TOTAL MAXIMUM DAILY LOAD (TMDL)

for

E. Coli

in the

Nonconnah Creek Watershed

(HUC 08010211)

Shelby and Fayette Counties, Tennessee

FINAL

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Submitted May 25, 2011
Approved by EPA Region 4 – June 17, 2011

DEPARTMENT OF ENVIRONMENT & CONSERVATION

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LIST OF ABBREVIATIONS

ADB	Assessment Database
AFO	Animal Feeding Operation
BMP	Best Management Practices
BST	Bacteria Source Tracking
CAFO	Concentrated Animal Feeding Operation
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CFU	Colony Forming Units
DEM	Digital Elevation Model
DWPC	Division of Water Pollution Control
E. coli	Escherichia coli
EPA	Environmental Protection Agency
GIS	Geographic Information System
HSPF	Hydrological Simulation Program - Fortran
HUC	Hydrologic Unit Code
LA	Load Allocation
LDC	Load Duration Curve
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
MST	Microbial Source Tracking
NHD	National Hydrography Dataset
NMP	Nutrient Management Plan
NPS	Nonpoint Source
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PCR	Polymerase Chain Reaction
PDFE	Percent of Days Flow Exceeded
PFGE	Pulsed Field Gel Electrophoresis
RM	River Mile
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
SWMP	Storm Water Management Program
TDEC	Tennessee Department of Environment & Conservation
TDOT	Tennessee Department of Transportation
TMDL	Total Maximum Daily Load
TWRA	Tennessee Wildlife Resources Agency
USGS	United States Geological Survey
UCF	Unit Conversion Factor
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility

SUMMARY SHEET

Total Maximum Daily Load for E. coli in Nonconnah Creek Watershed (HUC 08010211)

Impaired Waterbody Information

State: Tennessee
Counties: Shelby and Fayette
Watershed: Nonconnah Creek (HUC 08010211)
Constituents of Concern: E. coli

Waterbodies Addressed in This Document:

Waterbody ID	Waterbody	Miles Impaired
TN08010211001 – 0100	HORN LAKE CUTOFF	16.4
TN08010211001 – 1000	HORN LAKE CREEK	10.3
TN08010211001 – 2000	HORN LAKE CREEK	5.2
TN08010211007 – 1000 [c]	CYPRESS CREEK	18.2
TN0801021100711 – 0200	CANE CREEK	7.2
TN0801021100711 – 0300	BLACK BAYOU	7.9
TN0801021100711 – 0400	TEN MILE CREEK	13.3
TN0801021100711 – 0500	HURRICANE CREEK	13.3
TN0801021100711 – 0600	DAYS CREEK	10.6
TN0801021100711 – 1000 [c]	NONCONNAH CREEK	3.2
TN0801021100711 – 2000 [c]	NONCONNAH CREEK	4.86
TN0801021100711 – 3000 [c]	NONCONNAH CREEK	4.1
TN0801021100720 – 0100 [a]	UNNAMED TRIB TO NONCONNAH CREEK	3.91
TN0801021100720 – 0200 [a]	UNNAMED TRIB TO NONCONNAH CREEK	4.02
TN0801021100720 – 0300 [a]	UNNAMED TRIB TO NONCONNAH CREEK	3.09
TN0801021100720 – 0400 [b]	UNNAMED TRIB TO NONCONNAH CREEK	10.07
TN0801021100720 – 0410 [b]	UNNAMED TRIB TO THE UNNAMED TRIB TO NONCONNAH CREEK	2.53
TN0801021100720 – 0500 [b]	UNNAMED TRIB TO NONCONNAH CREEK	8.93
TN0801021100720 – 1000 [c]	NONCONNAH CREEK	8.3
TN0801021100720 – 2000 [c]	NONCONNAH CREEK	6.2
TN0801021100720 – 3000 [c]	NONCONNAH CREEK	6.5
TN08010211176 – 1000 [c]	JOHN'S CREEK	13.7

[a] Several unnamed tributaries to Nonconnah Creek were not listed as impaired by E. coli. However, analysis of monitoring data suggested that they were impaired.
[b] The waterbody ID has changed for several of the unnamed tributaries to Nonconnah Creek.
[c] These waterbodies were included in the previous TMDL approved in 2001.

Designated Uses:

The designated use classifications for waterbodies in the Nonconnah Creek Watershed include fish and aquatic life, irrigation, livestock watering & wildlife, and recreation.

Water Quality Targets:

Derived from *State of Tennessee Water Quality Standards, Chapter 1200-4-3, General Water Quality Criteria, 2007 Version* for recreation use classification (most stringent):

> The concentration of the E. coli group shall not exceed 126 colony forming units per 100 mL, as a geometric mean based on a minimum of 5 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. For the purposes of determining the geometric mean, individual samples having an E. coli concentration of less than 1 per 100 mL shall be considered as having a concentration of 1 per 100 mL.
>
> Additionally, the concentration of the E. coli group in any individual sample taken from a lake, reservoir, State Scenic River, Exceptional Tennessee Water or ONRW (1200-4-3-.06) shall not exceed 487 colony forming units per 100 mL. The concentration of the E. coli group in any individual sample taken from any other waterbody shall not exceed 941 colony forming units per 100 mL.

For further information on Tennessee's general water quality standards, see:

http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-03.pdf.

TMDL Scope:

Waterbodies identified on the Proposed Final 2010 303(d) list as impaired due to E. coli. TMDLs were developed for impaired waterbodies on a HUC-12 subwatershed or waterbody drainage area basis. This TMDL supersedes the pathogen TMDLs approved by EPA in 2001. Since 2001: (1) water quality standards have changed from fecal coliform to e. coli; (2) additional waterbodies have been listed; and (3) TDEC has developed an improved flow-based methodology.

Analysis of monitoring data for several unnamed tributaries to Nonconnah Creek suggests that they are also impaired due to E. coli. At this time, listing is suggested for these waterbodies.

Analysis/Methodology:

The TMDLs for impaired waterbodies in the Nonconnah Creek Watershed were developed using a load duration curve methodology to assure compliance with the E. coli 126 CFU/100 mL geometric mean and the 487 CFU/100 mL maximum water quality criteria for lakes, reservoirs, State Scenic Rivers, or Exceptional Tennessee Waters and 941 CFU/100 mL maximum water quality criterion for all other waterbodies. A duration curve is a cumulative frequency graph that represents the percentage of time during which the value of a given parameter is equaled or exceeded. Load duration curves are developed from flow duration curves and can illustrate existing water quality conditions (as represented by loads calculated from monitoring data), how these conditions compare to desired targets, and the region of the waterbody flow zone represented by these existing loads. Load duration curves were also used to determine percent load reduction goals to meet the target maximum loading for E. coli. When sufficient data were available, load reductions were also determined based on geometric mean criterion.

Critical Conditions:

Water quality data collected over a period of up to 10 years for load duration curve analysis were used to assess the water quality standards representing a range of hydrologic and meteorological conditions.

For each impaired waterbody, critical conditions were determined by evaluating the percent load reduction goals and the percent of samples exceeding TMDL target concentrations (percent exceedance), for each hydrologic flow zone, to meet the target (TMDL) loading for E. coli. The percent load reduction goal and/or the percent exceedance of the greatest magnitude corresponds with the critical flow zone(s).

Seasonal Variation:

The 10-year period used for HSPF model simulation period for development of load duration curve analysis included all seasons and a full range of flow and meteorological conditions.

Margin of Safety (MOS):

Explicit MOS = 10% of the E. coli water quality criteria for each impaired subwatershed or drainage area.

TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0101	Nonconnah Creek	TN0801021100720 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.428 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.967 \times 10^{7} \times Q$	$1.967 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.482 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to the Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0410	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$
0102	John's Creek	TN08010211176 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.254 \times 10^{6} \times Q$	$1.254 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$
		TN0801021100720 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$
		TN0801021100720 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0100	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.032 \times 10^{7} \times Q$	$1.032 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.466 \times 10^{7} \times Q$	$1.466 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$7.359 \times 10^{6} \times Q$	$7.359 \times 10^{6} \times Q$
0103	Black Bayou	TN0801021100711 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.670 \times 10^{6} \times Q$	$4.670 \times 10^{6} \times Q$
	Cane Creek	TN0801021100711 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.235 \times 10^{6} \times Q$	$4.235 \times 10^{6} \times Q$
	Days Creek	TN0801021100711 – 0600	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.481 \times 10^{6} \times Q$	$3.481 \times 10^{6} \times Q$
	Hurricane Creek	TN0801021100711 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.221 \times 10^{6} \times Q$	$4.221 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$
		TN0801021100711 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$
	Tenmile Creek	TN0801021100711 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.646 \times 10^{6} \times Q$	$3.646 \times 10^{6} \times Q$

TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0201	Cypress Creek	TN08010211007 – 1000	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.424 \times 10^{6} \times Q$	$1.424 \times 10^{6} \times Q$
0301	Horn Lake Creek	TN08010211001 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$7.080 \times 10^{5} \times Q$	$7.080 \times 10^{5} \times Q$
0302	Horn Lake Creek	TN08010211001 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.554 \times 10^{5} \times Q$	$5.554 \times 10^{5} \times Q$
	Horn Lake Cutoff	TN08010211001 – 0100	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.604 \times 10^{6} \times Q$	$1.604 \times 10^{6} \times Q$

Notes: NA = Not Applicable.
Q = Mean Daily In-stream Flow (cfs).

a. WLAs for WWTFs are expressed as E. coli loads (CFU/day). All current and future WWTFs must meet water quality standards as specified in their NPDES permit.

b. Applies to any MS4 discharge loading in the subwatershed. Future MS4s will be assigned waste load allocations (WLAs) consistent with load allocations (LAs) assigned to precipitation induced nonpoint sources.

PROPOSED E. COLI TOTAL MAXIMUM DAILY LOAD (TMDL) NONCONNAH CREEK WATERSHED (HUC 08010211)

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 waterbodies that are not attaining water quality standards. State water quality standards consist of designated uses 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 SCOPE OF DOCUMENT

This document presents details of TMDL development for waterbodies in the Nonconnah Creek Watershed, identified on the Proposed Final 2010 303(d) list as not supporting designated uses due to E. coli. Portions of the Nonconnah Creek Watershed lie in 2 states: Tennessee and Mississippi. This document addresses only impaired waterbodies in Tennessee. TMDL analyses were performed primarily on a 12-digit hydrologic unit area (HUC-12) basis. This TMDL supersedes the pathogen TMDLs approved by EPA in 2001. Since 2001: (1) water quality standards have changed from fecal coliform to e. coli; (2) additional waterbodies have been listed; and (3) TDEC has developed an improved flow-based methodology.

3.0 WATERSHED DESCRIPTION

The Nonconnah Creek Watershed (HUC 08010211) is located in southwestern Tennessee (Figure 1). The Nonconnah Creek Watershed lies within two Level III ecoregions (Mississippi Alluvial Plain and Mississippi Valley Loess Plains) and contains three Level IV ecoregions as shown in Figure 2 (USEPA, 1997):

- The **Northern Holocene Meander Belts (73a)** within Tennessee is a relatively flat region of Quaternary alluvial deposits of sand, silt, clay, and gravel. It is bounded distinctly on the east by the Bluff Hills (74a), and on the west by the Mississippi River. Average elevations are 200-300 feet with little relief. Most of the region is in cropland, with some areas of deciduous forest. Soybeans, cotton, corn, sorghum, and vegetables are the main crops. The natural vegetation consists of Southern floodplain forest (oak, tupelo, bald cypress). The two main distinctions in the Tennessee portion of the ecoregion are between areas of loamy, silty, and sandy soils with better drainage, and areas of more clayey soils of poor drainage that may contain wooded swamp-land and oxbow lakes. Waterfowl, raptors, and migratory songbirds are relatively abundant in the region.
- The **Bluff Hills (74a)** consist of sand, clay, silt, and lignite, and are capped by loess greater than 60 feet deep. The disjunct region in Tennessee encompasses those thick

loess areas that are generally the steepest, most dissected, and forested. The carved loess has a mosaic of microenvironments, including dry slopes and ridges, moist slopes, ravines, bottomland areas, and small cypress swamps. While oak-hickory is the general forest type, some of the undisturbed bluff vegetation is rich in mesophytes, such as beech and sugar maple, with similarities to hardwood forests of eastern Tennessee. Smaller streams of the Bluff Hills have localized reaches of increased gradient and small areas of gravel substrate that create aquatic habitats that are distinct from those of the Loess Plains (74b) to the east. Unique, isolated fish assemblages more typical of upland habitats can be found in these stream reaches. Gravels are also exposed in places at the base of the bluffs.

- The **Loess Plains (74b)** are gently rolling, irregular plains, 250-500 feet in elevation, with loess up to 50 feet thick. The region is a productive agricultural area of soybeans, cotton, corn, milo, and sorghum crops, along with livestock and poultry. Soil erosion can be a problem on the steeper, upland Alfisol soils; bottom soils are mostly silty Entisols. Oak-hickory and southern floodplain forests are the natural vegetation types, although most of the forest cover has been removed for cropland. Some less-disturbed bottomland forest and cypress-gum swamp habitats still remain. Several large river systems with wide floodplains, the Obion, Forked Deer, Hatchie, Loosahatchie, and Wolf, cross the region. Streams are low-gradient and murky with silt and sand bottoms, and most have been channelized.

The Nonconnah Creek Watershed, located in Shelby and Fayette Counties, Tennessee, has a drainage area of approximately 190 square miles (mi^2) in Tennessee. The entire watershed, including portions of Tennessee and Mississippi, drains approximately 283 mi^2. Watershed land use distribution is based on the Multi-Resolution Land Characteristic (MRLC) databases derived from Landsat Thematic Mapper digital images from around 2001. Although changes in the land use of the Nonconnah Creek Watershed have occurred since 2001 as a result of rapid development, this is the most current land use data available. Land use in the Nonconnah Creek Watershed is summarized in Table 1 and shown in Figure 3. Predominant land use in the Tennessee portion of the Nonconnah Creek Watershed is urban (64.0%) followed by agriculture (17.4%). Details of land use distribution of impaired subwatersheds in the Nonconnah Creek Watershed are presented in Appendix A.

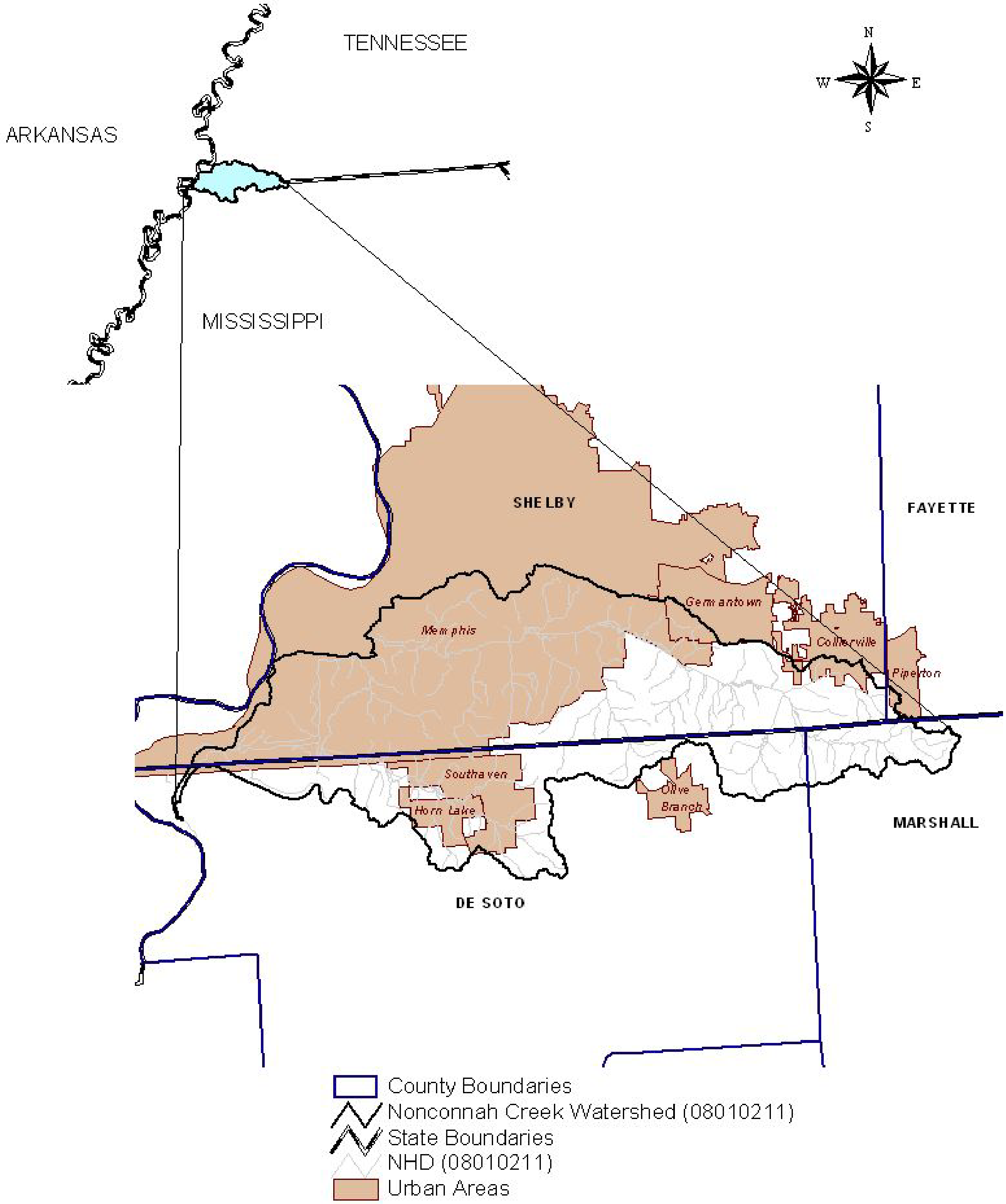

Figure 1. Location of the Nonconnah Creek Watershed.

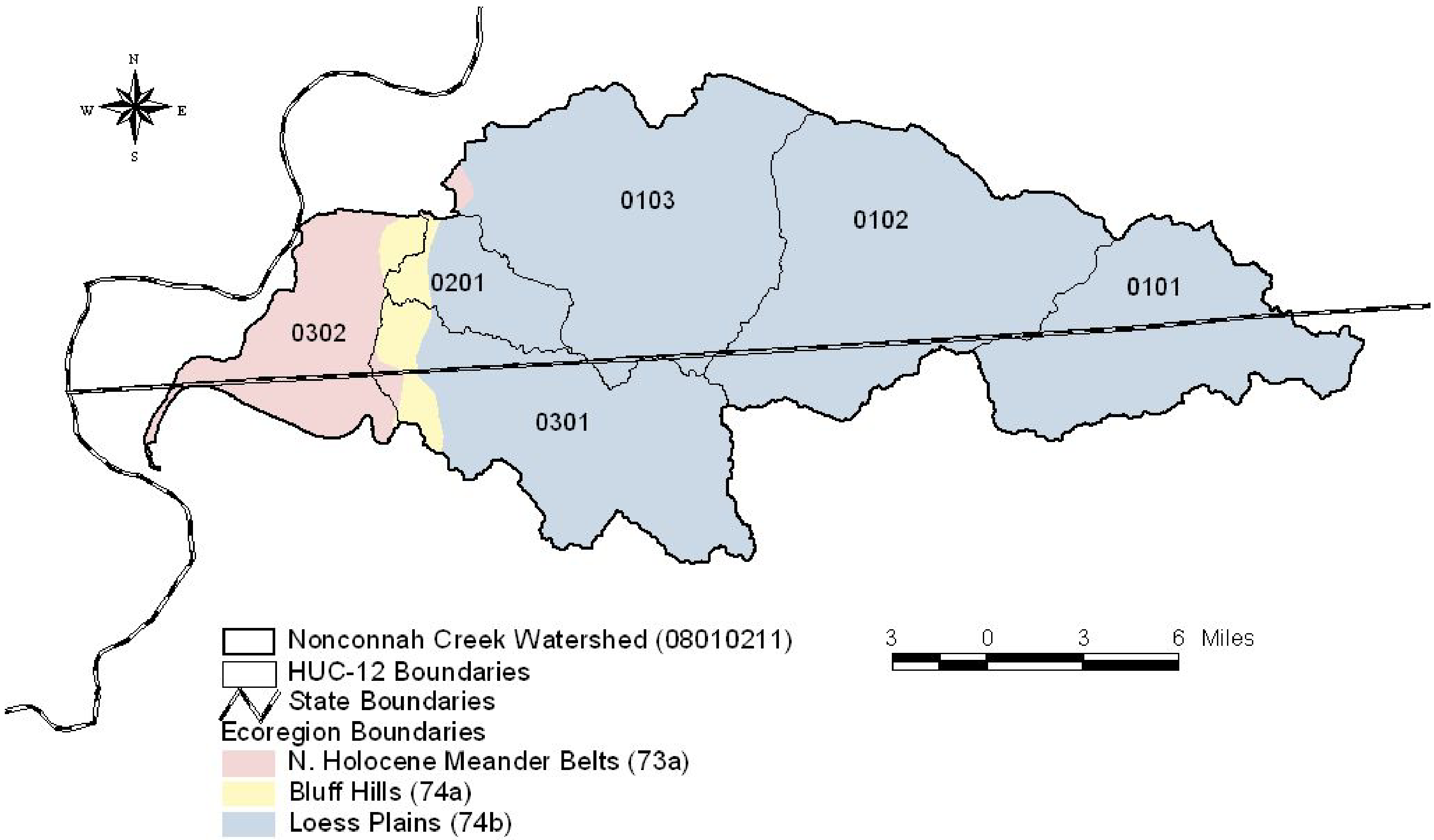

Figure 2. Level IV Ecoregions in the Nonconnah Creek Watershed.

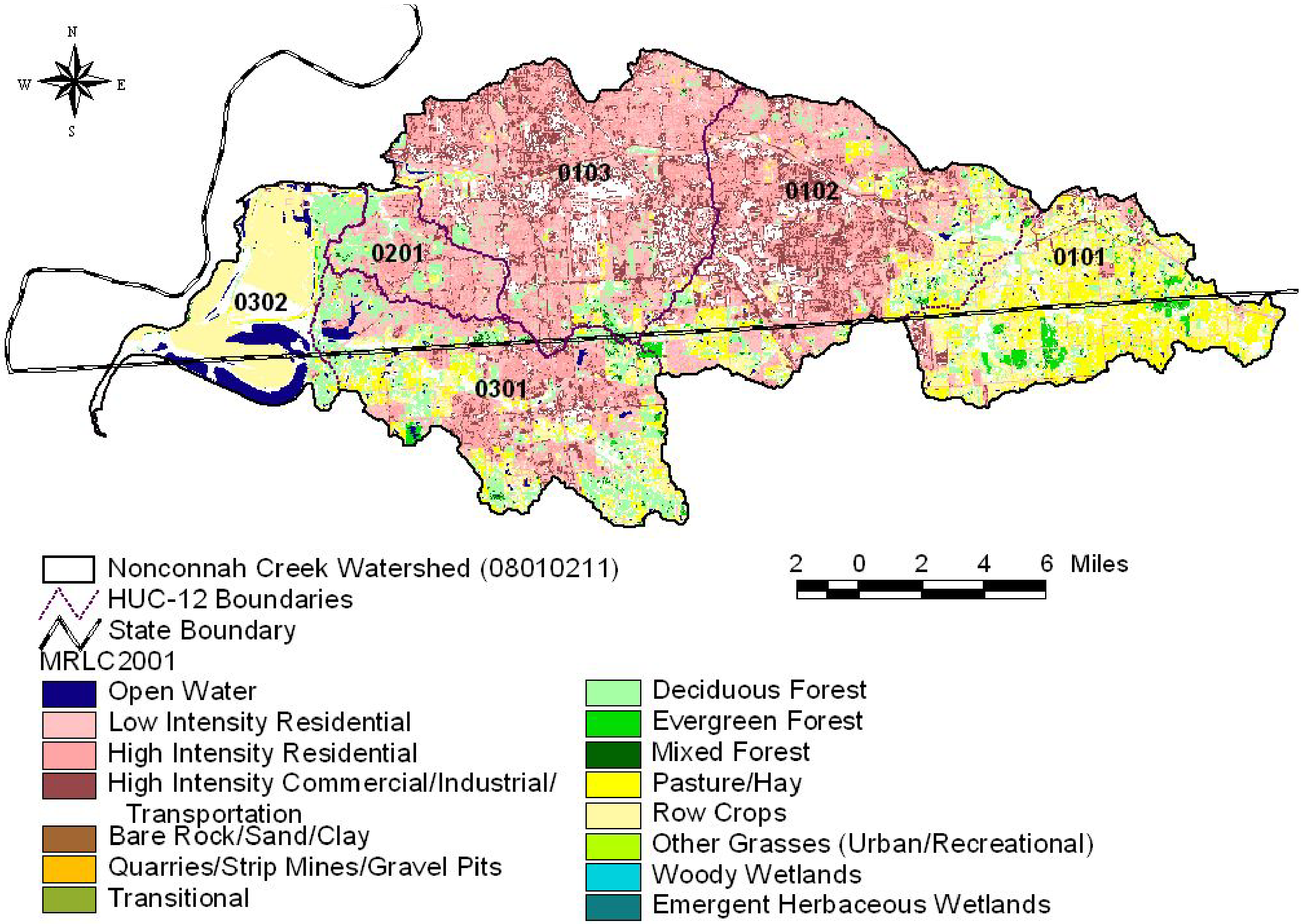

Figure 3. Land Use Characteristics of the Nonconnah Creek Watershed.

Table 1. MRLC Land Use Distribution – Nonconnah Creek Watershed (08010211)

Land use	Nonconnah Creek Watershed (TN & MS)		Nonconnah Creek Watershed (TN only)	
	[acres]	[%]	[acres]	[%]
Open Water	3,880	2.2	2,224	1.8
Developed Open Space	34,290	19.2	26,498	21.2
Low Intensity Development	31,843	17.8	25,847	20.7
Medium Intensity Development	20,773	11.6	18,035	14.4
High Intensity Development	10,489	5.9	9,659	7.7
Barren Land (Rock/Sand/Clay)	47	0.0	44	0.0
Deciduous Forest	17,494	9.8	10,301	8.2
Evergreen Forest	2,016	1.1	491	0.4
Mixed Forest	1,150	0.6	652	0.5
Shrub/Scrub	7,472	4.2	2,947	2.4
Grassland/Herbaceous	263	0.1	172	0.1
Pasture/Hay	14,961	8.4	6,186	4.9
Cultivated Crops	24,383	13.6	15,647	12.5
Woody Wetlands	9,417	5.3	6,297	5.0
Emergent Herbaceous Wetlands	218	0.1	138	0.1
Total	178,696	100.0	125,138	100.0

4.0 PROBLEM DEFINITION

The State of Tennessee's Proposed Final 2010 303(d) list (TDEC, 2010), http://tn.gov/environment/wpc/publications/pdf/2010proposed_final_303dlist.pdf, was submitted to the U.S. Environmental Protection Agency (EPA), Region IV in August of 2010. This list identified portions of 19 waterbodies in the Nonconnah Creek Watershed as not fully supporting designated use classifications due, in part, to E. coli (see Table 2 & Figure 4). The designated use classifications for these waterbodies include fish and aquatic life, irrigation, livestock watering & wildlife, and recreation.

5.0 WATER QUALITY CRITERIA & TMDL TARGET

As previously stated, the designated use classifications for the Nonconnah Creek waterbodies include fish & aquatic life, recreation, irrigation, and livestock watering & wildlife. Of the use classifications with numeric criteria for E. coli, the recreation use classification is the most stringent and will be used to establish target levels for TMDL development. The coliform water quality criteria, for protection of the recreation use classification, is established by *State of Tennessee Water Quality Standards, Chapter 1200-4-3, General Water Quality Criteria, 2007 Version* (TDEC, 2007).

Portions of the Horn Lake Cutoff and Cypress Creek have been classified as Exceptional Tennessee Waters. As of April 1, 2011, none of the other impaired waterbodies in the Nonconnah Creek Watershed have been classified as lakes, reservoirs, State Scenic Rivers, or Exceptional Tennessee Waters.

For further information concerning Tennessee's general water quality criteria and Tennessee's Antidegradation Statement, including the definition of Exceptional Tennessee Water, see:

http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-03.pdf .

The geometric mean standard for the E. coli group of 126 colony forming units per 100 ml (CFU/100 ml) and the sample maximum of 487 CFU/100 ml have been selected as the appropriate numerical targets for TMDL development for Exceptional Tennessee Waters. The geometric mean standard for the E. coli group of 126 colony forming units per 100 ml (CFU/100 ml) and the sample maximum of 941 CFU/100 ml have been selected as the appropriate numerical targets for TMDL development for the other impaired waterbodies.

Table 2 Proposed Final 2010 303(d) List for E. coli Impaired Waterbodies – Nonconnah Creek Watershed

Waterbody ID	Impacted Waterbody	Miles/Acres Impaired	Cause (Pollutant)	Pollutant Source
TN08010211001 – 0100	HORN LAKE CUTOFF	16.4	Low Dissolved Oxygen Total Phosphorus Loss of biological integrity due to siltation Arsenic Escherichia coli	Discharges from MS4 Area
TN08010211001 – 1000	HORN LAKE CREEK (Mississippi River to Horn Lake Cutoff)	10.3	Low Dissolved Oxygen Loss of biological integrity due to siltation Escherichia coli	Discharges from MS4 Area
TN08010211001 – 2000	HORN LAKE CREEK (Horn Lake Cutoff to Mississippi stateline)	5.2	Low Dissolved Oxygen Loss of biological integrity due to siltation Arsenic Escherichia coli	Sources Outside of State Land Development
TN08010211007 – 1000	CYPRESS CREEK	18.2	Low Dissolved Oxygen Total Phosphorus Arsenic Escherichia coli	Discharges from MS4 Area
TN0801021100711 – 0200	CANE CREEK	7.2	Low Dissolved Oxygen Total Phosphorus Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization Collection System Failure
TN0801021100711 – 0300	BLACK BAYOU	7.9	Phosphate Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization
TN0801021100711 – 0400	TENMILE CREEK	13.3	Low Dissolved Oxygen Total Phosphorus Loss of biological integrity due to siltation Escherichia coli	Discharges from MS4 Area
TN0801021100711 – 0500	HURRICANE CREEK	13.3	Low Dissolved Oxygen Total Phosphorus Other anthropogenic substrate alterations Escherichia coli	Discharges from MS4 Area Industrial Stormwater Discharge Channelization
TN0801021100711 – 0600	DAYS CREEK	10.6	Total Phosphorus Other anthropogenic substrate alterations Escherichia coli	Discharges from MS4 Area Channelization

Table 2 (cont'd) Proposed Final 2010 303(d) List for E. coli Impaired Waterbodies – Nonconnah Creek Watershed

Waterbody ID	Impacted Waterbody	Miles/Acres Impaired	Cause (Pollutant)	Pollutant Source
TN0801021100711 – 1000	NONCONNAH CREEK (McKellar Lake to Cane Creek)	3.2	PCBs Dioxins Chlordane Total Phosphorus Loss of biological integrity due to siltation Physical Substrate Habitat Alterations Low Dissolved Oxygen Escherichia coli	Discharges from MS4 Area Contaminated Sediment Channelization
TN0801021100711 – 2000	NONCONNAH CREEK (Cane Creek to Hurricane Creek)	4.86	Total Phosphorus Loss of biological integrity due to siltation Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization
TN0801021100711 – 3000	NONCONNAH CREEK (Hurricane Creek to Johns Creek)	4.1	Loss of biological integrity due to siltation Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization
TN0801021100720 – 0100	UNNAMED TRIB TO NONCONNAH CREEK	3.91	Total Phosphorus Loss of biological integrity due to siltation Other Anthropogenic Habitat Alterations Escherichia coli	Discharges from MS4 Area
TN0801021100720 – 0200	UNNAMED TRIB TO NONCONNAH CREEK	4.02	Escherichia coli	Discharges from MS4 Area
TN0801021100720 – 0300	UNNAMED TRIB TO NONCONNAH CREEK	3.09	Total Phosphorus Loss of biological integrity due to siltation	Specialty Crop Production
TN0801021100720 – 0400	UNNAMED TRIB TO NONCONNAH CREEK	10.07	Total Phosphorus Loss of biological integrity due to siltation Escherichia coli	Sources Outside State Borders
TN0801021100720 – 0410	UNNAMED TRIB TO THE UNNAMED TRIB TO NONCONNAH CREEK	2.53	Low Dissolved Oxygen Total Phosphorus Loss of biological integrity due to siltation Escherichia coli	Pasture Grazing Sources Outside State Borders

Table 2 (cont'd) Proposed Final 2010 303(d) List for E. coli Impaired Waterbodies – Nonconnah Creek Watershed

Waterbody ID	Impacted Waterbody	Miles/Acres Impaired	Cause (Pollutant)	Pollutant Source
TN0801021100720 – 0500	UNNAMED TRIB TO NONCONNAH CREEK	8.93	Low Dissolved Oxygen Total Phosphorus Loss of biological integrity due to siltation Escherichia coli	Pasture Grazing Sources Outside State Borders
TN0801021100720 – 1000	NONCONNAH CREEK (Johns Creek to Winchester Rd)	8.3	Total Phosphorus Loss of biological integrity due to siltation Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization
TN0801021100720 – 2000	NONCONNAH CREEK (Winchester Rd to unnamed trib at Bailey Rd)	6.2	Loss of biological integrity due to siltation Physical Substrate Habitat Alterations Escherichia coli	Discharges from MS4 Area Land Development Channelization
TN0801021100720 – 3000	NONCONNAH CREEK (unnamed trib at Bailey Rd to headwaters)	6.5	Total Phosphorus Physical Substrate Habitat Alterations	Discharges from MS4 Area Nonirrigated Crop Production Channelization
TN08010211176 – 1000	JOHN'S CREEK	13.7	Total Phosphorus Loss of biological integrity due to siltation Other Anthropogenic Habitat Alterations Escherichia coli	Discharges from MS4 Area Channelization Collection System Failure

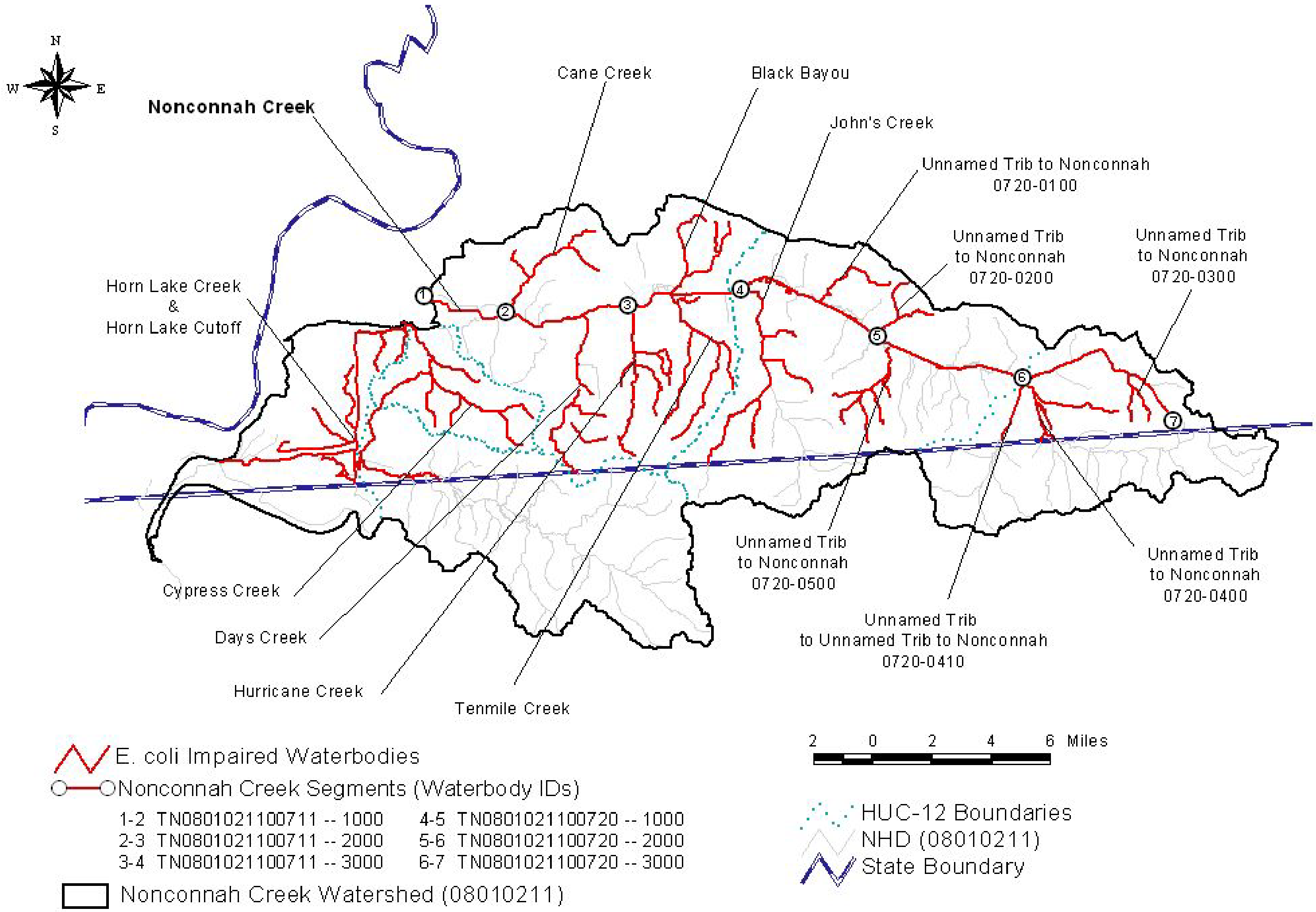

Figure 4. Waterbodies Impaired by E. Coli (as Documented on the Proposed Final 2010 303(d) List).

6.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

There are multiple water quality monitoring stations that provide data for HUC-12s containing waterbodies identified as impaired for E. coli in the Nonconnah Creek Watershed. Monitoring stations located on Exceptional Tennessee Waters have been italicized:

- HUC-12 08010211_0101:
  - NONCO025.2SH – Nonconnah Creek, at Byhalia Rd.
  - NONCO2T0.3SH – Trib to Nonconnah Creek, at Shelby Dr. just west of Reynolds Rd.
  - NONCO3T0.4SH – Trib to Nonconnah Creek, at Shelby Dr. east of Reynolds Rd.
  - NONCO3T1.4SH – Trib to Nonconnah Creek, at Holmes Rd. east of Reynolds Rd.
  - NONCO6T0.3SH – Trib to Nonconnah Creek, at East Shelby Dr.
- HUC-12 08010211_0102:
  - JOHNS000.5SH – John's Creek, at American Way Rd. crossing
  - JOHNS003.6SH – John's Creek, at Raines Rd.
  - JOHNS006.6SH – John's Creek, at Holmes Rd.
  - NONCO011.85SH – Nonconnah Creek, at Perkins Rd. crossing
  - NONCO012.1SH – Nonconnah Creek, at Thousand Oaks, north of American Way
  - NONCO014.0SH – Nonconnah Creek, Old Ridgeway-Hickory Hill Rd. bridge crossing
  - NONCO017.0SH – Nonconnah Creek, at Winchester Rd.
  - NONCO020.9SH – Nonconnah Creek, at Forest Hill-Irene Rd.
  - NONCO1T0.9SH – Trib to Nonconnah Creek, at Barnstable Rd. (Lowrance Rd.)
  - NONCO4T0.5SH – Trib to Nonconnah Creek, at Quince Rd. west of Kirby
  - NONCO5T0.1SH – Trib to Nonconnah Creek, at Quince Rd. north of Winchester
- HUC-12 08010211_0103:
  - BLACK000.2SH – Black Bayou, at Getwell Service Rd.
  - BLACK001.1SH – Black Bayou, at Dunn Rd.
  - CANE000.6SH – Cane Creek, at railroad crossing near P&B Company on Prospect Street
  - CANE001.4SH – Cane Creek, u/s Mallory Ave. in Pine Hills Municipal Golf Course, Memphis
  - CANE002.8SH – Cane Creek, at Ragan Street
  - DAYS000.5SH – Days Creek, at Directors Row
  - HURRI000.4SH – Hurricane Creek, at Democrat Rd.
  - HURRI002.6SH – Hurricane Creek, at Runway Rd.
  - HURRI003.8SH – Hurricane Creek, at Shelby Dr.

