0.2
Row Crops	0.0	0.0	28.0	0.3	1564.0	1.6	40.0	0.4	7.0	0.1	219.0	0.5
Transitional	0.0	0.0	0.0	0.0	501.0	0.5	725.0	8.1	48.0	0.6	175.0	0.4
Woody Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	292.0	3.3	0.0	0.0	0.0	0.0
Total	**3717.0**	**100.0**	**10827.0**	**100.0**	**98904.0**	**100.0**	**8946.0**	**100.0**	**7388.0**	**100.0**	**39923.0**	**100.0**

Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Land Use	Ecosite Subwatershed											
	Eco68a27		Eco68a28		Eco68c12		Eco68c13		Eco68c15		Eco68c20	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	6654.0	56.2	10209.0	63.7	518.0	64.0	1935.0	73.7	11337.0	80.4	9931.0	78.7
Emergent Herbaceous Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	1485.0	12.5	1487.0	9.3	48.0	5.9	81.0	3.1	878.0	6.2	871.0	6.9
High Intensity Commercial/ Industrial / Transportation	4.0	0.0	21.0	0.0	0.0	0.0	9.0	0.3	48.0	0.3	48.0	0.4
High Intensity Residential	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.1	11.0	0.1
Low Intensity Residential	2.0	0.0	89.0	0.6	0.0	0.0	22.0	0.8	111.0	0.8	111.0	0.9
Mixed Forest	3626.0	30.6	3574.0	22.3	244.0	30.1	390.0	14.8	1291.0	9.2	1233.0	9.8
Open Water	3.0	0.0	1.0	0.0	0.0	0.0	3.0	0.1	37.0	0.3	37.0	0.3
Other Grasses (Urban/ Recreational)	0.0	0.0	44.0	0.3	0.0	0.0	12.0	0.5	40.0	0.3	40.0	0.3
Pasture / Hay	62.0	0.5	469.0	2.9	0.0	0.0	109.0	4.1	193.0	1.4	181.0	1.4
Quarries / Strip Mines/ Gravel Pits	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Row Crops	0.0	0.0	139.0	0.9	0.0	0.0	64.0	2.4	41.0	0.3	38.0	0.3
Transitional	0.0	0.0	3.0	0.0	0.0	0.0	2.0	0.1	119.0	0.8	116.0	0.9
Woody Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**11836.0**	**100.0**	**16036.0**	**99.9**	**810.0**	**100.0**	**2627.0**	**100.0**	**14106.0**	**100.0**	**12617.0**	**100.0**

Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Land Use	Ecosite Subwatershed											
	Eco71g03		Eco71g04		Eco71g10		Eco71h03		Eco71h06		Eco71h09	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	6703.0	47.4	9087.0	53.2	2726.0	76.5	6784.0	81.6	7788.0	88.7	6264.0	79.0
Emergent Herbaceous Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	1206.0	8.5	384.0	2.2	80.0	2.2	137.0	1.6	137.0	1.6	245.0	3.1
High Intensity Commercial/ Industrial / Transportation	13.0	0.1	143.0	0.0	23.0	0.6	20.0	0.2	2.0	0.0	6.0	0.1
High Intensity Residential	0.0	0.0	4.0	0.0	0.0	0.0	14.0	0.2	0.0	0.0	0.0	0.0
Low Intensity Residential	90.0	0.6	132.0	0.8	3.0	0.1	136.0	1.6	2.0	0.0	36.0	0.5
Mixed Forest	2635.0	18.6	1612.0	9.4	169.0	4.7	757.0	9.1	604.0	6.9	722.0	9.1
Open Water	2.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Other Grasses (Urban/ Recreational)	175.0	1.2	33.0	0.2	54.0	1.5	52.0	0.6	0.0	0.0	0.0	0.0
Pasture / Hay	3138.0	22.2	4331.0	25.3	335.0	9.4	395.0	4.7	193.0	2.2	494.0	6.2
Quarries / Strip Mines/ Gravel Pits	0.0	0.0	42.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Row Crops	184.0	1.3	1319.0	7.7	170.0	4.8	23.0	0.3	50.0	0.6	167.0	2.1
Transitional	0.0	0.0	0.0	0.0	5.0	0.1	0.0	0.0	1.0	0.0	0.0	0.0
Woody Wetlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**14146.0**	**100.0**	**17090.0**	**99.2**	**3565.0**	**100.0**	**8318.0**	**100.0**	**8778.0**	**100.0**	**7934.0**	**100.0**

APPENDIX D

Estimate of Existing Point Source Loads for Ready Mixed Concrete Facilities & NPDES Permitted Mining Sites with TSS Limits

Determination of Existing Point Source Sediment Loads

Existing point source sediment loads for several classes of permitted facilities located in impaired HUC-12 subwatersheds were estimated using the methodologies described below.

Mining Sites

Existing loads for permitted mining sites are based on an assumed runoff from the site drainage area, the daily maximum permit limit for TSS, and the area of the HUC-12 subwatershed in which the mining site is located (ref.: Table D-1). Site runoff was estimated by assuming that one half of the annual precipitation falling on the site area results in runoff. Annual precipitation for the Caney Fork watershed is approximately 52 in/yr.

$$AAL_{Mining} = \frac{(A_d)\ (DMax)\ (Precip)\ (0.2266\ lb\text{-}l/ac\text{-}in\text{-}mg)\ (0.5)}{(A_{HUC\text{-}12})}$$

where: AAL_{Mining} = Average annual load [lb/yr]
A_d = Facility (site) drainage area [acres]
DMax = Daily maximum concentration limit for TSS [mg/l]
Precip = Average annual precipitation for watershed [in/yr]
$A_{HUC\text{-}12}$ = Area of impaired HUC-12 subwatershed [acres]

Table D-1 Estimate of Existing Load – NPDES Permitted Mining Sites

HUC-12 Subwatershed (05130108___)	Subwatershed Area	Precip.[a]	NPDES Permit No.	Site Drainage Area	Daily Maximum TSS Limit	Annual Average Load
	[acres]	[in/yr]		[acres]	[mg/l]	[lb/ac/yr]
0702	33,699	52	TN0062910	18.00	40	0.126
0806	24,284	52	TN0004227	158.00	30	1.150
			TN0069124	91.01	40	0.883

[a] Livestock Waste Facilities Handbook, 2nd Edition, 1985, Figure 11-12b

Ready Mixed Concrete Facilities (RMCFs)

Total loading from RMCFs is the sum of loading from process wastewater discharges and storm water runoff. Estimates of loading from this source was not determined since the only facility was not in an impaired subwatershed.

Total Existing Point Source Loads for Impaired HUC-12 Subwatersheds

Estimated point source loads were summed for each impaired HUC-12 subwatershed and then compared to both existing and target subwatershed sediment loads (ref.: Table D-2).

Table D-2 Estimate of Existing Point Source Loads in Impaired HUC-12 Subwatersheds

HUC-12 Subwatershed (05130108__)	NPDES Permit No.	Facility Type	Average Annual Point Source Load	Existing Subwatershed Load	Point Source Percentage of Existing Load	Subwatershed Target Load	Point Source Percentage of Target Load
			[lb/ac/yr]	[lb/ac/yr]	[%]	[lb/ac/yr]	[%]
0702	TN006291	Mining	0.126	452	0.03	356.9	0.04
0806	TN000422	Mining	1.150				
	TN006912	Mining	0.883				
	Subwatershed Total		2.033	1,589	0.13	597.6	0.34

APPENDIX E

Summary of NPDES Permit No. TNR10-0000
General NPDES Permit for Storm Water Discharges Associated With Construction Activity

NPDES Permit No. TNR10-0000
General NPDES Permit for Storm Water Discharges Associated With Construction Activity

Information regarding permitting requirements for construction storm water may be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrm.php

NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*, may also be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrmrul.pdf

The following is a summary of key provisions of NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*, that relate directly to implementation of Waste Load Allocations (WLAs) for sediment in impaired waterbodies in the Caney Fork River watershed.

Tennessee General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* became effective on July 1, 2000 and is required for construction sites that disturb five acres or more. The permit authorizes storm water discharges from construction activities, storm water discharges from construction support activities, and certain non-storm water discharges associated with construction activities. The permit also covers discharges from construction sites that disturb less than five acres if the Director of the Division of Water Pollution Control has determined that the discharge from the site contributes to, or is likely to contribute to, a violation of a State water quality standard, or is likely to be a significant contributor of pollutants to the waters of the State. Discharges that result in violations of State water quality standards are prohibited. Construction activities are required to be carried out in such a manner to prevent violations of State water quality standards.

The permitted construction activity is required to develop, maintain, and implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) to minimize erosion of soil and the discharge of pollutants to waters of the State. At a minimum, the SWPPP must include:

- Description of the site, description of the intended sequence of major activities which disturb soil, estimates of total area of the site and area disturbed, any data describing the soil or the quality of any site discharge, site location, identification of storm water outfalls, and identification of receiving waters.

- Description of appropriate control measures and the general timing during the construction process that measures will be implemented. (The permit describes in some detail minimum requirements for: 1) erosion and sediment controls designed to retain sediment on site; 2) stabilization practices for disturbed portions of the site; 3) structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and pollutant discharge resulting from a 2 year, 24 storm (approximately 3.5 inches/24 hours

for the Caney Fork River watershed); and 4) storm water management measures that will be installed after construction operations have been completed).

- Maintenance procedures to ensure that vegetation, erosion and sediment control measures are kept in good and effective operating condition.

- A schedule of inspections by qualified personnel of disturbed areas of the construction site that are not fully stabilized, storage areas exposed to precipitation, structural control measures, outfall points and locations where vehicles enter and exit the site. These inspections must be performed before certain anticipated storm events, within 24 hours after storm events of 0.5 inches, or greater, and at least once every two weeks (once per week for receiving streams identified as impaired on the 303(d) List for siltation). Based on the results of inspections, inadequate or damaged control measures must be modified or repaired as necessary before the next anticipated storm event (within seven days maximum). Also based on the results of inspections, pollution prevention measures must be revised as necessary within a specified time frame. Inspections must be documented.

- Sources of authorized non-storm water that are combined with storm water discharges associated with construction activity must be identified in the plan and appropriate pollution prevention measures for the non-storm water component of the discharge identified and implemented.

Additional requirements are specified for discharges into waters identified on the Tennessee 303(d) List for siltation. These additional requirements include:

- The SWPPP must be submitted to the local Environmental Assistance Center (EAC) prior to the start of construction.

- More frequent (weekly) inspections of erosion and sediment controls. Inspections and the condition of erosion and sediment controls must be certified to TDEC on a weekly basis.

- If TDEC learns that a discharge is causing a violation of water quality standards or contributing to the impairment of a water identified as impaired on the 303(d) List, the discharger will be notified that the discharge is no longer eligible for coverage under the general permit and that additional discharges must be covered under an individual permit.

APPENDIX F

Site-specific Analysis of Subwatershed 051301080805

F.1 Sediment Tool Analysis Anomalies

The Watershed Characterization System (WCS) Sediment Tool (v.2.6) can be used to determine an existing average annual sediment load at a watershed scale (ref.: Appendix B). This GIS based tool uses the best available spatial data and the universal soil loss equation (USLE) to calculate the annual sediment load. The spatial data are neither current enough nor at a fine enough scale to model in-stream bank erosion or riparian sediment loads.

The current Multi-Resolution Land Characteristic (MRLC) land use data used by the Sediment Tool was produced from satellite imagery acquired during the period from 1992 through 1995 in a 30-meter by 30-meter cell sized grid. Since only one specific land use type was assigned to each grid cell, some loss of resolution in the data was possible. Also, the National Hydrography Dataset (NHD) stream data used by the Sediment Tool was created at 1:100,000 scale. Consequently, small streams may not be represented in the model, resulting in local or site-specific sediment sources not being accounted for.

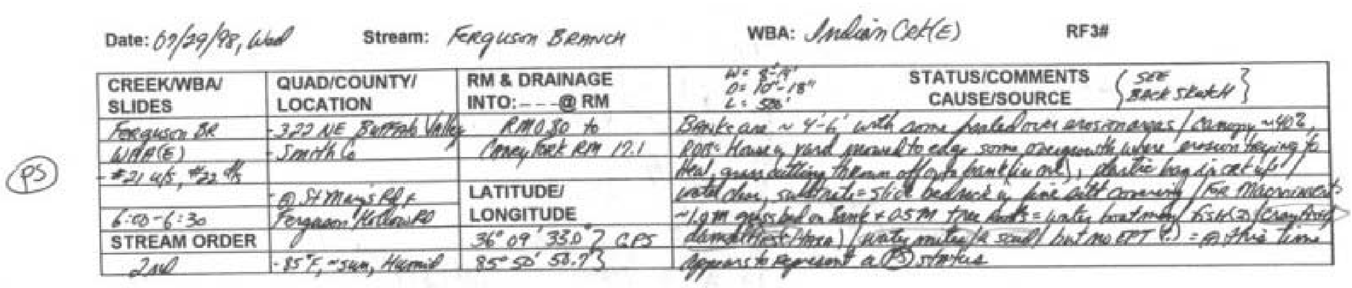
Ferguson Branch, Rock Springs Branch, and Indian Creek, all located in HUC-12 subwatershed 051301080805, were assessed as impaired due to siltation and other habitat alterations. Analysis using the Sediment Tool, however, indicated that the existing sediment load for the subwatershed was lower than the target load for Level IV ecoregion 71h (no reduction in sediment loading required). A more comprehensive, site-specific analysis of Ferguson Branch, Rock Springs Branch, and Indian Creek is needed to determine the causes of impairment.

F.2 Ferguson Branch Subwatershed Analysis

Ferguson Branch (TN05130108001_0200) was placed on the 2002 303(d) List as not fully supporting designated uses due to siltation and habitat alteration associated with riparian loss.

Ferguson Branch was monitored in 1998 by the Nashville Environmental Field Office (NEFO). A waterbody assessment at RM 0.8 found no clean water indicator organisms (zero EPT). Notes report a substrate of slick bedrock with a fine silt covering and thinned stream bank riparian areas with some healed over erosion areas. The assessment further indicated 40% canopy and yards mowed to the edge of the stream, with grass cuttings thrown into the stream (Figure F-1).

Figure F-1 Ferguson Branch Field Sheet - July 29, 1998

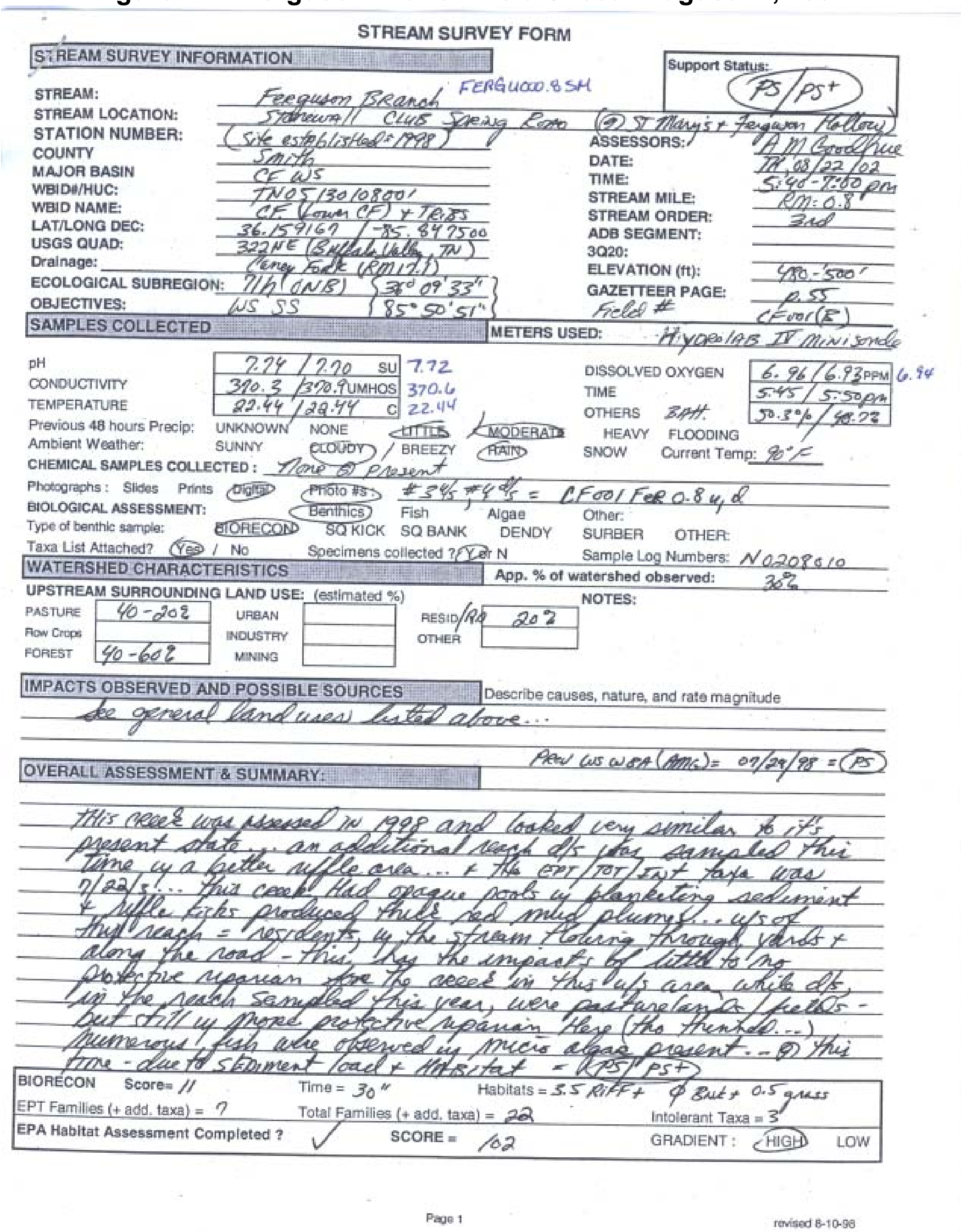


Date: 07/29/98, Wed Stream: Ferguson Branch WBA: Indian Crk(E) RF3#

CREEK/WBA/ SLIDES	QUAD/COUNTY/ LOCATION	RM & DRAINAGE INTO: - - - @ RM	STATUS/COMMENTS CAUSE/SOURCE
Ferguson Br	-322 NE Buffalo Valley	RM 0.80 to	Banks are ~ 4'-6' with some healed over erosion areas / Canopy ~40%,
WAA(E)	-Smith Co	Caney Fork RM 12.1	[illegible]
-#21 u/s, #22 d/s			[illegible]
	-@ St Marys Rd &	LATITUDE/	[illegible]
6:00-6:30	Ferguson Hollow Rd	LONGITUDE	[illegible]
STREAM ORDER		36° 09' 33.0" GPS	[illegible] = @ this time
2nd	-85°F, ~sun, Humid	85° 50' 53.7"	Appears to represent a (PS) status

Ferguson Branch was monitored again in 2002 by the NEFO. A biorecon at RM 0.8 showed the stream was partially supporting at this location and looked similar to what it had at the previous visit except that during the last visit it was noted that the stream was clear. The stream had biological scores of 7 EPT, 3 intolerant, and 22 total families and was assessed as partially supporting due to sediment load and habitat alteration (Figure F-2). During this visit, there were opaque pools with blanketing sediment and riffle kicks producing thick red mud plumes. Notes show evidence of thinned riparian (ref.: Figure F-3).

Figure F-2 Ferguson Branch Field Sheet - August 22, 2002



STREAM SURVEY FORM

STREAM SURVEY INFORMATION

Support Status: PS/PS+

STREAM: Ferguson Branch FERGU000.8SM
STREAM LOCATION: Stonewall Club Spring Road (@ St Mary's + Ferguson Hollow)
STATION NUMBER: (Site established 1998)
COUNTY: Smith
MAJOR BASIN: CF WS
WBID#/HUC: TN05130108001
WBID NAME: CF (Lower CF) + Tribs
LAT/LONG DEC: 36.159167 / -85.847500
USGS QUAD: 322NE (Buffalo Valley, TN)
Drainage: Caney Fork (RM 12?)
ECOLOGICAL SUBREGION: 71h (ONB) (36° 09' 33")
OBJECTIVES: WS SS (85° 50' 51")
ASSESSORS: A M Goodhue
DATE: TH, 08/22/02
TIME: 5:40-7:00 pm
STREAM MILE: RM: 0.8
STREAM ORDER: 3rd
ADB SEGMENT:
3Q20:
ELEVATION (ft): 480-500'
GAZETTEER PAGE: p. 55
Field #: CF001(E)

SAMPLES COLLECTED

METERS USED: Hydrolab IV mini sonde

pH: 7.74 / 7.70 SU 7.72
CONDUCTIVITY: 370.3 / 370.9 UMHOS 370.6
TEMPERATURE: 22.44 / 22.44 C 22.44
DISSOLVED OXYGEN: 6.96 / 6.93 PPM 6.94
TIME: 5:45 / 5:50 pm
OTHERS: %DO: 50.3% / 48.73
Previous 48 hours Precip: UNKNOWN NONE LITTLE (MODERATE) HEAVY FLOODING
Ambient Weather: SUNNY (CLOUDY) / BREEZY (RAIN) SNOW Current Temp: 90°F
CHEMICAL SAMPLES COLLECTED: None @ present
Photographs: Slides Prints (Digital) (Photo #s): #3 4/5, #4 4/5 = CF001 FeB 0.8 u, d
BIOLOGICAL ASSESSMENT: (Benthics) Fish Algae Other:
Type of benthic sample: (BIORECON) SQ KICK SQ BANK DENDY SURBER OTHER:
Taxa List Attached? (Yes) / No Specimens collected ? (Y) or N Sample Log Numbers: N0208010

WATERSHED CHARACTERISTICS

App. % of watershed observed: 30%

UPSTREAM SURROUNDING LAND USE: (estimated %)

PASTURE	40-20%	URBAN		RESID/RD	20%
Row Crops		INDUSTRY		OTHER	
FOREST	40-60%	MINING			

NOTES:

IMPACTS OBSERVED AND POSSIBLE SOURCES — Describe causes, nature, and rate magnitude

See general land uses listed above...