  - NONCO001.8SH – Nonconnah Creek, at Rivergate Rd.
  - NONCO006.9SH – Nonconnah Creek, at Nonconnah Blvd.
  - TMILE000.1SH – Tenmile Creek, at American Way
- HUC-12 08010211_0201:
  - *CCSOU001.1SH – Cypress Creek, at Weaver Rd.*
  - *CCSOU002.9SH – Cypress Creek, at Levi Rd.*
  - *CCSOU004.0SH – Cypress Creek, east of Horn Lake Rd. in the adjacent park*
  - *CCSOU004.7SH – Cypress Creek, at Byron Rd.*
  - *CCSOU1T0.6SH – Trib to Cypress Creek, at Weaver Rd.*
  - *CCSOU2T0.2SH – Trib to Cypress Creek, at Levi Rd.*
  - *CCSOU3T0.6SH – Trib to Cypress Creek, at McCorkle Rd.*
- HUC-12 08010211_0301:
  - HLAKE004.0SH – Horn Lake Creek, at Weaver Rd.
- HUC-12 08010211_0302:
  - HLAKE000.0SH – Horn Lake Creek, at Lower Levee Rd., lower section of creek
  - *HLCUT000.0SH – Horn Lake Cutoff, west of Shelby Dr., NW of Robco Lake*

The location of these monitoring stations is shown in Figure 5. Water quality monitoring results for these stations are tabulated in Appendix B.

Examination of the data shows exceedances of the 487 CFU/100 mL maximum E. coli standard and 941 CFU/100 mL maximum E. coli standard at most monitoring stations. Water quality monitoring results for those stations with 10% or more of samples exceeding water quality maximum criteria are summarized in Table 3. Whenever a minimum of 5 samples was collected at a given monitoring station over a period of not more than 30 consecutive days, the geometric mean was calculated.

Table 3 Summary of Water Quality Monitoring Data

Monitoring Station	Date Range	E. Coli (Max WQ Target = 941 CFU/100 mL)[a]				
		Data Pts.	Min. [CFU/100 ml]	Avg. [CFU/100 ml]	Max. [CFU/100 ml]	No. Exceed. WQ Max. Target
BLACK000.2SH	2006 – 2007	20	10	5,036	24,196	17
BLACK001.1SH	2001 – 2003	8	80.8	7,526	24,192	7
CANE000.6SH	1999 – 2007	25	40	2,439	24,196	11
CANE001.4SH	2007	5	46	1,353	3,873	2
CANE002.8SH	2001 – 2007	8	270	3,975	5,794	6
CCSOU001.1SH [b]	*2001 – 2007*	*57*	*16.9*	*2,560*	*38,730*	*29*
CCSOU002.9SH [b]	*2001 – 2006*	*47*	*20*	*8,451*	*241,920*	*25*
CCSOU004.0SH [b]	*2001 – 2006*	*57*	*10.9*	*41,074*	*1,986,300*	*35*
CCSOU004.7SH [b]	*2001 – 2005*	*11*	*309*	*2,839*	*8,000*	*10*
CCSOU1T0.6SH [b]	*2001 – 2006*	*31*	*3*	*2,684*	*34,360*	*12*
CCSOU2T0.2SH [b]	*2001 – 2006*	*46*	*20*	*4,047*	*57,940*	*31*
CCSOU3T0.6SH	*2001*	*2*	*2,419.2*	*6,112*	*9,804*	*2*
DAYS000.5SH [b]	1999 – 2009	136	1	2,477	80,000	51
HLAKE000.0SH	1999 – 2006	28	37	541	2,909	5
HLAKE004.0SH	1998 – 2006	27	0	767	5,475	7
HLCUT000.0SH	*1999 – 2006*	*24*	*0*	*328*	*1,700*	*6*
HURRI000.4SH [b]	1999 – 2009	120	1	3,635	80,000	37
HURRI002.6SH	2001 – 2003	8	20	4,317	24,192	5
HURRI003.8SH	2006 – 2007	10	16	2,212	15,531	2
JOHNS000.5SH [b]	1999 – 2009	135	1	3,271	80,000	56
JOHNS003.6SH	2001 – 2003	8	512	2,879	9,208	7
NONCO001.8SH [b]	1998 – 2009	147	1	2,463	80,000	57

Table 3 (cont'd) Summary of TDEC Water Quality Monitoring Data

Monitoring Station	Date Range	E. Coli (Max WQ Target = 941 CFU/100 mL)[a]				
		Data Pts.	Min. [CFU/100 ml]	Avg. [CFU/100 ml]	Max. [CFU/100 ml]	No. Exceed. WQ Max. Target
NONCO006.9SH [b]	1998 – 2009	138	1	2,392	80,000	46
NONCO011.85SH	1998 – 1999	3	1,299.7	2,046	2,419.2	3
NONCO012.1SH [b]	2000 – 2009	110	1	3,420	80,000	42
NONCO014.0SH	1998 – 1999	3	33.7	1,624	2,419.2	2
NONCO017.0SH	2001 – 2007	24	1	889	5,475	7
NONCO020.9SH [b]	1998 – 2009	138	1	1,467	80,000	24
NONCO025.2SH	2001 – 2007	18	1	619	4,360	3
NONCO1T0.9SH	2001 – 2007	27	28	1,168	6,500	11
NONCO2T0.3SH	2001 – 2007	26	20	1,269	13,000	8
NONCO3T0.4SH	2006 – 2007	15	4	2,869	20,000	4
NONCO3T1.4SH	2001 – 2003	5	21.2	2,614	8,664	3
NONCO4T0.5SH	2006 – 2007	13	31	626	2,400	3
NONCO5T0.1SH	2006 – 2007	13	10	1,342	6,867	5
NONCO6T0.3SH	2006 – 2007	12	10	281	1,300	1
TENMI000.1SH	1999 – 2007	14	56.5	4,138	24,196	8

[a] Maximum water quality target is 487 CFU/100 mL for lakes, reservoirs, State Scenic Rivers, or Exceptional Tennessee Waters waterbodies and 941 CFU/100 mL for other waterbodies. Waterbodies utilizing the 487 CFU/100 mL target are italicized.

[b] Includes Memphis monitoring data for MS4 permit.

Several of the water quality monitoring stations (Table 3 and Appendix B) have at least one E. coli sample value reported as >2419. For the purpose of calculating summary data statistics, TMDLs, Waste Load Allocations (WLAs), and Load Allocations (LAs), these data values are treated as (equal to) 2419. Therefore, the calculated results are considered to be estimates. Future E. coli sample analyses at these sites should follow established protocol. See Section 9.4.

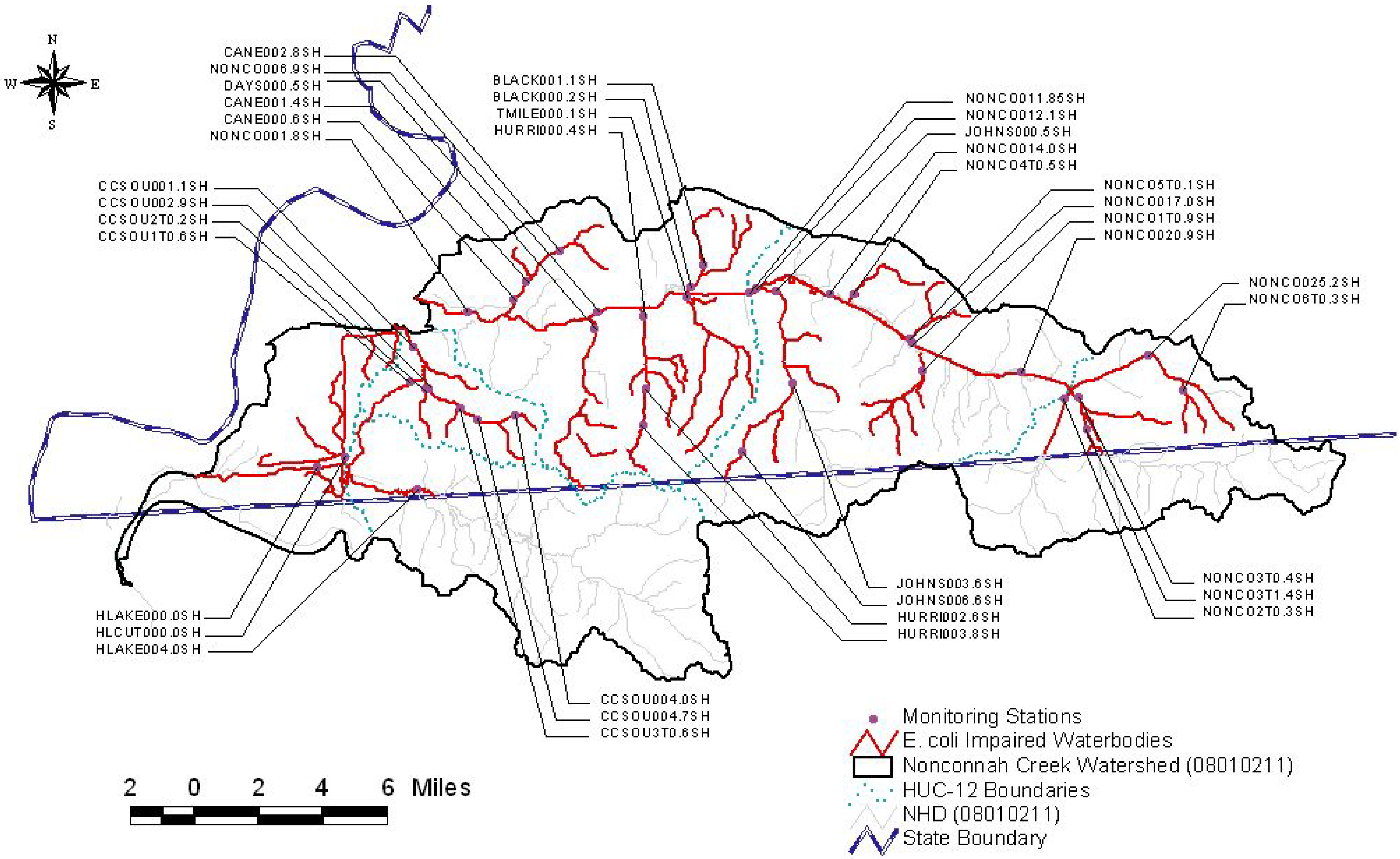

Figure 5. Water Quality Monitoring Stations in the Nonconnah Creek Watershed

7.0 SOURCE ASSESSMENT

An important part of TMDL analysis is the identification of individual sources, or source categories of pollutants in the watershed that affect pathogen loading and the amount of loading contributed by each of these sources.

Under the Clean Water Act, sources are classified as either point or nonpoint sources. Under 40 CFR §122.2, (http://www.epa.gov/epacfr40/chapt-I.info/chi-toc.htm), 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 (http://cfpub1.epa.gov/npdes/index.cfm) regulates point source discharges. Point sources can be described by three broad categories: 1) NPDES regulated municipal (http://cfpub1.epa.gov/npdes/home.cfm?program_id=13) and industrial (http://cfpub1.epa.gov/npdes/home.dfm?program_id=14) wastewater treatment facilities (WWTFs); 2) NPDES regulated industrial and municipal storm water discharges (http://cfpub1.epa.gov/npdes/home.cfm?program_id=6); and 3) NPDES regulated Concentrated Animal Feeding Operations (CAFOs) (http://cfpub1.epa.gov/npdes/home.cfm?program_id=7)). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES regulated point sources. Nonpoint sources are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. For the purposes of this TMDL, all sources of pollutant loading not regulated by NPDES permits are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

7.1 Point Sources

7.1.1 NPDES Regulated Municipal and Industrial Wastewater Treatment Facilities

Both treated and untreated sanitary wastewater contain coliform bacteria. There are 2 WWTFs in the Nonconnah Creek Watershed that have NPDES permits authorizing the discharge of treated sanitary wastewater. The facility located in Mississippi discharges directly to Nonconnah Creek, while the facility in Tennessee does not. There are also 2 WWTFs outside of the Nonconnah Creek Watershed that have collection systems that may extend into the Nonconnah Creek Watershed. (See Figure 6.) The permit limits for discharges from most WWTFs in Tennessee are in accordance with the coliform criteria specified in Tennessee Water Quality Standards for the protection of the recreation use classification.

Non-permitted point sources of (potential) E. coli contamination of surface waters associated with STP collection systems include leaking collection systems (LCSs) and sanitary sewer overflows (SSOs).

> *Note: As stated in Section 5.0, the current coliform criteria are expressed in terms of E. coli concentration, whereas previous criteria were expressed in terms of fecal coliform and E. coli concentration. Due to differences in permit issuance dates, some permits still have fecal coliform limits instead of E. coli. As permits are reissued, limits for fecal coliform will be replaced by E. coli limits.*

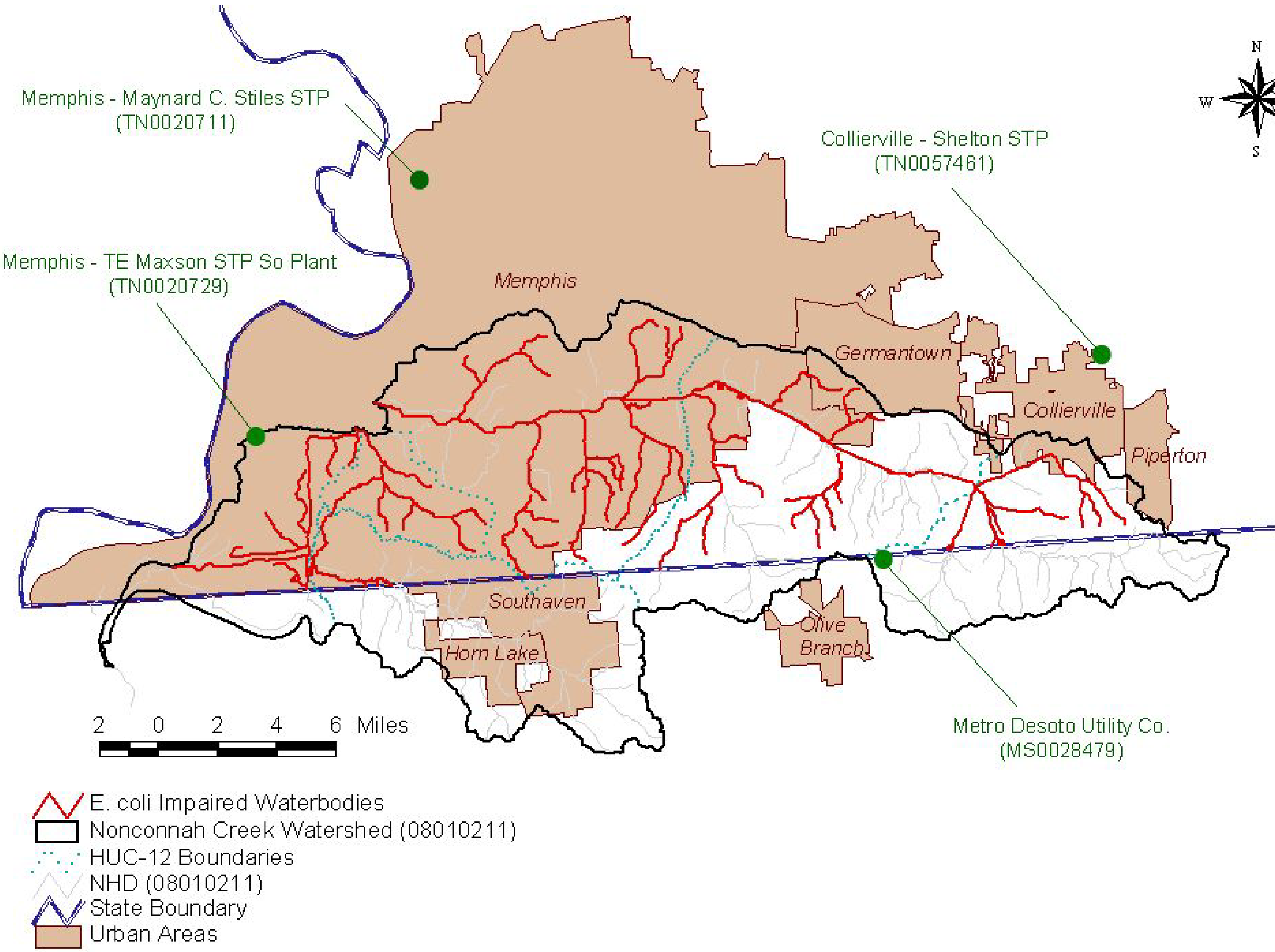

Figure 6. NPDES Regulated Point Sources in and near Impaired Subwatersheds and Drainage Areas of the Nonconnah Creek Watershed.

Table 4 NPDES Permitted WWTFs with Collection Systems Serving Impaired Subwatersheds or Drainage Areas

NPDES Permit No.	Facility	Design Flow [MGD]	Receiving Stream
TN0020711	Memphis – Maynard C. Stiles STP	135	Mississippi River @ mile 738.8
TN0020729	Memphis – TE Maxson STP So. Plant	90	Mississippi River @ mile 725
TN0057461	Collierville – Shelton STP	3.5	Wolf River @ mile 30.9
MS0028479	Metro Desoto Utility Co.	0.537	Nonconnah Creek

7.1.2 NPDES Regulated Municipal Separate Storm Sewer Systems (MS4s)

Municipal Separate Storm Sewer Systems (MS4s) are considered to be point sources of E. coli. Discharges from MS4s occur in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. Phase I of the EPA storm water program (http://cfpub.epa.gov/npdes/stormwater/swphases.cfm#phase1) requires large and medium MS4s to obtain NPDES storm water permits. Large and medium MS4s are those located in incorporated places or counties serving populations greater than 100,000 people. At present, Memphis (TNS068276) is the only MS4 of this size in the Nonconnah Creek Watershed.

As of March 2003, regulated small MS4s in Tennessee must also obtain NPDES permits in accordance with the Phase II storm water program (http://cfpub.epa.gov/npdes/stormwater/swphases.cfm#phase2). A small MS4 is designated as *regulated* if: a) it is located within the boundaries of a defined urbanized area that has a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile; b) it is located outside of an urbanized area but within a jurisdiction with a population of at least 10,000 people, a population density of 1,000 people per square mile, and has the potential to cause an adverse impact on water quality; or c) it is located outside of an urbanized area but contributes substantially to the pollutant loadings of a physically interconnected MS4 regulated by the NPDES storm water program. Most regulated small MS4s in Tennessee obtain coverage under the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (http://state.tn.us/environment/wpc/ppo/TN%20Small%20MS4%20Modified%20General%20Permit%202003.pdf) (TDEC, 2003). At present, Collierville (TN0075230), Germantown (TN0075337), and Shelby County (TN0075663) MS4s, which discharge into the Nonconnah Creek watershed, are covered under Phase II of the NPDES Storm Water Program.

The Tennessee Department of Transportation (TDOT) has been issued an individual MS4 permit (TNS077585) that authorizes discharges of storm water runoff from State roads and interstate highway right-of-ways that TDOT owns or maintains, discharges of storm water runoff from TDOT owned or operated facilities, and certain specified non-storm water discharges. This permit covers all eligible TDOT discharges statewide, including those located outside of urbanized areas. TDOT's individual MS4 permit may be obtained from the Tennessee Department of Environment and Conservation (TDEC) website: http://state.tn.us/environment/wpc/stormh2o/TNS077585.pdf .

For information regarding storm water permitting in Tennessee, see the TDEC website:

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

7.1.3 NPDES Concentrated Animal Feeding Operations (CAFOs)

Animal feeding operations (AFOs) are agricultural enterprises where animals are kept and raised in confined situations. AFOs congregate animals, feed, manure and urine, dead animals, and production operations on a small land area. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures, fields, or on rangeland (USEPA, 2002a). Concentrated Animal Feeding Operations (CAFOs) are AFOs that meet certain criteria with respect to animal type, number of animals, and type of manure management system. CAFOs are considered to be potential point sources of pathogen loading and are required to obtain an NPDES permit. Most CAFOs in Tennessee obtain coverage under TNA000000, *Class II Concentrated Animal Feeding Operation General Permit* (http://state.tn.us/environment/wpc/programs/cafo/CAFO_GP_04.pdf), while larger Class I CAFOs are required to obtain an individual NPDES permit. As of April 1, 2011, there are no Class I CAFOs with individual permits or Class II CAFOs with coverage under the general NPDES permit located in the Nonconnah Creek Watershed.

7.2 Nonpoint Sources

Nonpoint sources of coliform bacteria are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of coliform bacteria on land surfaces and wash off as a result of storm events. Nonpoint sources of E. coli loading are primarily associated with agricultural and urban land uses. The vast majority of waterbodies identified on the Proposed Final 2010 303(d) List as impaired due to E. coli are attributed to nonpoint agricultural or urban sources.

7.2.1 Wildlife

Wildlife deposit coliform bacteria, with their feces, onto land surfaces where it can be transported during storm events to nearby streams. The overall deer density for Tennessee was estimated by the Tennessee Wildlife Resources Agency (TWRA) to be 23 animals per square mile.

7.2.2 Agricultural Animals

Agricultural activities can be a significant source of coliform bacteria loading to surface waters. The activities of greatest concern are typically those associated with livestock operations:

- Agricultural livestock grazing in pastures deposit manure containing coliform bacteria onto land surfaces. This material accumulates during periods of dry weather and is available for washoff and transport to surface waters during storm events. The number of animals in pasture and the time spent grazing are important factors in determining the loading contribution.

- Processed agricultural manure from confined feeding operations is often applied to land surfaces and can provide a significant source of coliform bacteria loading. Guidance for issues relating to manure application is available through the University of Tennessee Agricultural Extension Service and the Natural Resources Conservation Service (NRCS).

Agricultural livestock and other unconfined animals often have direct access to waterbodies and can provide a concentrated source of coliform bacteria loading directly to a stream.

Data sources related to livestock operations include the 2007 Census of Agriculture (http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Tennessee/index.asp). Livestock data for counties located within the Nonconnah Creek Watershed are summarized in Table 5. Note that, due to confidentiality issues, any tabulated item that identifies data reported by a respondent or allows a respondent's data to be accurately estimated or derived is suppressed and coded with a 'D' (USDA, 2009).

Table 5 Livestock Distribution in the Nonconnah Creek Watershed

County	Livestock Population (2007 Census of Agriculture)							
	Beef Cow	Milk Cow	Poultry		Hogs	Sheep	Goats	Horse
			Layers	Broilers				
Fayette	12,833	151	790	15	(D)	180	337	2,626
Shelby	(D)	(D)	606	70	42	107	649	1,975

* In keeping with the provisions of Title 7 of the United States Code, no data are published in the 2007 Census of Agriculture that would disclose information about the operations of an individual farm or ranch. Any tabulated item that identifies data reported by a respondent or allows a respondent's data to be accurately estimated or derived is suppressed and coded with a 'D' (USDA, 2009).

7.2.3 Failing Septic Systems

Some of the coliform loading in the Nonconnah Creek Watershed can be attributed to failure of septic systems and illicit discharges of raw sewage. Estimates from 1997 county census data of people in the Nonconnah Creek Watershed utilizing septic systems were compiled using the WCS and are summarized in Table 6. In western Tennessee, it is estimated that there are approximately 2.51 people per household on septic systems, some of which can be reasonably assumed to be failing. As with livestock in streams, discharges of raw sewage provide a concentrated source of coliform bacteria directly to waterbodies.

Table 6 Estimated Population on Septic Systems in the Nonconnah Creek Watershed

County	Total Population (2000 Census)	Total Population (1990 Census)	% of Population on Septic Systems (1990 Census)
Fayette	28,806	25,559	70.1
Shelby	897,465	826,330	0.25

7.2.4 Urban Development

Nonpoint source loading of coliform bacteria from urban land use areas is attributable to multiple sources. These include: stormwater runoff, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. Impervious surfaces in urban areas allow runoff to be conveyed to streams quickly, without interaction with soils and groundwater. Urban land use area in impaired subwatersheds in the Nonconnah Creek Watershed ranges from 8% to 83%. Land use for the Nonconnah Creek impaired drainage areas is summarized in Figures 7 and 8 and tabulated in Appendix A.

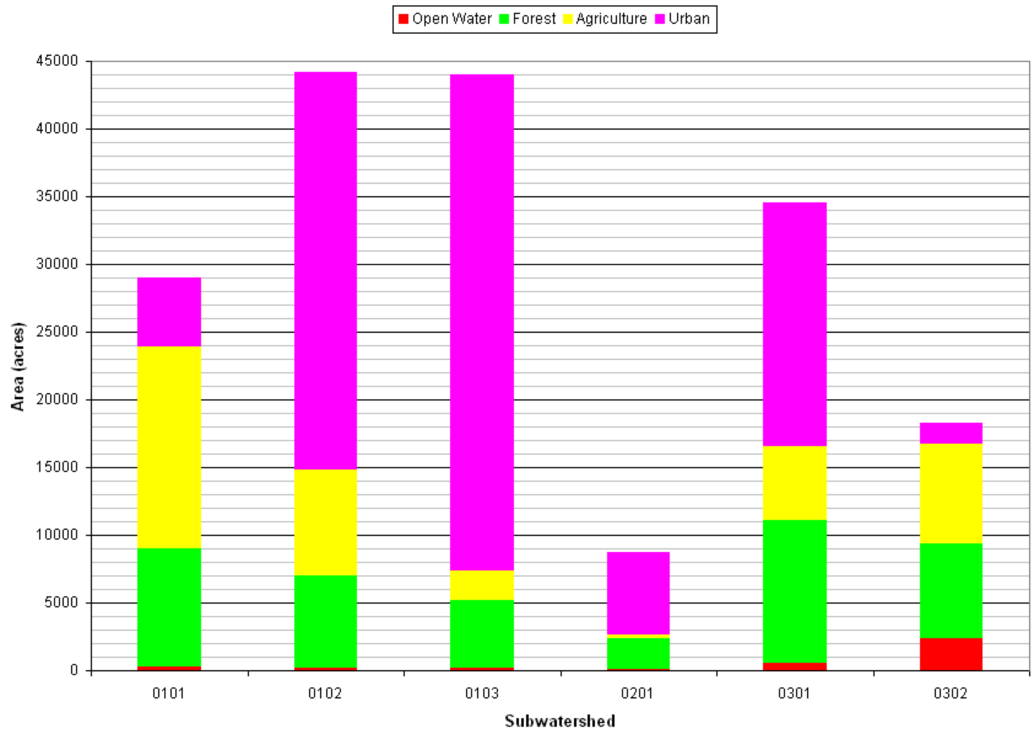

Figure 7. Land Use Area of Nonconnah Creek E. coli-Impaired Subwatersheds

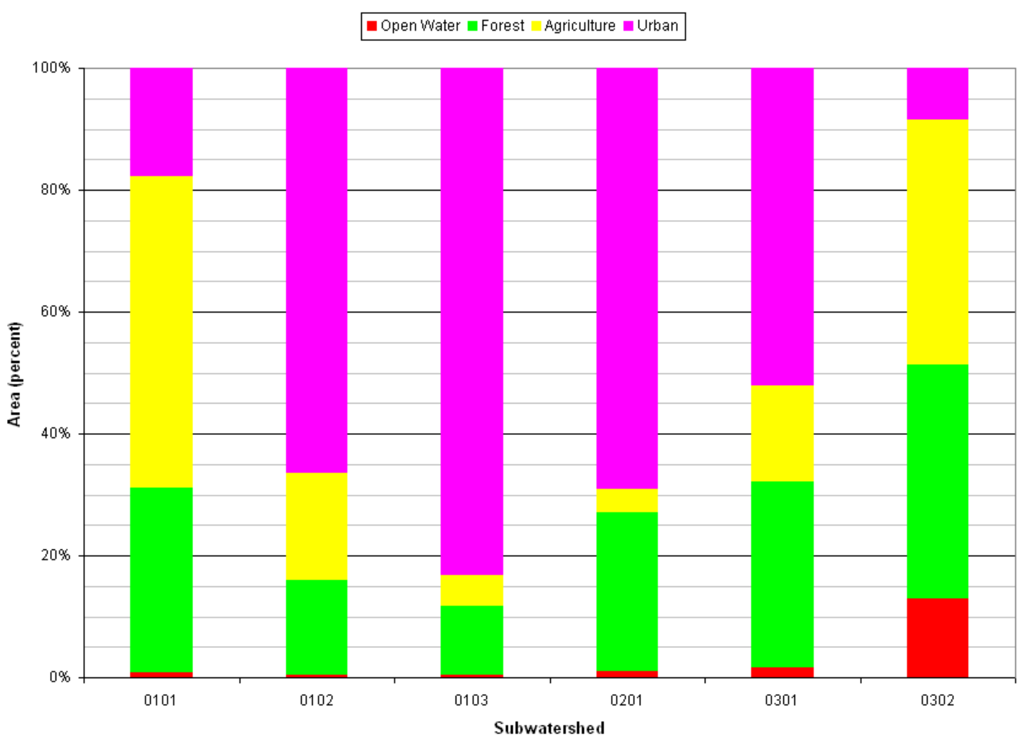

Figure 8. Land Use Percent of the Nonconnah Creek E. coli-Impaired Subwatersheds

8.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOADS

The Total Maximum Daily Load (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) that 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) (http://www.epa.gov/epacfr40/chapt-I.info/chi-toc.htm) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

This document describes TMDL, Waste Load Allocation (WLA), Load Allocation (LA), and Margin of Safety (MOS) development for waterbodies identified as impaired due to E. coli on the Proposed Final 2010 303(d) list. As part of the process of developing TMDLs, all monitoring data for the Nonconnah Creek Watershed was compiled. Several waterbodies not listed as impaired due to E. coli but located in HUC-12 subwatersheds containing waterbodies listed as impaired were also investigated. Whenever analysis of monitoring data suggested possible impairment, TMDLs were developed for these non-listed waterbodies.

8.1 Expression of TMDLs, WLAs, & LAs

In this document, the E. coli TMDL is a daily load expressed as a function of mean daily flow (daily loading function). For implementation purposes, corresponding percent load reduction goals (PLRGs) to decrease E. coli loads to TMDL target levels, within each respective flow zone, are also expressed. WLAs & LAs for precipitation-induced loading sources are also expressed as daily loading functions in CFU/day/acre. Allocations for loading that is independent of precipitation (WLAs for WWTFs and LAs for “other direct sources”) are expressed as CFU/day.

8.2 Area Basis for TMDL Analysis

The primary area unit of analysis for TMDL development was the HUC-12 subwatershed containing one or more waterbodies assessed as impaired due to E. coli (as documented on the Proposed Final 2010 303(d) List).

8.3 TMDL Analysis Methodology

TMDLs for the Nonconnah Creek Watershed were developed using load duration curves for analysis of impaired HUC-12 subwatersheds or specific waterbody drainage areas. A load duration curve (LDC) is a cumulative frequency graph that illustrates existing water quality conditions (as represented by loads calculated from monitoring data), how these conditions compare to desired targets, and the portion of the waterbody flow zone represented by these existing loads. Load duration curves are considered to be well suited for analysis of periodic monitoring data collected by grab sample. LDCs were developed at monitoring site locations in impaired waterbodies and daily loading functions were expressed for TMDLs, WLAs, LAs, and MOS. In addition, load reductions (PLRGs) for each flow zone were calculated for prioritization of implementation measures according to the methods described in Appendix E.

8.4 Critical Conditions and Seasonal Variation

The critical condition for non-point source E. coli loading is an extended dry period followed by a rainfall runoff event. During the dry weather period, E. coli bacteria builds up on the land surface, and is washed off by rainfall. The critical condition for point source loading occurs during periods of low streamflow when dilution is minimized. Both conditions are represented in the TMDL analyses.

The twelve-year period from January 1, 1998 to December 31, 2009 was used to simulate flow. This 12-year period contained a range of hydrologic conditions that included both low and high streamflows. Critical conditions are accounted for in the load duration curve analyses by using the entire period of flow and water quality data available for the impaired waterbodies.

In the Nonconnah Creek Watershed, water quality data have been collected during most flow ranges. For each subwatershed, the critical flow zone has been identified based on the incremental levels of impairment relative to the target loads. Based on the location of the water quality exceedances on the load duration curves and the distribution of critical flow zones, no one delivery mode for E. coli appears to be dominant for waterbodies in the Nonconnah Creek Watershed (see Section 9.1.2 and 9.1.3).

Seasonal variation was incorporated in the load duration curves by using the entire simulation period and all water quality data collected at the monitoring stations.

8.5 Margin of Safety

There are two methods for incorporating MOS in TMDL analysis: a) implicitly incorporate the MOS using conservative model assumptions; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For development of pathogen TMDLs in the Nonconnah Creek Watershed, an explicit MOS, equal to 10% of the E. coli water quality targets (ref.: Section 5.0), was utilized for determination of WLAs and LAs:

Instantaneous Maximum (lakes, reservoirs, State Scenic Rivers, or Exceptional Tennessee Waters waterbodies):	MOS = 49 CFU/100 ml
Instantaneous Maximum (all other waterbodies):	MOS = 94 CFU/100 ml
30-Day Geometric Mean:	MOS = 13 CFU/100 ml

8.6 Determination of TMDLs

E. coli daily loading functions were calculated for impaired segments in the Nonconnah Creek Watershed using LDCs to evaluate compliance with the single maximum target concentrations according to the procedure in Appendix C. These TMDL loading functions for impaired segments and subwatersheds are shown in Table 7.

8.7 Determination of WLAs & LAs

WLAs for MS4s and LAs for precipitation induced sources of E. coli loading were determined according to the procedures in Appendix C. These allocations represent the available loading after application of the explicit MOS. WLAs for existing WWTFs are equal to their existing NPDES permit limits. Since WWTF permit limits require that E. coli concentrations must comply with water quality criteria (TMDL targets) at the point of discharge (with few exceptions in Tennessee) and recognition that loading from these facilities are generally small in comparison to other loading sources, further reductions were not considered to be warranted. WLAs for CAFOs and LAs for “other direct sources” (non-precipitation induced) are equal to zero. WLAs & LAs are summarized in Table 7.

Table 7. TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0101	Nonconnah Creek	TN0801021100720 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.428 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.967 \times 10^{7} \times Q$	$1.967 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.482 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to the Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0410	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$
0102	John's Creek	TN08010211176 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.254 \times 10^{6} \times Q$	$1.254 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$
		TN0801021100720 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$
		TN0801021100720 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0100	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.032 \times 10^{7} \times Q$	$1.032 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.466 \times 10^{7} \times Q$	$1.466 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$7.359 \times 10^{6} \times Q$	$7.359 \times 10^{6} \times Q$
0103	Black Bayou	TN0801021100711 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.670 \times 10^{6} \times Q$	$4.670 \times 10^{6} \times Q$
	Cane Creek	TN0801021100711 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.235 \times 10^{6} \times Q$	$4.235 \times 10^{6} \times Q$
	Days Creek	TN0801021100711 – 0600	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.481 \times 10^{6} \times Q$	$3.481 \times 10^{6} \times Q$
	Hurricane Creek	TN0801021100711 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.221 \times 10^{6} \times Q$	$4.221 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$
		TN0801021100711 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$
	Tenmile Creek	TN0801021100711 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.646 \times 10^{6} \times Q$	$3.646 \times 10^{6} \times Q$

Table 7 (cont'd). TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0201	Cypress Creek	TN08010211007 – 1000	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.424 \times 10^{6} \times Q$	$1.424 \times 10^{6} \times Q$
0301	Horn Lake Creek	TN08010211001 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$7.080 \times 10^{5} \times Q$	$7.080 \times 10^{5} \times Q$
0302	Horn Lake Creek	TN08010211001 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.554 \times 10^{5} \times Q$	$5.554 \times 10^{5} \times Q$
	Horn Lake Cutoff	TN08010211001 – 0100	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.604 \times 10^{6} \times Q$	$1.604 \times 10^{6} \times Q$

Notes: NA = Not Applicable.
Q = Mean Daily In-stream Flow (cfs).

a. WLAs for WWTFs are expressed as E. coli loads (CFU/day). All current and future WWTFs must meet water quality standards as specified in their NPDES permit.
b. Applies to any MS4 discharge loading in the subwatershed. Future MS4s will be assigned waste load allocations (WLAs) consistent with load allocations (LAs) assigned to precipitation induced nonpoint sources.

9.0 IMPLEMENTATION PLAN

The TMDLs, WLAs, and LAs developed in Section 8 are intended to be the first phase of a long-term effort to restore the water quality of impaired waterbodies in the Nonconnah Creek Watershed through reduction of excessive E. coli loading. Adaptive management methods, within the context of the State's rotating watershed management approach, will be used to modify TMDLs, WLAs, and LAs as required to meet water quality goals.

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. Successful implementation relies on participation at the federal, state, local and non-governmental levels.

9.1 Application of Load Duration Curves for Implementation Planning

The Load Duration Curve (LDC) methodology (Appendix C) is a form of water quality analysis and presentation of data that aids in guiding implementation by targeting management strategies for appropriate flow conditions. One of the strengths of this method is that it can be used to interpret possible delivery mechanisms of E. coli by differentiating between point and non-point source problems. The load duration curve analysis can be utilized for implementation planning. See Cleland (2003) for further information on duration curves and TMDL development, and: http://www.tmdls.net/tipstools/docs/TMDLsCleland.pdf .

9.1.1 Flow Zone Analysis for Implementation Planning

A major advantage of the duration curve framework in TMDL development is the ability to provide meaningful connections between allocations and implementation efforts (USEPA, 2006). Because the flow duration interval serves as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree), allocations and reduction goals can be linked to source areas, delivery mechanisms, and the appropriate set of management practices. The use of duration curve zones (e.g., high flow, moist, mid-range, dry, and low flow) allows the development of allocation tables (USEPA, 2006) (Appendix E), which can be used to guide potential implementation actions to most effectively address water quality concerns.

For the purposes of implementation strategy development, available E. coli data are grouped according to flow zones, with the number of flow zones determined by the HUC-12 subwatershed or drainage area size, the total contributing area (for non-headwater HUC-12s), and/or the baseflow characteristics of the waterbody. In general, for drainage areas greater than 40 square miles, the duration curves will be divided into five zones (Figure 9): high flows (exceeded 0-10% of the time), moist conditions (10-40%), median or mid-range flows (40-60%), dry conditions (60-90%), and low flows (90-100%). For smaller drainage areas, flows occurring in the low flow zone (baseflow conditions) are often extremely low and difficult to measure accurately. In many small drainage areas, extreme dry conditions are characterized by zero flow for a significant percentage of time. For this reason, the low flow zone is best characterized as a broader range of conditions (or percent time) with subsequently fewer flow zones. Therefore, for most HUC-12 subwatershed drainage areas less than 40 square miles, the duration curves will be divided into four zones: high flows (exceeded 0-10% of the time), moist conditions (10-40%), median or mid-range flows (40-70%), and low flows (70-100%). Some small (<40 mi^2) waterbody drainage areas have sustained baseflow (no zero flows) throughout their period of record. For these waterbodies, the duration curves will be divided into five zones.

Given adequate data, results (allocations and percent load reduction goals) will be calculated for all flow zones; however, less emphasis is placed on the upper 10% flow range for pathogen (E. coli) TMDLs and implementation plans. The highest 10 percent flows, representing flood conditions, are considered non-recreational conditions: unsafe for wading and swimming. Humans are not expected to enter the water due to the inherent hazard from high depths and velocities during these flow conditions. As a rule of thumb, the *USGS Field Manual for the Collection of Water Quality Data* (Lane, 1997) advises its personnel not to attempt to wade a stream for which values of depth (ft) multiplied by velocity (ft/s) equal or exceed 10 ft^2/s to collect a water sample. Few observations are typically available to estimate loads under these adverse conditions due to the difficulty and danger of sample collection. Therefore, in general, the 0-10% flow range is beyond the scope of pathogen TMDLs and subsequent implementation strategies.

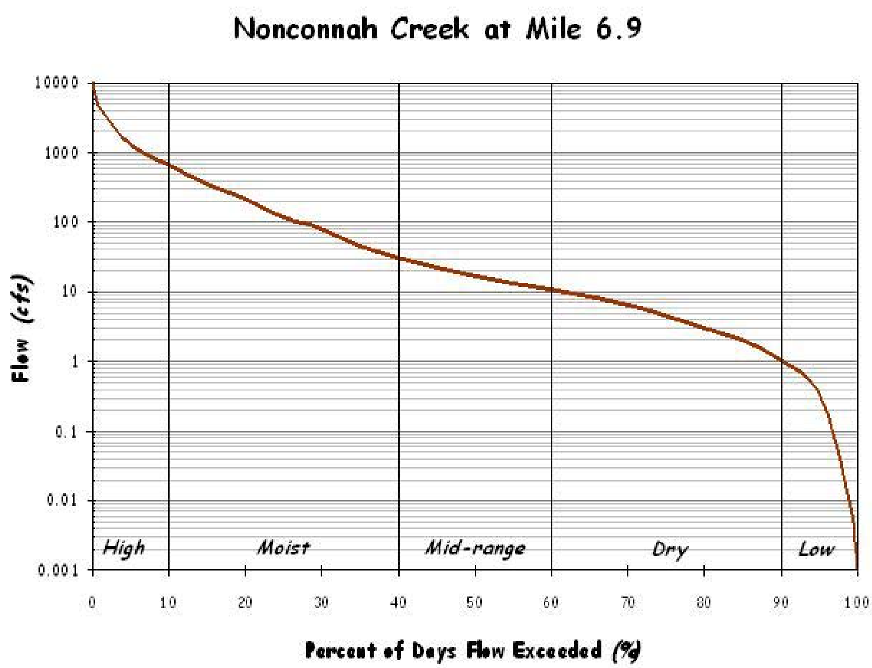

Figure 9. Five-Zone Flow Duration Curve for Nonconnah Creek at RM 6.9

9.1.2 Existing Loads and Percent Load Reductions

Each impaired waterbody has a characteristic set of pollutant sources and existing loading conditions that vary according to flow conditions. In addition, maximum allowable loading (assimilative capacity) of a waterbody varies with flow. Therefore, existing loading, allowable loading, and percent load reduction expressed at a single location on the LDC (for a single flow condition) do not appropriately represent the TMDL in order to address all sources under all flow conditions (i.e., at all times) to satisfy implementation objectives. The LDC approach provides a methodology for determination of assimilative capacity and existing loading conditions of a waterbody for each flow zone. Subsequently, each flow zone, and the sources contributing to impairment under the corresponding flow conditions, can be evaluated independently. Lastly, the critical flow zone (with the highest percent load reduction goal) and/or the highest percent of samples exceeding the TMDL target can be identified for prioritization of implementation actions.

Existing loading is calculated for each individual water quality sample as the product of the sample flow (cfs) times the single sample E. coli concentration (times a conversion factor). A percent load reduction is calculated for each water quality sample as that required to reduce the existing loading to the product of the sample flow (cfs) times the single sample maximum water quality standard (times a conversion factor). For samples with negative percent load reductions (non-exceedance: concentration below the single sample maximum water quality criterion), the percent reduction is assumed to be zero. The percent load reduction goal (PLRG) for a given flow zone is calculated as the mean of all the percent load reductions for a given flow zone. (See Appendix E.)

9.1.3 Critical Conditions

The critical condition for each impaired waterbody is defined as the flow zone with the largest PLRG and/or percent exceedance, excluding the “high flow” zone because these extremely high flows are not representative of recreational flow conditions, as described in Section 9.1.1. If the PLRG and/or percent exceedance in this zone is greater than all the other zones, the zone with the second highest PLRG and/or percent exceedance will be considered the critical flow zone. The critical conditions are such that if water quality standards were met under those conditions, they would likely be met overall.

9.2 Point Sources

9.2.1 NPDES Regulated Municipal and Industrial Wastewater Treatment Facilities

All present and future discharges from industrial and municipal wastewater treatment facilities are required to be in compliance with the conditions of their NPDES permits at all times, including elimination of bypasses and overflows. With few exceptions, in Tennessee, permit limits for treated sanitary wastewater require compliance with coliform water quality standards (ref: Section 5.0) prior to discharge. No additional reduction is required. WLAs for WWTFs are derived from facility design flows and permitted E. coli limits and are expressed as average loads in CFU per day.

9.2.2 NPDES Regulated Municipal Separate Storm Sewer Systems (MS4s)

For present and future regulated discharges from municipal separate storm sewer systems (MS4s), WLAs are and will be implemented through Phase I & II MS4 permits. These permits will require the development and implementation of a Storm Water Management Program (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. Both the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003) and the TDOT individual MS4 permit (TNS077585) require SWMPs to include minimum control measures. The permits also contain requirements regarding control of discharges of pollutants of concern into impaired waterbodies, implementation of provisions of approved TMDLs, and descriptions of methods to evaluate whether storm water controls are adequate to meet the requirements of approved TMDLs.

For guidance on the six minimum control measures for MS4s regulated under Phase I or Phase II, a series of fact sheets are available at: http://cfpub1.epa.gov/npdes/stormwater/swfinal.cfm?program_id=6 .

For further information on Tennessee's *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems*, see: http://state.tn.us/environment/wpc/ppo/TN%20Small%20MS4%20Modified%General%20Permit%202003.pdf .

In order to evaluate SWMP effectiveness and demonstrate compliance with specified WLAs, MS4s must develop and implement appropriate monitoring programs. An effective monitoring program could include:

- Effluent monitoring at selected outfalls that are representative of particular land uses or geographical areas that contribute to pollutant loading before and after implementation of pollutant control measures.
- Analytical monitoring of pollutants of concern (e.g., monthly) in receiving waterbodies, both upstream and downstream of MS4 discharges, over an extended period of time. In addition, intensive collection of pollutant monitoring data during the recreation season (June – September) at sufficient frequency to support calculation of the geometric mean.

When applicable, the appropriate Division of Water Pollution Control Environmental Field Office should be consulted for assistance in the determination of monitoring strategies, locations, frequency, and methods within 12 months after the approval date of TMDLs or designation as a regulated MS4. Details of the monitoring plans and monitoring data should be included in annual reports required by MS4 permits.

9.2.3 NPDES Regulated Concentrated Animal Feeding Operations (CAFOs)

WLAs provided to most CAFOs will be implemented through NPDES Permit No. TNA000000, General NPDES Permit for *Class II Concentrated Animal Feeding Operation* or the facility's individual permit. Provisions of the general permit include development and implementation of Nutrient Management Plan (NMPs), requirements regarding land application BMPs, and requirements for CAFO liquid waste management systems. For further information, see: http://state.tn.us/environment/wpc/permits/cafo.shtml.

9.3 Nonpoint Sources

The Tennessee Department of Environment & Conservation has no direct regulatory authority over most nonpoint source (NPS) discharges. Reductions of E. coli loading from nonpoint sources will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired waters. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. There are links to a number of publications and information resources on EPA's Nonpoint Source Pollution web page (http://www.epa.gov/owow/nps/pubs.html) relating to the implementation and evaluation of nonpoint source pollution control measures.

Local citizen-led and implemented management measures have the potential to provide the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. An excellent example of stakeholder involvement is the Cumberland River Compact. The Cumberland River Compact is a non-profit group made up of businesses, individuals, community organizations, and agencies working in the Cumberland River watershed. Members of the Compact work with educators, landowners, contractors, marinas and other interested groups to coordinate informational education programs that encourage all of us to be better stewards of our water resources. The Compact works with local, state and federal agencies and officials to promote and strengthen cooperative working relationships and encourage the development of reliable, easy-to-understand data about water quality. Members of the Compact work with local communities to develop watershed forums where citizens come together to learn more about their watershed and participate in developing a shared vision for the future. The Compact also serves as a clearing-house of available public education programs to landowner assistance. Information regarding the accomplishments of the Cumberland River Compact is available at their website:

http://www.cumberlandrivercompact.org/.

9.3.1 Urban Nonpoint Sources

Management measures to reduce pathogen loading from urban nonpoint sources are similar to those recommended for MS4s (Sect. 9.2.2). Specific categories of urban nonpoint sources include stormwater, illicit discharges, septic systems, pet waste, and wildlife:

Stormwater: Most mitigation measures for stormwater are not designed specifically to reduce bacteria concentrations (ENSR, 2005). Instead, BMPs are typically designed to remove sediment and other pollutants. Bacteria in stormwater runoff are, however, often attached to particulate matter. Therefore, treatment systems that remove sediment may also provide reductions in bacteria concentrations.

Illicit discharges: Removal of illicit discharges to storm sewer systems, particularly of sanitary wastes, is an effective means of reducing pathogen loading to receiving waters (ENSR, 2005). These include intentional illegal connections from commercial or residential buildings, failing septic systems, and improper disposal of sewage from campers and boats.

Septic systems: When properly installed, operated, and maintained, septic systems effectively reduce pathogen concentrations in sewage. To reduce the release of pathogens, practices can be employed to maximize the life of existing systems, identify failed systems, and replace or remove failed systems (USEPA, 2005a). Alternatively, the installation of public sewers may be appropriate.

Pet waste: If the waste is not properly disposed of, these bacteria can wash into storm drains or directly into water bodies and contribute to pathogen impairment. Encouraging pet owners to properly collect and dispose of pet waste is the primary means for reducing the impact of pet waste (USEPA, 2002b).

Wildlife: Reducing the impact of wildlife on pathogen concentrations in waterbodies generally requires either reducing the concentration of wildlife in an area or reducing their proximity to the waterbody (ENSR, 2005). The primary means for doing this is to eliminate human inducements for congregation. In addition, in some instances population control measures may be appropriate.

Two additional urban nonpoint source resource documents provided by EPA are:

National Management Measures to Control Nonpoint Source Pollution from Urban Areas (http://www.epa.gov/owow/nps/urbanmm/index.html) helps citizens and municipalities in urban areas protect bodies of water from polluted runoff that can result from everyday activities. The scientifically sound techniques techniques it presents are among the best practices known today. The guidance will also help states to implement their nonpoint source control programs and municipalities to implement their Phase II Storm Water Permit Programs (Publication Number EPA 841-B-05-004, November 2005).

The Use of Best Management Practices (BMPs) in Urban Watersheds (http://www.epa.gov/nrmrl/pubs/600r04184/600r04184chap1.pdf) is a comprehensive literature review on commonly used urban watershed Best Management Practices (BMPs) that heretofore was not consolidated. The purpose of this document is to serve as an information source to individuals and agencies/municipalities/watershed management groups/etc. on the existing state of BMPs in urban stormwater management (Publication Number EPA/600/R-04/184, September 2004).

9.3.2 Agricultural Nonpoint Sources

BMPs have been utilized in the Nonconnah Creek Watershed to reduce the amount of coliform bacteria transported to surface waters from agricultural sources. These BMPs (e.g., animal waste management systems, waste utilization, stream stabilization, fencing, heavy use area treatment, livestock exclusion, etc.) may have contributed to reductions in in-stream concentrations of coliform bacteria in one or more Nonconnah Creek Watershed E. coli-impaired subwatersheds during the TMDL evaluation period. The Natural Resources Conservation Service (NRCS) keeps a database of BMPs implemented in Tennessee. Those listed in the Nonconnah Creek Watershed are shown in Figure 10. It is recommended that additional information (e.g., livestock access to streams, manure application practices, etc.) be provided and evaluated to better identify and quantify agricultural sources of coliform bacteria loading in order to minimize uncertainty in future modeling efforts.

It is further recommended that additional BMPs be implemented and monitored to document performance in reducing coliform bacteria loading to surface waters from agricultural sources. Demonstration sites for various types of BMPs should be established and maintained, and their performance (in source reduction) evaluated over a period of at least two years prior to recommendations for utilization for subsequent implementation. E. coli sampling and monitoring are recommended during low-flow (baseflow) and storm periods at sites with and without BMPs and/or before and after implementation of BMPs.

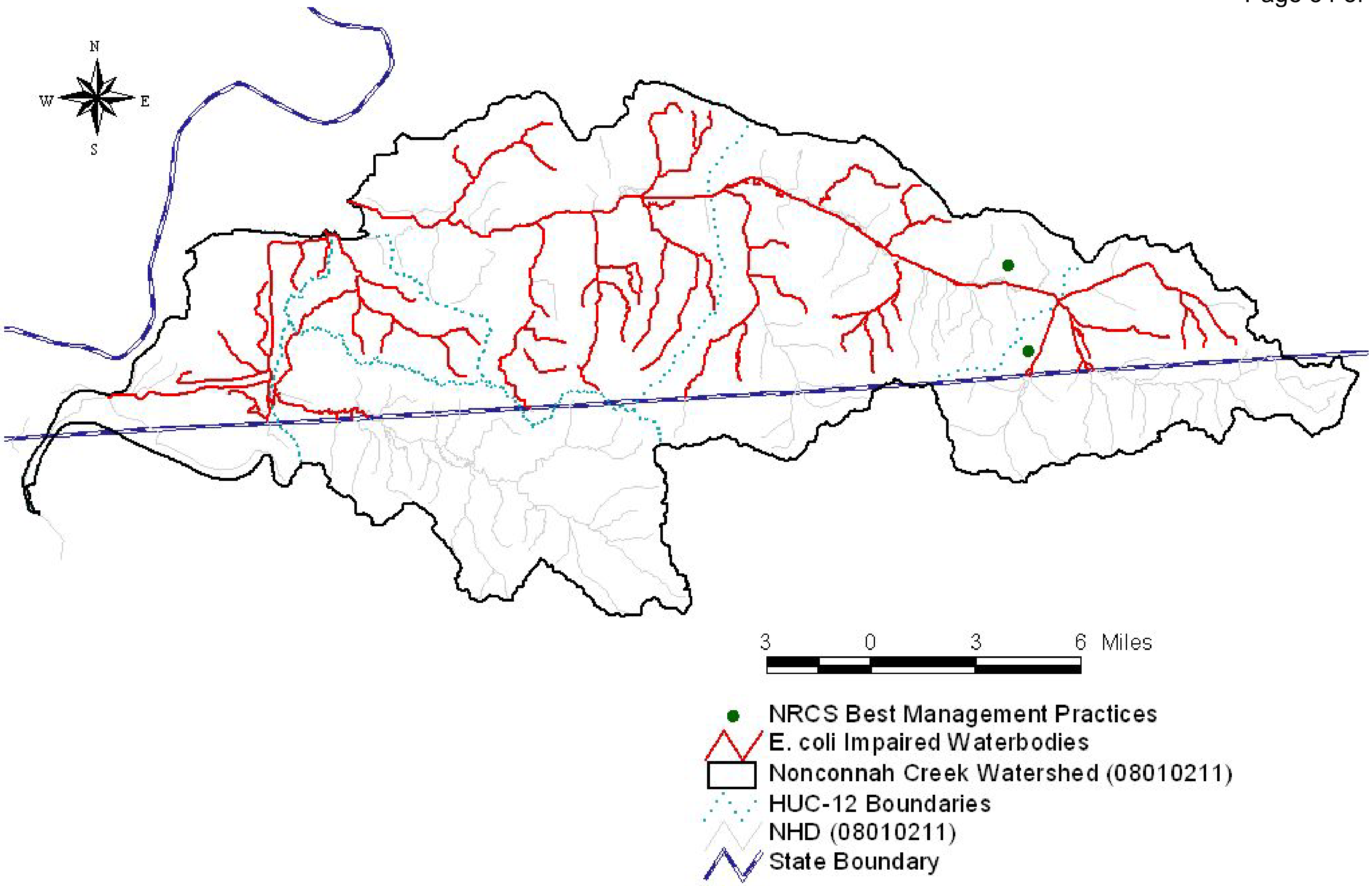

Figure 10. NRCS Best Management Practices located in the Nonconnah Creek Watershed.

For additional information on agricultural BMPs in Tennessee, see: http://state.tn.us/agriculture/nps/bmpa.ntml .

An additional agricultural nonpoint source resource provided by EPA is *National Management Measures to Control Nonpoint Source Pollution from Agriculture* (http://www.epa.gov/owow/nps/agmm/index.html): a technical guidance and reference document for use by State, local, and tribal managers in the implementation of nonpoint source pollution management programs. It contains information on the best available, economically achievable means of reducing pollution of surface and groundwater from agriculture (EPA 841-B-03-004, July 2003).

9.3.3 Other Nonpoint Sources

Additional nonpoint source references (not specifically addressing urban and/or agricultural sources) provided by EPA include:

National Management Measures to Control Nonpoint Source Pollution from Forestry (http://www.epa.gov/owow/nps/forestrymgmt/) helps forest owners protect lakes and streams from polluted runoff that can result from forestry activities. These scientifically sound techniques are the best practices known today. The report will also help states to implement their nonpoint source control programs (EPA 841-B-05-001, May 2005).

In addition, the EPA website, http://www.epa.gov/owow/nps/bestnpsdocs.html , contains a list of guidance documents endorsed by the Nonpoint Source Control Branch at EPA headquarters. The list includes documents addressing urban, agriculture, forestry, marinas, stream restoration, nonpoint source monitoring, and funding.

9.4 Additional Monitoring

Additional monitoring and assessment activities are recommended to determine whether implementation of TMDLs, WLAs, & LAs in tributaries and upstream reaches will result in achievement of in-stream water quality targets for E. coli.

9.4.1 Water Quality Monitoring

Activities recommended for the Nonconnah Creek Watershed:

- Verify the assessment status of stream reaches identified on the Proposed Final 2010 303(d) List as impaired due to E. coli. TMDLs will be revisited on 5-year watershed cycle as described above.
- Evaluate the effectiveness of implementation measures (see Sect. 9.6). Includes BMP performance analysis and monitoring by permittees and stakeholders. Where required TMDL loading reduction has been fully achieved, adequate data to support delisting should be collected.
- Provide additional data to clarify status of ambiguous sites (e.g., geometric mean data) for potential listing. Analyses of existing data at several monitoring sites on unlisted waterbodies in the Nonconnah Creek watershed suggest levels of impairment. Therefore,

additional data are required for listing determination.
Continue ambient (long-term) monitoring at appropriate sites and key locations.

Comprehensive water quality monitoring activities include sampling during all seasons and a broad range of flow and meteorological conditions. In addition, collection of E. coli data at sufficient frequency to support calculation of the geometric mean, as described in Tennessee's General Water Quality Criteria (TDEC, 2007), is encouraged. Finally, for individual monitoring locations, where historical E. coli data are greater than 1000 colonies/100 mL (or future samples are anticipated to be), a 1:100 dilution should be performed as described in Protocol A of the *Quality System Standard Operating Procedure for Chemical and Bacteriological Sampling of Surface Water* (TDEC, 2004).

9.4.2 Source Identification

An important aspect of E. coli load reduction activities is the accurate identification of the actual sources of pollution. In cases where the sources of E. coli impairment are not readily apparent, Microbial Source Tracking (MST) is one approach to determining the sources of fecal pollution and E. coli affecting a waterbody. Those methods that use bacteria as target organisms are also known as Bacterial Source Tracking (BST) methods. This technology is recommended for source identification in E. coli impaired waterbodies.

Bacterial Source Tracking is a collective term used for various emerging biochemical, chemical, and molecular methods that have been developed to distinguish sources of human and non-human fecal pollution in environmental samples (Shah, 2004). In general, these methods rely on genotypic (also known as "genetic fingerprinting"), or phenotypic (relating to the physical characteristics of an organism) distinctions between the bacteria of different sources. Three primary genotypic techniques are available for BST: ribotyping, pulsed field gel electrophoresis (PFGE), and polymerase chain reaction (PCR). Phenotypic techniques generally involve an antibiotic resistance analysis (Hyer, 2004).

The USEPA has published a fact sheet that discusses BST methods and presents examples of BST application to TMDL development and implementation (USEPA, 2002b). Various BST projects and descriptions of the application of BST techniques used to guide implementation of effective BMPs to remove or reduce fecal contamination are presented. The fact sheet can be found on the following EPA website: http://www.epa.gov/owm/mtb/bacsortk.pdf.

A multi-disciplinary group of researchers at the University of Tennessee, Knoxville (UTK) has developed and tested a series of different microbial assay methods based on real-time PCR to detect fecal bacterial concentrations and host sources in water samples (Layton, 2006). The assays have been used in a study of fecal contamination and have proven useful in identification of areas where cattle represent a significant fecal input and in development of BMPs. It is expected that these types of assays could have broad applications in monitoring fecal impacts from Animal Feeding Operations, as well as from wildlife and human sources. Additional information can be found on the following UTK website: http://web.utk.edu/~hydro/JournalPapers/Layton06AEM.pdf .

BST technology was utilized in a study conducted in Stock Creek (Little River watershed) (Layton, 2004). Microbial source tracking using real-time PCR assays to quantify *Bacteroides* 16S rRNA genes was used to determine the percent of fecal contamination attributable to cattle. E. coli loads attributable to cattle were calculated for each of nine sampling sites in the Stock Creek subwatershed on twelve sampling dates. At the site on High Bluff Branch (tributary to Stock Creek), none of the sample dates had E. coli loads attributable to cattle above the threshold. This suggests that at this site removal of E. coli attributable to cattle would have little impact on the total E. coli loads. The E. coli load attributable to cattle made a large contribution to the total E. coli load at each of the eight remaining sampling sites. At two of the sites (STOCK005.3KN and GHOLL000.6KN), 50–75% of the E. coli attributable to cattle loads alone was above the 126 CFU/100mL threshhold. This suggests that removal of the E. coli attributable to cattle at these sites would reduce the total E. coli load to acceptable limits.

The City of Memphis conducted a Microbial Source Tracking Study for South Cypress Creek, in the Nonconnah Creek watershed (Lawrence, 2003), to identify fecal sources in an urban watershed. The Institute for Environmental Health (IEH), in Seattle, WA, assisted with the project and conducted ribotyping on E. coli strains from fecal coliform samples. In addition, a library of known sources was supplemented with local data by the collection of scat samples for better matching of bacteria sources. The results indicated that human sources (including raw sewage) accounted for less than 20% of the total occurrences of E. coli from fecal samples. Avian and wild animal sources were the primary sources of fecal contributions to South Cypress Creek. The report can be found at the following websites: http://www.cityofmemphis.org/pdf_forms/MicrobialSourceTrackingStudy.pdf and http://www.cityofmemphis.org/pdf_forms/MicrobialSourceTrackingStudyFigures.pdf.

9.5 Source Area Implementation Strategy

Implementation strategies are organized according to the dominant landuse type and the sources associated with each (Table 8 and Appendix E). Each HUC-12 subwatershed is grouped and targeted for implementation based on this source area organization. Three primary categories are identified: predominantly urban, predominantly agricultural, and mixed urban/agricultural. See Appendix A for information regarding landuse distributation of impaired subwatersheds. For the purpose of implementation evaluation, urban is defined as residential, commercial, and industrial landuse areas with predominant source categories such as point sources (WWTFs), collection systems/septic systems (including SSOs and CSOs), and urban stormwater runoff associated with MS4s. Agricultural is defined as cropland and pasture, with predominant source categories associated with livestock and manure management activities. A fourth category (infrequent) is associated with forested (including non-agricultural undeveloped and unaltered [by humans]) landuse areas with the predominant source category being wildlife.

All impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas have been classified according to their respective source area types in Table 8. The implementation for each area will be prioritized according to the guidance provided in Sections 9.5.1 and 9.5.2, below. For all impaired waterbodies, the determination of source area types serves to identify the predominant sources contributing to impairment (i.e., those that should be targeted initially for implementation). However, it is not intended to imply that sources in other landuse areas are not contributors to impairment and/or to grant an exemption from addressing other source area contributions with implementation strategies and corresponding load reduction. For mixed use areas, implementation will follow the guidance established for both urban and agricultural areas, at a minimum.

Appendix E provides source area implementation examples for urban and agricultural subwatersheds, development of percent load reduction goals, and determination of critical flow zones (for implementation prioritization) for E. coli impaired waterbodies. Load duration curve analyses (TMDLs, WLAs, LAs, and MOS) and percent load reduction goals for all flow zones for all E. coli impaired waterbodies in the Nonconnah Creek Watershed are summarized in Table E-48.

Table 8. Source area types for waterbody drainage area analyses.

Waterbody Name	Source Area Type*			
	Urban	Agricultural	Mixed	Forested
Nonconnah Creek (720-3000)			ò	
UT2 (720-0410)		ò		
UT3 (720-0400)		ò		
UT6 (720-0300)		ò		
John's Creek	ò			
Nonconnah Creek (711-3000)	ò			
Nonconnah Creek (720-1000)	ò			
Nonconnah Creek (720-2000)	ò			
UT1 (720-0500)	ò			
UT4 (720-0100)	ò			
UT5 (720-0200)	ò			
Black Bayou	ò			
Cane Creek	ò			
Days Creek	ò			
Hurricane Creek	ò			
Nonconnah Creek (711-1000)	ò			
Nonconnah Creek (711-2000)	ò			
Tenmile Creek	ò			
Cypress Creek	ò			
Horn Lake Creek (001-2000)			ò	
Horn Lake Creek (001-1000)	ò			
Horn Lake Cutoff	ò			

* All waterbodies potentially have significant source contributions from other source type/landuse areas.

9.5.1 Urban Source Areas

For impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas classified as predominantly urban, implementation strategies for E. coli load reduction will initially and primarily target source categories similar to those listed in Table 9 (USEPA, 2006). Table 9 presents example urban area management practices and the corresponding potential relative effectiveness under each of the hydrologic flow zones. Each implementation strategy addresses a range of flow conditions and targets point sources, non-point sources, or a combination of each. For each waterbody, the existing loads and corresponding PLRG for each flow zone are calculated according to the method described in Section E.4. The resulting determination of the critical flow zone further focuses the types of urban management practices appropriate for development of an effective load reduction strategy for a particular waterbody.

Table 9. Example Urban Area Management Practice/Hydrologic Flow Zone Considerations.

Management Practice	Duration Curve Zone (Flow Zone)				
	High	Moist	Mid-Range	Dry	Low
Bacteria source reduction					
Remove illicit discharges			L	M	H
Address pet & wildlife waste		H	M	M	L
Combined sewer overflow management					
Combined sewer separation		H	M	L	
CSO prevention practices		H	M	L	
Sanitary sewer system					
Infiltration/Inflow mitigation	H	M	L	L	
Inspection, maintenance, and repair		L	M	H	H
SSO repair/abatement	H	M	L		
Illegal cross-connections					
Septic system management					
Managing private systems		L	M	H	M
Replacing failed systems		L	M	H	M
Installing public sewers		L	M	H	M
Storm water infiltration/retention					
Infiltration basin		L	M	H	
Infiltration trench		L	M	H	
Infiltration/Biofilter swale		L	M	H	
Storm Water detention					
Created wetland		H	M	L	

Table 9 (cont'd). Example Urban Area Management Practice/Hydrologic Flow Zone Considerations.

Management Practice	Duration Curve Zone (Flow Zone)				
	High	**Moist**	**Mid-Range**	**Dry**	**Low**
Low impact development					
Disconnecting impervious areas		L	M	H	
Bioretention	L	M	H	H	
Pervious pavement		L	M	H	
Green Roof		L	M	H	
Buffers		H	H	H	
New/existing on-site wastewater treatment systems					
Permitting & installation programs		L	M	H	M
Operation & maintenance programs		L	M	H	M
Other					
Point source controls		L	M	H	H
Landfill control		L	M	H	
Riparian buffers		H	H	H	
Pet waste education & ordinances		M	H	H	L
Wildlife management		M	H	H	L
Inspection & maintenance of BMPs	L	M	H	H	L

Note: Potential relative importance of management practice effectiveness under given hydrologic condition (*H: High, M: Medium, L: Low*)

9.5.2 Agricultural Source Areas

For impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas classified as predominantly agricultural, implementation strategies for E. coli load reduction will initially and primarily target source categories similar to those listed in Table 10 (USDA, 1988). Table 10 present example agricultural area management practices and the corresponding potential relative effectiveness under each of the hydrologic flow zones. Each implementation strategy addresses a range of flow conditions and targets point sources, non-point sources, or a combination of each. For each waterbody, the existing loads and corresponding PLRG for each flow zone are calculated according to the method described in Section E.4. The resulting determination of the critical flow zone further focuses the types of agricultural management practices appropriate for development of an effective load reduction strategy for a particular waterbody.

Table 10. Example Agricultural Area Management Practice/Hydrologic Flow Zone Considerations.

Flow Condition	High	Moist	Mid-range	Dry	Low
% Time Flow Exceeded	0-10	10-40	40-60	60-90	90-100
Grazing Management					
Prescribed Grazing (528A)	**H**	**H**	**M**	**L**	
Pasture & Hayland Mgmt (510)	**H**	**H**	**M**	**L**	
Deferred Grazing (352)	**H**	**H**	**M**	**L**	
Planned Grazing System (556)	**H**	**H**	**M**	**L**	
Proper Grazing Use (528)	**H**	**H**	**M**	**L**	
Proper Woodland Grazing (530)	**H**	**H**	**M**	**L**	
Livestock Access Limitation					
Livestock Exclusion (472)			**M**	**H**	**H**
Fencing (382)			**M**	**H**	**H**
Stream Crossing			**M**	**H**	**H**
Alternate Water Supply					
Pipeline (516)			**M**	**H**	**H**
Pond (378)			**M**	**H**	**H**
Trough or Tank (614)			**M**	**H**	**H**
Well (642)			**M**	**H**	**H**
Spring Development (574)			**M**	**H**	**H**
Manure Management					
Managing Barnyards	**H**	**H**	**M**	**L**	
Manure Transfer (634)	**H**	**H**	**M**	**L**	
Land Application of Manure	**H**	**H**	**M**	**L**	
Composting Facility (317)	**H**	**H**	**M**	**L**	
Vegetative Stabilization					
Pasture & Hayland Planting (512)	**H**	**H**	**M**	**L**	
Range Seeding (550)	**H**	**H**	**M**	**L**	
Channel Vegetation (322)	**H**	**H**	**M**	**L**	
Brush (& Weed) Mgmt (314)	**H**	**H**	**M**	**L**	

Table 10 (cont'd). Example Agricultural Area Management Practice/Hydrologic Flow Zone Considerations.

Flow Condition	High	Moist	Mid-range	Dry	Low
% Time Flow Exceeded	0-10	10-40	40-60	60-90	90-100
Vegetative Stabilization (cont'd)					
Conservation Cover (327)		**H**	**H**	**H**	
Riparian Buffers (391)		**H**	**H**	**H**	
Critical Area Planting (342)		**H**	**H**	**H**	
Wetland restoration (657)		**H**	**H**	**H**	
CAFO Management					
Waste Management System (312)	**H**	**H**	**M**		
Waste Storage Structure (313)	**H**	**H**	**M**		
Waste Storage Pond (425)	**H**	**H**	**M**		
Waste Treatment Lagoon (359)	**H**	**H**	**M**		
Mulching (484)	**H**	**H**	**M**		
Waste Utilization (633)	**H**	**H**	**M**		
Water & Sediment Control Basin (638)	**H**	**H**	**M**		
Filter Strip (393)	**H**	**H**	**M**		
Sediment Basin (350)	**H**	**H**	**M**		
Grassed Waterway (412)	**H**	**H**	**M**		
Diversion (362)	**H**	**H**	**M**		
Heavy Use Area Protection (561)					
Constructed Wetland (656)					
Dikes (356)	**H**	**H**	**M**		
Lined Waterway or Outlet (468)	**H**	**H**	**M**		
Roof Runoff Mgmt (558)	**H**	**H**	**M**		
Floodwater Diversion (400)	**H**	**H**	**M**		
Terrace (600)	**H**	**H**	**M**		
Potential for source area contribution under given hydrologic condition (H: High; M: Medium; L: Low)					

Note: Numbers in parentheses are the U.S. Soil Conservation Service practice number.

9.5.3 Forestry Source Areas

There are no impaired waterbodies with corresponding HUC-12 subwatersheds or drainage areas classified as source area type predominantly forested, with the predominant source category being wildlife, in the Nonconnah Creek Watershed.

9.6 Evaluation of TMDL Implementation Effectiveness

Evaluation of the effectiveness of TMDL implementation strategies should be conducted on multiple levels, as appropriate:

- HUC-12 or waterbody drainage area (i.e., TMDL analysis location)
- Subwatersheds or intermediate sampling locations
- Specific landuse areas (urban, pasture, etc.)
- Specific facilities (WWTF, CAFO, uniquely identified portion of MS4, etc.)
- Individual BMPs

In order to conduct an implementation effectiveness analysis on measures to reduce E. coli source loading, monitoring results should be evaluated in one of several ways. Sampling results can be compared to water quality standards (e.g., load duration curve analysis) for determination of impairment status, results can be compared on a before and after basis (temporal), or results can be evaluated both upstream and downstream of source reduction measures or source input (spatial). Considerations include period of record, data collection frequency, representativeness of data, and sampling locations.

In general, periods of record greater than 5 years (given adequate sampling frequency) can be evaluated for determination of relative change (trend analysis). For watersheds in second or successive TMDL cycles, data collected from multiple cycles can be compared. If implementation efforts have been initiated to reduce loading, evaluation of routine monitoring data may indicate improving or worsening conditions over time and corresponding effectiveness of implementation efforts. In the case of the Nonconnah Creek watershed, results of trend analysis were ambiguous or the change was minimal.

Water quality data for implementation effectiveness analysis can be presented in multiple ways. For example, Figure 11 shows best fit curve analyses (regressions) of flow (percent time exceeded) versus fecal coliform loading, for a historical (2002) TMDL analysis period versus a recent post-implementation period of sampling data (revised TMDL), for Oostanaula Creek at mile 28.4 (Hiwassee River watershed). The LDC of the single sample maximum water quality standard is also plotted to illustrate the relative degree of impairment for each period. Figure 12 shows a LDC analysis of fecal coliform loading statistics for Oostanaula Creek for the same two periods. In addition, the 90th percentiles for each flow zone are plotted for comparison. Lastly, Figure 13 shows fecal coliform concentration data statistics for recent versus historical data. The individual flow zone analyses are presented in a box and whisker plot of recent [2] versus historical [1] data. Note that Figures 11-13 present the same data, from approved TMDLs (2 cycles), each clearly illustrating improving conditions between historical and recent periods.

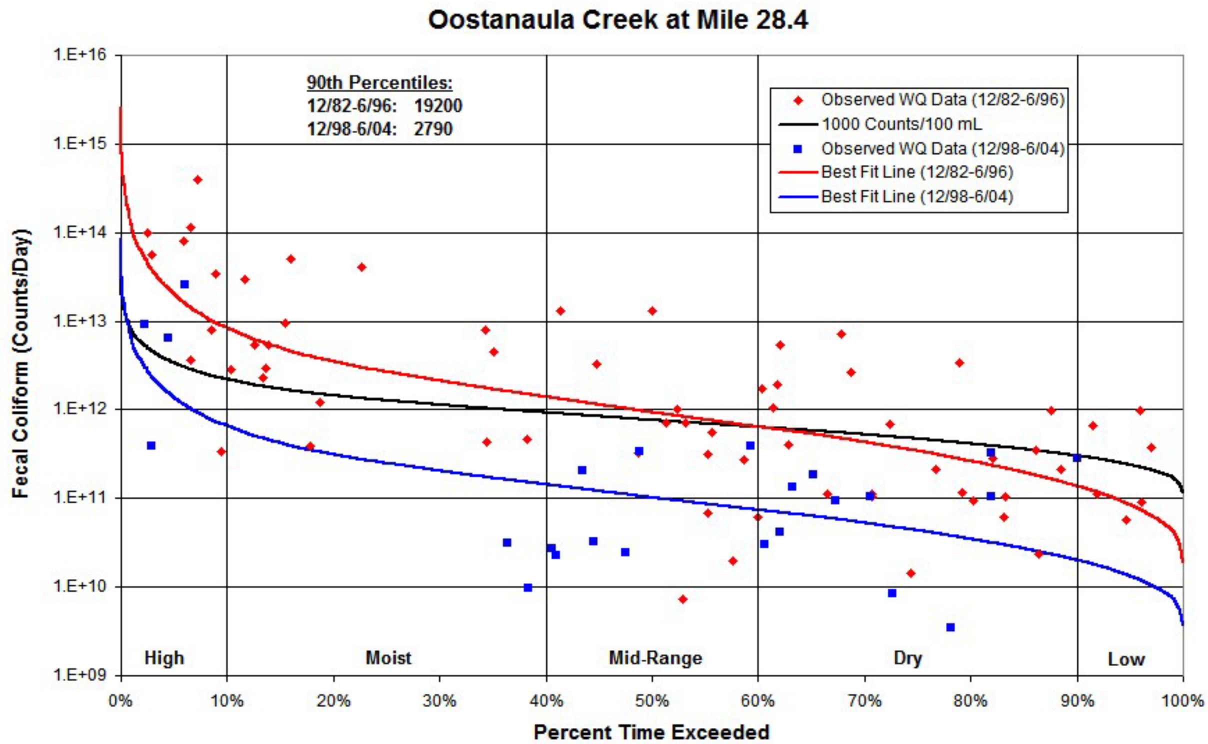

Figure 11. Oostanaula Creek TMDL implementation effectiveness (LDC regression analysis).

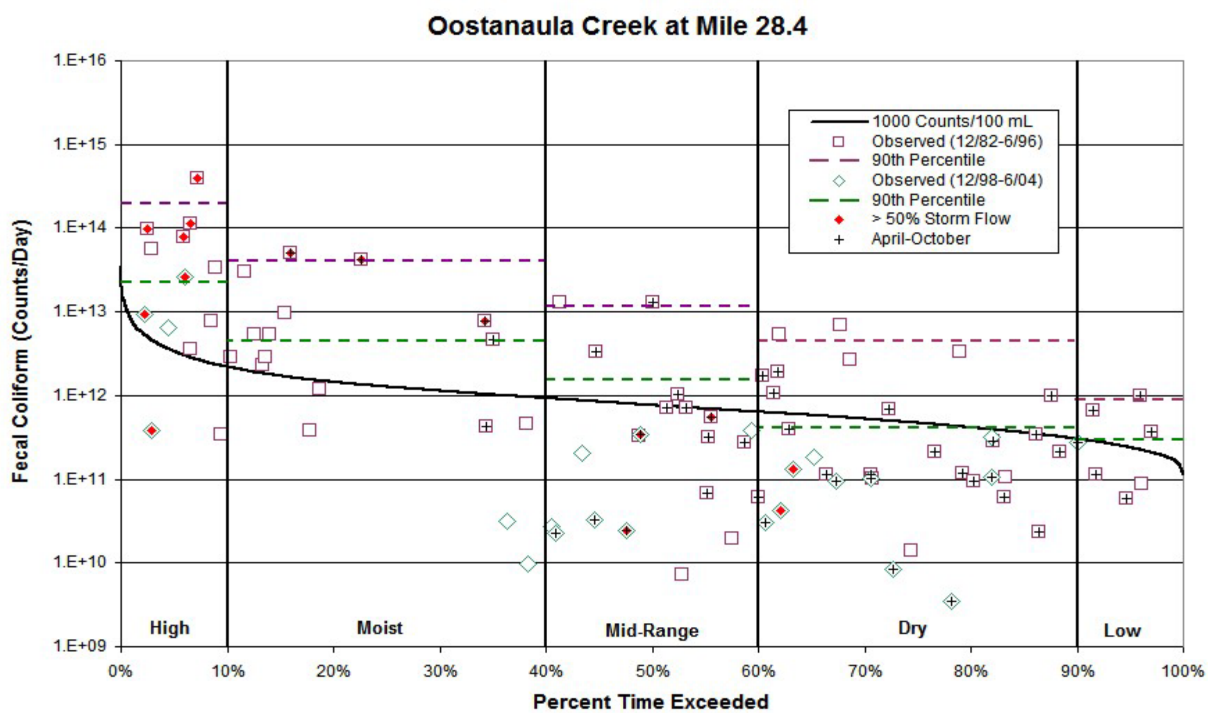

Figure 12. Oostanaula Creek TMDL implementation effectiveness (LDC analysis).