Prev WS WBA (AMC) = 09/29/98 = (PS)

OVERALL ASSESSMENT & SUMMARY:

This creek was assessed in 1998 and looked very similar to it's present state... an additional reach d/s was sampled this time w/ a better riffle area... & the EPT/TOT/INT taxa was 7/22/3!... This creek had opaque pools w/ blanketing sediment & riffle kicks produced thick red mud plumes... u/s of this reach = residents w/ the stream flowing through yards & along the road - this has the impacts of little to no protective riparian for the creek in this u/s area, while d/s in the reach sampled this year, were pastureland / fields - but still w/ more protective riparian here (tho thinned...) numerous fish were observed w/ micro algae present... @ this time - due to sediment load + habitat = PS/PS+

BIORECON Score = 11 Time = 30" Habitats = 3.5 Riff + 0 Bnk + 0.5 grass
EPT Families (+ add. taxa) = 7 Total Families (+ add. taxa) = 22 Intolerant Taxa = 3
EPA Habitat Assessment Completed ? ✓ SCORE = 102 GRADIENT: (HIGH) LOW

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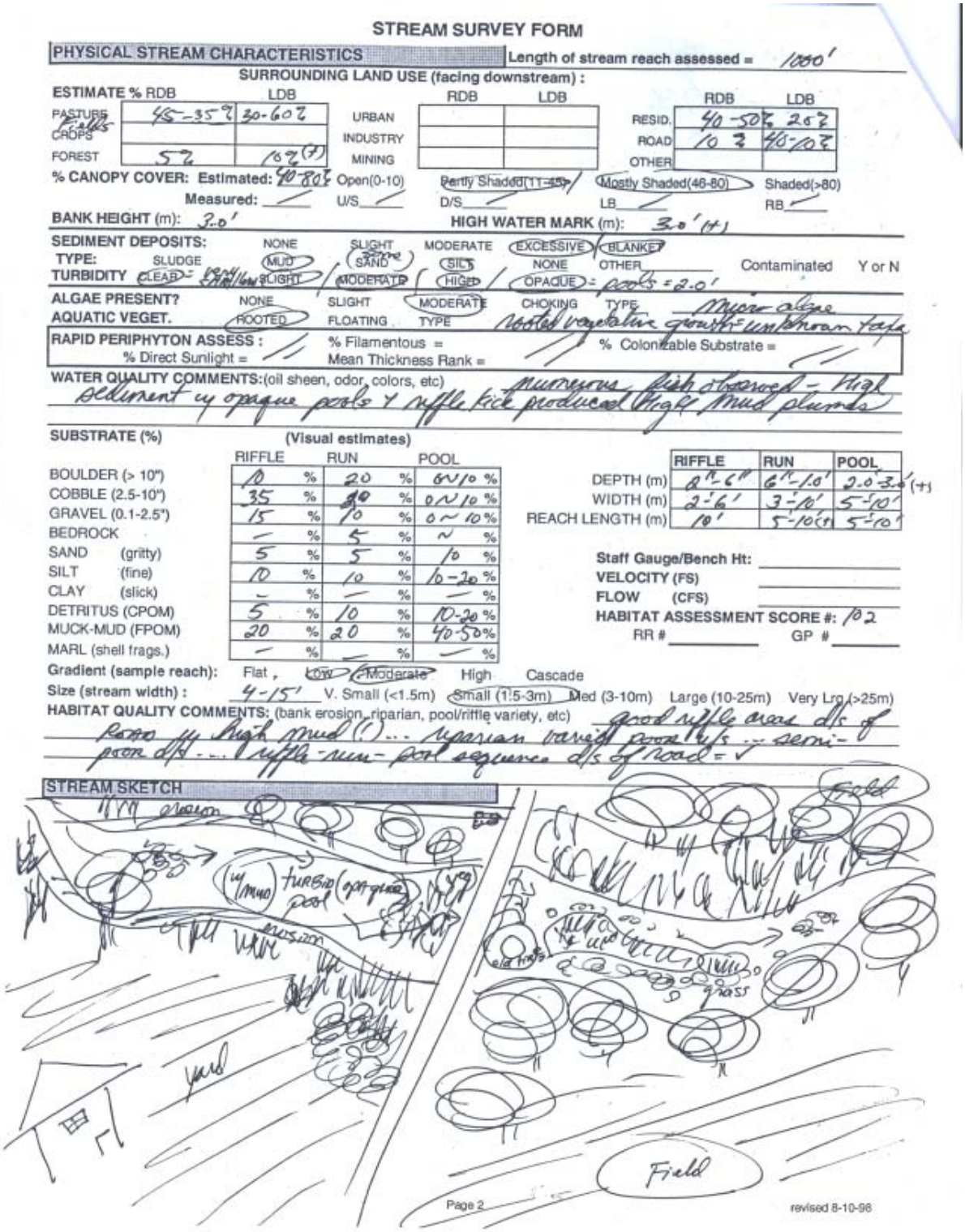
Figure F-2 (Cont.) Ferguson Branch Field Sheet - August 22, 2002



STREAM SURVEY FORM

PHYSICAL STREAM CHARACTERISTICS — Length of stream reach assessed = 1000'

SURROUNDING LAND USE (facing downstream):

ESTIMATE %	RDB	LDB
PASTURE/Fields	45-35%	30-60%
CROPS		
FOREST	5%	10% (?)

	RDB	LDB
URBAN		
INDUSTRY		
MINING		

	RDB	LDB
RESID.	40-50%	20%
ROAD	10%	40-10%
OTHER		

% CANOPY COVER: Estimated: 40-80% Open(0-10) Partly Shaded(11-45) Mostly Shaded(46-80) Shaded(>80)
Measured: ___ U/S ___ D/S ___ LB ___ RB ___

BANK HEIGHT (m): 3.0' HIGH WATER MARK (m): 3.0' (+)

SEDIMENT DEPOSITS: NONE SLIGHT MODERATE EXCESSIVE BLANKET
TYPE: SLUDGE MUD SAND SILT NONE OTHER ___ Contaminated Y or N
TURBIDITY CLEAR SLIGHT MODERATE HIGH OPAQUE = pools = 2.0'

ALGAE PRESENT? NONE SLIGHT MODERATE CHOKING TYPE Micro algae
AQUATIC VEGET. ROOTED FLOATING TYPE rooted vegetative growth = upstream tails

RAPID PERIPHYTON ASSESS: % Direct Sunlight = ___ % Filamentous = ___ Mean Thickness Rank = ___ % Colonizable Substrate = ___

WATER QUALITY COMMENTS: (oil sheen, odor, colors, etc) numerous fish observed - high sediment in opaque pools & riffle kick produced thick mud plumes

SUBSTRATE (%) (Visual estimates)

	RIFFLE	RUN	POOL
BOULDER (> 10")	10 %	20 %	60/10 %
COBBLE (2.5-10")	35 %	40 %	0N/10 %
GRAVEL (0.1-2.5")	15 %	10 %	0 ~ 10%
BEDROCK	— %	5 %	~ %
SAND (gritty)	5 %	5 %	10 %
SILT (fine)	10 %	10 %	10-20 %
CLAY (slick)	— %	— %	— %
DETRITUS (CPOM)	5 %	10 %	10-20 %
MUCK-MUD (FPOM)	20 %	20 %	40-50%
MARL (shell frags.)	— %	— %	— %

	RIFFLE	RUN	POOL
DEPTH (m)	2"-6"	6"-1.0'	2.0-3.0' (+)
WIDTH (m)	2-6'	3-10'	5-10'
REACH LENGTH (m)	10'	5-10' (5)	5-10'

Staff Gauge/Bench Ht: ___
VELOCITY (FS) ___
FLOW (CFS) ___
HABITAT ASSESSMENT SCORE #: 102
RR # ___ GP # ___

Gradient (sample reach): Flat, Low, Moderate, High, Cascade
Size (stream width): 4-15' V. Small (<1.5m) Small (1.5-3m) Med (3-10m) Large (10-25m) Very Lrg (>25m)

HABITAT QUALITY COMMENTS: (bank erosion, riparian, pool/riffle variety, etc) good riffle area d/s of poor d/s to high mud (!) ... riparian variety poor u/s ... semi-poor d/s ... riffle-run-pool sequence d/s of road = ✓

STREAM SKETCH

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Figure F-3 Ferguson Branch - August 22, 2002

F.3 Rock Springs Branch Subwatershed Analysis

Rock Springs Branch (TN05130108001_0400) was placed on the 2002 303(d) List as not fully supporting designated uses due to siltation and habitat alteration associated with riparian loss and pasture grazing.

Rock Springs Branch was monitored in 1998 by the Nashville Environmental Field Office (NEFO). A waterbody assessment at RM 1.15 showed depressed biology. Notes report the presence of cattle in the stream with thinned stream bank riparian areas (Figure F-4).

Figure F-4 Rock Springs Branch Field Sheet - July 29, 1998

Date: 07/29/98, WED **Stream:** Rock Springs Branch **WBA:** Indian Crk(C) **RF3#**

(PS)

CREEK/WBA/ SLIDES	QUAD/COUNTY/ LOCATION	RM & DRAINAGE INTO:___@ RM	W=15' D=6"-15" L=100' STATUS/COMMENTS CAUSE/SOURCE [See back sketch]
-Rock Spring Br	-322NE Buffalo Valley	RM 1.15 to	u/s of St Mary's Rd no Riparian ROB or LOB (see slide #17) with cows in
-WBA(C)	-Putnam Co	Caney Fork RM 20.5	ck! d/s more riparian area / u/s canopy = 0%, d/s canopy = 90%, substrate =
#17 u/s / #18 d/s			Bedrock w/ thin silt layer, banks (R) = 1-2', vegetated, rd also runs along
	- At Baker Rd off St.	LATITUDE/	d/s LOB w/ some riparian ~20-30' [illegible]
(5:00 - 5:30)	Mary's Rd	LONGITUDE	[illegible], EPT = 1 family E
STREAM ORDER		36 07 16.5 GPS	[illegible] habitat sampled was [illegible] should be more
~3RD	Overcast, 87°F, Humid	85 47 37.7	EPT, at this time represents (PS) status

Rock Springs Branch was monitored again in 2002 by the NEFO. A biorecon at RM 0.9 showed the stream was supporting at this location. This site had an established riparian zone and was downstream of the agricultural impacts seen in 1998. However, it was noted that the upstream area still appeared to be impacted per visual inspection. Cattle were still noted in the creek and there was no riparian zone (Figure F-5). This indicates the importance of a healthy riparian area and its ability to protect the stream's health.

Figure F-5 Rock Springs Branch Field Sheet - August 22, 2002

STREAM SURVEY FORM

→ See comments

STREAM SURVEY INFORMATION

(NOTE: This site is d/s of prev. site)

Support Status: (S) / (S+)

STREAM: Rock Spring Branch
STREAM LOCATION: off Bates Road
STATION NUMBER: RSPRI000.9PU
COUNTY: Putnam
MAJOR BASIN: CF WS
WBID#/HUC: TN05130108001
WBID NAME: Lower CF + Tribs
LAT/LONG DEC: 36.1541 67 / -85.7950 00
USGS QUAD: 322NE (Buffalo Valley)
Drainage: CF (RM 20.5) TN
ECOLOGICAL SUBREGION: 71H (ONB) (36°09'15" / 85°47'42")
OBJECTIVES: WS SS

ASSESSORS: A M Goodhue
DATE: TH, 08/22/02
TIME: 7:15 - 8:30pm
STREAM MILE: RM: 0.9
STREAM ORDER: 4th
ADB SEGMENT:
3Q20:
ELEVATION (ft): 480-500'
GAZETTEER PAGE: 055
Field #: CF001(c)

SAMPLES COLLECTED

METERS USED: HydroLab IV Minisonde

pH: 7.92 / 7.84 SU 78.8
CONDUCTIVITY: 392.1 UMHOS
TEMPERATURE: 26.60 / 26.59 C 26.6
DISSOLVED OXYGEN: 4.42 / 4.30 PPM 4.36
TIME: 7:20 / 7:25pm
OTHERS: %Sat. 47.7% / 47.2%

Previous 48 hours Precip: UNKNOWN NONE (LITTLE) / (MODERATE) HEAVY FLOODING
Ambient Weather: SUNNY (CLOUDY) BREEZY RAIN SNOW Current Temp: 90°F (sunset)
CHEMICAL SAMPLES COLLECTED: None @ present
Photographs: Slides Prints (Digital) (Photo #s): #5 u/s, #6 d/s = CF001 Roc 0.9 u,d
BIOLOGICAL ASSESSMENT: (Benthics) Fish Algae Other:
Type of benthic sample: (BIORECON) SQ KICK SQ BANK DENDY SURBER OTHER:
Taxa List Attached? (Yes) / No Specimens collected ? (Y) or N Sample Log Numbers: N0208011

WATERSHED CHARACTERISTICS

App. % of watershed observed: 25-40%

UPSTREAM SURROUNDING LAND USE: (estimated %)

NOTES:

PASTURE	55-70%	URBAN		RESID/RD	10-20%
Row Crops	RB	INDUSTRY		OTHER	
FOREST	20-25%	MINING			

IMPACTS OBSERVED AND POSSIBLE SOURCES — Describe causes, nature, and rate magnitude

See general land uses listed above...

OVERALL ASSESSMENT & SUMMARY: (WS WBA (AMG) = PREV. 09/29/98 = (PS) @ u/s RM 1.2 ...)

In 1998 this creek was assessed u/s ≈ 0.3 mi... that assessment represented the status of the creek in that area... no riparian w/ cows in crk area etc ... for this assessment the lower bottom reach RM0.0 to 1.0 was assessed... the mouth + u/s for a distance, was deeper pooled water... along Bates Rd = site assessed = riparian present, but thinned along ROB due to road - still the creek is fairly well protected in this lower reach... fish were observed + good habitat (substrate w/ nice cobble) was available... EPT/TOT/Int = 12/29/6... very good numbers of taxa for a predominantly riffle RAB collection (0.5 jabs = Bank roots...) - this emphasizes the fact that a protective riparian area has the ability to definitely ↑ the stream health = (S/S+)... it should be noted the upper reach, sampled

BIORECON Score = 15 Time = 35+ Habitats = 3.5 RIFF + 0.5 Bnk + ϕ grass
EPT Families (+ add. taxa) = 12 Total Families (+ add. taxa) = 29 Intolerant Taxa = 6
EPA Habitat Assessment Completed ? ✓ SCORE = 137 GRADIENT: (HIGH) LOW

in 1998, appears (visually) to be in the same condition as it was in 1998 ... (@ that time = PS...)

Page 1 revised 8-10-98

Figure F-5 (Cont.) Rock Springs Branch Field Sheet - August 22, 2002

STREAM SURVEY FORM

PHYSICAL STREAM CHARACTERISTICS Length of stream reach assessed = 1000'

SURROUNDING LAND USE (facing downstream) :

ESTIMATE %	RDB	LDB		RDB	LDB		RDB	LDB
PASTURE	20%	20%	URBAN			RESID.	10%	10%
CROPS			INDUSTRY			ROAD	60%	20%
FOREST	50%	10%	MINING			OTHER		

% CANOPY COVER: Estimated: 80% (+) Open(0-10) Partly Shaded(11-45) Mostly Shaded(46-80) Shaded(>80)
Measured: — U/S — D/S — LB — RB —

BANK HEIGHT (m): 0.2 - 2.0' (+) **HIGH WATER MARK** (m): 2.0' (+)

SEDIMENT DEPOSITS: NONE SLIGHT MODERATE EXCESSIVE (some) BLANKET
TYPE: SLUDGE MUD SAND SILT NONE OTHER Contaminated Y or N
TURBIDITY CLEAR SLIGHT MODERATE (pools) HIGH OPAQUE
ALGAE PRESENT? NONE SLIGHT MODERATE CHOKING TYPE Micro algae
AQUATIC VEGET. ROOTED FLOATING TYPE none

RAPID PERIPHYTON ASSESS : % Filamentous = % Colonizable Substrate =
% Direct Sunlight = Mean Thickness Rank =

WATER QUALITY COMMENTS: (oil sheen, odor, colors, etc) fish observed, good epifaunal substrate w/ some micro algae - fairly clear flow w/ more turbidity in pools.

SUBSTRATE (%) (Visual estimates)

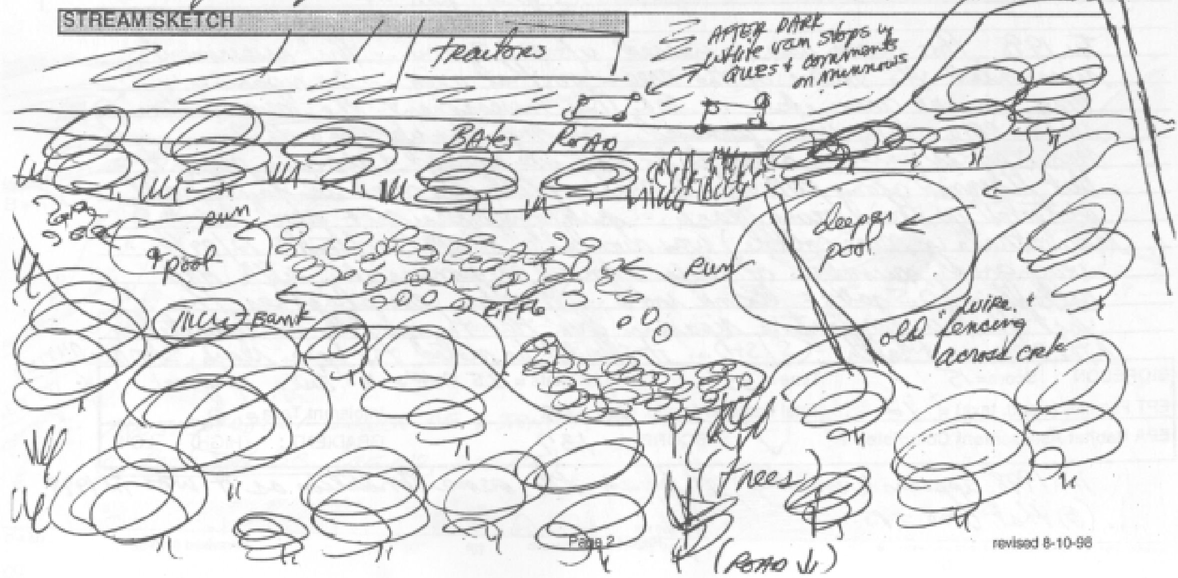
	RIFFLE	RUN	POOL
BOULDER (> 10")	10 %	10 %	5 %
COBBLE (2.5-10")	40 %	30 %	10 %
GRAVEL (0.1-2.5")	15 %	15 %	5 %
BEDROCK	5 %	5 %	20 %
SAND (gritty)	10 %	10 %	10 %
SILT (fine)	15 %	20 %	30 %
CLAY (slick)	— %	— %	— %
DETRITUS (CPOM)	5 %	10 %	20 %
MUCK-MUD (FPOM)	— %	— %	— %
MARL (shell frags.)	— %	— %	— %

	RIFFLE	RUN	POOL
DEPTH (m)	1.0"-3.0"	3.0"-1.0'	1.0-2.0'
WIDTH (m)	4-10'	4-10'	8-10'
REACH LENGTH (m)	5-10' (+)	10' (+)	8-10'

Staff Gauge/Bench Ht:
VELOCITY (FS)
FLOW (CFS)
HABITAT ASSESSMENT SCORE #: 137
RR # GP #

Gradient (sample reach): Flat Low Moderate High Cascade
Size (stream width) : 20-30' V. Small (<1.5m) Small (1.5-3m) Med (3-10m) Large (10-25m) Very Lrg (>25m)
HABITAT QUALITY COMMENTS: (bank erosion, riparian, pool/riffle variety, etc) moderately stable banks w/ good riffle-run-pool sequence + low but adequate flow.

STREAM SKETCH



revised 8-10-98

Central office staff returned to Rock Springs Branch on August 1, 2004 to conduct site reconnaissance and photo document any site-specific sediment sources in the watershed. Cattle were seen in the area with free access to the stream. There was no riparian zone present. This particular site also had some recent land disturbance that appeared to be associated with the creation of two ponds (Figures F-6 through F-9). The upper headwater portions of the watershed were more agricultural use with pasture and some row crops.

Figure F-6 Rock Springs Branch (RM 1.3) - Upstream

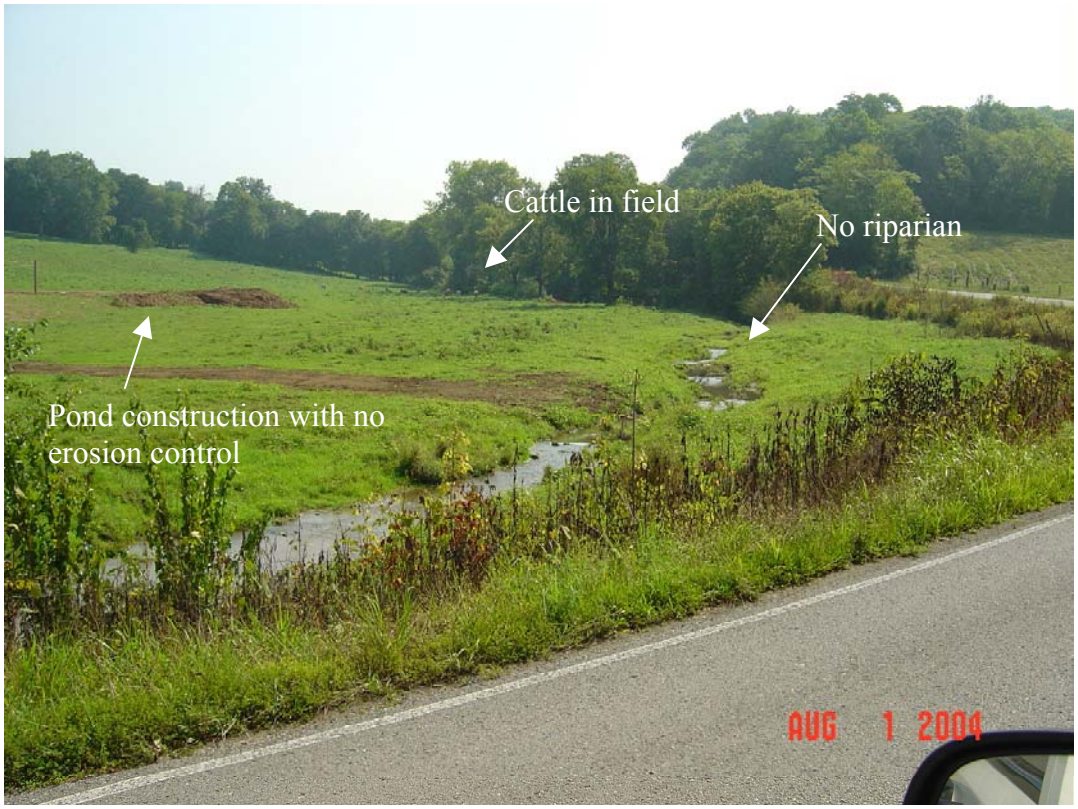


Figure F-7 Rock Springs Branch (RM 1.3) Upstream

Figure F-8 Rock Springs Branch (RM 1.3) Pond Construction With No Erosion Control