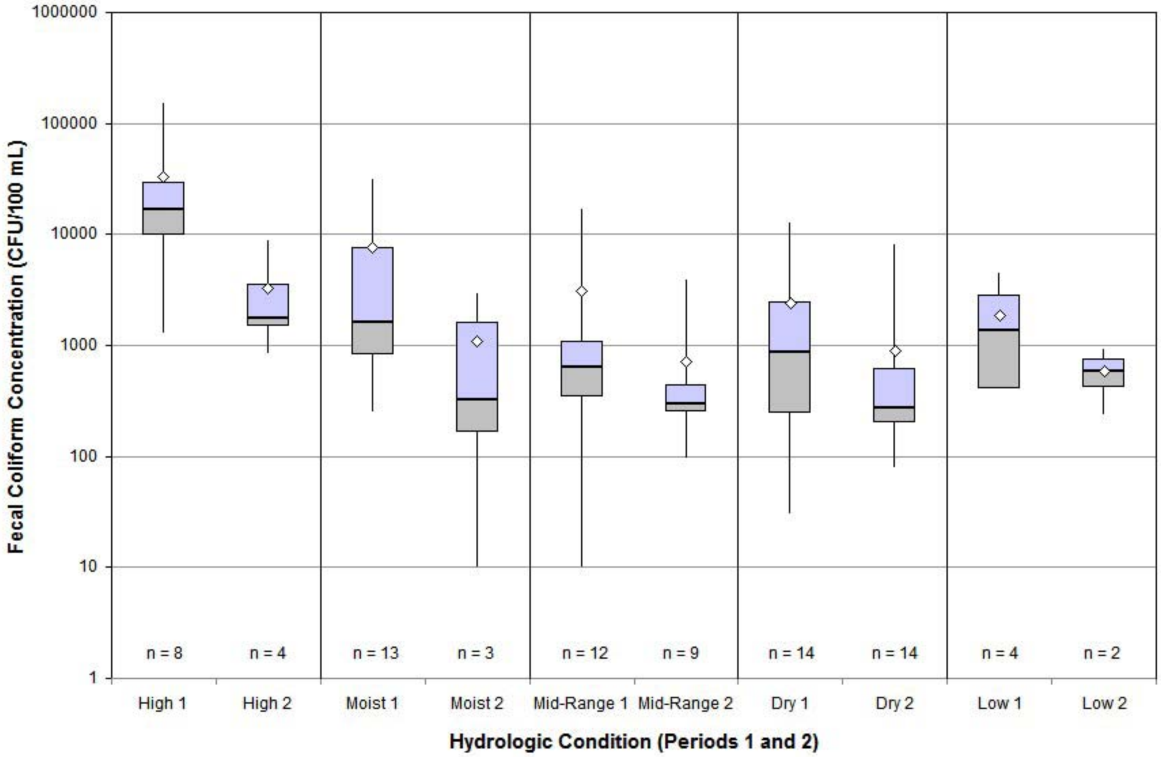

Figure 13. Oostanaula Creek TMDL implementation effectiveness (box and whisker plot).

10.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed pathogen TMDLs for the Nonconnah Creek Watershed were placed on Public Notice for a 35-day period and comments solicited. 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 announcement invited public and stakeholder comment and provided 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 which is sent to approximately 90 interested persons or groups who have requested this information.

3) Letters were sent to WWTFs located in E. coli-impaired subwatersheds or drainage areas in and near the Nonconnah Creek Watershed, permitted to discharge treated effluent containing pathogens, advising them of the proposed TMDLs and their availability on the TDEC website. The letters also stated that a copy of the draft TMDL document would be provided on request. A letter was sent to the following facilities:

   Memphis – Maynard C. Stiles STP (TN0020711)
   Memphis – TE Maxton STP So Plant (TN0020729)
   Collierville – Shelton STP (TN0057461)

4) A draft copy of the proposed TMDL was sent to those MS4s that are wholly or partially located in E. coli-impaired subwatersheds. A draft copy was sent to the following entities:

   Collierville (TNS075230)
   Germantown (TNS075337)
   Shelby County (TNS075663)
   City of Memphis MS4 (TNS068276)
   Tennessee Dept. of Transportation (TNS077585)

5) A letter was sent to water quality partners in the Nonconnah Creek Watershed advising them of the proposed pathogen TMDLs and their availability on the TDEC website. The letter also stated that a written copy of the draft TMDL document would be provided upon request. A letter was sent to the following partners:

   Natural Resources Conservation Service
   Tennessee Department of Agriculture
   Tennessee Wildlife Resources Agency
   The Nature Conservancy
   Tennessee Water Education Team

11.0 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 this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

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APPENDIX A

Land Use Distribution in the Nonconnah Creek Watershed

Table A-1. 2001 MRLC Land Use Distribution of Nonconnah Creek Subwatersheds

Land Use	Impaired Subwatershed (08010211____)					
	0101 (Nonconnah headwaters)		0102 (Nonconnah middle)		0103 (Nonconnah mouth)	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	232.2	0.80	185.4	0.42	158.3	0.36
Developed Open Space	2,069.5	7.13	9,481.6	21.48	12,152.3	27.63
Low Intensity Development	1,480.3	5.10	9,397.7	21.29	11,655.3	26.50
Medium Intensity Development	1,201.6	4.14	7,009.6	15.88	7,723.3	17.56
High Intensity Development	388.9	1.34	3,407.7	7.72	5,057.9	11.50
Bare Rock	2.9	0.01	4.4	0.01	4.4	0.01
Deciduous Forest	2,815.4	9.70	2,922.2	6.62	3,078.7	7.00
Evergreen Forest	1,039.1	3.58	481.1	1.09	211.1	0.48
Mixed Forest	287.3	0.99	225.1	0.51	224.3	0.51
Shrub/Scrub	2,295.9	7.91	1,748.0	3.96	791.7	1.80
Grassland/Herbaceous	75.5	0.26	39.7	0.09	4.4	0.01
Pasture/Hay	7,157.6	24.66	3,050.2	6.91	1,051.2	2.39
Row Crops	7,714.8	26.58	4,758.4	10.78	1,187.5	2.70
Woody Wetlands	2,226.2	7.67	1,394.9	3.16	659.7	1.50
Emergent Herbaceous Wetlands	43.5	0.15	30.9	0.07	17.6	0.04
Subtotal - Forest	8,785.9	30.27	6,846.3	15.51	4,992.0	11.35
Subtotal - Agriculture	14,872.4	51.24	7,808.6	17.69	2,238.7	5.09
Subtotal – Urban	5,140.3	17.71	29,296.6	66.37	36,588.7	83.19
Total	**29,030.8**	**100.00**	**44,136.9**	**100.00**	**43,977.7**	**100.0**

Table A-1 (cont'd). 2001 MRLC Land Use Distribution of Nonconnah Creek Subwatersheds

Land Use	Impaired Subwatershed (08010211____)					
	0201 (Cypress Creek)		0301 (Horn Lake headwaters)		0302 (Horn Lake mouth)	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	80.8	0.93	566.7	1.64	2,367.0	12.93
Developed Open Space	2,978.1	34.27	8,133.7	23.54	1,096.6	5.99
Low Intensity Development	1,943.1	22.36	6,271.3	18.15	314.9	1.72
Medium Intensity Development	728.2	8.38	2,691.7	7.79	109.8	0.60
High Intensity Development	362.4	4.17	922.6	2.67	23.8	0.13
Bare Rock	12.2	0.14	20.7	0.06	27.5	0.15
Deciduous Forest	1,874.5	21.57	6,146.9	17.79	2,903.4	15.86
Evergreen Forest	4.3	0.05	411.2	1.19	20.1	0.11
Mixed Forest	29.5	0.34	342.1	0.99	102.5	0.56
Shrub/Scrub	139.0	1.60	2,353.0	6.81	519.9	2.84
Grassland/Herbaceous	0.0	0.00	20.7	0.06	106.2	0.58
Pasture/Hay	114.7	1.32	2,494.7	7.22	596.8	3.26
Row Crops	218.1	2.51	2,926.6	8.47	6,758.8	36.92
Woody Wetlands	195.5	2.25	1,205.9	3.49	3,286.0	17.95
Emergent Herbaceous Wetlands	9.6	0.11	48.4	0.14	71.4	0.39
Subtotal - Forest	2,264.7	26.06	10,548.9	30.53	7,037.1	38.44
Subtotal - Agriculture	332.8	3.83	5,421.3	15.69	7,355.6	40.18
Subtotal – Urban	6,011.9	69.18	18,019.2	52.15	1,545.1	8.44
Total	**8,690.2**	**100.00**	**34,556.1**	**100.00**	**18,304.8**	**100.00**

APPENDIX B

Water Quality Monitoring Data
For Nonconnah Creek Watershed

There are a number of water quality monitoring stations that provide data for waterbodies identified as impaired for pathogens in the Nonconnah Creek Watershed. The location of these monitoring stations is shown in Figure 5. Monitoring data recorded by TDEC at these stations are tabulated in Table B-1. Monitoring data reported by Memphis as part of their MS4 permit are tabulated in Table B-2.

Table B-1. TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
BLACK000.2SH	7/19/06	78
	8/10/06	50
	8/16/06	2400
	8/21/06	>24000
	8/22/06	5500
	8/23/06	3100
	9/13/06	>2400
	10/11/06	<100
	11/8/06	>2400
	12/6/06	2200
	1/10/07	2800
	1/24/07	>2400
	2/12/07	10
	2/14/07	1200
	2/15/07	1200
	2/20/07	27
	3/7/07	63
	4/4/07	>2400
	5/16/07	>24196
	6/20/07	>24196
BLACK001.1SH	7/11/01	>2419.2
	10/9/01	2063
	1/8/02	80.8
	4/9/02	24192
	7/9/02	2419.2
	10/8/02	24192
	2/4/03	>2419.2
	4/28/03	>2419.2
CANE000.6SH	10/5/99	307.6
	7/10/01	556
	8/8/01	11192
	9/12/01	816.4

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CANE000.6SH (cont'd)	10/10/01	820
	11/14/01	110.6
	12/11/01	461.1
	1/9/02	131.3
	2/13/02	137.4
	3/13/02	>2419.2
	4/10/02	836
	5/8/02	1541
	6/12/02	2613
	7/19/06	40
	8/16/06	730
	9/13/06	84
	10/11/06	50
	11/8/06	2400
	12/6/06	2400
	1/10/07	1900
	2/14/07	1100
	3/7/07	86
	4/4/07	>2400
	5/16/07	>24196
	6/20/07	3654
CANE001.4SH	8/7/07	14
	8/14/07	411
	8/21/07	>2420
	8/28/07	3873
	9/4/07	46
CANE002.8SH	7/11/01	>2419.2
	10/9/01	>2419.2
	1/8/02	2419.2
	4/9/02	15531
	7/9/02	270
	10/8/02	>2419.2
	2/4/03	5794
	4/28/03	529.8

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli
		[cts./100 mL]
CCSOU001.1SH	1/31/01	770.1
	2/28/01	517.2
	3/28/01	42.6
	4/26/01	313
	5/23/01	2419.2
	6/19/01	2419.2
	7/25/01	790
	8/29/01	>2419.2
	10/2/01	2350
	10/30/01	4106
	12/5/01	159.7
	1/16/02	1203.3
	4/24/02	>24192
	5/16/02	1730
	6/17/02	253
	6/18/02	191.8
	6/19/02	191.8
	6/20/02	686.7
	6/24/02	547.5
	6/25/02	866.4
	6/26/02	6131
	6/27/02	218
	7/9/02	126.1
	7/15/02	38730
	9/8/03	162.4
	10/29/03	52.9
	12/9/03	22.3
	1/13/04	40.2
	2/9/04	191.8
	3/10/04	101
	4/13/04	>2419.2
	5/11/04	203
	6/15/04	209.8
	7/12/04	547.5
	8/10/04	920.8

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CCSOU001.1SH (cont'd)	7/20/05	>2419.2
	8/24/05	16.9
	9/28/05	250
	10/26/05	96
	12/7/05	30
	12/28/05	57
	1/25/06	2000
	3/1/06	18
	3/28/06	68
	4/26/06	580
	5/31/06	>2400
	6/20/06	440
CCSOU002.9SH	5/23/01	2419.2
	8/29/01	193.5
	12/5/01	410.6
	5/16/02	579.4
	6/17/02	222.4
	6/18/02	162.4
	6/19/02	770.1
	6/20/02	2419.2
	6/24/02	2214.2
	6/25/02	2419.2
	6/26/02	24192
	6/27/02	241920
	7/9/02	1000
	7/15/02	14390
	9/8/03	130.9
	10/29/03	2419.2
	12/29/03	148
	1/13/04	84
	2/9/04	344.8
	3/10/04	159.7
	4/13/04	2419.2
	5/11/04	754
	6/15/04	2419.2
	7/12/04	325.5
	8/10/04	2419.2

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CCSOU002.9SH (cont'd)	7/20/05	2419.2
	8/24/05	63
	9/28/05	520
	10/26/05	84
	12/7/05	40
	12/28/05	80
	1/25/06	1400
	3/1/06	68
	3/28/06	20
	4/26/06	290
	5/31/06	2400
	6/20/06	370
CCSOU004.0SH	1/31/01	>2419.2
	2/28/01	1203.3
	3/28/01	34.5
	4/26/01	1119.9
	5/23/01	2481
	6/19/01	1986.3
	7/25/01	2141
	8/29/01	770.1
	10/2/01	151.5
	10/30/01	>2419.2
	12/5/01	2000
	1/16/02	10.9
	5/16/02	2210
	6/17/02	537
	6/18/02	344.8
	6/19/02	84.7
	6/20/02	613.1
	6/24/02	307.6
	6/25/02	>2419.2
	6/26/02	>24192
	6/27/02	>241920
	7/9/02	2000
	7/15/02	1986300

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CCSOU004.0SH (cont'd)	9/8/03	547.5
	10/29/03	>2419.2
	12/9/03	410
	1/13/04	520
	2/9/04	410.6
	3/10/04	365.4
	4/13/04	>2419.2
	5/11/04	110
	6/15/04	328.2
	7/12/04	22.6
	8/10/04	1119.9
	7/20/05	>2419.2
	8/24/05	63
	9/28/05	730
	10/26/05	200
	12/7/05	240
	12/28/05	32
	1/5/06	1300
	1/25/06	1200
	3/1/06	240
	3/28/06	100
	4/26/06	2400
	5/31/06	250
	6/20/06	2400
CCSOU004.7SH	5/23/01	2419.2
	8/29/01	1986.3
	12/5/01	2419.2
CCSOU1T0.6SH	5/23/01	2419.2
	12/5/01	387.3
	5/16/02	1119.9
	7/15/02	34360
	9/8/03	26.9
	10/29/03	2419.2
	1/13/04	31
	2/9/04	298.7
	3/10/04	64.4

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CCSOU1T0.6SH (cont'd)	4/13/04	2419.2
	5/11/04	1333
	6/15/04	2419.2
	7/20/05	101.7
	9/28/05	730
	12/28/05	9.5
	1/25/06	170
	3/1/06	3
	3/28/06	410
	4/26/06	440
	5/31/06	2400
	6/20/06	3700
CCSOU2T0.2SH	5/23/01	1732.9
	8/29/01	344.1
	12/5/01	547.8
	5/16/02	1986.3
	6/17/02	980.4
	6/18/02	727
	6/19/02	547.5
	6/20/02	344.8
	6/24/02	125.9
	6/25/02	2419.2
	6/26/02	24192
	6/27/02	57940
	7/9/02	630
	7/15/02	19180
	9/8/03	325.5
	12/29/03	365.4
	1/13/04	20
	2/9/04	111.2
	3/10/04	172.3
	4/13/04	2419.2
	5/11/04	1198
	6/15/04	2419.2
	7/12/04	1299.7
	8/10/04	1203.3

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
CCSOU2T0.2SH (cont'd)	7/20/05	1553.1
	8/24/05	2419.2
	9/28/05	1100
	10/26/05	320
	12/7/05	43
	12/28/05	2400
	1/25/06	350
	3/1/06	2400
	3/28/06	41
	4/26/06	5200
	5/31/06	2400
	6/20/06	6100
CCSOU3T0.6SH	5/23/01	9804
	12/5/01	2419.2
DAYS000.5SH	6/9/99	488.4
	7/10/01	7270
	8/8/01	1110
	9/12/01	547.5
	10/10/01	537
	11/14/01	1986.3
	12/11/01	>2419.2
	1/9/02	58.3
	2/13/02	261.3
	3/13/02	>2419.2
	4/10/02	425
	5/8/02	>24192
	6/12/02	6488
	8/10/06	60
	11/21/06	>2400
	2/21/07	3400
	5/9/07	1664
HLAKE000.0SH	4/21/99	131.7
	10/21/99	135.4
	4/18/00	148.3
	1/31/01	866.4
	2/28/01	86.7

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
HLAKE000.0SH (cont'd)	3/28/01	41.9
	4/26/01	151.5
	5/23/01	2909
	6/19/01	83.2
	7/25/01	866.4
	8/29/01	68.3
	10/2/01	67.6
	10/30/01	461.1
	12/5/01	248.1
	1/16/02	39.7
	4/24/02	1553.1
	7/20/05	>2419.2
	8/24/05	100
	9/28/05	730
	10/26/05	150
	12/7/05	260
	12/28/05	460
	1/25/06	1200
	3/1/06	37
	3/28/06	100
	4/26/06	610
	5/31/06	110
	6/20/06	1100
HLAKE004.0SH	9/9/98	15.8
	9/9/99	>2419.2
	1/31/01	1119.1
	2/28/01	158.4
	3/28/01	27.5
	4/26/01	980.4
	5/23/01	5475
	6/19/01	68.6
	7/25/01	275.3
	8/29/01	10.7
	10/2/01	79.4
	10/30/01	63.1
	12/5/01	165.8

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
HLAKE004.0SH (cont'd)	1/16/02	39.7
	4/24/02	2419.2
	7/20/05	>2419.2
	8/24/05	0
	9/28/05	610
	10/26/05	24
	12/7/05	84
	12/28/05	520
	1/25/06	690
	3/1/06	55
	3/28/06	50
	4/26/06	520
	5/31/06	20
	6/20/06	2400
HLCUT000.0SH	4/21/99	22.6
	10/21/99	73.3
	4/18/00	82.6
	1/31/01	28.8
	2/28/01	10.1
	3/28/01	0
	4/26/01	6.2
	5/23/01	829
	6/19/01	6.3
	7/25/01	18.3
	8/29/01	5.2
	10/2/01	30.5
	10/30/01	160.7
	12/5/01	56.3
	1/16/02	26.5
	7/20/05	980.4
	9/28/05	920
	12/7/05	130
	12/28/05	1700
	1/25/06	870
	3/1/06	100
	3/28/06	120

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
HLCUT000.0SH (cont'd)	4/26/06	870
	6/20/06	820
HURRI000.4SH	6/9/99	>2419.2
	7/10/01	1376
	8/8/01	583
	9/12/01	1726
	10/10/01	512
	11/14/01	396.8
	3/13/02	2419.2
	4/10/02	9804
	5/8/02	648.8
	6/12/02	776
	8/10/06	380
	11/21/06	2400
	2/21/07	400
	5/9/07	426
HURRI002.6SH	7/11/01	>2419.2
	10/9/01	257
	1/8/02	>2419.2
	4/9/02	24192
	7/9/02	>2419.2
	10/8/02	2750
	2/4/03	20
	4/28/03	58.3
HURRI003.8SH	7/19/06	550
	8/16/06	17
	10/11/06	34
	11/8/06	550
	12/6/06	17
	2/14/07	160
	3/7/07	16
	4/4/07	5200
	5/16/07	15531
	6/20/07	41

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
JOHNS000.5SH	6/9/99	2419.2
	7/10/01	3448
	8/8/01	6131
	9/12/01	5172
	10/10/01	803
	11/14/01	88.9
	12/11/01	>2419.5
	1/9/02	1986.3
	2/13/02	209.8
	3/13/02	1732
	4/10/02	1455
	5/8/02	>2419.2
	6/12/02	6867
	8/10/06	38
	11/21/06	110
	2/21/07	7.3
	5/9/07	411
JOHNS003.6SH	7/11/01	1299.7
	10/9/01	1450
	1/8/02	2419.2
	4/9/02	1850
	7/9/02	9208
	10/8/02	3873
	2/4/03	512
	4/28/03	>2419.2
NONCO001.8SH	11/5/98	148.3
	2/3/99	1119.9
	5/5/99	>2419.2
	9/1/99	95.9
	12/1/99	172.5
	3/22/00	1203.3
	3/14/01	4106
	7/10/01	220
	8/8/01	2492
	9/12/01	770.1

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO001.8SH (cont'd)	10/10/01	1723
	11/14/01	55.4
	12/11/01	1732.9
	1/9/02	1553.1
	2/13/02	579.4
	3/13/02	2419.2
	4/10/02	3448
	5/8/02	310
	6/12/02	1421
	8/20/02	934
	11/7/02	>2419.2
	2/11/03	4352
	5/27/03	45.5
	8/25/03	1413.6
	12/8/03	2481
	2/24/04	1043
	6/8/04	<10
	10/25/04	>2419.2
	2/8/05	2382
	6/29/05	1455
	9/21/05	111.2
	1/31/06	870
	5/24/06	62
	8/10/06	220
	9/13/06	1700
	10/11/06	17
	11/8/06	1100
	12/6/06	75
	1/10/07	1100
	2/14/07	1100
	3/7/07	25
	4/4/07	>2400
	5/16/07	>24196
	6/20/07	443
	7/25/07	27
	11/28/07	411

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO001.8SH (cont'd)	2/5/08	959
	4/23/08	62
	9/30/08	520
	12/17/08	866
	4/23/09	548
	6/30/09	37
	9/23/09	>2420
NONCO006.9SH	12/9/98	>2419.2
	2/25/99	125.9
	5/5/99	>2419.2
	7/10/01	218
	8/8/01	>2419.2
	9/12/01	770.1
	10/10/01	1723
	11/14/01	23.5
	12/11/01	866.4
	1/9/02	1732.9
	2/13/02	325.5
	3/13/02	>2419.2
	4/10/02	1112
	5/8/02	344.8
	6/12/02	2310
	8/10/06	1
	11/21/06	63
	2/21/07	16
	5/9/07	30
NONCO011.85SH	12/9/98	>2419.2
	2/25/99	1299.7
	5/5/99	>2419.2
NONCO012.1SH	7/10/01	1309
	8/8/01	8164
	9/12/01	1616
	10/10/01	2359
	11/14/01	85.7
	12/11/01	920.8

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO012.1SH (cont'd)	1/9/02	1986.3
	2/13/02	103.9
	3/13/02	1966.3
	4/10/02	1145
	5/8/02	2419.2
	6/12/02	1354
	8/10/06	10
	11/21/06	74
	2/21/07	63
	5/9/07	50
NONCO014.0SH	12/9/98	>2419.2
	2/25/99	33.7
	5/5/99	>2419.2
NONCO017.0SH	7/10/01	173
	8/8/01	3255
	9/12/01	1467
	10/10/01	644
	11/14/01	33.2
	12/11/01	344.6
	1/9/02	816.4
	2/13/02	56.1
	3/13/02	1413.6
	4/10/02	1112
	5/8/02	190.4
	6/12/02	613
	7/19/06	81
	8/16/06	<1
	9/13/06	200
	10/11/06	78
	11/8/06	730
	12/6/06	35
	1/10/07	460
	2/14/07	1300
	3/7/07	72
	4/4/07	>2400
	5/16/07	5475

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO017.0SH	6/20/07	389
NONCO020.9SH	12/9/98	>2419.2
	2/25/99	31.4
	5/5/99	>2419.2
	7/10/01	31
	8/8/01	231
	9/12/01	305
	10/10/01	2247
	11/14/01	31.8
	12/11/01	488.4
	1/9/02	570.4
	2/13/02	47.4
	3/13/02	866.4
	4/10/02	650
	5/8/02	85.7
	6/12/02	325.5
	8/10/06	4
	11/21/06	100
	2/21/07	25
	5/9/07	1120
NONCO025.2SH	7/11/01	>2419.2
	10/9/01	439
	1/8/02	>2419.2
	4/9/02	290.4
	10/8/02	4360
	2/4/03	35
	4/28/03	24.6
	7/12/06	17
	8/2/06	1
	10/18/06	580
	11/28/06	63
	12/19/06	6
	1/24/07	150
	2/28/07	210
	3/21/07	17

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO025.2SH (cont'd)	4/18/07	35
	5/23/07	5
	6/12/07	71
NONCO1T0.9SH	7/11/01	>2419.2
	10/9/01	759
	1/8/02	>2419.2
	4/9/02	2987
	7/9/02	331
	10/8/02	>2419.2
	2/4/03	1203.3
	4/28/03	228.2
	7/12/06	70
	8/2/06	28
	8/10/06	460
	8/16/06	220
	8/21/06	2400
	8/22/06	6500
	10/18/06	1600
	11/28/06	49
	12/19/06	93
	1/24/07	>2400
	2/12/07	190
	2/14/07	1300
	2/15/07	690
	2/20/07	260
	2/28/07	260
	3/21/07	1200
	4/18/07	600
	5/23/07	110
	6/12/07	345
NONCO2T0.3SH	7/11/01	2419.2
	10/9/01	2046
	1/8/02	816.4
	4/9/02	2909
	7/9/02	2050
	10/8/02	2723

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO2T0.3SH (cont'd)	2/4/03	365.4
	4/28/03	110.6
	7/12/06	46
	8/2/06	40
	8/10/06	40
	8/16/06	78
	8/21/06	>2400
	8/22/06	13000
	10/18/06	2600
	11/28/06	62
	12/19/06	39
	1/24/07	190
	2/28/07	340
	3/21/07	20
	4/18/07	100
	4/25/07	107
	5/2/07	313
	5/5/07	93
	5/23/07	26
	6/12/07	49
NONCO3T0.4SH	7/12/06	15
	8/16/06	11
	8/21/06	17000
	8/22/06	20000
	10/18/06	2900
	11/28/06	20
	12/19/06	10
	1/14/07	190
	2/28/07	380
	3/21/07	15
	4/18/07	55
	4/25/07	10
	5/2/07	4
	5/3/07	6
	6/12/07	>2419.6

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO3T1.4SH	7/11/01	>2419.2
	1/8/02	1553.1
	4/9/02	413
	10/8/02	8664
	2/4/03	21.2
NONCO4T0.5SH	8/16/06	250
	8/21/06	>2400
	8/22/06	930
	8/23/06	980
	10/18/06	870
	11/28/06	410
	12/19/06	86
	1/24/07	240
	2/28/07	66
	3/21/07	31
	4/18/07	58
	5/23/07	79
	6/12/07	1733
NONCO5T0.1SH	7/19/06	530
	8/16/06	22
	8/21/06	>2400
	8/22/06	1500
	8/23/06	270
	10/11/06	19
	11/8/06	550
	1/10/07	82
	2/14/07	2000
	3/7/07	<10
	4/4/07	>2400
	5/16/07	6867
	6/20/07	794
NONCO6T0.3SH	8/2/06	10
	8/10/06	12
	8/16/06	360
	10/18/06	1300
	11/28/06	52
	12/19/06	110

Table B-1 (Cont.). TDEC Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
NONCO6T0.3SH (cont'd)	1/24/07	390
	2/28/07	650
	3/21/07	36
	4/18/07	100
	5/23/07	71
	6/12/07	276
TENMI000.1SH	9/9/99	>2419.2
	8/8/01	12997
	12/11/01	123.6
	1/9/02	1413.6
	2/13/02	56.5
	3/13/02	2419.2
	4/10/02	259
	5/8/02	613.1
	6/12/02	7270
	11/8/06	>2400
	1/10/07	660
	2/14/07	700
	4/4/07	>2400
	5/16/07	>24196

Table B-2. Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
1N (NONCO020.9SH)	6/19/00	400
	7/24/00	280
	8/23/00	10
	9/20/00	10
	10/16/00	30
	10/24/00	10
	11/9/00	2500
	11/20/00	50
	12/6/00	10
	12/20/00	40
	1/10/01	10
	1/24/01	10
	2/6/01	10
	2/22/01	310
	3/6/01	130
	3/21/01	10
	4/3/01	10
	4/24/01	80000
	5/2/01	30
	6/11/01	120
	6/20/01	110
	7/19/01	6000
	8/29/01	10
	9/25/01	10
	10/23/01	10
	11/7/01	10
	12/4/01	10
	1/9/02	140
	2/12/02	10
	3/13/02	10
	4/18/02	20
	5/14/02	50
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	5

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
1N (NONCO020.9SH) (cont'd)	10/15/02	60
	11/11/02	50
	12/2/02	70
	1/8/03	10
	2/13/03	5
	3/11/03	9
	4/2/03	755
	5/14/03	6000
	6/12/03	5400
	7/10/03	900
	8/6/03	6000
	9/16/03	260
	10/15/03	4400
	11/11/03	200
	12/11/03	3000
	1/22/04	152
	2/24/04	2
	3/18/04	214
	4/21/04	300
	5/18/04	400
	6/17/04	2
	7/22/04	114
	8/18/04	133
	9/15/04	1400
	10/11/04	7000
	11/8/04	109
	12/1/04	1500
	1/6/05	1920
	1/25/05	66.7
	2/15/05	530
	3/15/05	33
	4/20/05	345
	5/10/05	236
	6/7/05	37000
	7/15/05	255
	8/8/05	145

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
1N (NONCO020.9SH) (cont'd)	9/21/05	127
	10/5/05	25
	11/9/05	1
	12/12/05	273
	01/11/06	3800
	01/30/06	1100
	02/07/06	200
	03/08/06	<20
	04/12/06	55
	05/16/06	73
	06/07/06	40
	7/13/06	20
	8/10/06	20
	9/20/06	>2,000
	10/12/06	60
	11/21/06	400
	12/7/06	36
	1/24/07	560
	2/21/07	78
	3/21/07	36
	4/23/07	160
	5/9/07	20
	6/13/07	<1
	7/19/07	80
	8/27/07	440
	9/19/07	20
	10/17/07	417
	11/20/07	2100
	12/19/07	2000
	1/24/08	520
	2/14/08	1600
	3/12/08	280
	4/29/08	800
	5/29/08	2400
	6/19/08	<10
	7/15/08	30

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
1N (NONCO020.9SH) (cont'd)	8/19/08	310
	9/25/08	30
	10/22/08	<10
	11/20/08	<10
	12/11/08	140
	1/22/09	<10
	2/24/09	<10
	3/5/09	320
	4/23/09	60
	5/20/09	200
	6/17/09	180
3N (JOHNS000.5SH)	6/19/00	11000
	7/24/00	3100
	8/23/00	1400
	9/20/00	230
	10/16/00	160
	10/24/00	70
	11/9/00	6700
	11/20/00	140
	12/6/00	100
	12/20/00	1000
	1/10/01	30
	1/24/01	600
	2/6/01	10
	2/22/01	1100
	3/6/01	50
	3/21/01	13000
	4/3/01	130
	4/24/01	80000
	5/2/01	7000
	6/11/01	150
	6/20/01	330
	7/19/01	80000
	8/29/01	10
	9/25/01	40
	10/23/01	100
	11/7/01	40

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
3N (JOHNS000.5SH) (cont'd)	12/4/01	10
	1/9/02	20
	2/12/02	20
	3/13/02	20
	4/18/02	30
	5/14/02	70
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	18
	10/15/02	70
	11/11/02	500
	12/2/02	140
	1/8/03	130
	2/13/03	8
	3/11/03	10
	4/2/03	270
	5/14/03	6000
	6/12/03	6000
	7/10/03	11000
	8/6/03	6000
	9/16/03	3400
	10/15/03	2800
	11/11/03	1900
	12/11/03	2800
	1/22/04	300
	2/24/04	13700
	3/18/04	1200
	4/21/04	800
	5/18/04	1000
	6/17/04	2700
	7/22/04	1800
	8/18/04	2300
	9/15/04	2200
	10/11/04	12000
	11/8/04	467
	12/1/04	6200

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
3N (JOHNS000.5SH) (cont'd)	1/6/05	7200
	1/25/05	16200
	3/15/05	82
	4/20/05	500
	5/10/05	8800
	6/7/05	15200
	7/15/05	1800
	8/8/05	200
	9/21/05	1020
	10/5/05	2500
	11/9/05	160
	12/12/05	440
	01/11/06	10400
	01/30/06	1820
	02/07/06	600
	03/08/06	109
	04/12/06	127
	05/16/06	273
	06/07/06	80
	7/13/06	140
	8/10/06	220
	9/20/06	>10,000
	10/12/06	273
	11/21/06	200
	12/7/06	118
	1/24/07	423
	2/21/07	64
	3/21/07	112
	4/23/07	2,000
	5/9/07	400
	6/13/07	130
	7/19/07	540
	8/27/07	>2000
	9/19/07	400
	10/17/07	3000
	11/20/07	360
	12/19/07	1100

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
3N (JOHNS000.5SH) (cont'd)	1/24/08	440
	2/14/08	700
	3/12/08	7600
	4/29/08	900
	5/29/08	2800
	6/19/08	150
	7/15/08	330
	8/19/08	90
	9/25/08	210
	10/22/08	2800
	11/20/08	20
	12/11/08	4900
	1/22/09	790
	2/24/09	550
	3/5/09	1200
	4/23/09	260
	5/20/09	300
	6/17/09	430
4N (NONCO012.1SH)	6/19/00	6000
	7/24/00	2300
	8/23/00	10
	9/20/00	30
	10/16/00	10
	10/24/00	120
	11/9/00	29000
	11/20/00	170
	12/6/00	10
	12/20/00	200
	1/10/01	10
	1/24/01	1800
	2/6/01	10
	2/22/01	300
	3/6/01	110
	3/21/01	230
	4/3/01	120
	4/24/01	80000
	5/2/01	11000

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
4N (NONCO012.1SH) (cont'd)	6/11/01	130
	6/20/01	170
	7/19/01	80000
	8/29/01	10
	9/25/01	60
	10/23/01	70
	11/7/01	10
	12/4/01	10
	1/9/02	90
	2/12/02	10
	3/13/02	30
	4/18/02	10
	5/14/02	100
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	12
	10/15/02	50
	11/11/02	1600
	12/2/02	110
	1/8/03	50
	2/13/03	6
	3/11/03	9
	4/2/03	670
	5/14/03	5300
	6/12/03	5100
	7/10/03	11000
	8/6/03	6000
	9/16/03	3000
	10/15/03	6600
	11/11/03	4
	12/11/03	6100
	1/22/04	172
	2/24/04	4900
	3/18/04	5900
	4/21/04	5300

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
4N (NONCO012.1SH) (cont'd)	5/18/04	5500
	6/17/04	1000
	7/22/04	3400
	8/18/04	124
	9/15/04	9600
	10/11/04	9000
	11/8/04	511
	12/1/04	4200
	1/6/05	7300
	2/15/05	290
	3/15/05	49
	4/20/05	560
	5/10/05	5200
	6/7/05	218
	8/8/05	620
	9/21/05	309
	11/9/05	127
	01/11/06	7200
	01/30/06	2040
	04/12/06	740
	05/16/06	182
	06/07/06	140
	7/13/06	160
	8/10/06	20
	9/20/06	>10,000
	11/21/06	200
	12/7/06	27
	1/24/07	580
	2/21/07	64
	4/23/07	180
	5/9/07	70
	6/13/07	70
	7/19/07	440
	2/14/08	1700
	4/29/08	1500
	5/29/08	2400

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
4N (NONCO012.1SH) (cont'd)	6/19/08	2100
	12/11/08	190
	5/20/09	520
6N (HURRI000.4SH)	6/19/00	2100
	7/24/00	3000
	8/23/00	1400
	9/20/00	40
	11/9/00	2200
	11/20/00	150
	12/6/00	80000
	12/20/00	10
	1/10/01	10
	1/24/01	10
	2/6/01	10
	2/22/01	1300
	3/6/01	20
	3/21/01	10
	4/3/01	13000
	4/24/01	80000
	5/2/01	50
	6/11/01	230
	6/20/01	490
	7/19/01	9000
	8/29/01	10
	9/25/01	170
	10/23/01	200
	11/7/01	10
	12/4/01	10
	1/9/02	10
	2/12/02	50
	3/13/02	10
	4/18/02	70
	5/14/02	90
	6/24/02	10
	7/22/02	1
	8/7/02	1

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
6N (HURRI000.4SH) (cont'd)	9/18/02	4
	10/15/02	240
	11/11/02	200
	12/2/02	370
	1/8/03	10
	2/13/03	8
	3/11/03	10
	4/2/03	340
	5/14/03	6000
	6/12/03	6000
	7/10/03	9500
	8/6/03	6000
	9/16/03	7200
	10/15/03	190
	11/11/03	12000
	12/11/03	1800
	1/22/04	7100
	2/24/04	900
	3/18/04	1700
	4/21/04	1800
	5/18/04	2100
	6/17/04	2800
	7/22/04	1200
	8/18/04	33.3
	9/15/04	860
	10/11/04	8000
	11/8/04	780
	12/1/04	1200
	1/6/05	1600
	1/25/05	107
	2/15/05	610
	3/15/05	115
	4/20/05	200
	5/10/05	16800
	6/7/05	11200
	7/15/05	760
	8/8/05	760

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
6N (HURRI000.4SH) (cont'd)	9/21/05	19800
	10/5/05	1750
	11/9/05	3800
	01/11/06	15600
	01/30/06	2340
	02/07/06	4100
	03/08/06	400
	04/12/06	840
	05/16/06	640
	06/07/06	210
	7/13/06	940
	8/10/06	300
	9/20/06	>2,000
	10/12/06	400
	11/21/06	17,800
	12/7/06	667
	1/24/07	345
	2/21/07	2,667
	3/21/07	200
	4/23/07	<200
	5/9/07	600
	6/13/07	200
	1/24/08	10800
	2/14/08	6400
	3/12/08	560
	4/29/08	3100
	5/29/08	800
	6/19/08	360
	9/25/08	360
	12/11/08	410
	1/22/09	6400
	2/24/09	1200
	3/5/09	680
	4/23/09	280
	5/20/09	480
	6/17/09	200

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
7N (DAYS000.5SH)	6/19/00	800
	7/24/00	1200
	8/23/00	12000
	9/20/00	26000
	10/16/00	120
	10/24/00	10
	11/9/00	4100
	11/20/00	10
	12/6/00	1000
	12/20/00	320
	1/10/01	400
	1/24/01	610
	2/6/01	100
	2/22/01	300
	3/6/01	10
	3/21/01	10
	4/3/01	350
	4/24/01	12000
	5/2/01	1500
	6/11/01	1000
	6/20/01	510
	7/19/01	80000
	8/29/01	10
	9/25/01	10
	10/23/01	170
	11/7/01	10
	12/4/01	10
	1/9/02	190
	2/12/02	40
	3/13/02	10
	4/18/02	50
	5/14/02	110
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	7

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
7N (DAYS000.5SH) (cont'd)	10/15/02	120
	11/11/02	2900
	12/2/02	570
	1/8/03	90
	2/13/03	6
	3/11/03	9
	4/2/03	580
	5/14/03	6000
	6/12/03	4600
	7/10/03	5700
	8/6/03	6000
	9/16/03	270
	10/15/03	5700
	11/11/03	500
	12/11/03	1300
	1/22/04	40
	2/24/04	500
	3/18/04	3600
	4/21/04	3100
	5/18/04	3400
	6/17/04	1100
	7/22/04	700
	8/18/04	667
	9/15/04	660
	10/11/04	7000
	11/8/04	99
	12/1/04	9000
	1/6/05	1600
	1/25/05	93
	2/15/05	109
	3/15/05	5500
	4/20/05	364
	5/10/05	1800
	6/7/05	1500
	7/15/05	5400
	8/8/05	1460

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
7N (DAYS000.5SH) (cont'd)	9/21/05	236
	10/5/05	150
	11/9/05	660
	12/12/05	1540
	01/11/06	11600
	01/30/06	2340
	02/07/06	2100
	03/08/06	127
	04/12/06	345
	05/16/06	36
	06/07/06	63
	7/13/06	1,960
	8/10/06	60
	9/20/06	>2,000
	10/12/06	2,400
	11/21/06	2,200
	12/7/06	309
	1/24/07	480
	2/21/07	3,400
	3/21/07	360
	4/23/07	340
	5/9/07	740
	6/13/07	100
	7/19/07	352
	8/27/07	290
	9/19/07	40
	10/17/07	800
	11/20/07	250
	12/19/07	440
	1/24/08	40
	2/14/08	260
	3/12/08	2000
	4/29/08	6800
	5/29/08	1900
	6/19/08	130
	7/15/08	90