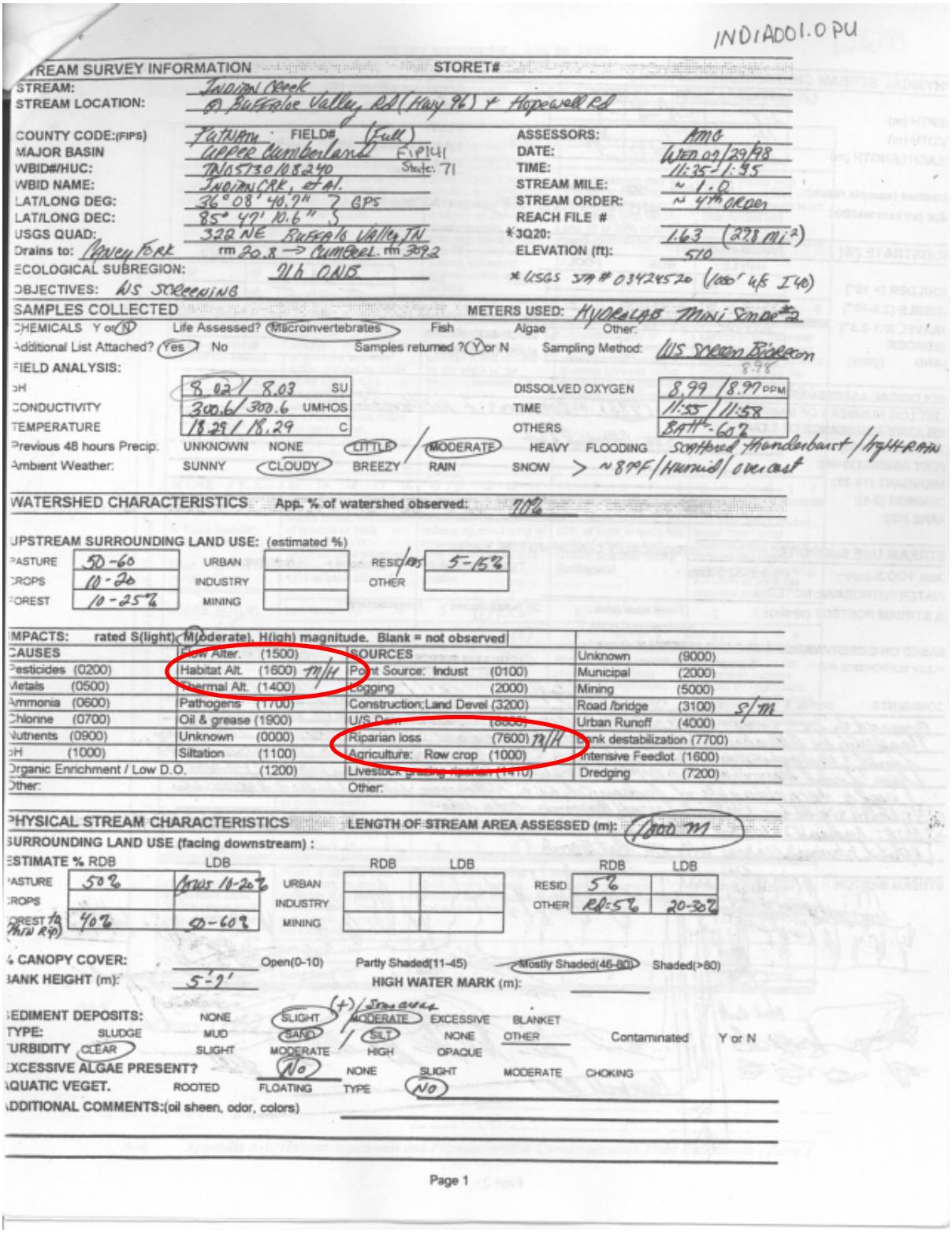
Figure F-9 Rock Springs Branch (RM 1.3) Pond Construction With No Erosion Control

F.4 Indian Creek Subwatershed Analysis

Indian Creek (TN05130108048_1000) was placed on the 2002 303(d) List as not fully supporting designated uses due to siltation and habitat alteration associated with gravel dredging and road maintenance.

Indian Creek was monitored in 1998 by the NEFO. A biorecon at RM 1.0 showed the stream to be impaired with 4 EPT, 1 intolerant, and 14 total families (Figure F-10). Notes show evidence of riparian loss and habitat alteration with slight to moderate siltation. Waterbody assessments and two sites further up in the watershed also noted thinned riparian areas but no singular major cause of impairment (Figures F-11 and F-12).

Figure F-10 Indian Creek field sheet - July 29, 1998



INDIA001.0 PU

STREAM SURVEY INFORMATION STORET#

STREAM: Indian Creek
STREAM LOCATION: @ Buffalo Valley Rd (Hwy 96) & Hopewell Rd

COUNTY CODE:(FIPS) Putnam FIELD# (Full) ASSESSORS: AMG
MAJOR BASIN Upper Cumberland EPI4 DATE: Wed 07/29/98
WBID#/HUC: TN05130108240 State: 71 TIME: 11:35-1:35
WBID NAME: INDIAN CRK, et Al. STREAM MILE: ~ 1.0
LAT/LONG DEG: 36° 08' 40.7" ? GPS STREAM ORDER: ~ 4th order
LAT/LONG DEC: 85° 47' 10.6" ? REACH FILE #
USGS QUAD: 322 NE Buffalo Valley TN *3Q20: 1.63 (22.8 mi²)
Drains to: Caney Fork rm 20.8 → Cumberl. rm 309.2 ELEVATION (ft): 510
ECOLOGICAL SUBREGION: Nh ONS * USGS STA # 03424520 (1000' u/s I40)
OBJECTIVES: WS Screening

SAMPLES COLLECTED METERS USED: HYDROLAB Mini Sonde #2
CHEMICALS Y or (N) Life Assessed? (Macroinvertebrates) Fish Algae Other:
Additional List Attached? (Yes) No Samples returned ? (Y) or N Sampling Method: WS Screen Bioscreen 8-98

FIELD ANALYSIS:

pH	8.02 / 8.03	SU	DISSOLVED OXYGEN	8.99 / 8.97 PPM
CONDUCTIVITY	300.6 / 300.6	UMHOS	TIME	11:55 / 11:58
TEMPERATURE	18.29 / 18.29	C	OTHERS	BATH-602

Previous 48 hours Precip: UNKNOWN NONE (LITTLE) / (MODERATE) HEAVY FLOODING Scattered thunderburst / high rain
Ambient Weather: SUNNY (CLOUDY) BREEZY RAIN SNOW > ~89°F / Humid / overcast

WATERSHED CHARACTERISTICS App. % of watershed observed: 70%

UPSTREAM SURROUNDING LAND USE: (estimated %)

PASTURE	50-60	URBAN		RESID/RS	5-15%
CROPS	10-20	INDUSTRY		OTHER	
FOREST	10-25%	MINING			

IMPACTS: rated S(light) (M)oderate), H(igh) magnitude. Blank = not observed

CAUSES			SOURCES				
Pesticides	(0200)	Flow Alter. (1500)			Unknown	(9000)	
Metals	(0500)	Habitat Alt. (1600)	M/H	Point Source: Indust (0100)	Municipal	(2000)	
Ammonia	(0600)	Thermal Alt. (1400)		Logging (2000)	Mining	(5000)	
Chlorine	(0700)	Pathogens (1700)		Construction;Land Devel (3200)	Road /bridge	(3100)	S/M
Nutrients	(0900)	Oil & grease (1900)		U/S Dam (8000)	Urban Runoff	(4000)	
pH	(1000)	Unknown (0000)		Riparian loss (7600) M/H	Bank destabilization	(7700)	
Organic Enrichment / Low D.O.		Siltation (1100)		Agriculture: Row crop (1000)	Intensive Feedlot	(1600)	
Other:		Other:		Livestock grazing/Riparian (1410)	Dredging	(7200)	

PHYSICAL STREAM CHARACTERISTICS LENGTH OF STREAM AREA ASSESSED (m): 1000 M

SURROUNDING LAND USE (facing downstream):

ESTIMATE %	RDB	LDB		RDB	LDB		RDB	LDB
PASTURE	50%	40-05 10-20%	URBAN			RESID	5%	
CROPS			INDUSTRY			OTHER	RD: 5%	20-30%
FOREST (Thin Rip)	40%	50-60%	MINING					

% CANOPY COVER: Open(0-10) Partly Shaded(11-45) (Mostly Shaded(46-80)) Shaded(>80)
BANK HEIGHT (m): 5-7' HIGH WATER MARK (m):

SEDIMENT DEPOSITS: NONE (SLIGHT) (MODERATE) EXCESSIVE BLANKET (+) Some areas
TYPE: SLUDGE MUD (SAND) / (SILT) NONE OTHER Contaminated Y or N
TURBIDITY (CLEAR) SLIGHT MODERATE HIGH OPAQUE
EXCESSIVE ALGAE PRESENT? (No) NONE SLIGHT MODERATE CHOKING
AQUATIC VEGET. ROOTED FLOATING TYPE (NO)
ADDITIONAL COMMENTS:(oil sheen, odor, colors)

Page 1

Figure F-10 (cont.) Indian Creek Field Sheet - July 29, 1998

'HYSICAL STREAM CHARACTERISTICS (cont.)

	RIFFLE	RUN	POOL
EPTH (m)	2-7"	7"-18"-3'	~3'
VIDTH (m)	12'	4-7'	4'
EACH LENGTH (m)	15'	20-50' (?)	7'

Staff Gauge/Bench Ht: ____
VELOCITY (CFS) ____
FLOW (CFS) ____
HABITAT ASSESSMENT SCORE #:
RR # ____ GP # ____

Gradient (sample reach): Flat Low Mode. High Cascade
Size (stream width): V. Small (<1.5m) Small (1.5-3m) (Med (3-10m)) Large (10-25m) Very Lrg (>25m)

SUBSTRATE (%) (Visual estimates)

	RIFFLE	RUN	POOL
BOULDER (> 10")	%	%	%
COBBLE (2.5-10")	5-8 %	5-8 %	%
GRAVEL (0.1-2.5")	85-90 %	85-90 %	%
BEDROCK	%	%	%
SAND (gritty)	5 %	5 %	%

	RIFFLE	RUN	POOL
CLAY (slick)	%	%	%
SILT	5 %	5 %	%
DETRITUS (CPOM)	%	%	%
MUCK-MUD (FPOM)	%	%	%
MARL (shell frags.)	%	%	%

BIOLOGICAL ASSESSMENT
LIST LOG NUMBERS OF SAMPLES: (988) = Biorecon: 2 Riffle + 2 Banks
RELATIVE ABUNDANCE OF TAXA — HABITAT: 144
DOMINANT (>=50): SEE Attached List
VERY ABUND. (30-49):
ABUNDANT (10-29):
COMMON (3-9):
RARE (<3):

STREAM USE SUPPORT: SPECIFICALLY CLASSIFIED FOR: (circle)
Dom. H2O Supply Ind. H2O Supply Navigation TIER II/TIER III Trout >> Nat. Repr?
WATER WITHDRAWL NOTED
IS STREAM POSTED? (circle) Fish Tissue Advis.: Bacteriological Advis. Do Not Consume Precautionary

BASED ON OBSERVATIONS AND DATA, STREAM IS: (circle)
FULLY SUPPORTING (FS) SUPPORTING, BUT THREATENED (TH) (PARTIALLY SUPPORTING (PS)) NONSUPPORTING (NS)

COMMENTS: photos ? (Y) or N Roll # Photo # 5 u/s #6 d/s = At first glance this stream appeared to look good - upon investigation of macroinvertebrates - dominance [illegible] by [illegible] (snails) + [illegible] abundant, EPT = 4 families / [illegible] [illegible] 3, Heptageniidae, Hydropsychidae = C/A + a Plecoptera taxa = common - should have found more than this EPT (it should be noted in upper W.S. ~4-5 yrs ago I used a tributary u/s of Indian Crk as a reference site + I'll visit [illegible] Crk u/s of this site to cr status) [illegible] seen here
NOTE: Indian (F) = u/s site = same bugs found, EPT where are you? this stream doesn't exhibit obvious reasons why EPT not found

STREAM SKETCH

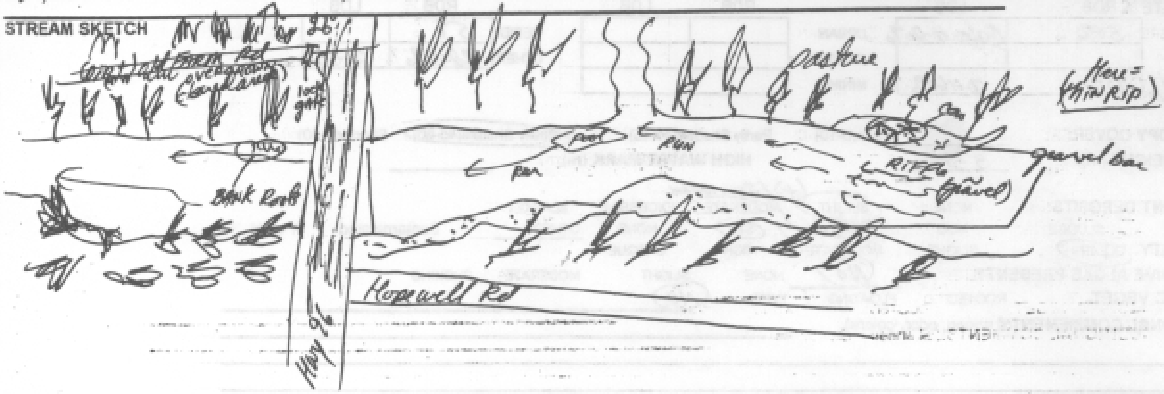


Figure F-11 Indian Creek Field Sheet (RM 2.4) - July 29, 1998

Date: 07/29/98, WED Stream: Indian Cek WBA: Indian Cek (slides (2)) RF3#

CREEK/WBA/ SLIDES	QUAD/COUNTY/ LOCATION	RM & DRAINAGE INTO:--------- @ RM	STATUS/COMMENTS CAUSE/SOURCE (SEE BACK SKETCH)
Indian Cek	-322 NE Buffalo Valley	Indian Cek RM 2.4	Dry runoff area u/s of Hopewell Rd & where it
WBA slides (2)	-Putnam Co	to Caney Fork RM 20.8	enters Indian Cek at Maddux Cemetery
11th, 12th & 2nd Cek			Rd - see back sketch = Mottee as travel u/s Indian
	-@ Hopewell Rd and	LATITUDE/	Creek in this area = pasture / hay fields / road
-3:30-4:00	Maddux Cemet. Rd	LONGITUDE	& some riparian fair to good in places other places
STREAM ORDER	-Recent thunderburst,	36°08' 25.3"	little to none - I still gravel substrate at this
Runoff to Ind. Cek	intern. sun/cloudy 87°F	85° 46' 33.3"	site / Indian Cek's clear water

Figure F-12 Indian Creek Field Sheet (RM 4.85) - July 29, 2004

Date: 07/29/98 Stream: Indian Cek WBA: Indian Cek (F) RF3#

CREEK/WBA/ SLIDES	QUAD/COUNTY/ LOCATION	RM & DRAINAGE INTO: ---@ RM	W= 15-18' D= 6"-24" L= [illegible] STATUS/COMMENTS CAUSE/SOURCE (SEE BACK SKETCH)
Indian Cek	-326 NW Baxter TN	RM 4.85	This site looked similar to Indian Cek Full site except stream
WBA(F)		to Caney Fork RM 20.8	size a little smaller & more cobble substrate - Canopy ~ 65-70%,
#25 riffle shot	-Putnam Co		Banks ~ 6-8', [illegible] areas, LOB = roads, thin/no
(END of FILM Roll)	-Indian Cek Rd ~	LATITUDE/	riparian to fair riparian in areas, ROB = pasture, fields w/ riparian
7:25-8:15	0.2 mi d/s [illegible]	LONGITUDE	varying again from none to fair / bugs recalled same status
STREAM ORDER	Hollow	36° 09' 01.3" 7 GPS	as at full site, - EPT where are you? (Cobble ~ 25-35%, Gravel 50-
	-Dusk, 84°F	85° 44' 22.5"	60%, sand 5-10%)

Indian Creek was monitored again in 2002 by the NEAC. A biorecon at RM 1.0 showed the stream to be partially supporting. The stream had biological scores of 8 EPT, 2 intolerant, and 19 total families. Notes show evidence of thinned riparian and moderate siltation in the form of sand (Figure F-13). Again, no one source turned out to cause the siltation problem.

Central office staff returned to Indian Creek on August 1, 2004 to conduct site reconnaissance and photo document any site-specific sediment sources in the watershed. There were several sediment sources documented including cattle with stream access, row crops, riparian loss, stream bank grading and gravel dredging (Figures F-14 through F-18). All of these are potential sediment sources that are near the stream corridor and likely contribute to stream impairment. The GIS-based model does not account for near-stream sediment sources.

Figure F-13 Indian Creek Field Sheet - August 24, 2002

leans to (PS)... → Borderline stream...

STREAM SURVEY FORM

STREAM SURVEY INFORMATION

Support Status: PS+ / S--

STREAM: Indian Crk INDIA001.0PU (50' d/s of road)
STREAM LOCATION: Hwy 96 (Ammonett Rd) @ Hopewell Rd
STATION NUMBER: Site established 07/29/98
COUNTY: Putnam
MAJOR BASIN: CF WS
WBID#/HUC: TN05130108048
WBID NAME: Indian Crk + Tribs
LAT/LONG DEC: 36.144722 / -85.786389
USGS QUAD: 322NE (Buffalo Valley, TN)
Drainage: Caney Fork (Rem 20.8)
ECOLOGICAL SUBREGION: 71h (ONB) [36° 08' 41" / 85° 47' 11"]
OBJECTIVES: WS SS

ASSESSORS: AM Goodfriend
DATE: Sat 08/24/02
TIME: 1:00 - 3:20 pm
STREAM MILE: RM 1.0
STREAM ORDER: 2/3
ADB SEGMENT:
3Q20: USGS STA# 03424520 (100 4/5 Pts) = 1.63 (29.8 mi²)
ELEVATION (ft): ~570'
GAZETTEER PAGE: 055
Field # (Indian Crk) CF048(A)

SAMPLES COLLECTED — METERS USED: Hydrolab IV minisonde

~~pH~~ and	295.0 / 295.0 SU	DISSOLVED OXYGEN	7.97 / 7.97 PPM
~~CONDUCTIVITY~~ pH	7.89 / 7.89 UMHOS	TIME	1:25 / 1:30 pm
TEMPERATURE	23.79 / 23.85 C (23.97)	OTHERS Sat.	92.1% / 96.42

Previous 48 hours Precip: UNKNOWN NONE (LITTLE) / (MODERATE) HEAVY FLOODING
Ambient Weather: (SUNNY) / (CLOUDY) BREEZY RAIN SNOW Current Temp: ~92°F & Humid
CHEMICAL SAMPLES COLLECTED: None @ present
Photographs: Slides Prints (Digital) (Photo #s:) #7 4/5, #8 4/5 = CF048 Ind 1.0 u, d
BIOLOGICAL ASSESSMENT: (Benthics) Fish Algae Other:
Type of benthic sample: (BIORECON) SQ KICK SQ BANK DENDY SURBER OTHER:
Taxa List Attached? (Yes) / No Specimens collected ? (Y) or N Sample Log Numbers: N0208012

WATERSHED CHARACTERISTICS — App. % of watershed observed: 60-70%

UPSTREAM SURROUNDING LAND USE: (estimated %)

PASTURE	70 - 45%	URBAN		RESID/Rd	10 - 15%
Row Crops	10 - 15%	INDUSTRY		OTHER	
FOREST	10 - 25 %	MINING			

NOTES:

IMPACTS OBSERVED AND POSSIBLE SOURCES — Describe causes, nature, and rate magnitude

See general land uses listed above...