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
7N (DAYS000.5SH) (cont'd)	8/19/08	40
	9/25/08	630
	10/22/08	60
	11/20/08	30
	11/25/08	
	12/11/08	930
	1/22/09	<10
	2/24/09	5100
	3/5/09	800
	4/23/09	700
	5/20/09	680
	6/17/09	220
8N (NONCO006.9SH)	6/19/00	3800
	7/24/00	130
	8/23/00	10
	9/20/00	70
	10/16/00	90
	10/24/00	10
	11/9/00	17000
	11/20/00	100
	12/6/00	20
	12/20/00	20
	1/10/01	200
	1/24/01	60
	2/6/01	40
	2/22/01	330
	3/6/01	130
	3/21/01	10
	4/3/01	150
	4/24/01	68000
	5/2/01	120
	6/11/01	170
	6/20/01	180
	7/19/01	80000
	8/29/01	10
	9/25/01	10

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
8N (NONCO006.9SH) (cont'd)	10/23/01	230
	11/7/01	10
	12/4/01	10
	1/9/02	80
	2/12/02	10
	3/13/02	10
	4/18/02	30
	5/14/02	70
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	21
	10/15/02	140
	11/11/02	2100
	12/2/02	1030
	1/8/03	10
	2/13/03	7
	3/11/03	8
	4/2/03	150
	5/14/03	6000
	6/12/03	5800
	7/10/03	5400
	8/6/03	6000
	9/16/03	1600
	10/15/03	1900
	11/11/03	4
	12/11/03	4900
	1/22/04	420
	2/24/04	300
	3/18/04	1400
	4/21/04	1400
	5/18/04	120
	6/17/04	2300
	7/22/04	600
	8/18/04	333
	9/15/04	1730

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
8N (NONCO006.9SH) (cont'd)	10/11/04	11000
	11/8/04	960
	12/1/04	6100
	1/6/05	2670
	1/25/05	187
	2/15/05	1060
	3/15/05	460
	4/20/05	127
	5/10/05	13600
	6/7/05	15600
	7/15/05	1100
	8/8/05	3400
	9/21/05	309
	10/5/05	250
	11/9/05	420
	12/12/05	1640
	01/11/06	5800
	01/30/06	2440
	02/07/06	900
	03/08/06	7600
	04/12/06	182
	05/16/06	1000
	06/07/06	63
	7/13/06	60
	8/10/06	<20
	9/20/06	>2,000
	10/12/06	20
	11/21/06	<200
	12/7/06	27
	1/24/07	980
	2/21/07	57
	3/21/07	36
	4/23/07	228
	5/9/07	88
	6/13/07	8
	7/19/07	140

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
8N (NONCO006.9SH) (cont'd)	8/27/07	2,000
	9/19/07	20
	10/17/07	210
	11/20/07	40
	12/19/07	4,400
	1/24/08	640
	2/14/08	1,800
	3/12/08	340
	4/29/08	1,800
	5/29/08	1,900
	6/19/08	10
	7/15/08	70
	8/19/08	210
	9/25/08	150
	10/22/08	150
	11/20/08	<10
	12/11/08	210
	1/22/09	40
	2/24/09	90
	3/5/09	<10
	4/23/09	160
	5/20/09	650
	6/17/09	460
9N (NONCO001.8SH)	6/19/00	1500
	7/24/00	40000
	8/23/00	150
	9/20/00	50
	10/16/00	70
	10/24/00	90
	11/9/00	21000
	11/20/00	90
	12/6/00	2100
	12/20/00	30
	1/10/01	2500
	1/24/01	40
	2/6/01	60

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
9N (NONCO001.8SH) (cont'd)	2/22/01	170
	3/6/01	100
	3/21/01	10
	4/3/01	230
	4/24/01	80000
	5/2/01	14000
	6/11/01	130
	6/20/01	410
	7/19/01	5000
	8/29/01	30
	9/25/01	10
	10/23/01	160
	11/7/01	20
	1/9/02	10
	2/12/02	10
	3/13/02	10
	4/18/02	40
	5/14/02	40
	6/24/02	10
	7/22/02	1
	8/7/02	1
	9/18/02	19
	10/15/02	170
	11/11/02	3200
	12/2/02	530
	1/8/03	40
	2/13/03	7
	3/11/03	10
	4/2/03	330
	5/14/03	6000
	6/12/03	6000
	7/10/03	5800
	8/6/03	6000
	9/16/03	1600
	10/15/03	6500
	11/11/03	200

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
9N (NONCO001.8SH) (cont'd)	12/11/03	4800
	1/22/04	44
	2/24/04	1100
	3/18/04	500
	4/21/04	300
	5/18/04	60
	6/17/04	600
	7/22/04	1400
	8/18/04	203
	9/15/04	520
	10/11/04	4000
	11/8/04	270
	12/1/04	3300
	1/6/05	1600
	2/15/05	550
	3/15/05	49
	4/20/05	127
	5/10/05	2800
	6/7/05	20400
	8/8/05	3400
	9/21/05	255
	10/5/05	200
	11/9/05	127
	12/12/05	1180
	01/11/06	6600
	01/30/06	4200
	02/07/06	600
	03/08/06	200
	04/12/06	364
	05/16/06	520
	06/07/06	700
	7/13/06	840
	8/10/06	640
	9/20/06	>2,000
	3/21/07	24
	6/13/07	160

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
9N (NONCO001.8SH) (cont'd)	7/19/07	180
	8/27/07	>4000
	9/19/07	<200
	10/17/07	560
	11/20/07	<20
	8/19/08	150
	10/22/08	90
	11/20/08	<10
	12/11/08	3600
SP2 (CCSOU001.1SH)	1/3/05	1060
	1/5/05	1240
	1/7/05	16400
	1/10/05	1100
	1/13/05	20000
	1/17/05	667
	1/18/05	257
	1/20/05	218
	1/24/05	291
	1/27/05	55
SP3 (CCSOU1T0.6SH)	1/3/05	110
	1/5/05	420
	1/7/05	13600
	1/10/05	367
	1/13/05	12600
	1/17/05	143
	1/18/05	314
	1/20/05	127
	1/24/05	164
	1/27/05	109
SP4 (CCSOU2T0.2SH)	1/3/05	460
	1/5/05	1060
	1/7/05	13700
	1/10/05	540
	1/13/05	21200
	1/17/05	1270
	1/18/05	1200

Table B-2 (cont'd). Memphis MS4 Water Quality Monitoring Data

Monitoring Station	Date	E. Coli [cts./100 mL]
SP4 (CCSOU2T0.2SH) (cont'd)	1/20/05	540
	1/24/05	291
	1/27/05	327
SP5 (CCSOU002.9SH)	1/3/05	660
	1/5/05	540
	1/7/05	16700
	1/10/05	900
	1/13/05	24200
	1/17/05	680
	1/18/05	218
	1/20/05	420
	1/24/05	182
	1/27/05	55
SP7 (CCSOU004.0SH)	1/3/05	9000
	1/5/05	1740
	1/7/05	8000
	1/10/05	720
	1/13/05	21600
	1/17/05	940
	1/18/05	660
	1/20/05	460
	1/24/05	90.9
	1/27/05	91
SP8 (CCSOU004.7SH)	1/3/05	8000
	1/5/05	7400
	1/10/05	3240
	1/17/05	1380
	1/18/05	1220
	1/20/05	720
	1/24/05	2140
	1/27/05	309

APPENDIX C

Load Duration Curve Development and Determination of Daily Loading

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), nonpoint source loads (Load Allocations), and an appropriate margin of safety (MOS) that takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + MOS$$

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) (http://www.epa.gov/epacfr40/chapt-I.info/chi-toc.htm) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

C.1 Development of TMDLs

E. coli TMDLs, WLAs, and LAs were developed for impaired subwatersheds and drainage areas in the Nonconnah Creek Watershed using Load Duration Curves (LDCs). Daily loads for TMDLs, WLAs, and LAs are expressed as a function of daily mean in-stream flow (daily loading function).

C.1.1 Development of Flow Duration Curves

A flow duration curve is a cumulative frequency graph, constructed from historic flow data at a particular location, that represents the percentage of time a particular flow rate is equaled or exceeded. Flow duration curves are developed for a waterbody from daily discharges of flow over an extended period of record. In general, there is a higher level of confidence that curves derived from data over a long period of record correctly represent the entire range of flow. The preferred method of flow duration curve computation uses daily mean data from U.S. Geological Survey (USGS) continuous-record stations (http://waterdata.usgs.gov/tn/nwis/sw) located on the waterbody of interest. For ungaged streams, alternative methods must be used to estimate daily mean flow. These include: 1) regression equations (using drainage area as the independent variable) developed from continuous record stations in the same ecoregion; 2) drainage area extrapolation of data from a nearby continuous-record station of similar size and topography; and 3) calculation of daily mean flow using a dynamic computer model, such as the Windows version of Hydrologic Simulation Program - Fortran (WinHSPF).

Flow duration curves for impaired waterbodies in the Nonconnah Creek Watershed were derived from WinHSPF hydrologic simulations based on parameters derived from calibrations at USGS Station Nos. 07032200 (see Appendix D for details of calibration). For example, a flow-duration curve for Nonconnah Creek was constructed using simulated daily mean flow for the period from 1/1/98 through 12/31/09 (RM 6.9 corresponds to the location of monitoring station NONCO006.9SH). This flow duration curve is shown in Figure C-1 and represents the cumulative distribution of daily discharges arranged to show percentage of time specific flows were exceeded during the period of record (the highest daily mean flow during this period is exceeded 0% of the time and the lowest daily mean flow is equaled or exceeded 100% of the time). Flow duration curves for other impaired waterbodies were derived using a similar procedure.

C.1.2 Development of Load Duration Curves and TMDLs

When a water quality target concentration is applied to the flow duration curve, the resulting load duration curve (LDC) represents the allowable pollutant loading in a waterbody over the entire range of flow. Pollutant monitoring data, plotted on the LDC, provides a visual depiction of stream water quality as well as the frequency and magnitude of any exceedances. Load duration curve intervals can be grouped into several broad categories or zones, in order to provide additional insight about conditions and patterns associated with the impairment. For example, the duration curve could be divided into five zones: high flows (exceeded 0-10% of the time), moist conditions (10-40%), median or mid-range flows (40-60%), dry conditions (60-90%), and low flows (90-100%). Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left on the LDC (representing zones of higher flow) generally reflect potential nonpoint source contributions (Stiles, 2003).

E. coli load duration curves for impaired waterbodies in the Nonconnah Creek Watershed were developed from the flow duration curves developed in Section C.1.1, E. coli target concentrations, and available water quality monitoring data. Load duration curves and required load reductions were developed using the following procedure (Nonconnah Creek is shown as an example):

1. A target load-duration curve (LDC) was generated for Nonconnah Creek by applying the E. coli target concentration of 941 CFU/100 mL to each of the ranked flows used to generate the flow duration curve (ref.: Section D.1) and plotting the results. The E. coli target maximum load corresponding to each ranked daily mean flow is:

   $(\text{Target Load})_{\text{Nonconnah Creek}}$ = (941 CFU/100 mL) x (Q) x (UCF)

   where: Target Load = TMDL (CFU/day)
   Q = daily instream mean flow
   UCF = the required unit conversion factor

   TMDL = $(2.30\text{x}10^{10})$ x (Q) CFU/day

2. Daily loads were calculated for each of the water quality samples collected at monitoring station NONCO006.9SH (ref.: Table B-1) by multiplying the sample concentration by the daily mean flow for the sampling date and the required unit conversion factor. NONCO006.9SH was selected for LDC analysis because it has multiple exceedances of the target concentration in multiple flow zones.

   Note: In order to be consistent for all analyses, the derived daily mean flow was used to compute sampling data loads, even if measured ("instantaneous") flow data was available for some sampling dates.

   Example – 8/8/01 sampling event:
   Modelled Flow = 29.19 cfs
   Concentration = 2419.2 CFU/100 mL
   Daily Load = $1.73\text{x}10^{12}$ CFU/day

3. Using the flow duration curves developed in C.1.1, the "percent of days the flow was exceeded" (PDFE) was determined for each sampling event. Each sample load was then plotted on the load duration curves developed in Step 1 according to the PDFE. The resulting E. coli load duration curve for is shown in Figure C-2.

LDCs of other impaired waterbodies were derived in a similar manner and are shown in Appendix E.

C.2 Development of WLAs & LAs

As previously discussed, a TMDL can be expressed as the sum of all point source loads (WLAs), nonpoint source loads (LAs), and an appropriate margin of safety (MOS) that takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

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

Expanding the terms:

$$TMDL = [\Sigma WLAs]_{WWTF} + [\Sigma WLAs]_{MS4} + [\Sigma WLAs]_{CAFO} + [\Sigma LAs]_{DS} + [\Sigma LAs]_{SW} + MOS$$

For E. coli TMDLs in each impaired subwatershed or drainage area, WLA terms include:

- $[\Sigma WLAs]_{WWTF}$ is the allowable load associated with discharges of NPDES permitted WWTFs located in impaired subwatersheds or drainage areas. Since NPDES permits for these facilities specify that treated wastewater must meet in-stream water quality standards at the point of discharge, no additional load reduction is required. WLAs for WWTFs are calculated from the facility design flow and the Monthly Average permit limit.
- $[\Sigma WLAs]_{CAFO}$ is the allowable load for all CAFOs in an impaired subwatershed or drainage area. All wastewater discharges from a CAFO to waters of the state of Tennessee are prohibited, except when either chronic or catastrophic rainfall events cause an overflow of process wastewater from a facility properly designed, constructed, maintained, and operated to contain:
    - All process wastewater resulting from the operation of the CAFO (such as wash water, parlor water, watering system overflow, etc.); plus,
    - All runoff from a 25-year, 24-hour rainfall event for the existing CAFO or new dairy or cattle CAFOs; or all runoff from a 100-year, 24-hour rainfall event for a new swine or poultry CAFO.

  Therefore, a WLA of zero has been assigned to this class of facilities.
- $[\Sigma WLAs]_{MS4}$ is the allowable E. coli load for discharges from MS4s. E. coli loading from MS4s is the result of buildup/wash-off processes associated with storm events.

LA terms include:

- $[\Sigma LAs]_{DS}$ is the allowable E. coli load from "other direct sources". These sources include leaking septic systems, illicit discharges, and animals access to streams. The LA specified for all sources of this type is zero CFU/day (or to the maximum extent feasible).
- $[\Sigma LAs]_{SW}$ represents the allowable E. coli loading from nonpoint sources indirectly going to surface waters from all land use areas (except areas covered by a MS4 permit) as a result of the buildup/wash-off processes associated with storm events (i.e., precipitation induced).

Since $[\sum WLAs]_{CAFO} = 0$ and $[\sum LAs]_{DS} = 0$, the expression relating TMDLs to precipitation-based point and nonpoint sources may be simplified to:

$$TMDL - MOS = [WLAs]_{WWTF} + [\sum WLAs]_{MS4} + [\sum LAs]_{SW}$$

As stated in Section 8.4, an explicit MOS, equal to 10% of the E. coli water quality targets (ref.: Section 5.0), was utilized for determination of the percent load reductions necessary to achieve and WLAs and LAs:

Instantaneous Maximum (lake, reservoir, State Scenic River, Exceptional Tennessee Waters):

Target – MOS = (487 CFU/100 ml) – 0.1(487 CFU/100 ml)

Target – MOS = 438 CFU/100 ml

Instantaneous Maximum (other):

Target – MOS = (941 CFU/100 ml) – 0.1(941 CFU/100 ml)

Target – MOS = 847 CFU/100 ml

30-Day Geometric Mean: Target – MOS = (126 CFU/100 ml) – 0.1(126 CFU/100 ml)

Target – MOS = 113 CFU/100 ml

C.2.1 Daily Load Calculation

Since WWTFs discharge must comply with instream water quality criteria (TMDL target) at the point of discharge, WLAs for WWTFs are expressed as a constant term. In addition, WLAs for MS4s and LAs for precipitation-based nonpoint sources are equal on a per unit area basis and may be expressed as the daily allowable load per unit area (acre) resulting from a decrease in in-stream E. coli concentrations to TMDL target values minus MOS:

WLA[MS4] = LA = {TMDL – MOS – WLA[WWTFs]} / DA

where: DA = waterbody drainage area (acres)

Using Nonconnah Creek as an example:

$$TMDL_{Nonconnah\ Creek} = (941\ CFU/100\ mL) \times (Q) \times (UCF)$$

$$= 2.30 \times 10^{10} \times Q$$

$MOS_{Nonconnah\ Creek}$ = TMDL x 0.10 = $2.30x10^9$ x Q

MOS = $(2.30x10^9)$ x (Q) CFU/day

$WLA[MS4]_{Nonconnah\ Creek}$ = $LA_{Nonconnah\ Creek}$

= {TMDL – MOS – WLA[WWTFs]} / DA

= {$(2.30x10^{10}$ x Q) – $(2.30x10^9$ x Q) – $(1.913x10^{10})$} / $(9.19x10^4)$

WLA[MS4] = LA = [$(2.252x10^5$ x Q) – $(2.081x10^5)$]

TMDLs, WLAs, & LAs for other impaired subwatersheds and drainage areas were derived in a similar manner and are summarized in Table C-1.

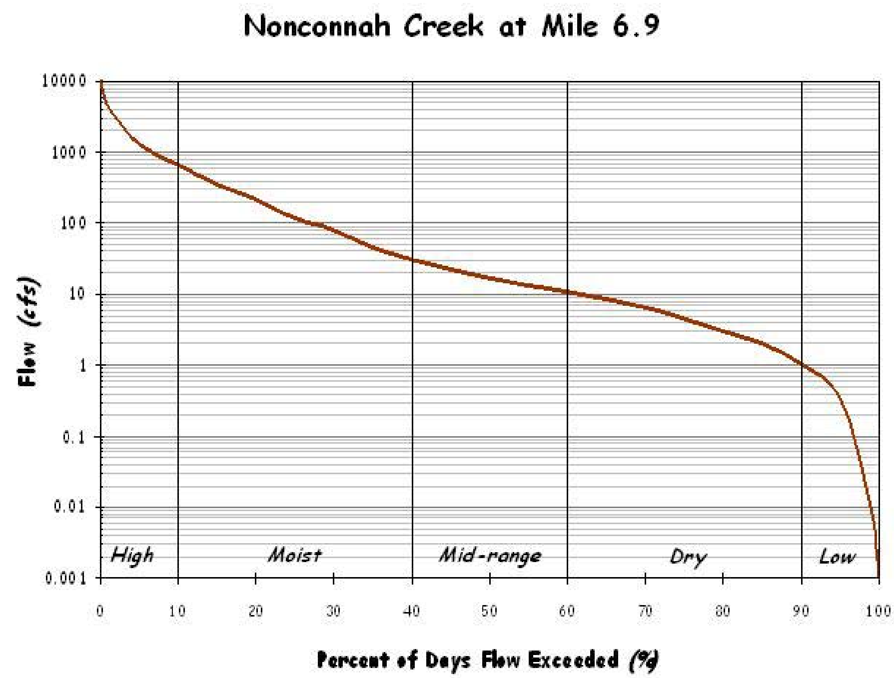

Figure C-1. Flow Duration Curve for Nonconnah Creek at Mile 6.9

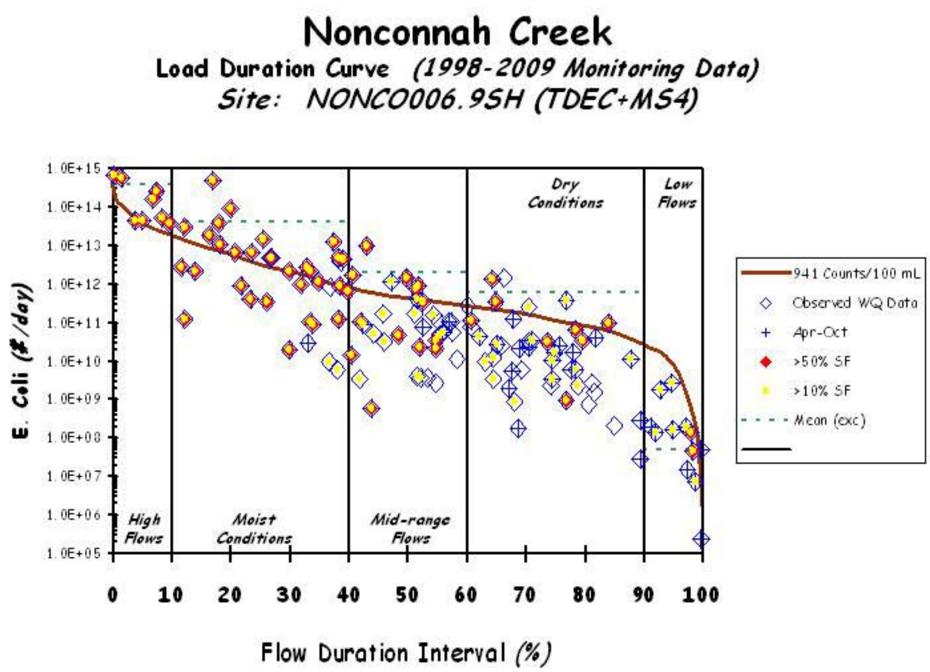

Figure C-2. E. Coli Load Duration Curve for Nonconnah Creek at Mile 6.9

Table C-1. TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0101	Nonconnah Creek	TN0801021100720 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.428 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.967 \times 10^{7} \times Q$	$1.967 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$1.482 \times 10^{6} \times Q$	$5.428 \times 10^{6} \times Q$
	Unnamed Trib to the Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0410	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$	$2.715 \times 10^{6} \times Q - 2.510 \times 10^{6}$
0102	John's Creek	TN08010211176 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.254 \times 10^{6} \times Q$	$1.254 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 3000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$	$2.896 \times 10^{5} \times Q - 2.676 \times 10^{5}$
		TN0801021100720 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$	$4.055 \times 10^{5} \times Q - 3.747 \times 10^{5}$
		TN0801021100720 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$	$6.698 \times 10^{5} \times Q - 6.190 \times 10^{5}$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0100	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.032 \times 10^{7} \times Q$	$1.032 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$1.466 \times 10^{7} \times Q$	$1.466 \times 10^{7} \times Q$
	Unnamed Trib to Nonconnah Creek	TN0801021100720 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	NA	$7.359 \times 10^{6} \times Q$	$7.359 \times 10^{6} \times Q$
0103	Black Bayou	TN0801021100711 – 0300	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.670 \times 10^{6} \times Q$	$4.670 \times 10^{6} \times Q$
	Cane Creek	TN0801021100711 – 0200	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.235 \times 10^{6} \times Q$	$4.235 \times 10^{6} \times Q$
	Days Creek	TN0801021100711 – 0600	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.481 \times 10^{6} \times Q$	$3.481 \times 10^{6} \times Q$
	Hurricane Creek	TN0801021100711 – 0500	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$4.221 \times 10^{6} \times Q$	$4.221 \times 10^{6} \times Q$
	Nonconnah Creek	TN0801021100711 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$	$1.875 \times 10^{5} \times Q - 1.733 \times 10^{5}$
		TN0801021100711 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	1.913×10^{10}	0	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$	$2.252 \times 10^{5} \times Q - 2.081 \times 10^{5}$
	Tenmile Creek	TN0801021100711 – 0400	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$3.646 \times 10^{6} \times Q$	$3.646 \times 10^{6} \times Q$

Table C-1 (cont'd). TMDLs, WLAs, & LAs for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

HUC-12 Subwatershed (08010211__) or Drainage Area (DA)	Impaired Waterbody Name	Impaired Waterbody ID	TMDL	MOS	WLAs			LAs
					WWTFs [a]	Collection Systems	MS4s [b]	
			[CFU/day]	[CFU/day]	[CFU/day]	[CFU/day]	[CFU/d/ac]	[CFU/d/ac]
0201	Cypress Creek	TN08010211007 – 1000	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.424 \times 10^{6} \times Q$	$1.424 \times 10^{6} \times Q$
0301	Horn Lake Creek	TN08010211001 – 2000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$7.080 \times 10^{5} \times Q$	$7.080 \times 10^{5} \times Q$
0302	Horn Lake Creek	TN08010211001 – 1000	$2.30 \times 10^{10} \times Q$	$2.30 \times 10^{9} \times Q$	NA	0	$5.554 \times 10^{5} \times Q$	$5.554 \times 10^{5} \times Q$
	Horn Lake Cutoff	TN08010211001 – 0100	$1.20 \times 10^{10} \times Q$	$1.20 \times 10^{9} \times Q$	NA	0	$1.604 \times 10^{6} \times Q$	$1.604 \times 10^{6} \times Q$

Notes: NA = Not Applicable.
Q = Mean Daily In-stream Flow (cfs).

a. WLAs for WWTFs are expressed as E. coli loads (CFU/day). All current and future WWTFs must meet water quality standards as specified in their NPDES permit.
b. Applies to any MS4 discharge loading in the subwatershed. Future MS4s will be assigned waste load allocations (WLAs) consistent with load allocations (LAs) assigned to precipitation induced nonpoint sources.

APPENDIX D

Hydrodynamic Modeling Methodology

HYDRODYNAMIC MODELING METHODOLOGY

D.1 Model Selection

The Windows version of Hydrologic Simulation Program - Fortran (HSPF) was selected for flow simulation of pathogen-impaired waters in the subwatersheds of the Nonconnah Creek Watershed. HSPF is a watershed model capable of performing flow routing through stream reaches.

D.2 Model Set Up

The Nonconnah Creek Watershed was delineated into subwatersheds in order to facilitate model hydrologic calibration. Boundaries were constructed so that subwatershed "pour points" coincided with HUC-12 delineations, 303(d)-listed waterbodies, and water quality monitoring stations. Watershed delineation was based on the NHD stream coverage and Digital Elevation Model (DEM) data. This discretization facilitates simulation of daily flows at water quality monitoring stations.

Several computer-based tools were utilized to generate input data for the WinHSPF model. The Watershed Characterization System (WCS), a geographic information system (GIS) tool, was used to display, analyze, and compile available information to support hydrology model simulations for selected subwatersheds. This information includes land use categories, point source dischargers, soil types and characteristics, population data (human and livestock), and stream characteristics.

An important factor influencing model results is the precipitation data contained in the meteorological data files used in these simulations. Weather data from multiple meteorological stations were available for the time period from January 1970 through December 2009. Meteorological data for a selected 12-year period were used for all simulations. The first year of this period was used for model stabilization with simulation data from the subsequent 11-year period (10/1/98 – 9/30/09) used for TMDL analysis.

D.3 Model Calibration

Hydrologic calibration of the watershed model involves comparison of simulated streamflow to historic streamflow data from U. S. Geological Survey (USGS) stream gaging stations for the same period of time. A USGS continuous record station located in the Nonconnah Creek Watershed was selected as the basis of the hydrology calibration. Station 07032200 is located on Nonconnah Creek near Germantown, TN and has a drainage area of 68.2 square miles.

Initial values for hydrologic variables were taken from an EPA developed default data set. During the calibration process, model parameters were adjusted within reasonable constraints until acceptable agreement was achieved between simulated and observed streamflow. Model parameters adjusted include: evapotranspiration, infiltration, upper and lower zone storage, groundwater storage, recession, losses to the deep groundwater system, and interflow discharge.

The results of the hydrologic calibration for Nonconnah Creek near Germantown, USGS Station 07032200, are shown in Table D-1 and Figures D-1 and D-2.

Table D-1. Hydrologic Calibration Summary: Nonconnah Creek near Germantown (USGS 07032200)

		66.844228	
Simulation Name:	USGS07032200	**Simulation Period:**	
		Watershed Area (ac):	42794.00
Period for Flow Analysis			
Begin Date:	**01/01/97**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/20006**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**234.01**	Total Observed In-stream Flow:	**226.62**
Total of highest 10% flows:	**186.79**	Total of Observed highest 10% flows:	**186.29**
Total of lowest 50% flows:	**2.95**	Total of Observed Lowest 50% flows:	**2.17**
Simulated Summer Flow Volume (months 7-9):	**19.05**	Observed Summer Flow Volume (7-9):	**20.67**
Simulated Fall Flow Volume (months 10-12):	**67.29**	Observed Fall Flow Volume (10-12):	**56.96**
Simulated Winter Flow Volume (months 1-3):	**92.00**	Observed Winter Flow Volume (1-3):	**93.00**
Simulated Spring Flow Volume (months 4-6):	**55.66**	Observed Spring Flow Volume (4-6):	**55.99**
Total Simulated Storm Volume:	**234.01**	Total Observed Storm Volume:	**226.62**
Simulated Summer Storm Volume (7-9):	**19.05**	Observed Summer Storm Volume (7-9):	**20.67**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**3.26**	10	
Error in 50% lowest flows:	**35.93**	10	
Error in 10% highest flows:	**0.27**	15	
Seasonal volume error - Summer:	**-7.81**	30	
Seasonal volume error - Fall:	**18.14**	30	
Seasonal volume error - Winter:	**-1.08**	30	
Seasonal volume error - Spring:	**-0.59**	30	
Error in storm volumes:	**3.26**	20	
Error in summer storm volumes:	**-7.81**	50	

Criteria for Median Monthly Flow Comparisons	
Lower Bound (Percentile):	25
Upper Bound (Percentile):	75

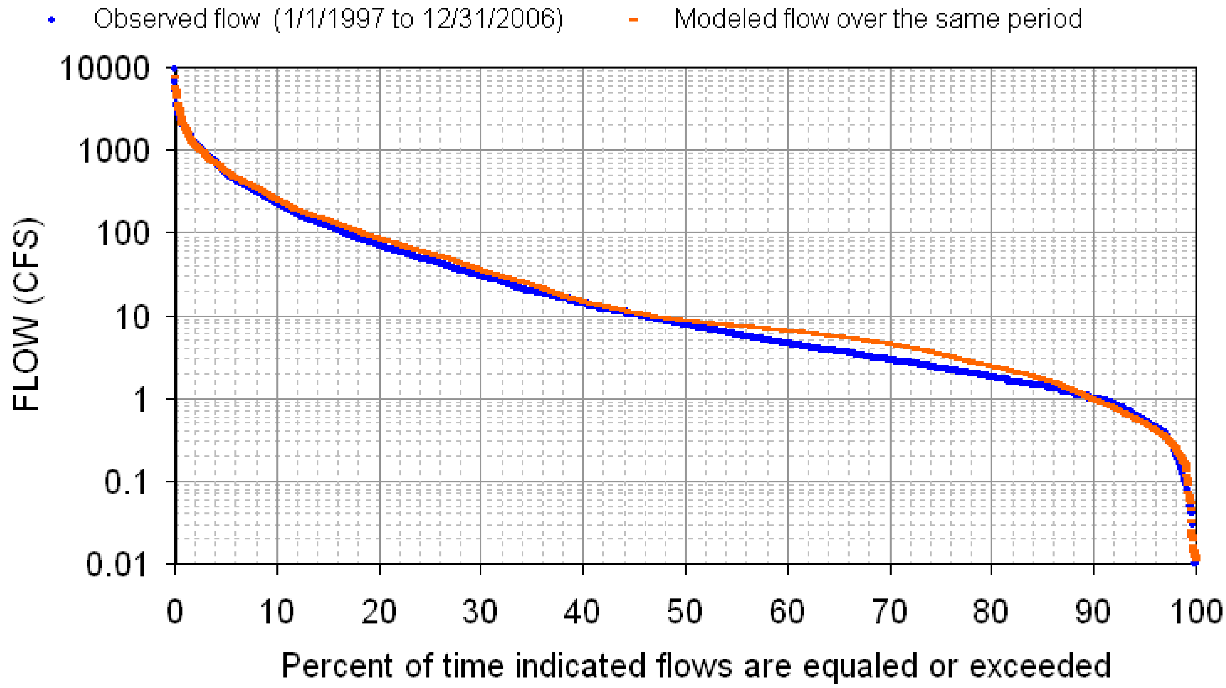

Figure D-1. Hydrologic Calibration: Nonconnah Creek, USGS 07032200 (CYs1997-2006)

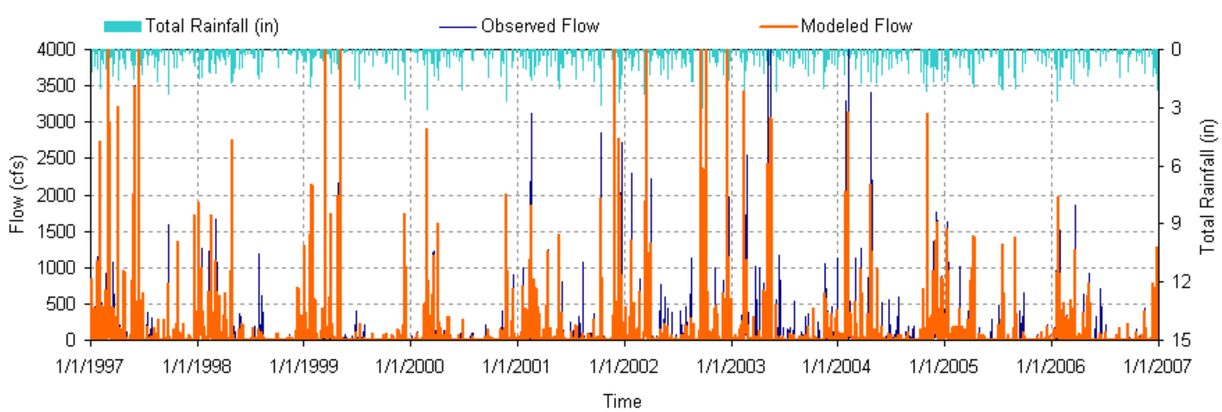

Figure D-2. 10-Year Hydrologic Comparison: Nonconnah Creek, USGS 07032200

APPENDIX E

Source Area Implementation Strategy

All impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas have been classified according to their respective source area types in Section 9.5, Table 8. The implementation for each area will be prioritized according to the guidance provided in Section 9.5.1 and 9.5.2, with examples provided in Section E.1 and E.2, below. For all impaired waterbodies, the determination of source area types serves to identify the predominant sources contributing to impairment (i.e., those that should be targeted initially for implementation). However, it is not intended to imply that sources in other landuse areas are not contributors to impairment and/or to grant an exemption from addressing other source area contributions with implementation strategies and corresponding load reduction. For mixed-use areas, implementation will follow the guidance established for both urban and agricultural areas, at a minimum.

E.1 Urban Source Areas

For impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas identified as predominantly urban source area types, the following example for Cypress Creek provides guidance for implementation analysis:

The Cypress Creek watershed, HUC-12 080102110201, lies in the southwestern portion of Memphis in the Nonconnah Creek watershed. The drainage area for Cypress Creek is approximately 8,690 acres (13.58 mi^2); therefore, four flow zones were used for the duration curve analysis (see Sect. 9.1.1).

Note: The Proposed Final 2010 303(d) List includes Discharges from MS4 Areas as the Pollutant Source category for Cypress Creek; therefore, Cypress Creek is listed in the Urban source area type in Section 9.5, Table 8.

The flow duration curve for Cypress Creek at mile 2.9 was constructed using simulated daily mean flow for the period from 1/1/98 through 9/30/09 (mile 2.9 corresponds to the location of monitoring station CCSOU002.9SH). This flow duration curve is shown in Figure E-1 and represents the cumulative distribution of daily discharges arranged to show percentage of time specific flows were exceeded during the period of record. Flow duration curves for other impaired waterbodies were developed using a similar procedure (Appendix C).

The E. coli LDC for Cypress Creek (Figure E-2) was analyzed to determine the frequency with which observed daily water quality loads exceed the E. coli target maximum daily loading (487 CFU/100 mL x flow [cfs] x conversion factor) under four flow conditions (low, mid-range, moist, and high). Observation of the plot illustrates that exceedances occurred during all flow conditions.

The critical flow condition appears to be during moist conditions. Therefore, the implementation strategy for the Cypress Creek watershed will require BMPs targeting non-point sources (dominant under high flow/runoff conditions).

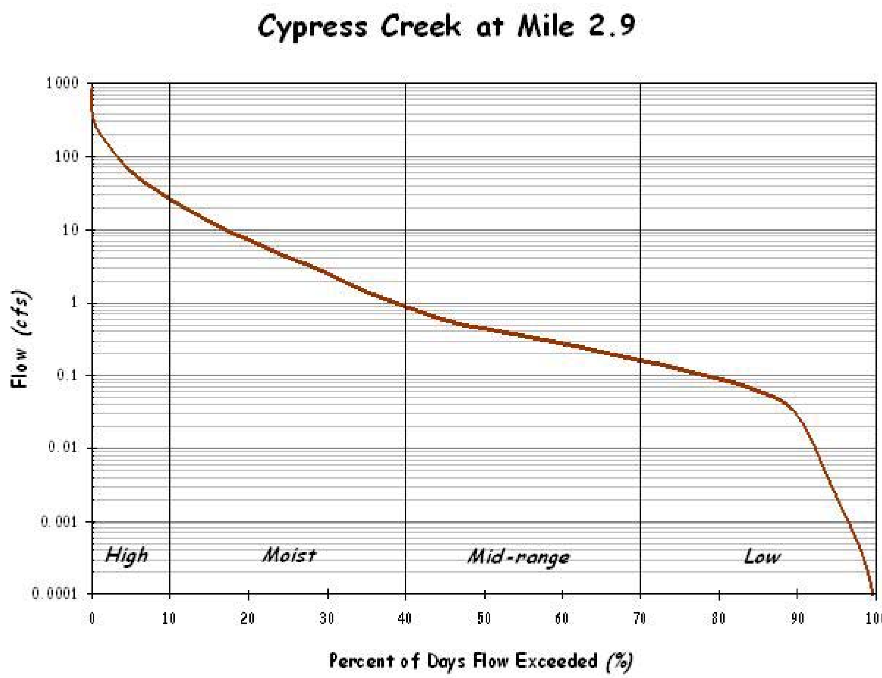

Figure E-1. Flow Duration Curve for Cypress Creek at Mile 2.9

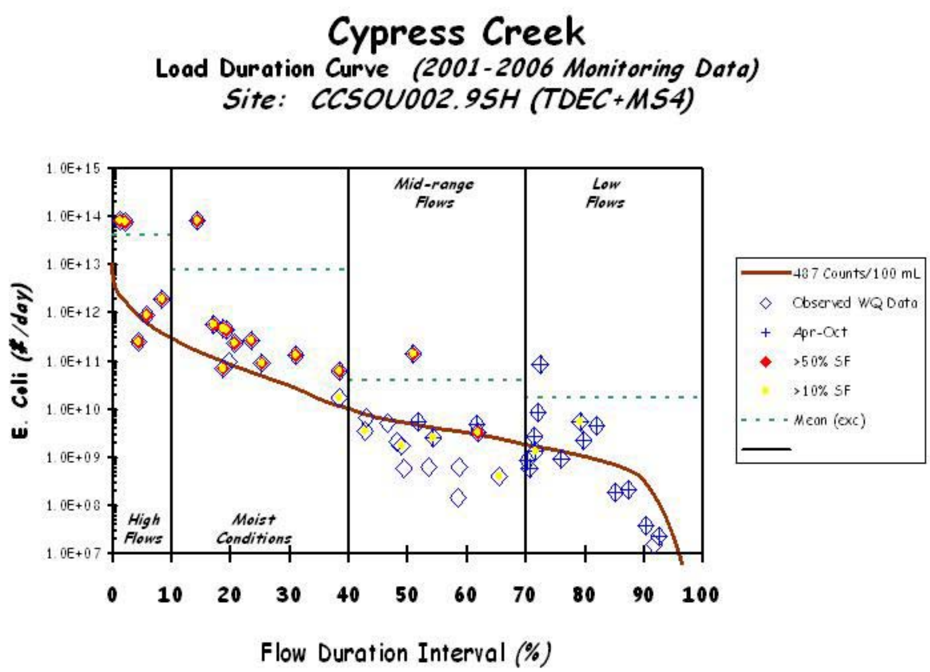

Figure E-2. E. Coli Load Duration Curve for Cypress Creek at Mile 2.9

Table E-1. Load Duration Curve Summary for Implementation Strategies (Example: Cypress Creek subwatershed, HUC-12 080102110201) (4 Flow Zones).