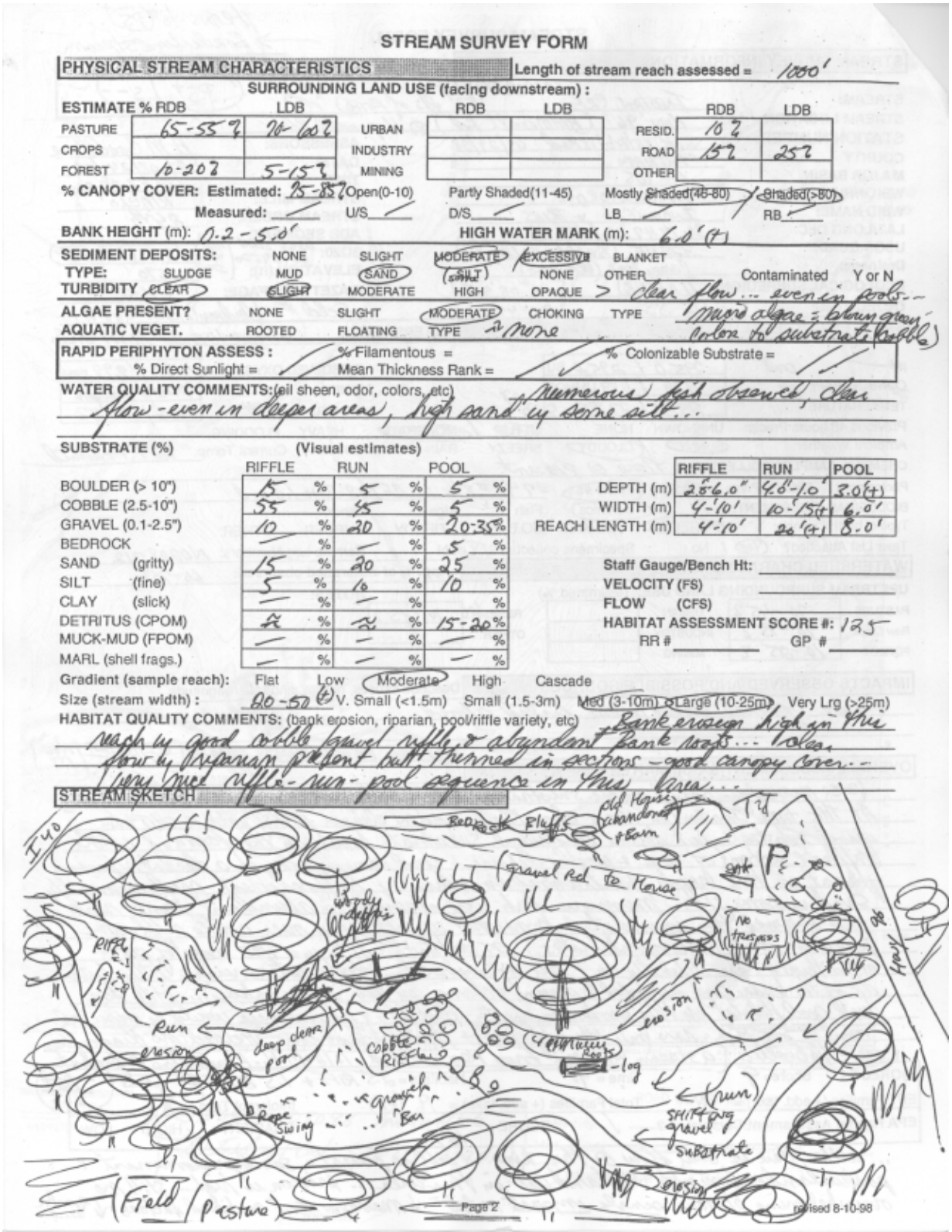
OVERALL ASSESSMENT & SUMMARY: (PS) = Prev WS WBA (AMG) = 07/29/98 [EPT/TOT/INT / HAB: 4/14/1 / 144]

(NOTE: microalgae covered cobble substrate = slick w/ dark green/brown visible covering...] At this time Indian Crk has a clear flow, even in deeper pools, with a shifting gravel substrate, but decent epifaunal substrate cover in the form of cobble riffles & sections of logs & woody debris... Good canopy cover w/ a decent riparian present in this reach tho thinned in areas, w/ high sediment predominantly sand w/ some silt... numerous fish were observed... abundant bank roots were observed (tho inundated somewhat w/ silt) & a nice cobble riffle was sampled for macroinvertebrates... EPT/TOT/INT = 8, 19, 3 w/ a HAB score of 125... altho these #'s are definitely an ↑ over #'s observed in 1998 (& note: a reach a little farther d/s of the bridge was sampled @ present = change in Hab. score values)... still for such good habitat in this ecoregion, greater diversity & abundances would be expected... - over 1/3 of EPT taxa = rare (only 1 each found) & plentiful bank roots yielded (no) dragonflies & one Elmid beetle... [a stream w/1.5 mi from Hen yielded 12/29/7]... Borderline @ present

BIORECON	Score = 9	Time = 40"	Habitats = 2.5 RIFF + 1.5 Bnk + ∅ grass		(= PS+ / S--)
EPT Families (+ add. taxa) = 8		Total Families (+ add. taxa) = 19 (+2)		Intolerant Taxa = 3	
EPA Habitat Assessment Completed ? ✓		SCORE = 125		GRADIENT : (HIGH) LOW	

... altho there is clear flow @ this time... & silt is present w/ sand predominant & pasturelands dominate the land use in this area... erosion is high... still no overwhelming obvious single impact noted = ↓ macroinv. #... & combined factors = ↓ quality

Figure F-13 (Cont.) Indian Creek Field Sheet - August 24, 2002



STREAM SURVEY FORM

PHYSICAL STREAM CHARACTERISTICS — Length of stream reach assessed = 1000'

SURROUNDING LAND USE (facing downstream):

ESTIMATE %	RDB	LDB		RDB	LDB		RDB	LDB
PASTURE	65-55%	70-60%	URBAN			RESID.	10%	
CROPS			INDUSTRY			ROAD	15%	25%
FOREST	10-20%	5-15%	MINING			OTHER		

% CANOPY COVER: Estimated: 25-35% Open(0-10) Partly Shaded(11-45) Mostly Shaded(46-80) Shaded(>80)
Measured: ___ U/S ___ D/S ___ LB ___ RB ___

BANK HEIGHT (m): 0.2 - 5.0' HIGH WATER MARK (m): 6.0'(+)

SEDIMENT DEPOSITS: NONE SLIGHT MODERATE EXCESSIVE BLANKET
TYPE: SLUDGE MUD SAND SILT NONE OTHER ___ Contaminated Y or N
TURBIDITY CLEAR SLIGHT MODERATE HIGH OPAQUE > clear flow... even in pools--
ALGAE PRESENT? NONE SLIGHT MODERATE CHOKING TYPE more algae = blue-green
AQUATIC VEGET. ROOTED FLOATING TYPE = none color to substrate/bank

RAPID PERIPHYTON ASSESS: % Filamentous = ___ % Colonizable Substrate = ___
% Direct Sunlight = ___ Mean Thickness Rank = ___

WATER QUALITY COMMENTS: (oil sheen, odor, colors, etc) numerous fish observed, clear flow - even in deeper areas, high sand & some silt...

SUBSTRATE (%) (Visual estimates)

	RIFFLE	RUN	POOL
BOULDER (> 10")	15 %	5 %	5 %
COBBLE (2.5-10")	55 %	45 %	5 %
GRAVEL (0.1-2.5")	10 %	20 %	20-35%
BEDROCK	— %	— %	5 %
SAND (gritty)	15 %	20 %	25 %
SILT (fine)	5 %	10 %	10 %
CLAY (slick)	— %	— %	%
DETRITUS (CPOM)	2 %	2 %	15-20%
MUCK-MUD (FPOM)	— %	— %	— %
MARL (shell frags.)	— %	— %	— %

	RIFFLE	RUN	POOL
DEPTH (m)	2-6.0"	4.0'-1.0'	3.0'(+)
WIDTH (m)	4'-10'	10'-15'(+)	6.0'
REACH LENGTH (m)	4'-10'	20'(+)	8.0'

Staff Gauge/Bench Ht: ___
VELOCITY (FS) ___
FLOW (CFS) ___
HABITAT ASSESSMENT SCORE #: 125
RR # ___ GP # ___

Gradient (sample reach): Flat Low Moderate High Cascade
Size (stream width): 20-50'(+) V. Small (<1.5m) Small (1.5-3m) Med (3-10m) Large (10-25m) Very Lrg (>25m)

HABITAT QUALITY COMMENTS: (bank erosion, riparian, pool/riffle variety, etc) Bank erosion high in this reach w good cobble gravel riffle & abundant bank roots... water flow & riparian present but thinned in sections - good canopy cover... very nice riffle-run-pool sequence in this area...

STREAM SKETCH

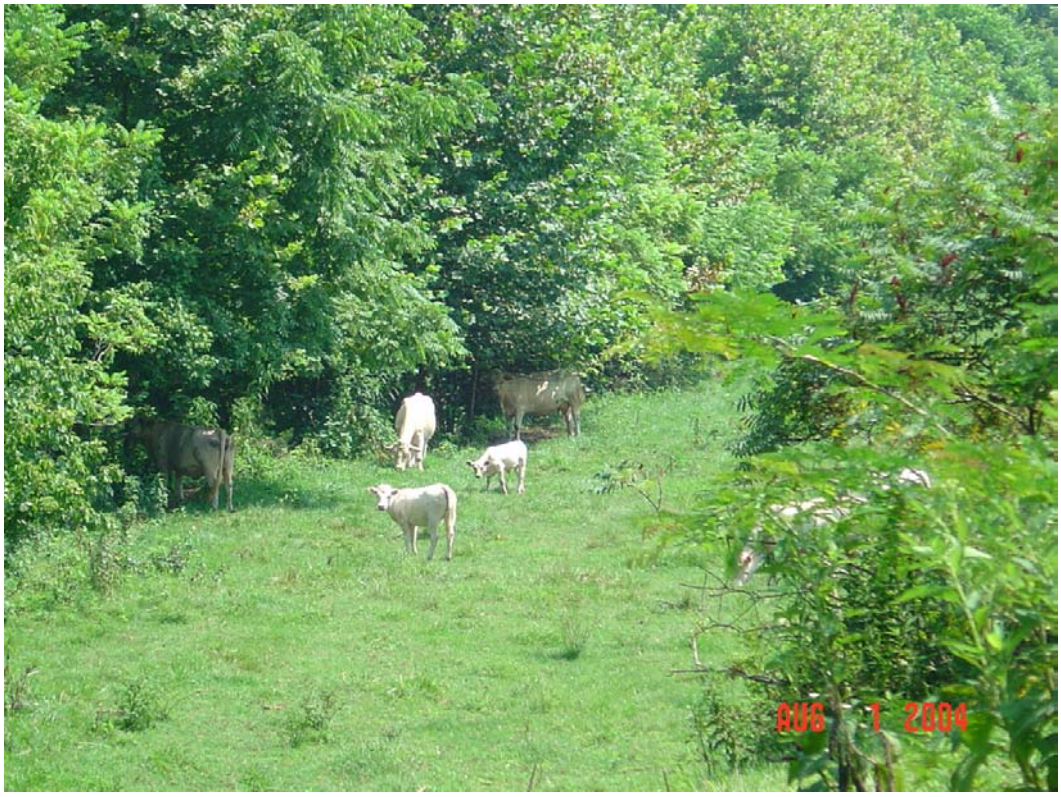
Figure F-14 Indian Creek Riparian Removal and Bank Grading

Figure F-15 Indian Creek Gravel Dredging and Bank Disturbance

Figure F-16 Indian Creek Tobacco Row Crops Near Stream

Figure F-17 Indian Creek Cattle With Stream Access

Figure F-18 Indian Creek Cattle with Stream Access



APPENDIX G

Public Comments Received

Comments from Save Our Cumberland Mountains (SOCM)

Paddock & Mastin
360 Roberts Hollow Lane
Cookeville, TN 38501-9224
931-268-2938 voice & fax
bpaddock@twlakes.net

July 27, 2005

Paul Davis, Director
Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

Dear Paul Davis,

The Roaring River Chapter of Save Our Cumberland Mountains offers these comments on the "Proposed Total Maximum Daily Load (TMDL) for Siltation & Habitat Alteration in the Caney Fork River Watershed" (issued January 7, 2005). We thank Environmental Program Manager Sherry Wang for presenting information on this TMDL at our July, 2005 Chapter meeting. We appreciate TDEC's invitation to the public to comment on the proposed TMDL, and the courtesy the Division has shown in providing an extended public comment period for the TMDL.

The Upper Cumberland Group of the Tennessee Chapter of the Sierra Club joins in these comments.

The SOCM Chapter has long had an interest in the Caney Fork Watershed. Our members recreate in this watershed and some are avid fishermen. We have carefully studied the stormwater issue, especially the increasing amount of impermeable surface in Cookeville which is adversely affecting Pigeon Roost Creek. Our members have hiked along the creek and taken photographs. We have studied the karst geology and understand the interactions which belie the simple distinction between surface and ground waters.

The Proposed TMDL is an adequate first cut but it is not clear how it will be translated into active measures to repair and restore our impaired waters. With the data available, the measures proposed appear to reasonably assign sources of the impairment but a real nexus to corrective action with respect to non-point sources is lacking in the implementation section. One of the immediate goals of the new EFO staff who will be coming to support the TMDL program should be to target monitoring to priority areas and to assure that permitting and enforcement staff have the immediate benefit of TMDL staff field observations and data.

We join the Caney Fork watershed Association in noting that very little "margin of safety" is included in this initial TMDL. The 5% of sediment load included as "MOS" in the load calculation is actually used to account for the loads of minor sources. While the modeling is said to provide some margin of safety, it understates the contribution of development and urban runoff because the modeling is based on 1998 source data. Development activity and the amount of impermeable surface has greatly increased in the watershed since that year. Construction activity is highly variable, changing from month to month.

We believe the TMDL should be strengthened by specific requirements from TDEC for more specificity and more immediate action from the City of Cookeville under the MS4 Phase II stormwater permits system. Few if any of the comments or recommendations provided by Dr. Vincent Neary (see attachment), a stormwater advisory committee member, were considered or adopted by the City of Cookeville when they developed their Notice of Intent (NOI) over two years ago. Dr. Neary was later dismissed from the stormwater advisory committee after submitting his comments because he was considered too critical. Without active enforcement of the City's grading permits system the goal of reducing pollution from stormwater will not be met. Cookeville has not established a funding mechanism to implement the Phase II program. This month the City adopted a budget allowing a $25,000 expenditure for Phase II. This about 25% of the amount needed for the first 12 months according to a statement by the City Manger in the January 3, 2005 Council "work session" on the Phase II program and its funding.

Cookeville has not taken any positive steps to stop the growth of impermeable surface area and to reduce the existing impermeable surface. Last year's changes in parking lot rules did not reduce either the number or size of stall requirements. Nor has the City been willing to waive parking place requirements in exchange for better stormwater best management practices like porous pavers or biodetention filtration, as was suggested for the new Electronic Express store parking adjacent to the Red Kap sinkhole.

The City's Planning and Codes unit seems oblivious to the Phase II requirements and totally unresponsive to the need for modern ordinances that assure that storm water is detained and absorbed rather than simply channelized into the karst system to rise again as Pigeon Roost Creek, assuring the continued listing 303(d) listing. The City has failed to entertain new proposals requiring permeable pavement, or a system of smaller daily needs parking areas with overflow parking on areas left with permeable and grassy cover. It is now recognized that stormwater from parking lots is better handled with depressed vegetated areas to collect and filter stormwater, the most recent city ordinance for retain shopping parking areas apparently requires that planted areas be raised and curbed, directly the opposite of good stormwater control engineering!

Expert advice from Tennessee Technological University has been offered and been ignored. We believe the Water Center and the engineering resources at TTU should be put to good use by the City. It appears to SOCM that the city has failed to follow through on various proposals to identify wetlands, and other wise contract for TTU expertise in understanding and protecting the watershed areas affected by the City.

Absent a prompt and active effort by the City there will be no significant improvement in the quality of Pigeon Roost as a 303(d) listed stream. Moreover, the City's insistence that there be "fifth interchange" and that the area along Mine Lick Creek be developed as an industrial park despite the 303(d) listed status of Mine Lick Creek will further exacerbate water pollution from storm water runoff.

The TMDL summarizes some of the new general stormwater construction permit requirements as including weekly sediment control inspections weekly (apparently by the permit holder) if the potentially receiving waters are 303(d) listed. Pigeon Roost Creek is so listed. How can concerned citizens determine if such weekly inspections are, in fact, occurring?

The "Implementation Plan" measures are modest, probably too modest. They do not impose any unnecessary burden on those who are currently contributing to water quality and habitat degradation. SOCM will continue to insist on strict compliance with both construction and industrial stormwater.

All stakeholders in the community must act to protect the watershed and to remedy the present cases of impaired waters and to prevent future impairment. SOCM has a variety of technical expertise among our members. We also have volunteers that have begun to act as monitors in the field, documenting pollution since the EFO is so understaffed. We welcome the opportunity to cooperate with TDEC in education, facilitation or research efforts directed toward implementation of the proposed TMDL.

In the future and for other proposed TMDLs please recognized the Roaring River Chapter of Save Our Cumberland Mountains and the Sierra club Upper Cumberland Group as stakeholder groups for the Caney Fork River Watershed and the Emory River Watershed.[1] Notification about TMDLs may be sent to the below signed as contact persons on water quality issues and programs.

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[1] We inquire as to any grant or assistance that may be available to help our work to implement the TMDLs under 40 C.F.R. PART 25 "Public Participation" and particular Section 25.3 "Policy and objectives" especially subsection (b).

"(b) Public participation is that part of the decision-making process through which responsible officials become aware of public attitudes by providing ample opportunity for interested and affected parties to communicate their views. Public participation includes providing access to the decision-making process, seeking input from and conducting dialogue with the public, assimilating public viewpoints and preferences, and demonstrating that those viewpoints and preferences have been considered by the decision-making official. Disagreement on significant issues is to be expected among government agencies and the diverse groups interested in and affected by public policy decisions. Public agencies should encourage full presentation of issues at an early stage so that they can be resolved and timely decisions can be made. <u>In the course of this process, responsible officials should make special efforts to encourage and assist participation by citizens representing themselves and by others whose resources and access to decision-making may be relatively limited.</u>

Sincerely yours,

Brian Paddock for SOCM

Mary Mastin, Conservation Chair
For the Sierra Club U.C. Group

cc: Charles Womack, Mayor, City of Cookeville

Comments from Caney Fork Watershed Association (CFWA)

Caney Fork Watershed Association
P.O. Box 165
Cookeville, TN 38503-0165
CFWA@blomand.net
www.cfwa-tn.org

July 27, 2005

Paul Davis, Director
Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

Director Davis,

The Caney Fork Watershed Association (CFWA) is delighted to have the opportunity to comment on the "Proposed Total Maximum Daily Load (TMDL) for Siltation & Habitat Alteration in the Caney Fork River Watershed", issued January 7, 2005. We appreciate the care that Environmental Program Manager Sherry Wang and her staff have taken in presenting and making available to the public the proposed TMDL, and the courtesy the Division has shown in providing an extended public comment period for the TMDL.

The Caney Fork Watershed is a great asset for our region and our country. This watershed provides our drinking water, accommodates and our stormwater runoff, and furnishes and supports the unparalleled recreation opportunities on which both our economy and quality of life depends. It is of utmost importance that all stakeholders in the community partner in protecting the watershed, and in taking measures to remediate the present cases of impaired waters and to prevent future impairment.

The Proposed TMDL is a very good initial basis with which to begin to achieve remediation of our impaired waters. Within the context of the data available, the measures proposed reasonably assign sources of the impairment and suggests measures toward remediation which are fair, will not impose undue burden on any stakeholder, and will likely produce marked improvement in the quality of the 303(d) listed impaired streams.

We note that very little "margin of safety" is included in this initial TMDL. The 5% of sediment load included as "MOS" in the load calculation is actually used to account for the loads of minor sources. While the modeling is said to provide some margin of safety, it likely underestimates the contribution of development and urban runoff, as the modeling is based on satellite imagery data

acquired between 1992 and 1995, and development and development activity have increased in the watershed in the past ten years. Also, CFWA believes that basing target loads on unimpaired reference streams in the same ecoregion is not a conservative measure, but is simply the most reasonable one. While the TMDL is not "conservative" in the sense of including a large margin of safety in assigning target loads, the loads do represent significant reductions, and can be reduced further, and with greater specificity in source allocation, when the effectiveness of the present TMDL has become clear.

The "Implementation Plan" measures are modest and do not appear to represent any unnecessary burden on stakeholders. The requirements on developers are very similar to those presently required. The rational for "singling out" the Cookeville and Smithville STP's for reduced NPDES requirements seems reasonable. It is unfortunate that explicit regulation cannot be applied to the major source of impairment, nonpoint source pollution, as this regulation would stimulate and facilitate better stewardship. However, in making clear the severity of impact of nonpoint sources, the TMDL can furnish a valuable tool in reducing the loads from these sources.

The mission of CFWA is, "The CFWA promotes conservation and improvement of the aquatic ecosystems of the watershed." Our primary activity is education, through our programs, field days, and other activities. An important goal of our organization is to facilitate communication among local stakeholders. We also have significant technical expertise among our supporters, and can implement "citizen science" and other technical projects. We welcome the opportunity to cooperate with TDEC in education, facilitation or research efforts directed toward implementation of the proposed TMDL.

Thank you for your good work!

Sincerely yours,

Mary Jane Ware, Chair
CFWA

Cookeville STP Comments (Reference: Caney Fork Watershed Association Comments)

From: Ronnie Kelly <rjk@cookeville-tn.org>
To: 'Caney Fork Watershed Association' <cfwa@blomand.net>, Paul Estill Davis <Paul.Estill.Davis@state.tn.us>
Date: 8/1/2005 11:56:53 AM
Subject: RE: Comment Letter on TMDL---Caney Fork

Mary Jane,
I received the following e-mail this morning and I have a couple of questions. I missed the meeting in Carthage so I was wondering if these comments were reviewed by the membership before being sent or were they just a product of the board? If the membership did not get a chance to review and agree with the comments then I would suggest that in the future the membership be given a chance for input before comments go out in their name. I consider myself a member and this is the first time that I have had a chance to review the comments.

There is a statement in the comments that refers to the Cookeville and Smithville STP's. This statement states, "The rational for "singling out" the Cookeville and Smithville STP's for reduced NPDES requirements seems reasonable." I had previously reviewed the proposed TMDL and did not remember the Cookeville and Smithville STP being "singled out". I have just gotten off of the TDEC web page and reviewed the proposed TMDL again and I can find no reference to the Cookeville and Smithville plant being "singled out". The only reference to Regulated Municipal Wastewater Treatment Facilities that I could find in the "Proposed Total Maximum Daily Load (TMDL) for Siltation & Habitat Alteration in the Caney Fork River Watershed", refers to the Cookeville and Smithville STP's only in a general sense found on page 19 of the document. It states "As stated in Section 3.0, the TSS component of WWTF discharges is generally composed of primarily organic material and is considered to be different in nature than the sediments produced from erosional processes. Therefore, TSS discharges from WWTF's are not included in the TMDL's developed for this document." Have I missed something somewhere? Please reference the page number where Cookeville and Smithville are "singled out" so that I can review the wording and try to understand the comments that were submitted and why that comment was included.

Ronnie Kelly