Hydrologic Condition		High	Moist	Mid-range	Low
% Time Flow Exceeded		0-10	10-40	40-70	70-100
Cypress Creek (080102110201)	Number of Samples	5	12	15	15
	% > 487 CFU/100 mL[1]	80.0	91.7	26.7	40.0
	Load Reduction[2]	60.2%	60.5%	10.3%	28.4%
TMDL (CFU/day)		7.513E+11	5.076E+10	4.140E+09	7.200E+08
Margin of Safety (CFU/day)		7.513E+10	5.076E+09	4.140E+08	7.200E+07
WLA (WWTFs) (CFU/day)		NA	NA	NA	NA
WLAs (MS4s) (CFU/day/acre)[3]		1.466E+08	9.902E+06	8.076E+05	1.405E+05
LA (CFU/day/acre)[3]		1.466E+08	9.902E+06	8.076E+05	1.405E+05
Implementation Strategies[4]					
Municipal NPDES			L	M	H
Stormwater Management			H	H	
SSO Mitigation		H	M	L	
Collection System Repair			H	M	
Septic System Repair			L	M	M
Potential for source area contribution under given flow condition (H: High; M: Medium; L: Low)					

1 Tennessee Maximum daily water quality criterion for E. coli.
2 Reductions (percent) based on mean of observed percent load reductions in range.
3 LAs and MS4s are expressed as daily load per unit area in order to provide for future changes in the distribution of LAs and MS4s (WLAs).
4 Watershed-specific Best Management Practices for Urban Source reduction. Actual BMPs applied may vary and should not be limited according to this grouping.

Table E-1 presents an allocation table of LDC analysis statistics for Cypress Creek E. coli and implementation strategies for each source category covering the entire range of flow (Stiles, 2003). The implementation strategies listed in Table E-1 are a subset of the categories of BMPs and implementation strategies available for application to the Nonconnah Creek watershed for reduction of E. coli loading and mitigation of water quality impairment from urban sources. Targeted implementation strategies and LDC analysis statistics for other impaired waterbodies and corresponding HUC-12 subwatersheds and drainage areas identified as predominantly urban source area types can be derived from the information and results available in Tables 9 and E-48.

Table E-48 presents LDC analyses (TMDLs, WLAs, LAs, and MOS) and PLRGs for all flow zones for all E. coli impaired waterbodies in the Nonconnah Creek watershed.

E.2 Agricultural Source Areas

For impaired waterbodies and corresponding HUC-12 subwatersheds or drainage areas identified as predominantly agricultural source area types, the following example for the headwaters of Nonconnah Creek provides guidance for implementation analysis.

The headwaters of Nonconnah Creek, HUC-12 080102110101, lie in a non-urbanized area of Shelby County near Memphis. The drainage area for Nonconnah at mile 25.2 is approximately 3,813 acres (5.96 mi^2); therefore, four flow zones were used for the duration curve analysis (see Sect. 9.1.1). The landuse for the drainage area of Nonconnah Creek at mile 25.2 is approximately 50.9% agricultural, with half of the remainder being forested. Urban areas make up approximately 19.9% of the total area. Therefore, the predominant landuse type and sources are agricultural, although urban sources may be a contributing factor.

The flow duration curve for Nonconnah Creek was constructed using simulated daily mean flow for the period from 1/1/98 through 12/31/09. This flow duration curve is shown in Figure E-3 and represents the cumulative distribution of daily discharges arranged to show percentage of time specific flows were exceeded during the period of record. Flow duration curves for other impaired waterbodies were developed using a similar procedure (see Appendix C).

The E. coli LDC for Nonconnah Creek at mile 25.2(Figure E-4) was analyzed to determine the frequency with which observed daily water quality loads exceed the E. coli target maximum daily loading (941 CFU/100 mL x flow [cfs] x conversion factor) under four flow conditions (low, mid-range, moist, and high). Observation of the plot illustrates that sampling events occurred during most flow conditions.

The critical flow condition appears to occur during moist flow conditions. However, several exceedances also occurred during mid-range flows. Therefore, the implementation strategy for the headwaters of Nonconnah Creek will require BMPs targeting both point sources (dominant under low flow/baseflow conditions) and non-point sources (dominant under high flow/runoff conditions).

Table E-2 presents an allocation table of Load Duration Curve analysis statistics for Nonconnah Creek at mile 25.2E. coli and targeted implementation strategies for each source category covering the entire range of flow (Stiles, 2003). The implementation strategies listed in Table E-2 are a subset of the categories of BMPs and implementation strategies available for application to the Nonconnah Creek watershed for reduction of E. coli loading and mitigation of water quality impairment from agricultural sources. Targeted implementation strategies and LDC analysis statistics for other impaired waterbodies and corresponding HUC-12 subwatersheds and drainage areas identified as predominantly agricultural source area types can be derived from the information and results available in Tables 10 and E-46.

Table E-48 presents LDC analyses (TMDLs, WLAs, LAs, and MOS) and PLRGs for all flow zones for all E. coli impaired waterbodies in the Nonconnah Creek watershed.

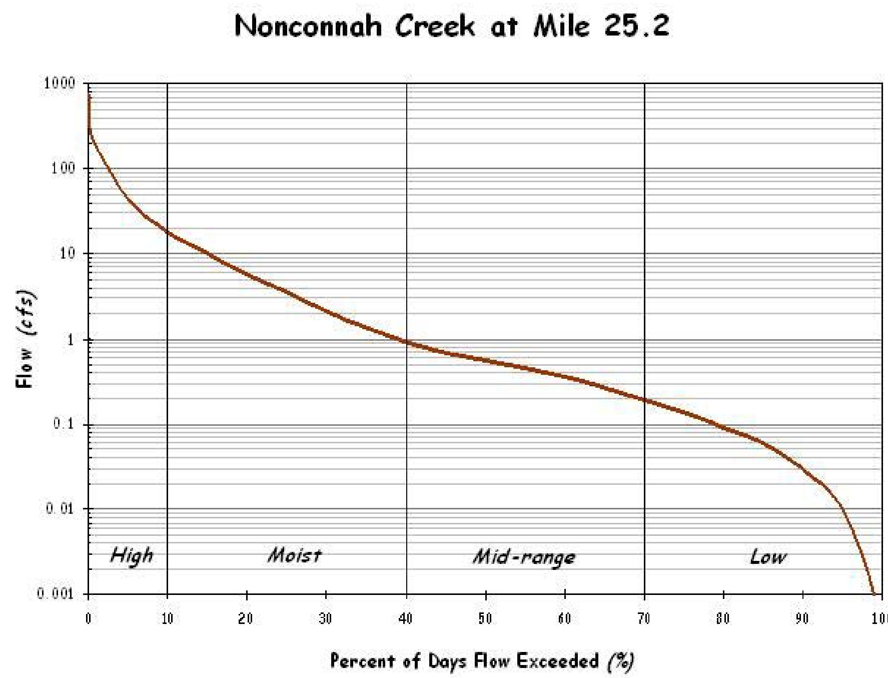

Figure E-3. Flow Duration Curve for Nonconnah Creek at Mile 25.2

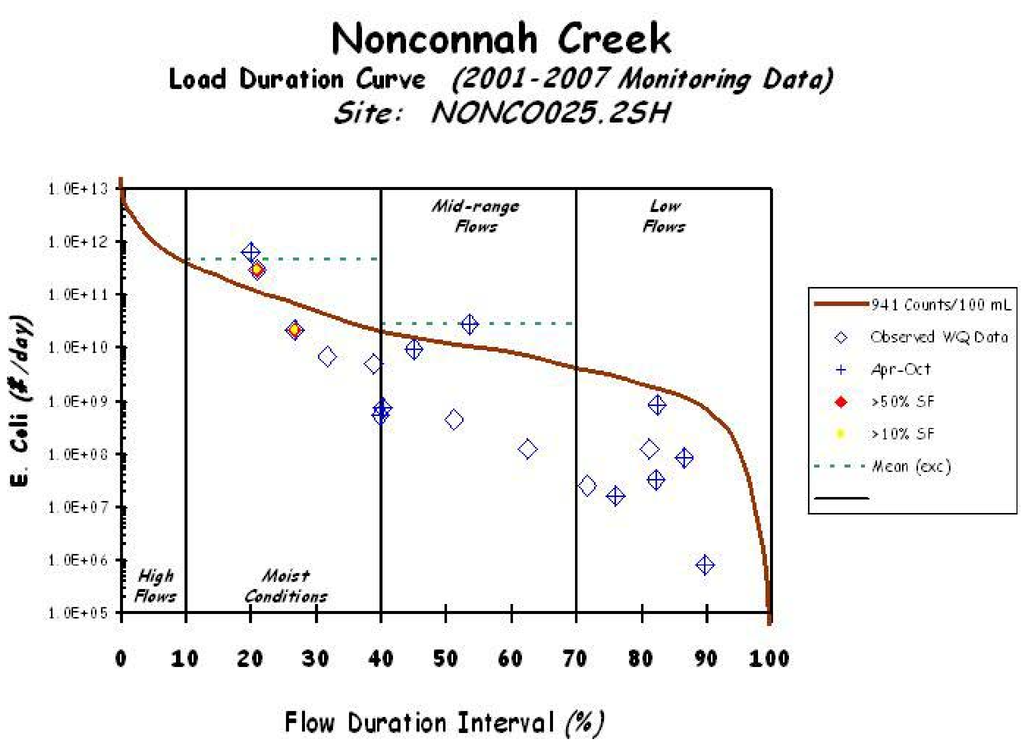

Figure E-4. E. Coli Load Duration Curve for Nonconnah Creek at Mile 25.2

Table E-2. Load Duration Curve Summary for Implementation Strategies (Example: Nonconnah Creek at mile 25.2, HUC-12 080102110101) (4 Flow Zones).

Hydrologic Condition		High	Moist	Mid-range	Low*
% Time Flow Exceeded		0-10	10-40	40-70	70-100
Nonconnah Creek at RM25.2 (080102110101)	Number of Samples	0	6	5	7
	% > 941 CFU/100 mL[1]	0	33.3	20.0	0
	Load Reduction[2]	NR	23.3%	12.2%	NR
TMDL (CFU/day)		9.936E+11	8.234E+10	1.035E+10	1.380E+09
Margin of Safety (CFU/day)		9.936E+10	8.234E+09	1.035E+09	1.380E+08
WLA (WWTFs) (CFU/day)		NA	NA	NA	NA
WLAs (MS4s) (CFU/day/acre)[3]		2.345E+08	1.943E+07	2.443E+06	3.257E+05
LA (CFU/day/acre)[3]		2.345E+08	1.943E+07	2.443E+06	3.257E+05
Implementation Strategies[4]					
Pasture and Hayland Management		H	H	M	L
Livestock Exclusion				M	H
Fencing				M	H
Manure Management		H	H	M	L
Riparian Buffers		L	M	H	M
Potential for source area contribution under given flow condition (H: High; M: Medium; L: Low)					

[1] Tennessee Maximum daily water quality criterion for E. coli.
[2] Reductions (percent) based on mean of observed percent load reductions in range.
[3] LAs and MS4s are expressed as daily load per unit area in order to provide for future changes in the distribution of LAs and MS4s (WLAs).
[4] Example Best Management Practices for Agricultural Source reduction. Actual BMPs applied may vary and should not be limited according to this grouping.

E.3 Forestry Source Areas

There are no impaired waterbodies with corresponding HUC-12 subwatersheds or drainage areas classified as source area type predominantly forested, with the predominant source category being wildlife, in the Nonconnah Creek watershed.

E.4 Calculation of Percent Load Reduction Goals and Determination of Critical Flow Zones

In order to facilitate implementation, corresponding percent reductions in loading required to decrease existing, in-stream E. coli loads to TMDL target levels (percent load reduction goals) were calculated. As a result, critical flow zones were determined and subsequently verified by secondary analyses. Therefore, the following example is from Cypress Creek.

1. For each flow zone, the mean of the percent exceedances of individual loads relative to their respective target maximum loads (at their respective PDFEs) was calculated. Each negative percent exceedance was assumed to be equal to zero.

Date	Sample Conc. (CFU/100 mL)	Flow (cfs)	Existing Load (CFU/Day)	Target (TMDL) Load (CFU/Day)	Percent Reduction
6/27/02	241,920	13.95	8.26E+13	1.66E+11	99.8
6/15/04	2,419.2	9.61	5.68E+11	1.14E+11	79.9
5/23/01	2,419.2	8.20	4.85E+11	9.77E+10	79.9
2/9/04	344.8	8.21	6.92E+10	9.78E+10	0(-41.2)
7/20/05	2,419.2	7.72	4.57E+11	9.20E+10	79.9
1/5/05	540	7.35	9.71E+10	8.76E+10	9.8
1/25/06	1,400	6.83	2.34E+11	8.14E+10	65.2
6/24/02	2,214.2	4.98	2.70E+11	5.93E+10	78.0
1/10/05	900	4.05	8.91E+10	4.82E+10	45.9
5/31/06	2,400	2.22	1.30E+11	2.64E+10	79.7
6/25/02	2,419.2	1.02	6.04E+10	1.22E+10	79.9
1/17/05	680	1.02	1.70E+10	1.21E+10	28.4
Percent Load Reduction Goal (PLRG) for Moist Conditions (Mean)					**60.5**

2. The PLRGs calculated for each of the flow zones, not including the high flow zone (see Section. 9.1.1), were compared and the PLRG of the greatest magnitude indicates the critical flow zone for prioritizing implementation actions for Cypress Creek.

Example – *High Flow Zone Percent Load Reduction Goal = 60.2*
Moist Conditions Flow Zone Percent Load Reduction Goal = 60.5
Mid-Range Flow Zone Percent Load Reduction Goal = 10.3
Low Flow Zone Percent Load Reduction Goal = 28.4

Therefore, the critical flow zone for prioritization of Cypress Creek implementation activities is the Moist Conditions Flow Zone and subsequently actions targeting both non-point source controls.

3. Due to the frequently limited availability of sampling data and subsequent randomness of distribution of samples by flow zone, the determination of the critical flow zone by PLRG calculation often has a high degree of uncertainty. Therefore, secondary analyses were conducted to verify or supplement the determination of the critical flow zones. For each flow zone, the percent of samples that exceed the E. coli TMDL target levels was calculated. For Cypress Creek:

Flow Zone	Number of Samples	Samples > 487 CFU/100 mL	% > 487 CFU/100 mL
High	5	4	80.0
Moist	***12***	***11***	***91.7***
Mid-Range	15	4	26.7
Low	15	5	40.0

The critical flow zone for prioritization of Cypress Creek implementation activities is confirmed as the moist conditions flow zone. If a different flow zone were indicated, both zones would receive equal emphasis for implementation prioritization.

4. Lastly, emphasis (priority) should be placed on recent data versus historical data. If data from multiple watershed cycles is available, analysis of recent data (current cycle) versus the entire period of record, or previous cycles, may identify different critical areas for implementation. Cypress Creek is shown as an example.

Zone	Period of Record (2001-2006)			Most Recent (2005-2006)		
	# of samples	% Red.	% Exc.	# of samples	% Red.	% Exc.
High	5	60.2	80.0	3	73.8	100.0
Moist	**12**	**60.5**	**91.7**	**6**	**51.5**	**100.0**
Mid-Range	15	10.3	26.7	9	0.7	11.1
Low	15	28.4	40.0	4	0.0	0.0
All Zones	*47*	*39.9*	*53.2*	*22*	*31.5*	*40.0*

In this case, the critical flow zone for prioritization of implementation activities is confirmed as the moist conditions zone.

PLRGs and critical flow zones of the other impaired waterbodies were derived in a similar manner and are shown in Table E-48.

<u>Geometric Mean Data</u>

For cases where five or more samples were collected over a period of not more than 30 consecutive days, the geometric mean E. coli concentration was determined and compared to the target geometric mean E. coli concentration of 126 CFU/100 mL. If the sample geometric mean exceeded the target geometric mean concentration, the reduction required to reduce the sample geometric mean value to the target geometric mean concentration was calculated.

Example: *Monitoring Location = Cypress Creek*
Sampling Period = 6/25/02 – 7/15/02
Geometric Mean Concentration = 11,529.6 CFU/100 mL
Target Concentration = 126 CFU/100 mL
Reduction to Target = 98.9%

For impaired waterbodies where monitoring data are limited to geometric mean data only, results can be utilized for general indication of relative impairment and, when plotted on a load duration curve, may indicate areas for prioritization of implementation efforts. For impaired waterbodies where both types of data are available, geometric mean data may be utilized to supplement the results of the individual flow zone calculations.

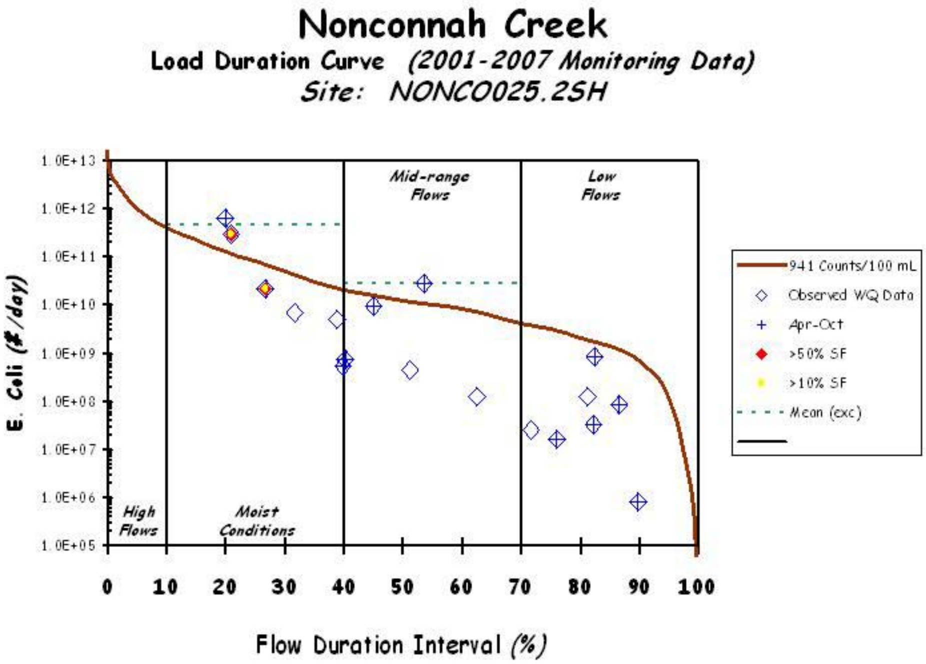

Figure E-5. E. Coli Load Duration Curve for Nonconnah Creek – RM25.2

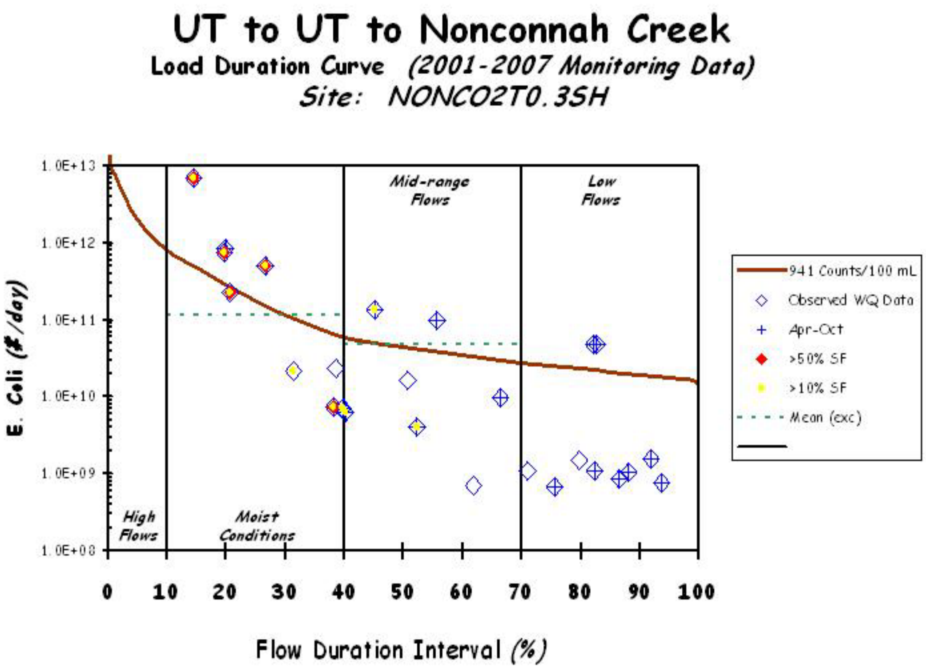

Figure E-6. E. Coli Load Duration Curve for UT to Nonconnah Creek – 2T0.3

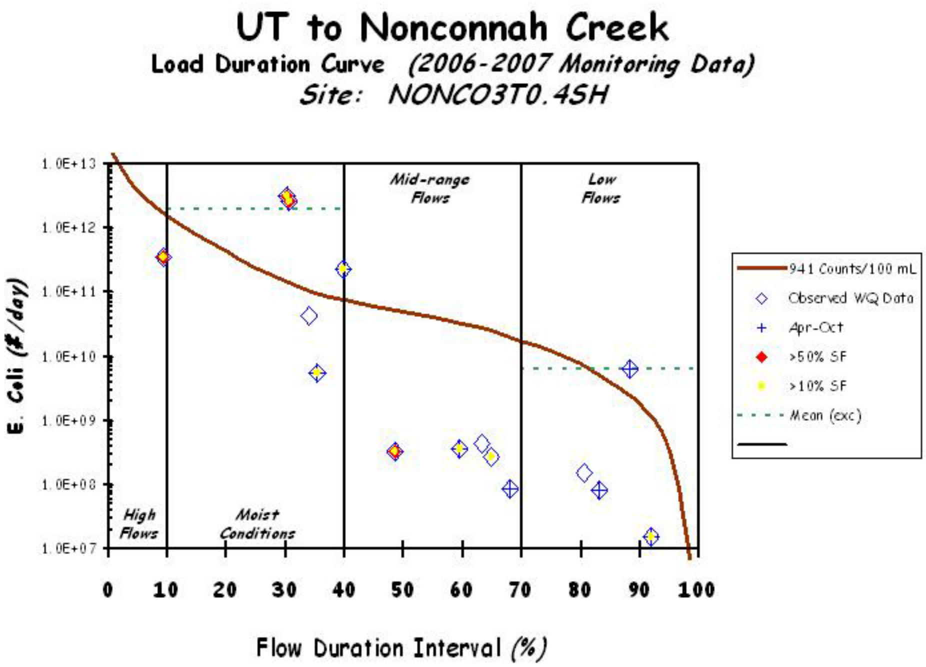

Figure E-7. E. Coli Load Duration Curve for UT to Nonconnah Creek – 3T0.4

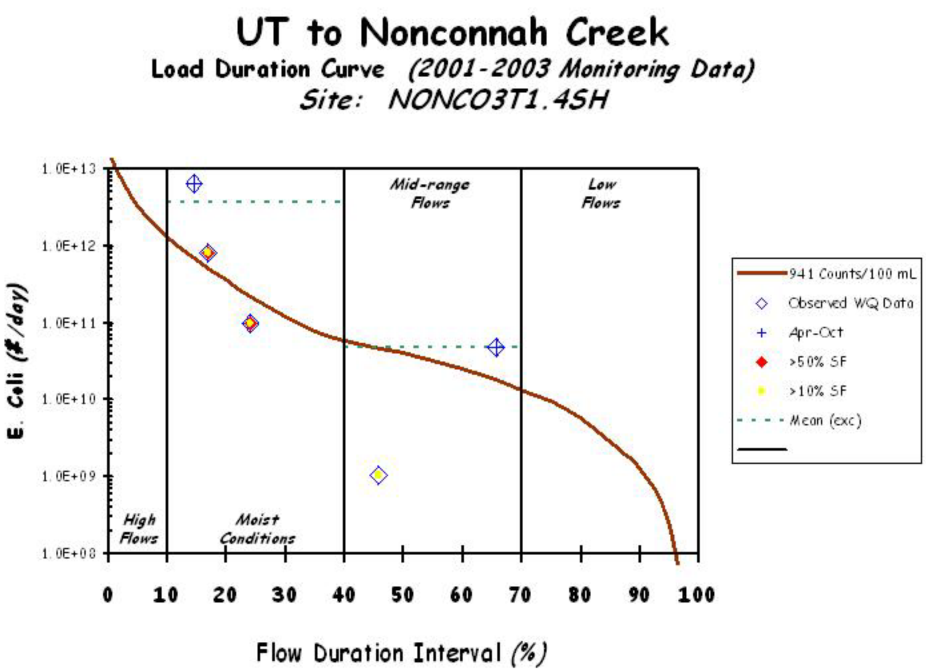

Figure E-8. E. Coli Load Duration Curve for UT to Nonconnah Creek – 3T1.4

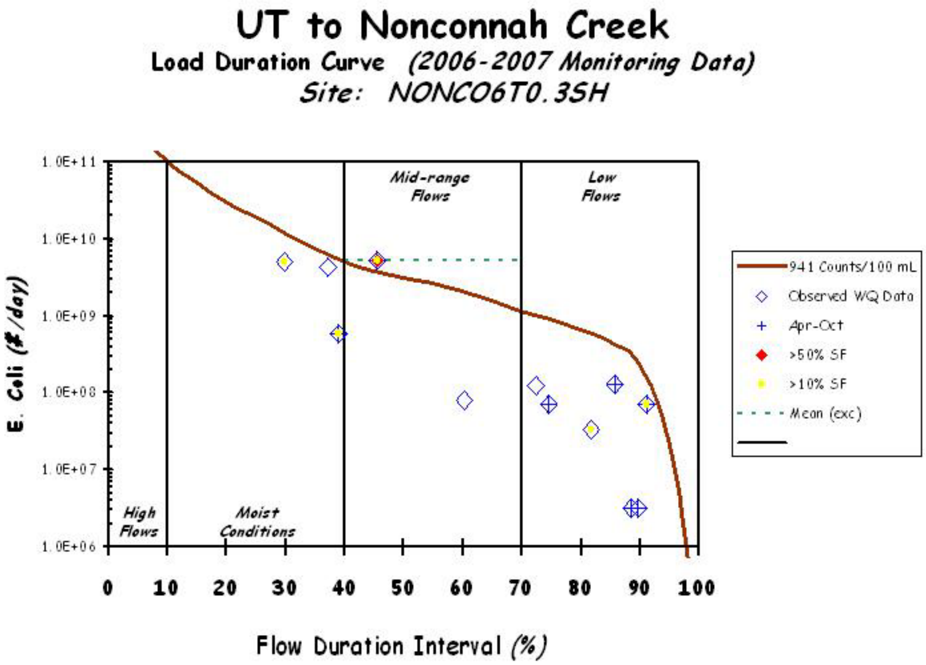

Figure E-9. E. Coli Load Duration Curve for UT to Nonconnah Creek – 6T0.3

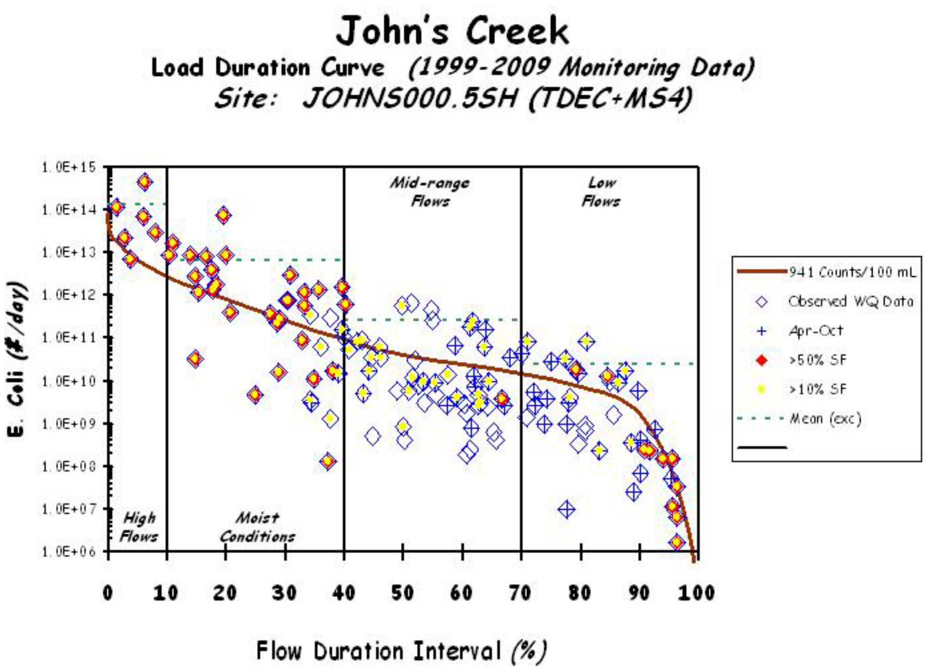

Figure E-10. E. Coli Load Duration Curve for John's Creek – RM0.5

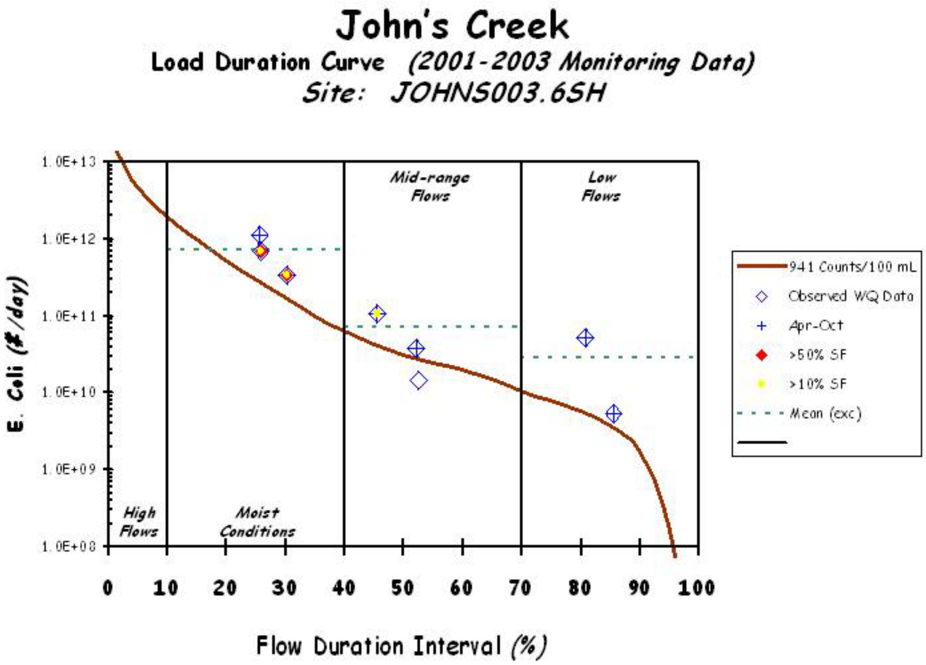

Figure E-11. E. Coli Load Duration Curve for John's Creek – RM3.6

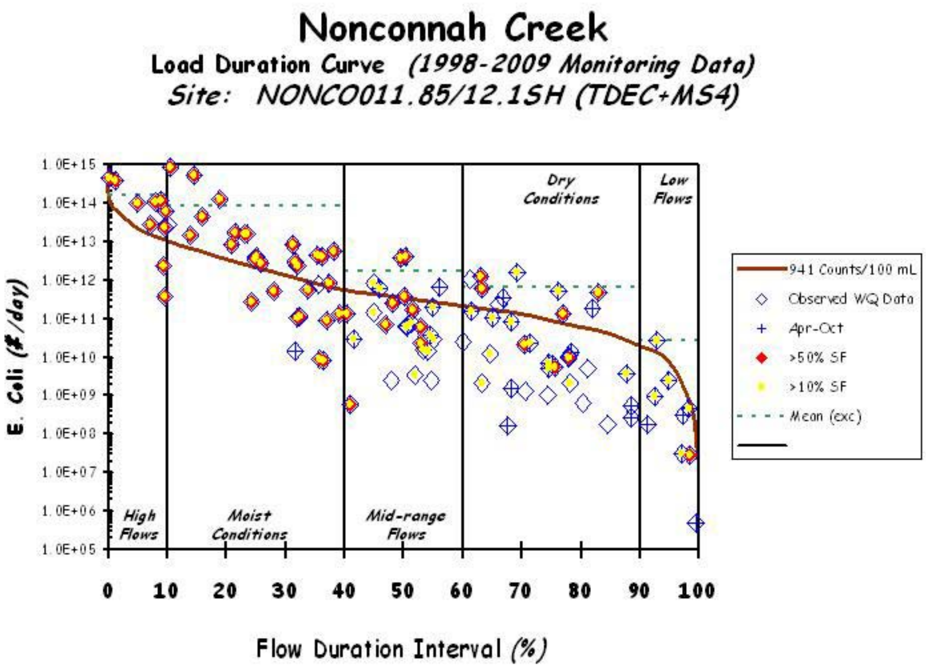

Figure E-12. E. Coli Load Duration Curve for Nonconnah Creek – RM11.85/12.0

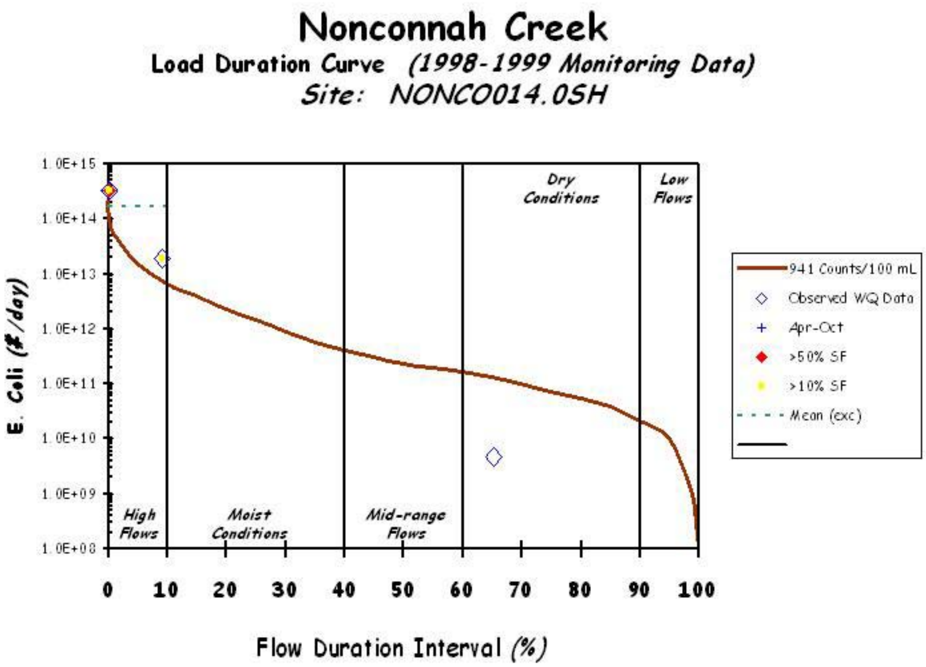

Figure E-13. E. Coli Load Duration Curve for Nonconnah Creek – RM14.0

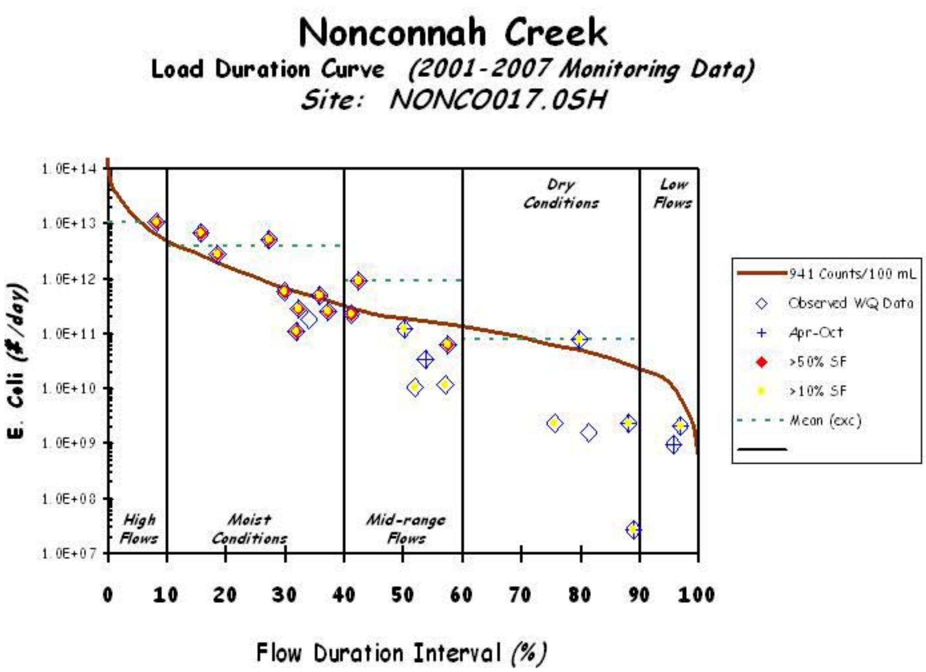

Figure E-14. E. Coli Load Duration Curve for Nonconnah Creek – RM17.0

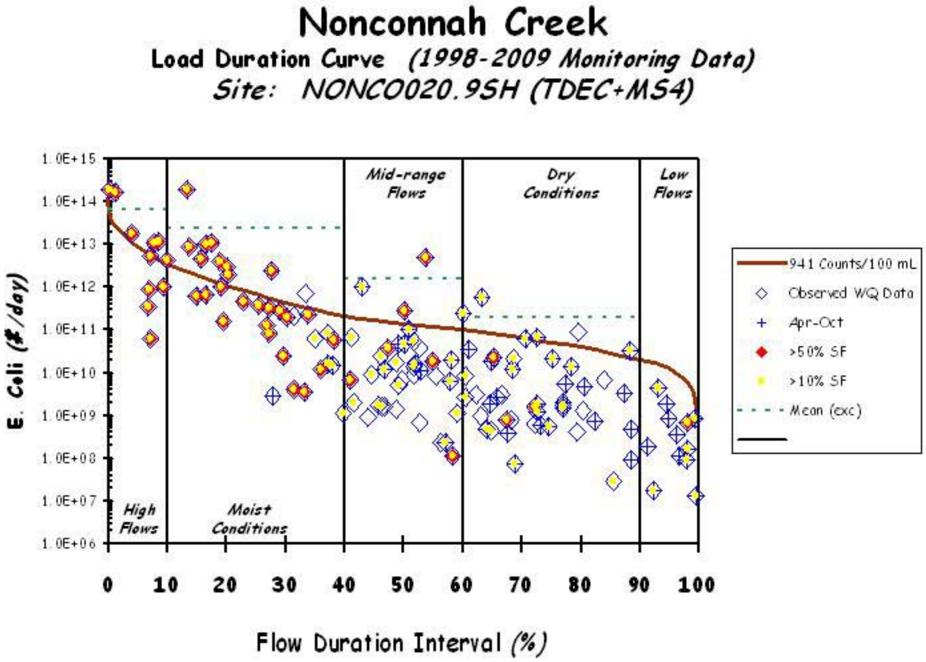

Figure E-15. E. Coli Load Duration Curve for Nonconnah Creek – RM20.9

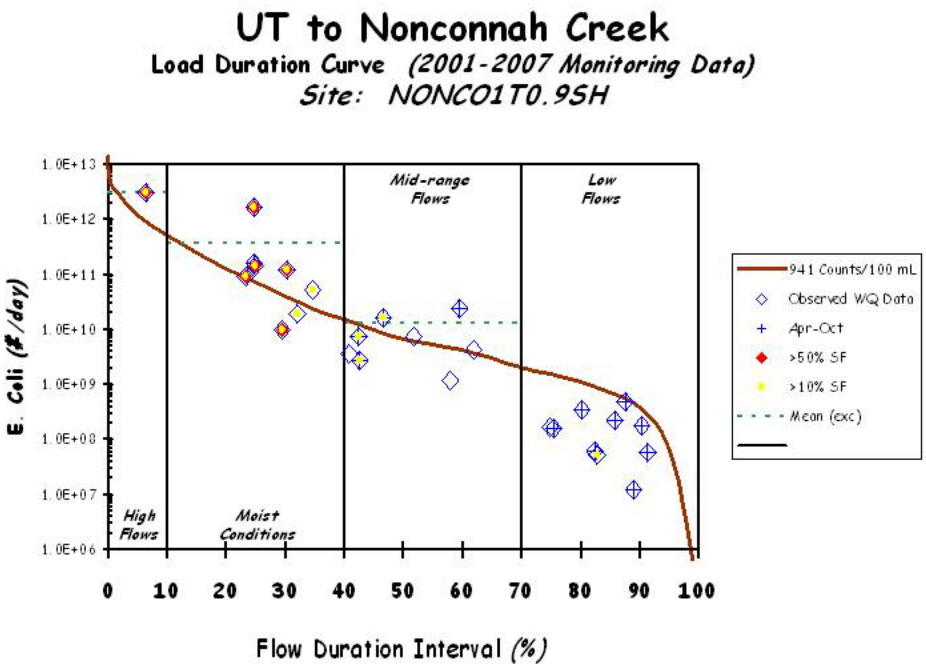

Figure E-16. E. Coli Load Duration Curve for UT to Nonconnah Creek – 1T0.9

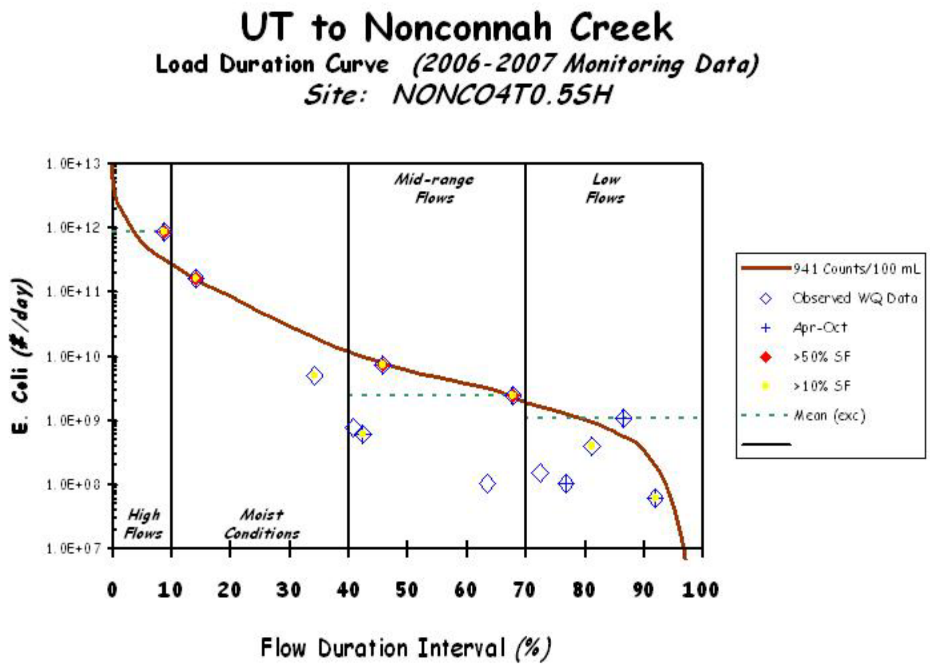

Figure E-17. E. Coli Load Duration Curve for UT to Nonconnah Creek – 4T0.5

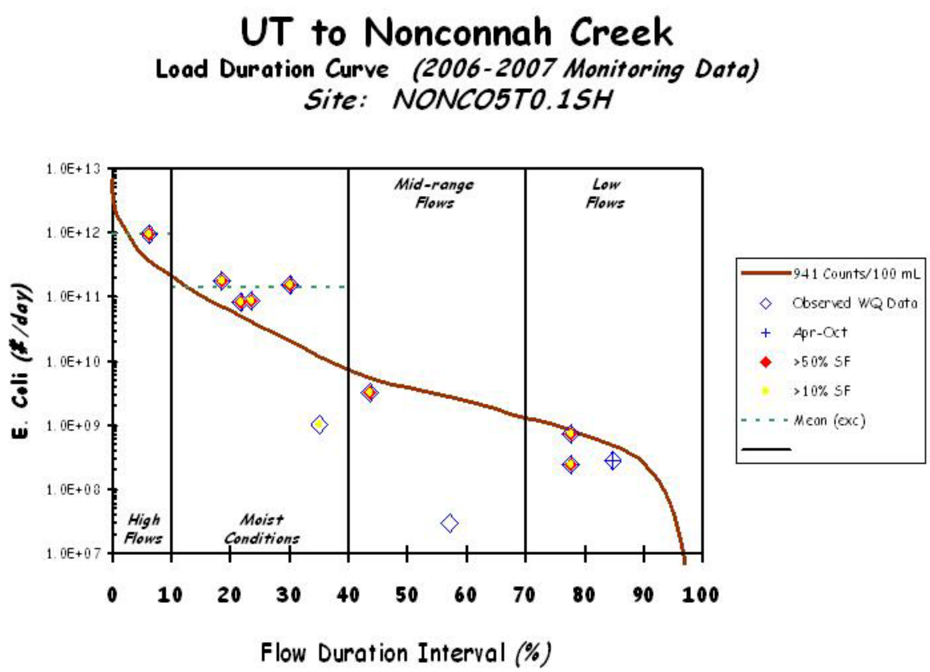

Figure E-18. E. Coli Load Duration Curve for UT to Nonconnah Creek – 5T0.1

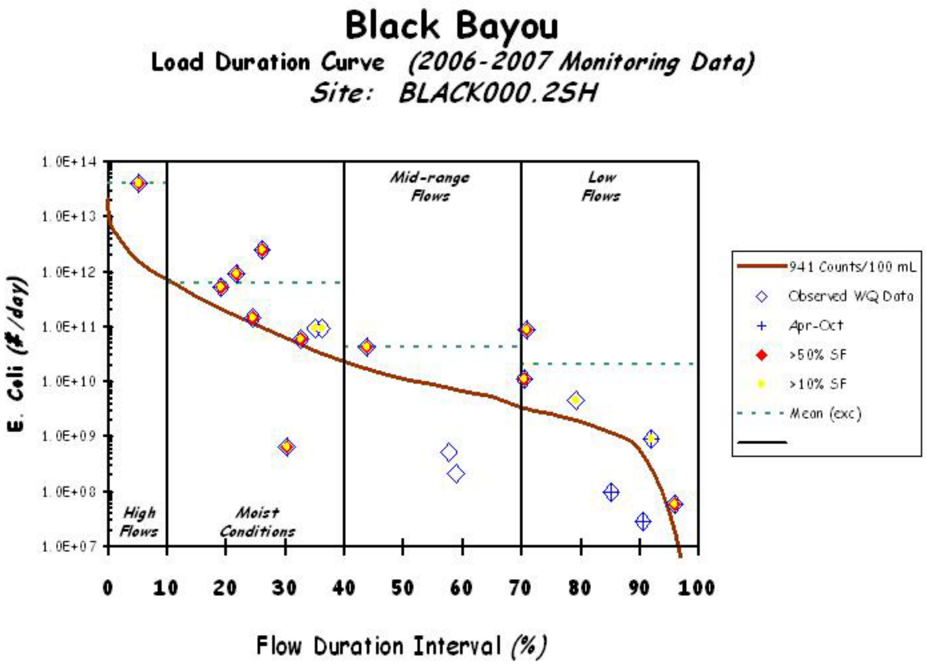

Figure E-19. E. Coli Load Duration Curve for Black Bayou – RM0.2

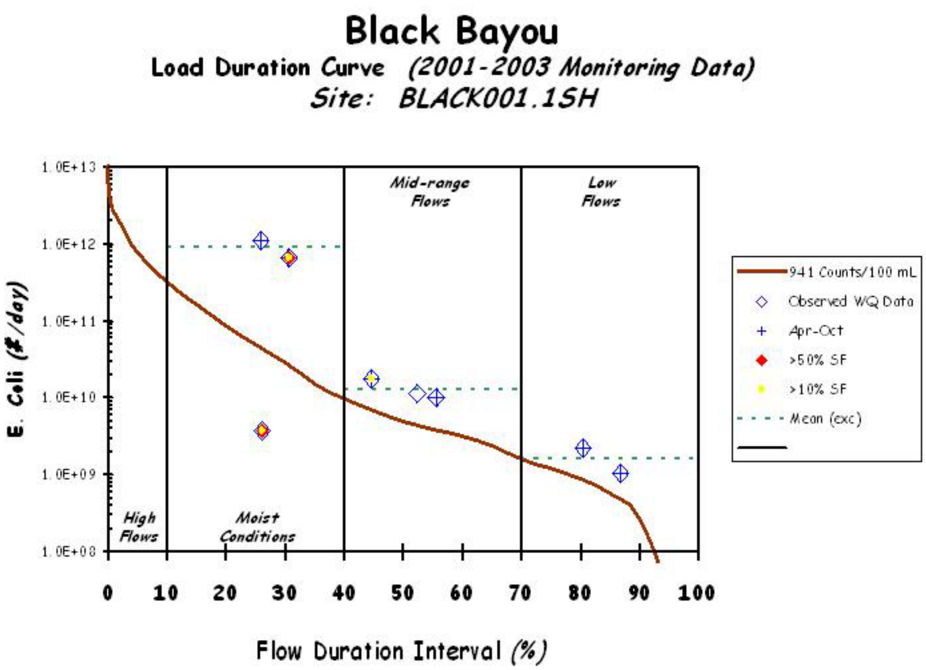

Figure E-20. E. Coli Load Duration Curve for Black Bayou – RM1.1

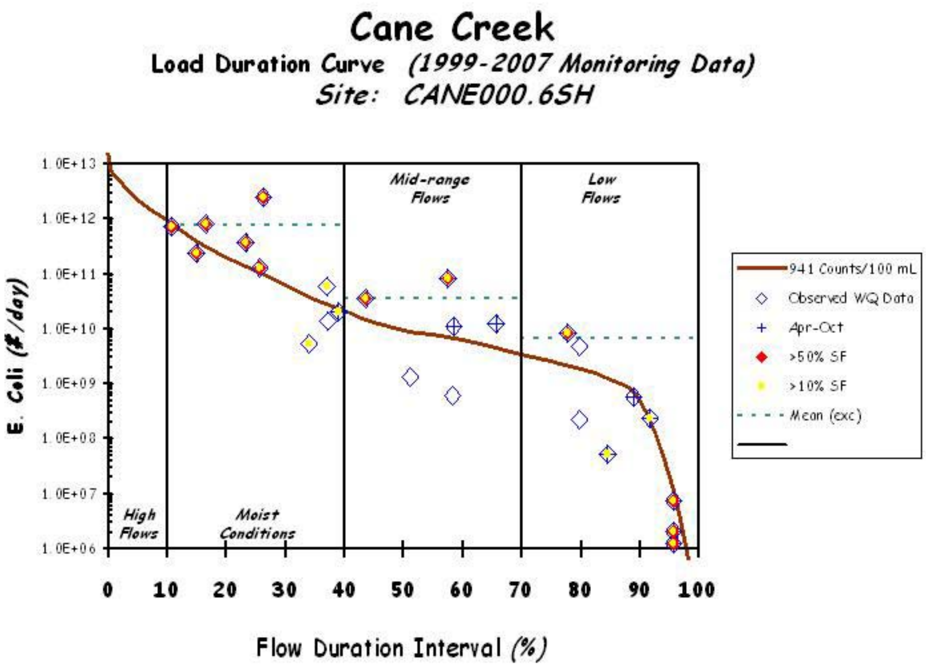

Figure E-21. E. Coli Load Duration Curve for Cane Creek – RM0.6

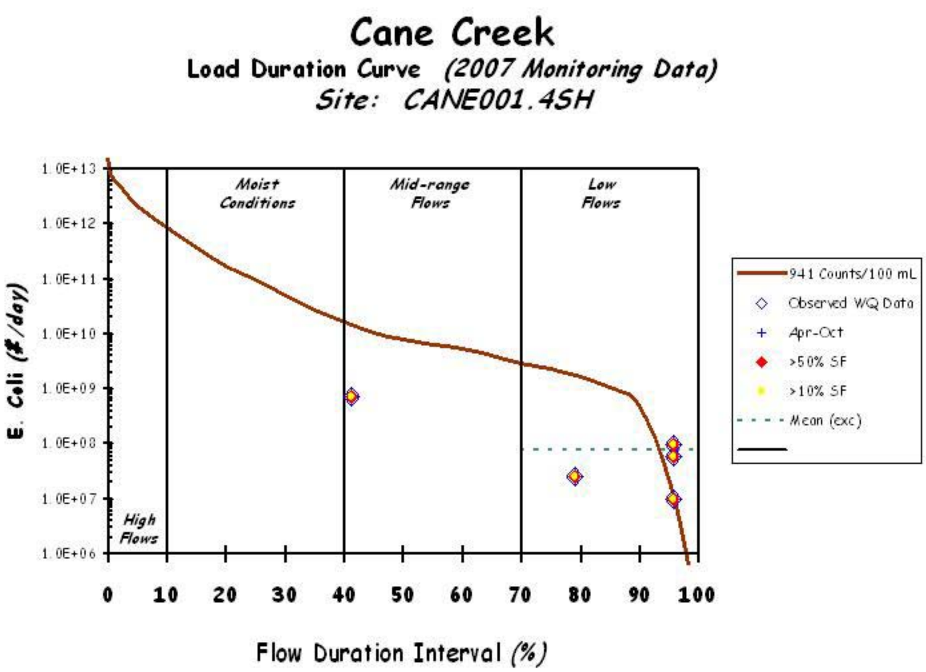

Figure E-22. E. Coli Load Duration Curve for Cane Creek – RM1.4

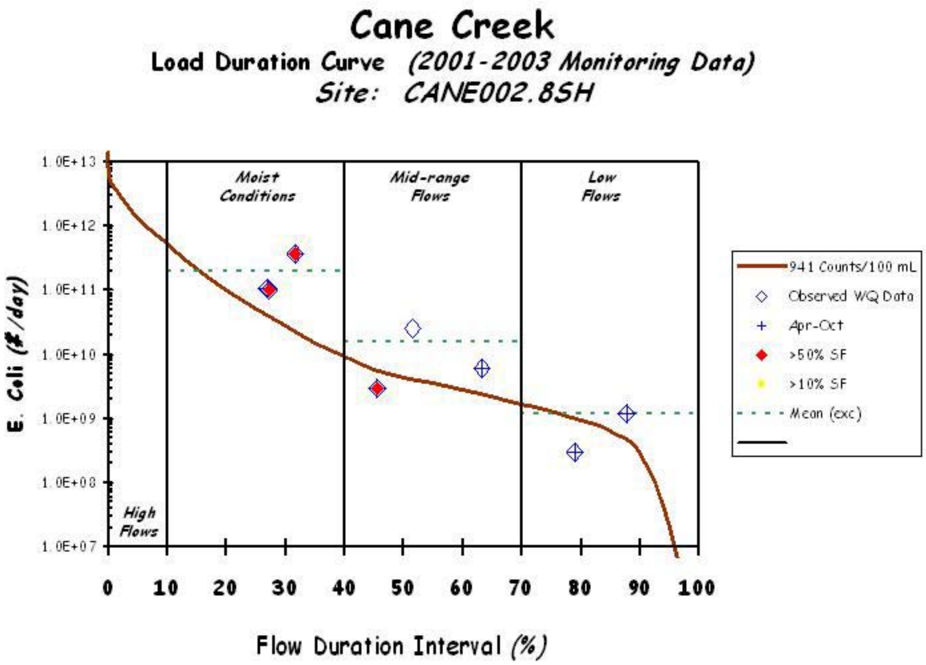

Figure E-23. E. Coli Load Duration Curve for Cane Creek – RM2.8

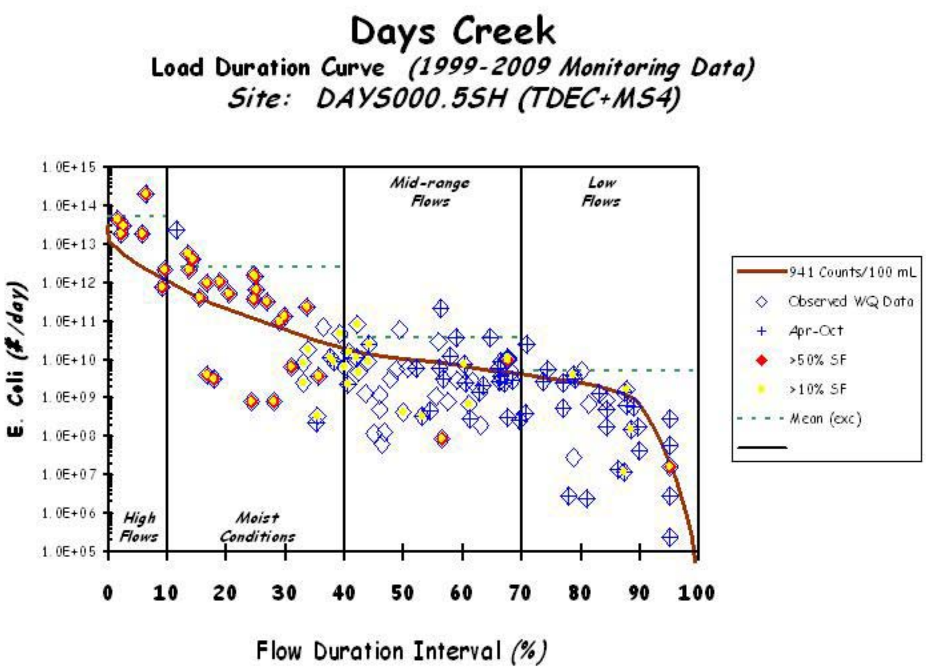

Figure E-24. E. Coli Load Duration Curve for Days Creek – RM0.5

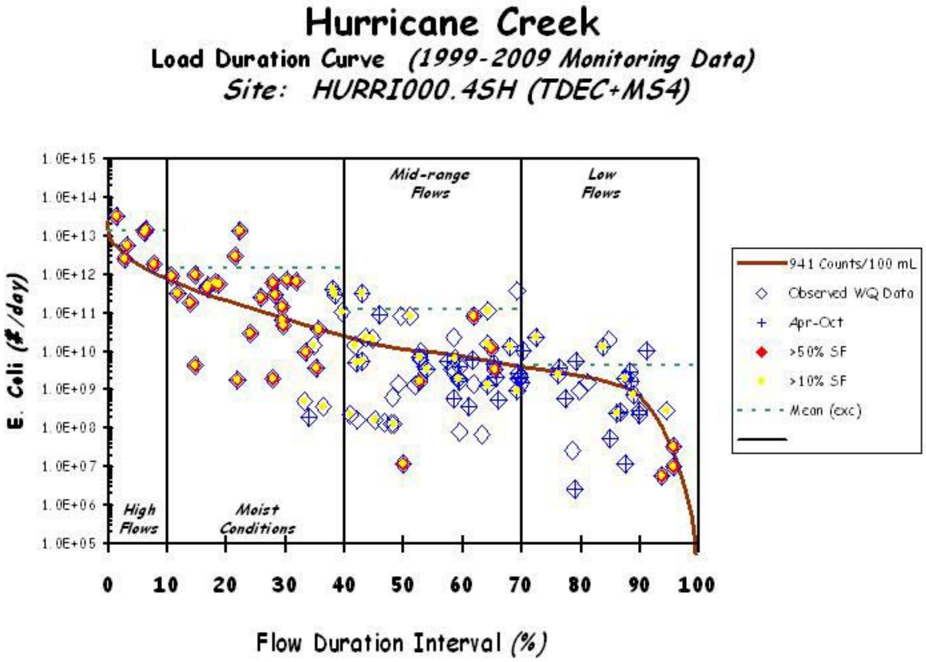

Figure E-25. E. Coli Load Duration Curve for Hurricane Creek – RM0.4

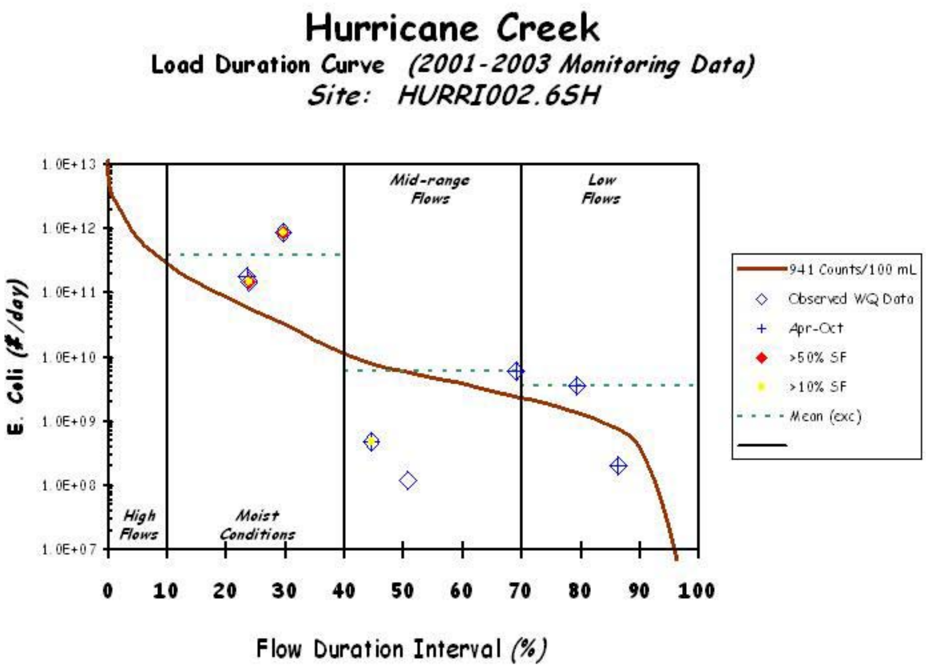

Figure E-26. E. Coli Load Duration Curve for Hurricane Creek – RM2.6

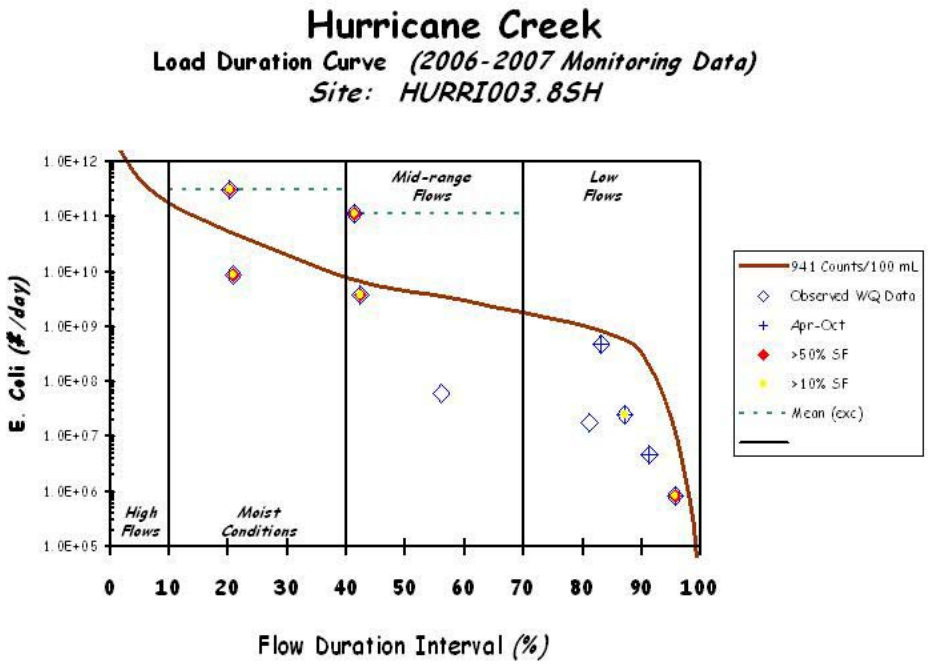

Figure E-27. E. Coli Load Duration Curve for Hurricane Creek – RM3.6

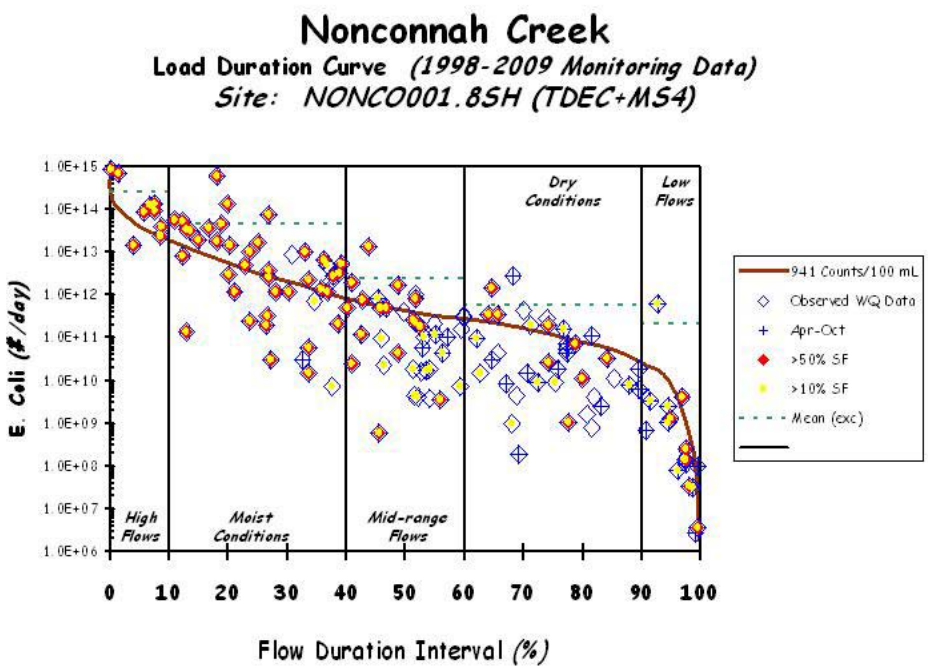

Figure E-28. E. Coli Load Duration Curve for Nonconnah Creek – RM1.8

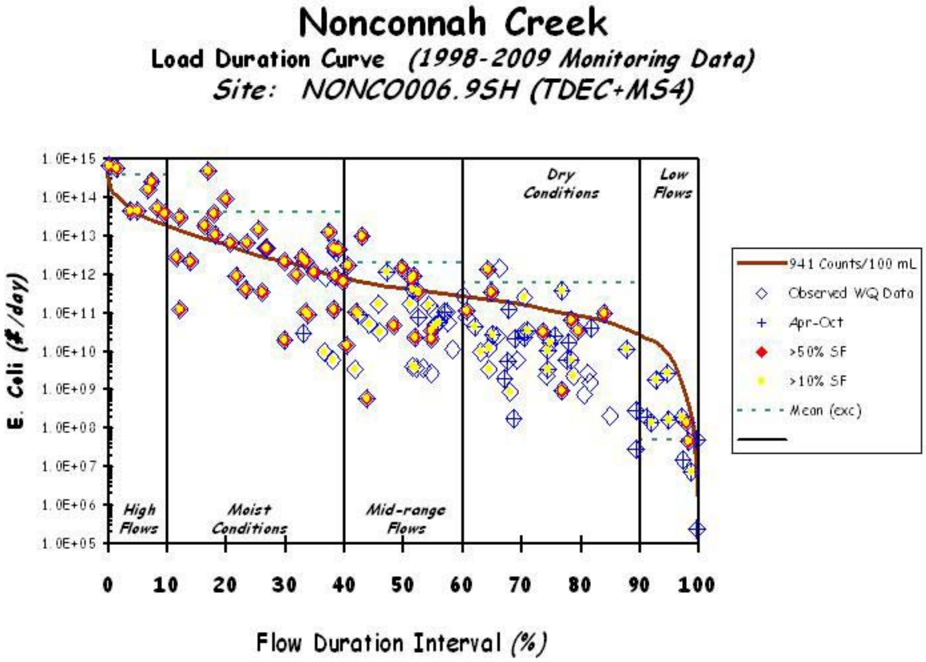

Figure E-29. E. Coli Load Duration Curve for Nonconnah Creek – RM6.9

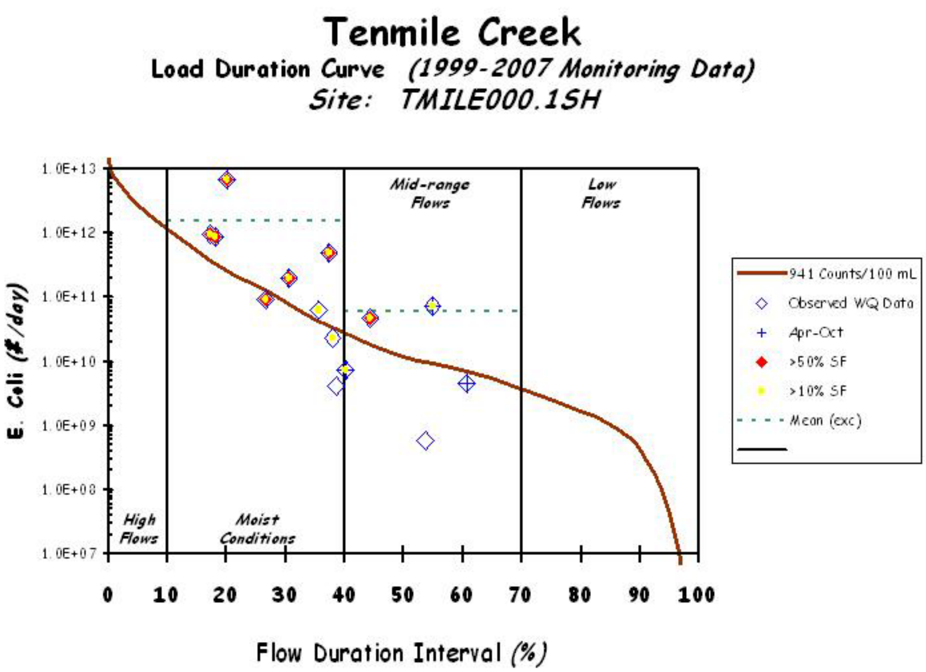

Figure E-30. E. Coli Load Duration Curve for Tenmile Creek – RM0.1

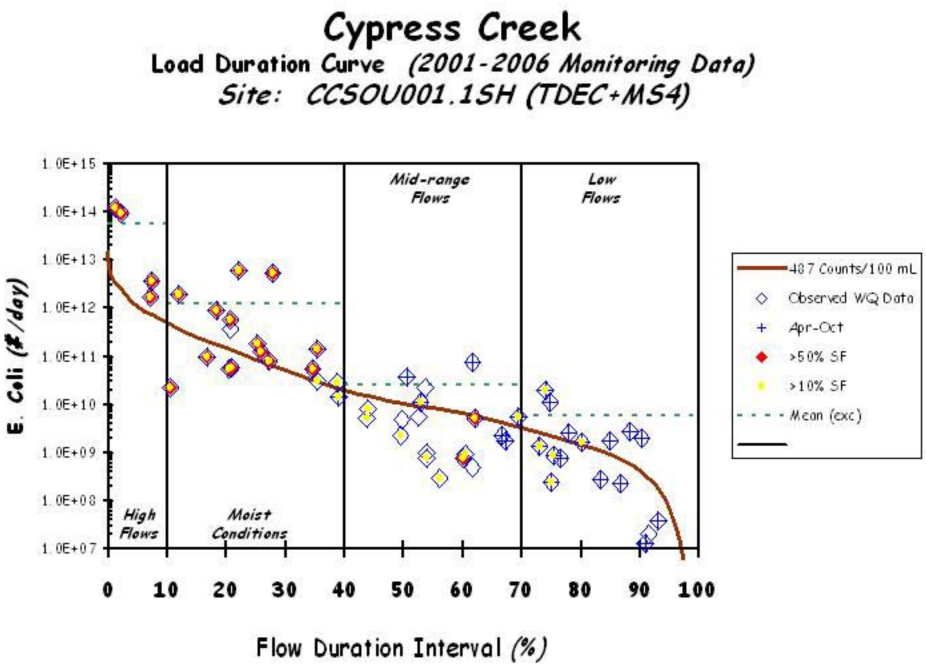

Figure E-31. E. Coli Load Duration Curve for Cypress Creek – RM1.1

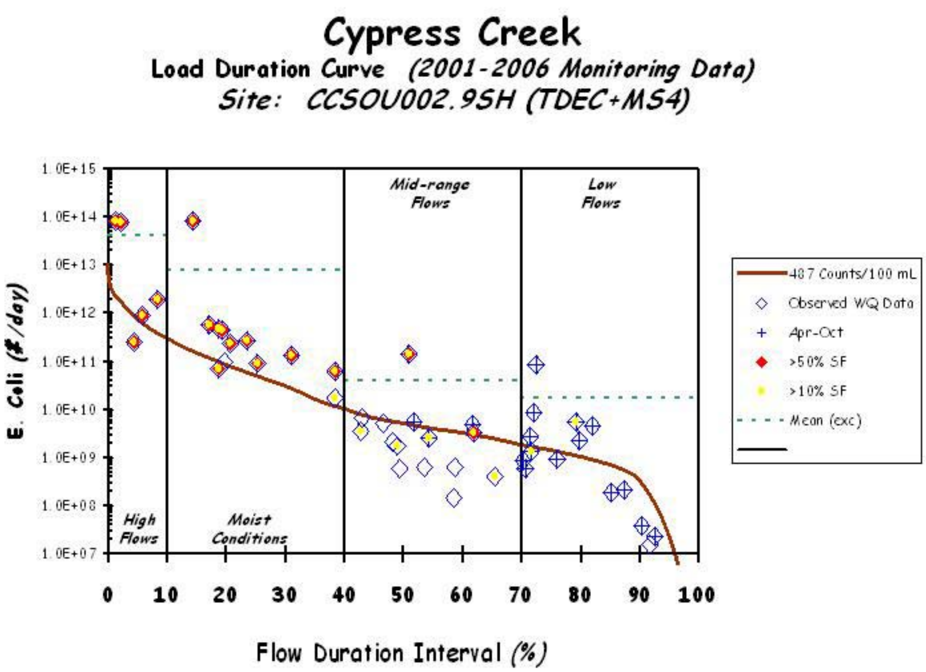

Figure E-32. E. Coli Load Duration Curve for Cypress Creek – RM2.9

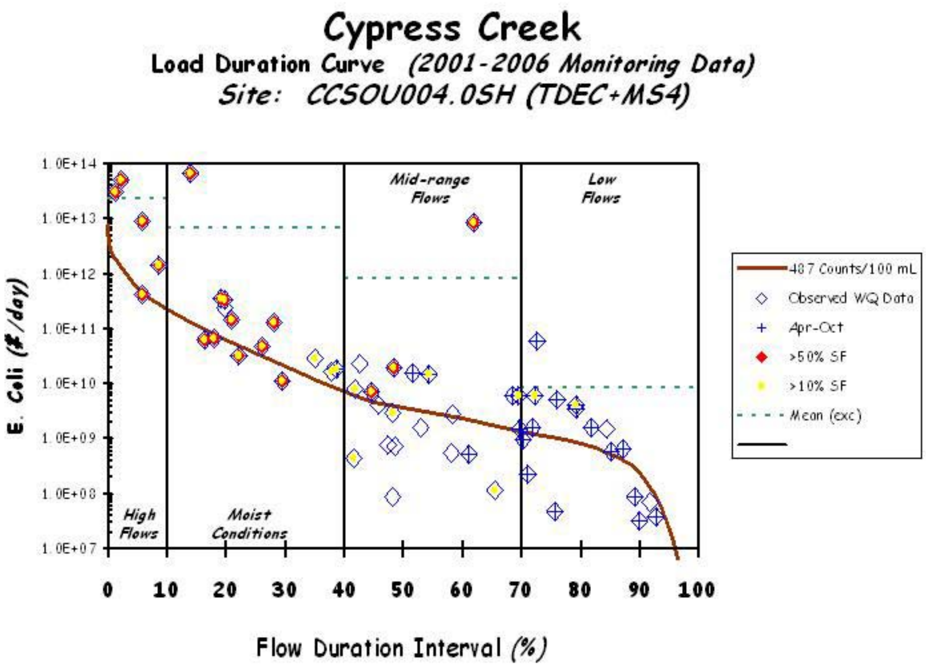

Figure E-33. E. Coli Load Duration Curve for Cypress Creek – RM4.0

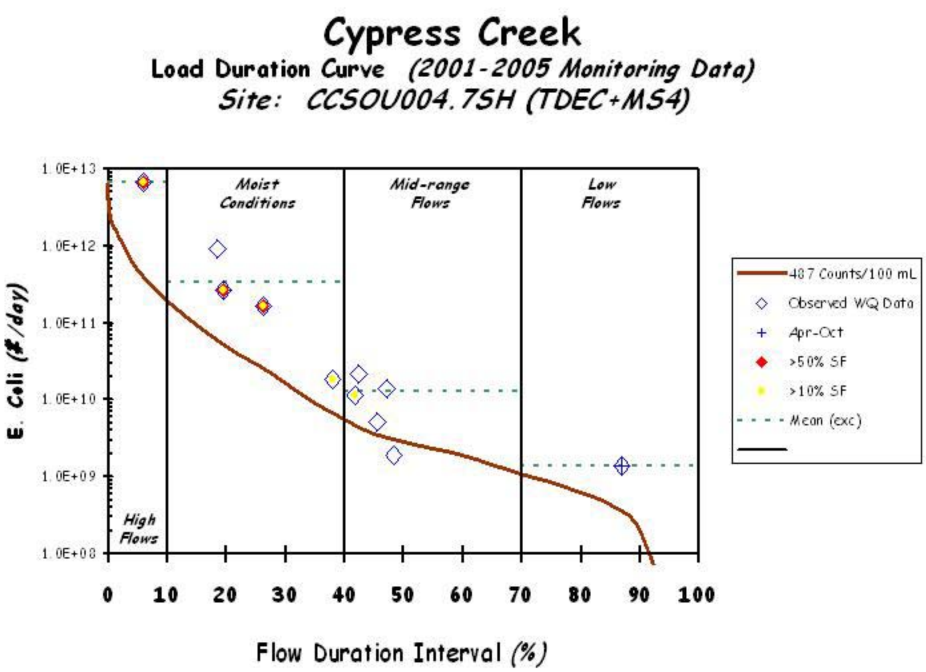

Figure E-34. E. Coli Load Duration Curve for Cypress Creek – RM4.7

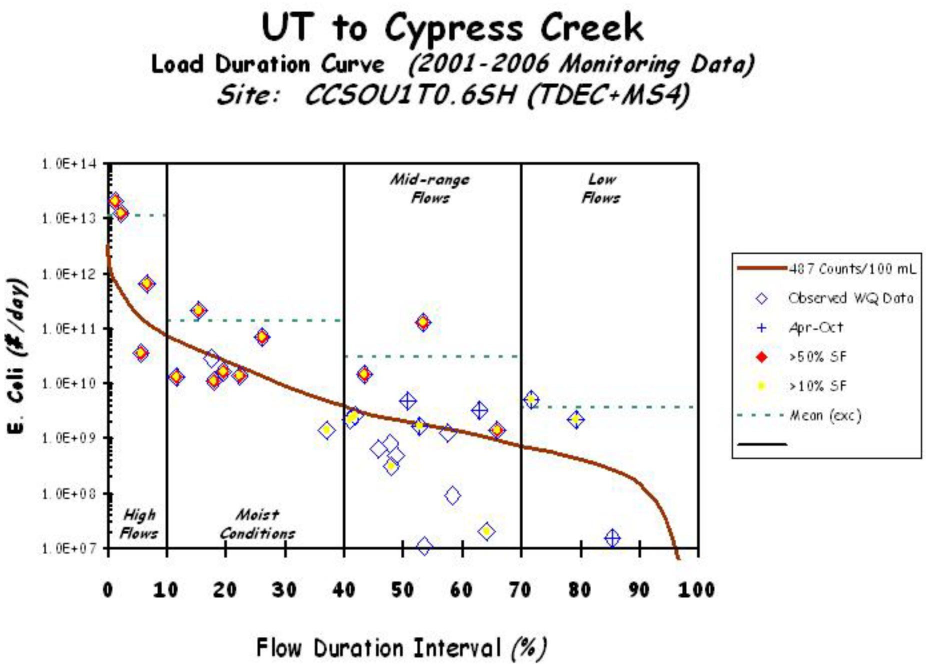

Figure E-35. E. Coli Load Duration Curve for UT to Cypress Creek – 1T0.6

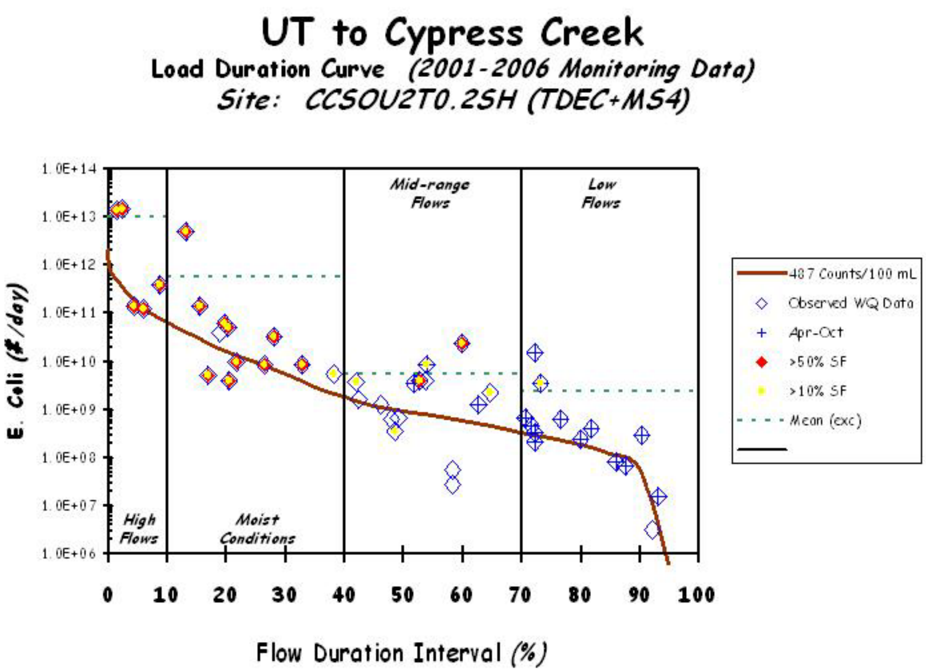

Figure E-36. E. Coli Load Duration Curve for UT to Cypress Creek – 2T0.2

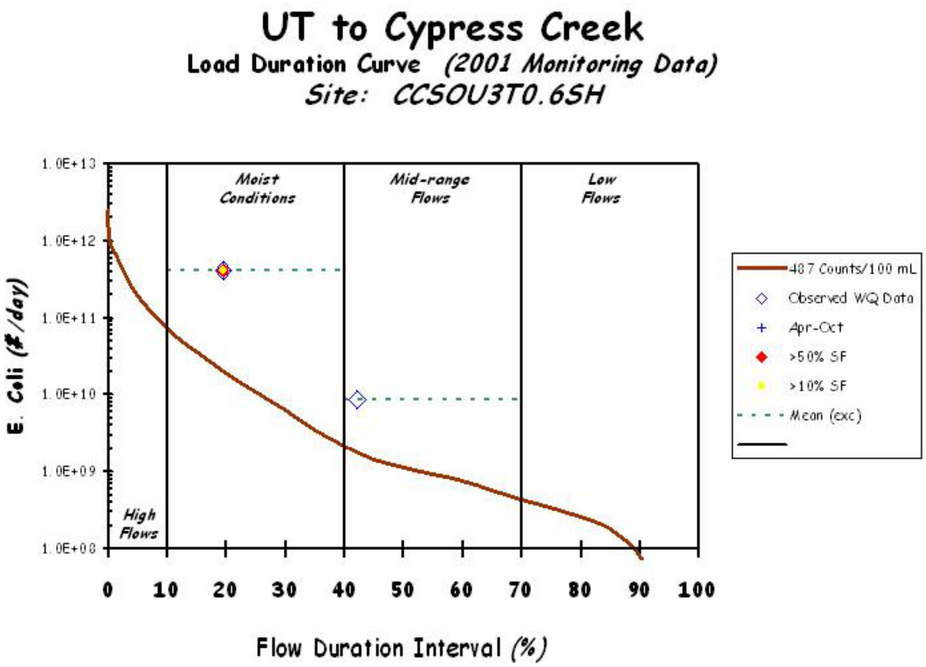

Figure E-37. E. Coli Load Duration Curve for Cypress Creek – 3T0.6

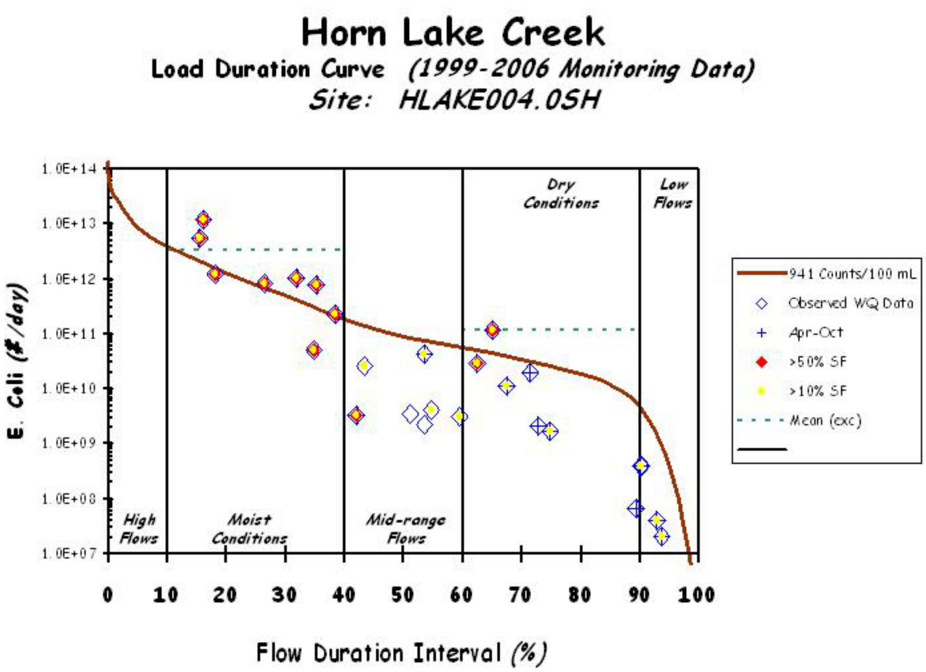

Figure E-38. E. Coli Load Duration Curve for Horn Lake Creek – RM4.0

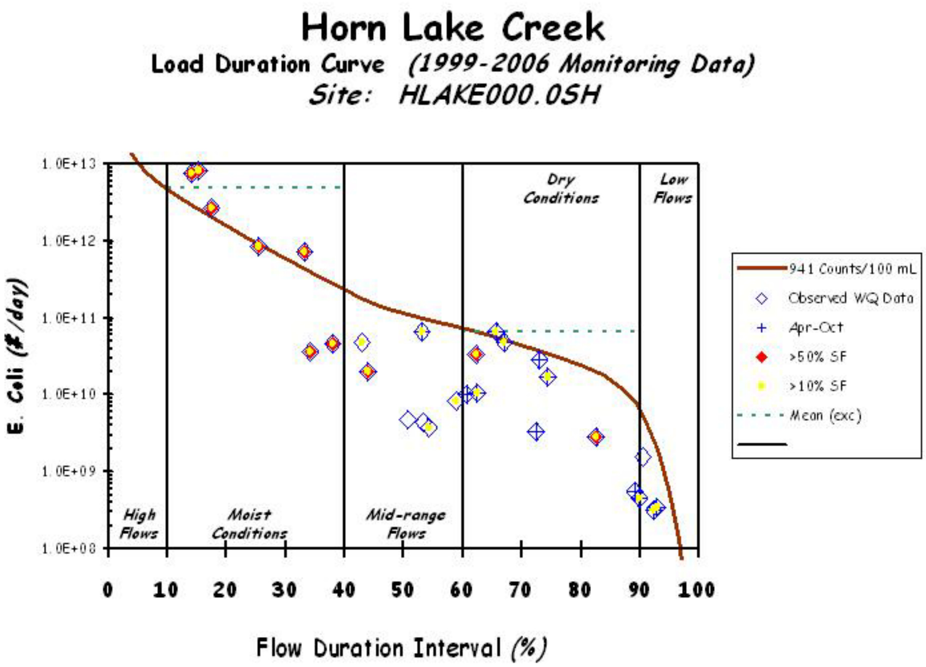

Figure E-39. E. Coli Load Duration Curve for Horn Lake Creek – RM0.0

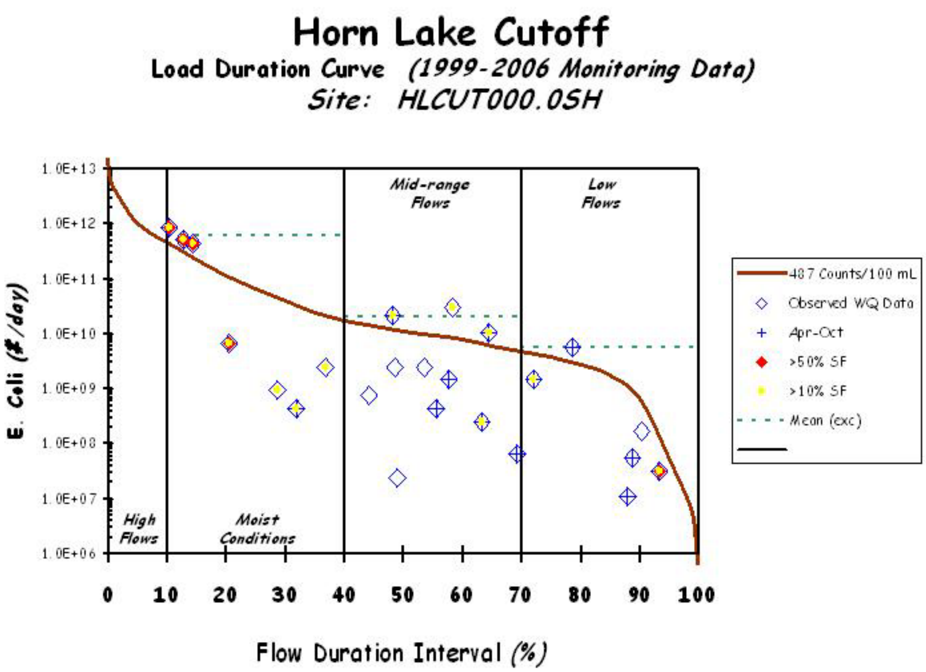

Figure E-40. E. Coli Load Duration Curve for Horn Lake Cutoff – RM0.0

Table E-3. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM25.2

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/8/02	Moist Conditions	5.87	20.0%	4,360	6.27E+11	**78.4**		
1/8/02		5.21	21.0%	2,419.2	3.08E+11	**61.1**		
4/9/02		3.10	26.7%	290.4	2.20E+10	NR		
1/24/07		1.88	31.6%	150	6.88E+09	NR		
2/28/07		1.00	38.8%	210	5.14E+09	NR		
4/28/03		0.92	39.9%	24.6	5.54E+08	NR	**23.3**	**24.3**
4/18/07	Mid-Range Flows	0.90	40.3%	35	7.74E+08	NR		
10/18/06		0.69	45.0%	580	9.81E+09	NR		
2/4/03		0.53	51.1%	35	4.50E+08	NR		
7/11/01		0.47	53.5%	2,419.2	2.78E+10	**61.1**		
3/21/07		0.31	62.5%	17	1.30E+08	NR	**12.2**	**13.0**
12/19/06	Low Flow Conditions	0.17	71.8%	6	2.52E+07	NR		
5/23/07		0.13	76.0%	5	1.63E+07	NR		
11/28/06		0.08	81.3%	63	1.29E+08	NR		
7/12/06		0.08	82.3%	17	3.24E+07	NR		
10/9/01		0.08	82.5%	439	8.27E+08	NR		
6/12/07		0.05	86.7%	71	8.69E+07	NR		
8/2/06		0.03	89.8%	1	8.07E+05	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-4. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 2T0.3

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
8/22/06	Moist Conditions	21.71	14.6%	13,000	6.91E+12	**92.8**		
8/21/06		12.76	19.7%	2,400	7.49E+11	**60.8**		
10/8/02		12.58	19.9%	2,723	8.38E+11	**65.4**		
1/8/02		11.20	20.8%	816.4	2.24E+11	NR		
4/9/02		7.02	26.6%	2,909	5.00E+11	**67.7**		
1/24/07		4.58	31.4%	190	2.13E+10	NR		
4/25/07		2.85	38.2%	107	7.47E+09	NR		
2/28/07		2.78	38.6%	340	2.31E+10	NR		
4/28/03		2.60	39.9%	110.6	7.04E+09	NR	**31.8**	**33.1**
4/18/07	Mid-Range Flows	2.56	40.3%	100	6.26E+09	NR		
10/18/06		2.13	45.3%	2,600	1.35E+11	**63.8**		
2/4/03		1.87	50.7%	365.4	1.67E+10	NR		
5/5/07		1.78	52.3%	93	4.05E+09	NR		
7/11/01		1.66	55.7%	2,419.2	9.83E+10	**61.1**		
3/21/07		1.45	61.9%	20	7.10E+08	NR		
5/2/07		1.28	66.6%	313	9.81E+09	NR	**17.8**	**18.9**
12/19/06	Low Flow Conditions	1.16	71.1%	39	1.11E+09	NR		
5/23/07		1.08	75.6%	26	6.89E+08	NR		
11/28/06		1.00	79.8%	62	1.52E+09	NR		
10/9/01		0.97	82.3%	2,046	4.84E+10	**54.0**		
7/12/06		0.96	82.4%	46	1.08E+09	NR		
7/9/02		0.96	82.8%	2,050	4.80E+10	**54.1**		
8/10/06		0.89	86.7%	40	8.71E+08	NR		
6/12/07		0.87	88.2%	49	1.04E+09	NR		
8/16/06		0.82	92.1%	78	1.56E+09	NR		
8/2/06		0.80	93.8%	40	7.78E+08	NR	**10.8**	**11.7**

Note: NR = No reduction required
NA = Not applicable

Table E-5. Calculated Load Reduction Based on Geomean Data – UT to Nonconnah Creek – 2T0.3

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
8/2/06	0.80	93.8%	40			
8/10/06	0.89	86.7%	40			
8/16/06	0.82	92.1%	78			
8/21/06	12.76	19.7%	2,400			
8/22/06	21.71	14.6%	13,000	329.7	**61.8**	**65.7**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-6. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 3T0.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/14/07	High Flows	74.18	9.4%	190	3.45E+11	NR	**NR**	**NR**
8/22/06	Moist Conditions	6.45	30.3%	20,000	3.15E+12	**95.3**	**51.5**	**52.3**
8/21/06		6.22	30.7%	17,000	2.59E+12	**94.5**		
2/28/07		4.59	34.1%	380	4.27E+10	NR		
4/18/07		4.18	35.5%	55	5.62E+09	NR		
10/18/06		3.30	39.8%	2,900	2.34E+11	**67.6**		
5/3/07	Mid-Range Flows	2.27	48.7%	6	3.33E+08	NR	**NR**	**NR**
4/25/07		1.45	59.5%	10	3.54E+08	NR		
3/21/07		1.21	63.3%	15	4.42E+08	NR		
12/19/06		1.09	64.9%	10	2.68E+08	NR		
5/2/07		0.86	68.2%	4	8.44E+07	NR		
11/28/06	Low Flows	0.31	80.7%	20	1.51E+08	NR	**15.3**	**16.2**
7/12/06		0.22	83.2%	15	8.22E+07	NR		
6/12/07		0.11	88.4%	2,419.6	6.22E+09	**61.1**		
8/16/06		0.06	92.0%	11	1.51E+07	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-7. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 3T1.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/8/02	Moist Conditions	30.89	14.6%	8,664	6.55E+12	**89.1**		
1/8/02		21.71	17.0%	1,553.1	8.25E+11	**39.4**		
4/9/02		9.92	24.1%	413	1.00E+11	NR	**42.9**	**45.2**
2/4/03	Mid-Range Flows	2.04	45.9%	21.2	1.06E+09	NR	**NR**	**NR**
7/11/01	Low Flows	0.81	65.8%	2,419.2	4.78E+10	**61.1**	**61.1**	**65.0**

Note: NR = No reduction required
NA = Not applicable

Table E-8. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 6T0.3

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/24/07	Moist Conditions	0.52	29.9%	390	4.95E+09	NR		
2/28/07		0.27	37.2%	650	4.34E+09	NR		
4/18/07		0.24	39.1%	100	5.75E+08	NR	**NR**	**NR**
10/18/06	Mid-Range Flows	0.17	45.6%	1,300	5.31E+09	**27.6**		
3/21/07		0.09	60.4%	36	8.10E+07	NR	**13.8**	**17.4**
12/19/06	Low Flows	0.05	72.6%	110	1.24E+08	NR		
5/23/07		0.04	74.8%	71	7.12E+07	NR		
11/28/06		0.03	81.9%	52	3.31E+07	NR		
6/12/07		0.02	85.8%	276	1.28E+08	NR		
8/2/06		0.01	88.7%	10	3.18E+06	NR		
8/10/06		0.01	89.9%	12	3.23E+06	NR		
8/16/06		0.01	91.2%	360	7.05E+07	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-9. Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
5/14/03	High Flows	772.40	1.4%	6,000	1.13E+14	**83.3**	68.3	69.5
7/15/05		497.60	2.7%	1,800	2.19E+13	**47.7**		
4/21/04		374.60	3.7%	800	7.33E+12	NR		
10/11/04		236.20	6.0%	12,000	6.93E+13	**92.2**		
7/19/01		229.80	6.1%	80,000	4.50E+14	**98.8**		
1/6/05		171.30	7.9%	7,200	3.02E+13	**86.9**		
10/17/07	Moist Conditions	116.40	10.3%	3,000	8.54E+12	**68.6**		
12/1/04		107.50	10.9%	6,200	1.63E+13	**84.8**		
12/11/08		71.10	13.9%	4,900	8.52E+12	**80.8**		
3/13/02		65.29	14.8%	1,732	2.77E+12	**45.7**		
3/13/02		65.29	14.8%	20	3.19E+10	NR		
10/10/01		58.82	15.4%	803	1.16E+12	NR		
11/9/00		50.64	16.6%	6,700	8.30E+12	**86.0**		
7/10/01		45.89	17.6%	3,448	3.87E+12	**72.7**		
3/18/04		45.54	17.7%	1,200	1.34E+12	**21.6**		
1/30/06		41.85	18.4%	1,820	1.86E+12	**48.3**		
4/24/01		37.89	19.6%	80,000	7.42E+13	**98.8**		
1/11/06		35.35	20.0%	10,400	8.99E+12	**91.0**		
11/11/02		32.85	20.7%	500	4.02E+11	NR		
6/24/02		19.90	25.0%	10	4.87E+09	NR		
5/18/04		15.06	27.5%	1,000	3.68E+11	**5.9**		
2/14/08		13.42	28.7%	700	2.30E+11	NR		
3/6/01		13.30	28.8%	50	1.63E+10	NR		
4/29/08		12.81	29.0%	900	2.82E+11	NR		
12/11/03		11.48	30.2%	2,800	7.86E+11	**66.4**		
5/29/08		11.17	30.5%	2,800	7.65E+11	**66.4**		

Table E-9 (cont'd). Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/10/03	Moist Conditions (cont'd)	10.83	30.8%	11,000	2.91E+12	**91.4**		
1/24/08		8.59	32.9%	440	9.24E+10	NR		
6/12/03		8.16	33.3%	6,000	1.20E+12	**84.3**		
10/15/03		8.14	33.3%	2,800	5.58E+11	**66.4**		
1/9/02		7.04	34.3%	1,986.3	3.42E+11	**52.6**		
1/9/02		7.04	34.3%	20	3.45E+09	NR		
9/18/02		6.97	34.4%	18	3.07E+09	NR		
5/14/02		6.60	34.8%	70	1.13E+10	NR		
5/10/05		6.24	35.7%	8,800	1.34E+12	**89.3**		
1/24/07		6.06	36.0%	423	6.27E+10	NR		
8/7/02		5.38	37.3%	1	1.32E+08	NR		
12/4/01		5.22	37.6%	10	1.28E+09	NR		
12/11/01		5.13	37.7%	2,419.5	3.04E+11	**61.1**		
7/13/06		4.97	38.1%	140	1.70E+10	NR		
4/3/01		4.55	39.1%	130	1.45E+10	NR		
4/10/02		4.35	39.6%	1,455	1.55E+11	**35.3**		
6/7/05		4.32	39.6%	15,200	1.61E+12	**93.8**		
12/19/07		4.21	39.9%	1,100	1.13E+11	**14.5**	**37.5**	**39.2**
8/8/01	Mid-Range Flows	4.10	40.3%	6,131	6.14E+11	**84.7**		
2/7/06		3.80	40.8%	600	5.57E+10	NR		
12/20/00		3.41	42.2%	1,000	8.33E+10	**5.9**		
3/5/09		3.15	43.0%	1,200	9.24E+10	**21.6**		
10/15/02		3.07	43.2%	70	5.26E+09	NR		
4/23/09		2.76	44.3%	260	1.76E+10	NR		
2/24/09		2.68	44.7%	550	3.60E+10	NR		
2/13/03		2.65	44.8%	8	5.19E+08	NR		

Table E-9 (cont'd). Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
2/22/01	Mid-Range Flows (cont'd)	2.37	46.0%	1,100	6.38E+10	**14.5**		
1/24/01		2.33	46.2%	600	3.42E+10	NR		
1/8/03		1.87	49.0%	130	5.93E+09	NR		
3/21/01		1.76	49.9%	13,000	5.59E+11	**92.8**		
2/12/02		1.75	50.0%	20	8.56E+08	NR		
3/11/03		1.73	50.2%	10	4.22E+08	NR		
11/20/00		1.68	50.9%	140	5.74E+09	NR		
1/25/05		1.65	51.3%	16,200	6.54E+11	**94.2**		
1/22/04		1.63	51.6%	300	1.19E+10	NR		
1/22/09		1.61	51.9%	790	3.11E+10	NR		
2/13/02		1.55	52.6%	209.8	7.96E+09	NR		
5/16/06		1.49	53.4%	273	9.96E+09	NR		
3/15/05		1.49	53.5%	82	2.99E+09	NR		
2/24/04		1.39	54.8%	13,700	4.66E+11	**93.1**		
3/12/08		1.38	54.9%	7,600	2.57E+11	**87.6**		
4/2/03		1.36	55.4%	270	8.95E+09	NR		
12/2/02		1.35	55.5%	140	4.62E+09	NR		
8/19/08		1.25	57.3%	90	2.75E+09	NR		
11/8/04		1.24	57.5%	467	1.41E+10	NR		
5/8/02		1.17	58.8%	2,419.2	6.94E+10	**61.1**		
6/11/01		1.15	59.1%	150	4.22E+09	NR		
3/8/06		1.10	60.3%	109	2.93E+09	NR		
2/21/07		1.08	60.7%	7.3	1.93E+08	NR		
2/21/07		1.08	60.7%	64	1.69E+09	NR		
2/6/01		1.06	61.3%	10	2.59E+08	NR		
6/12/02		1.06	61.3%	6,867	1.78E+11	**86.3**		

Table E-9 (cont'd). Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
4/18/02	Mid-Range Flows (cont'd)	1.04	61.6%	30	7.63E+08	NR	18.7	19.5
9/20/06		1.02	61.8%	10,000	2.51E+11	**90.6**		
4/20/05		1.02	61.9%	500	1.25E+10	NR		
5/20/09		1.01	62.1%	300	7.43E+09	NR		
11/21/06		0.981	62.8%	110	2.64E+09	NR		
11/21/06		0.981	62.8%	200	4.80E+09	NR		
4/12/06		0.972	63.1%	127	3.02E+09	NR		
6/17/04		0.938	63.7%	2,700	6.20E+10	**65.1**		
5/2/01		0.924	63.9%	7,000	1.58E+11	**86.6**		
3/21/07		0.900	64.4%	112	2.47E+09	NR		
6/17/09		0.897	64.5%	430	9.44E+09	NR		
1/10/01		0.850	65.4%	30	6.24E+08	NR		
11/20/08		0.841	65.7%	20	4.12E+08	NR		
8/8/05		0.783	66.7%	200	3.83E+09	NR		
6/19/08		0.745	67.2%	150	2.73E+09	NR		
4/23/07		0.703	68.2%	2,000	3.44E+10	**53.0**		
10/22/08	Low Flows	0.622	70.2%	2,800	4.26E+10	**66.4**		
12/6/00		0.583	71.0%	100	1.43E+09	NR		
8/6/03		0.577	71.1%	6,000	8.47E+10	**84.3**		
5/9/07		0.542	72.2%	411	5.45E+09	NR		
5/9/07		0.542	72.2%	400	5.30E+09	NR		
9/25/08		0.530	72.4%	210	2.72E+09	NR		
6/7/06		0.490	73.9%	80	9.59E+08	NR		
6/20/01		0.483	74.3%	330	3.90E+09	NR		
6/9/99		0.466	75.1%	2,419.2	2.76E+10	**61.1**		
9/16/03		0.396	77.4%	3,400	3.29E+10	**72.3**		

Table E-9 (cont'd). Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/22/02	Low Flows (cont'd)	0.394	77.6%	1	9.64E+06	NR		
10/23/01		0.390	77.7%	100	9.54E+08	NR		
7/15/08		0.385	78.1%	330	3.11E+09	NR		
12/12/05		0.378	78.2%	440	4.07E+09	NR		
9/15/04		0.347	79.3%	2,200	1.87E+10	**57.2**		
11/7/01		0.334	79.7%	40	3.27E+08	NR		
7/22/04		0.335	79.7%	1,800	1.48E+10	**47.7**		
12/7/06		0.307	80.8%	118	8.86E+08	NR		
11/14/01		0.304	80.9%	88.9	6.61E+08	NR		
6/19/00		0.301	81.0%	11,000	8.10E+10	**91.4**		
9/25/01		0.236	83.3%	40	2.31E+08	NR		
10/5/05		0.212	84.6%	2,500	1.30E+10	**62.4**		
11/11/03		0.203	85.1%	1,900	9.44E+09	**50.5**		
11/20/07		0.187	85.7%	360	1.65E+09	NR		
8/18/04		0.163	86.5%	2,300	9.17E+09	**59.1**		
9/12/01		0.132	87.7%	5,172	1.67E+10	**81.8**		
6/13/07		0.110	88.7%	130	3.50E+08	NR		
8/29/01		0.100	89.1%	10	2.45E+07	NR		
7/24/00		0.079	89.9%	3,100	5.99E+09	**69.6**		
8/10/06		0.076	90.2%	38	7.07E+07	NR		
8/10/06		0.076	90.2%	220	4.09E+08	NR		
11/9/05		0.064	90.8%	160	2.51E+08	NR		
9/20/00		0.041	91.9%	230	2.31E+08	NR		
9/21/05		0.030	92.6%	1,020	7.49E+08	**7.7**		
9/19/07		0.015	94.0%	400	1.47E+08	NR		
7/19/07		0.004	95.5%	540	5.28E+07	NR		

Table E-9 (cont'd). Calculated Load Reduction Based on Daily Loading – John's Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/16/00	Low Flows	0.003	95.7%	160	1.17E+07	NR		
8/27/07		0.003	95.7%	2,000	1.47E+08	**53.0**		
8/23/00		0.001	96.4%	1,400	3.43E+07	**32.8**		
10/24/00		0.001	96.4%	70	1.71E+06	NR		
10/12/06		0.001	96.4%	273	6.68E+06	NR	**21.9**	**23.1**

Note: NR = No reduction required
NA = Not applicable

Table E-10. Calculated Load Reduction Based on Daily Loading – John's Creek – RM3.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/8/02	Moist Conditions	12.02	25.6%	3,873	1.14E+12	**75.7**		
1/8/02		11.76	25.8%	2,419.2	6.96E+11	**61.1**		
4/9/02		7.36	30.3%	1,850	3.33E+11	**49.1**	**62.0**	**65.0**
4/28/03	Mid-Range Flows	1.79	45.6%	2,419.2	1.06E+11	**61.1**		
7/11/01		1.21	52.1%	1,299.7	3.83E+10	**27.6**		
2/4/03		1.18	52.6%	512	1.48E+10	NR	**29.6**	**32.5**
7/9/02	Low Flows	0.23	80.9%	9,208	5.25E+10	**89.8**		
10/9/01		0.15	85.7%	1,450	5.32E+09	**35.1**	**62.4**	**65.4**

Note: NR = No reduction required
NA = Not applicable

Table E-11. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM11.85/12.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/5/99	High Flows	7730.00	0.2%	2,419.2	4.58E+14	**61.1**	**57.3**	**59.6**
5/14/03		2873.00	1.2%	5,300	3.73E+14	**82.2**		
12/1/04		989.40	5.0%	4,200	1.02E+14	**77.6**		
11/11/02		704.40	7.1%	1,600	2.76E+13	**41.2**		
1/6/05		616.80	8.0%	7,300	1.10E+14	**87.1**		
10/11/04		534.50	9.0%	9,000	1.18E+14	**89.5**		
12/11/08		503.80	9.3%	190	2.34E+12	NR		
3/13/02		493.70	9.5%	1,966.3	2.38E+13	**52.1**		
3/13/02		493.70	9.5%	30	3.62E+11	NR		
4/21/04		484.40	9.7%	5,300	6.28E+13	**82.2**		
12/9/98	Moist Conditions	453.10	10.1%	2,419.2	2.68E+13	**61.1**		
7/19/01		430.90	10.6%	80,000	8.43E+14	**98.8**		
1/30/06		298.40	13.9%	2,040	1.49E+13	**53.9**		
4/24/01		277.90	14.6%	80,000	5.44E+14	**98.8**		
1/11/06		245.00	15.9%	7,200	4.32E+13	**86.9**		
11/9/00		173.90	19.0%	29,000	1.23E+14	**96.8**		
5/29/08		137.80	21.0%	2,400	8.09E+12	**60.8**		
5/18/04		130.90	21.5%	5,500	1.76E+13	**82.9**		
3/18/04		111.30	23.2%	5,900	1.61E+13	**84.1**		
12/11/03		108.70	23.5%	6,100	1.62E+13	**84.6**		
3/6/01		100.90	24.3%	110	2.72E+11	NR		
4/29/08		96.99	25.0%	1,500	3.56E+12	**37.3**		
2/14/08		95.09	25.1%	1,700	3.95E+12	**44.6**		
7/10/01		88.80	25.8%	1,309	2.84E+12	**28.1**		
2/15/05		72.73	28.1%	290	5.16E+11	NR		
10/15/03		51.52	31.3%	6,600	8.32E+12	**85.7**		

Table E-11 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM11.85/12.1

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
10/10/01	Moist Conditions (cont'd)	49.85	31.7%	2,359	2.88E+12	**60.1**		
9/18/02		48.83	31.7%	12	1.43E+10	NR		
1/9/02		47.01	32.0%	1,986.3	2.28E+12	**52.6**		
1/9/02		47.01	32.0%	90	1.04E+11	NR		
5/14/02		45.44	32.4%	100	1.11E+11	NR		
1/24/07		40.82	33.8%	580	5.79E+11	NR		
5/10/05		35.51	35.5%	5,200	4.52E+12	**81.9**		
12/11/01		35.00	35.7%	920.8	7.88E+11	NR		
12/4/01		34.93	35.8%	10	8.55E+09	NR		
6/12/03		34.00	36.2%	5,100	4.24E+12	**81.5**		
6/24/02		33.33	36.5%	10	8.15E+09	NR		
4/3/01		31.64	37.1%	120	9.29E+10	NR		
4/10/02		30.76	37.5%	1,145	8.62E+11	**17.8**		
8/8/01		28.51	38.2%	8,164	5.69E+12	**88.5**		
12/20/00		26.60	39.2%	200	1.30E+11	NR	**44.7**	**47.0**
6/7/05	Mid-Range Flows	24.60	40.5%	218	1.31E+11	NR		
8/7/02		23.87	41.1%	1	5.84E+08	NR		
10/15/02		23.16	41.6%	50	2.83E+10	NR		
1/24/01		19.44	45.1%	1,800	8.56E+11	**47.7**		
2/22/01		19.39	45.1%	300	1.42E+11	NR		
6/12/02		18.60	46.0%	1,354	6.16E+11	**30.5**		
11/20/00		17.43	47.1%	170	7.25E+10	NR		
2/13/03		16.65	48.0%	6	2.44E+09	NR		
8/8/05		16.50	48.2%	620	2.50E+11	NR		
9/20/06		15.36	49.6%	10,000	3.76E+12	**90.6**		
6/17/04		15.01	50.1%	1,000	3.67E+11	**5.9**		

Table E-11 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM11.85/12.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/10/03	Mid-Range Flows (cont'd)	14.81	50.4%	11,000	3.99E+12	**91.4**		
1/22/04		14.65	50.5%	172	6.16E+10	NR		
5/16/06		14.59	50.6%	182	6.50E+10	NR		
3/21/01		14.10	51.3%	230	7.93E+10	NR		
11/8/04		13.97	51.6%	511	1.75E+11	NR		
2/12/02		13.59	51.9%	10	3.32E+09	NR		
11/21/06		12.70	53.0%	74	2.30E+10	NR		
11/21/06		12.70	53.0%	200	6.21E+10	NR		
1/8/03		12.55	53.3%	50	1.54E+10	NR		
3/15/05		12.10	54.2%	49	1.45E+10	NR		
6/11/01		11.78	54.5%	130	3.75E+10	NR		
3/11/03		11.68	54.7%	9	2.57E+09	NR		
4/2/03		11.66	54.9%	670	1.91E+11	NR		
2/13/02		11.46	55.2%	103.9	2.91E+10	NR		
5/8/02		11.10	56.1%	2,419.2	6.57E+11	**61.1**	**12.6**	**13.6**
12/2/02	Dry Conditions	9.46	60.1%	110	2.55E+10	NR		
2/24/04		9.00	61.3%	4900	1.08E+12	**80.8**		
4/12/06		8.89	61.5%	740	1.61E+11	NR		
8/6/03		8.37	63.2%	6000	1.23E+12	**84.3**		
2/6/01		8.35	63.3%	10	2.04E+09	NR		
9/16/03		8.35	63.3%	3000	6.13E+11	**68.6**		
2/21/07		7.74	64.7%	63	1.19E+10	NR		
2/21/07		7.74	64.7%	64	1.21E+10	NR		
4/20/05		7.57	65.2%	560	1.04E+11	NR		
2/25/99		7.20	66.2%	1299.7	2.29E+11	**27.6**		
6/19/08		6.98	66.9%	2100	3.58E+11	**55.2**		

Table E-11 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM11.85/12.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/22/02	Dry Conditions (cont'd)	6.66	67.7%	1	1.63E+08	NR		
4/18/02		6.39	68.4%	10	1.56E+09	NR		
5/20/09		6.39	68.4%	520	8.13E+10	NR		
5/2/01		6.00	69.4%	11,000	1.62E+12	**91.4**		
7/13/06		5.53	70.5%	160	2.16E+10	NR		
1/10/01		5.43	70.8%	10	1.33E+09	NR		
4/23/07		5.26	71.5%	180	2.32E+10	NR		
12/6/00		4.16	74.5%	10	1.02E+09	NR		
5/9/07		4.03	74.7%	50	4.93E+09	NR		
5/9/07		4.03	74.7%	70	6.91E+09	NR		
10/23/01		3.88	75.3%	70	6.65E+09	NR		
9/25/01		3.73	75.7%	60	5.48E+09	NR		
6/19/00		3.55	76.2%	6,000	5.21E+11	**84.3**		
9/12/01		3.35	77.1%	1,616	1.32E+11	**41.8**		
6/7/06		3.13	78.0%	140	1.07E+10	NR		
11/9/05		3.12	78.1%	127	9.68E+09	NR		
12/7/06		3.09	78.3%	27	2.04E+09	NR		
6/20/01		3.07	78.4%	170	1.28E+10	NR		
11/7/01		2.60	80.4%	10	6.37E+08	NR		
11/14/01		2.46	81.3%	85.7	5.16E+09	NR		
7/22/04		2.28	82.0%	3,400	1.89E+11	**72.3**		
9/15/04		2.08	83.0%	9,600	4.88E+11	**90.2**		
11/11/03		1.85	84.7%	4	1.81E+08	NR		
8/18/04		1.20	87.9%	124	3.64E+09	NR		
8/10/06		1.07	88.7%	10	2.62E+08	NR		
8/10/06		1.07	88.7%	20	5.25E+08	NR	**18.8**	**19.6**

Table E-11 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM11.85/12.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/29/01	Low Flows	0.71	91.4%	10	1.72E+08	NR		
6/13/07		0.56	92.6%	70	9.61E+08	NR		
7/24/00		0.50	93.1%	2,300	2.79E+10	**59.1**		
9/21/05		0.33	95.1%	309	2.49E+09	NR		
10/16/00		0.13	97.2%	10	3.16E+07	NR		
10/24/00		0.10	97.5%	120	3.05E+08	NR		
7/19/07		0.05	98.4%	440	4.84E+08	NR		
9/20/00		0.04	98.6%	30	2.86E+07	NR		
8/23/00		0.00	99.7%	10	4.89E+05	NR	**6.6**	**7.0**

Note: NR = No reduction required
NA = Not applicable

Table E-12. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM14.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/5/99	High Flows	5406.00	0.2%	2,419.2	3.20E+14	**61.1**		
12/9/98		325.20	9.2%	2,419.2	1.92E+13	**61.1**	**61.1**	**65.0**
2/25/99	Dry Conditions	5.75	65.4%	33.7	4.74E+09	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-13. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM17.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
3/13/02	High Flows	304.40	8.2%	1,413.6	1.05E+13	**33.4**	**33.4**	**40.1**
4/4/07	Moist Conditions	120.20	15.8%	2,400	7.06E+12	**60.8**	**20.7**	**23.1**
2/14/07		87.78	18.6%	1,300	2.79E+12	**27.6**		
5/16/07		39.60	27.3%	5,475	5.30E+12	**82.8**		
1/9/02		29.84	29.9%	816.4	5.96E+11	NR		
7/10/01		25.98	31.8%	173	1.10E+11	NR		
1/10/07		24.92	32.3%	460	2.80E+11	NR		
12/11/01		21.74	34.1%	344.6	1.83E+11	NR		
4/10/02		18.74	35.9%	1,112	5.10E+11	**15.4**		
10/10/01		16.50	37.2%	644	2.60E+11	NR		
11/8/06	Mid-Range Flows	12.50	41.2%	730	2.23E+11	NR	**10.2**	**10.6**
8/8/01		11.54	42.5%	3,255	9.19E+11	**71.1**		
6/12/02		8.22	50.2%	613	1.23E+11	NR		
2/13/02		7.68	51.9%	56.1	1.05E+10	NR		
5/8/02		7.32	53.8%	190.4	3.41E+10	NR		
3/7/07		6.65	57.1%	72	1.17E+10	NR		
6/20/07		6.55	57.5%	389	6.23E+10	NR		
12/6/06	Dry Conditions	2.72	75.7%	35	2.33E+09	NR	**7.2**	**8.5**
9/12/01		2.18	79.9%	1,467	7.81E+10	**35.9**		
11/14/01		2.02	81.4%	33.2	1.64E+09	NR		
7/19/06		1.21	88.2%	81	2.40E+09	NR		
8/16/06		1.12	89.0%	1	2.75E+07	NR		
10/11/06	Low Flows	0.52	95.8%	78	9.96E+08	NR	**NR**	**NR**
9/13/06		0.43	97.0%	200	2.12E+09	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-14. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
5/5/99	High Flows	3140	0.2%	2,419.2	1.86E+14	**61.1**		
5/14/03		1112.0	1.2%	6,000	1.63E+14	**84.3**		
12/1/04		485.0	3.9%	1,500	1.78E+13	**37.3**		
11/11/02		281.5	6.7%	50	3.44E+11	NR		
12/11/08		258.9	7.0%	140	8.87E+11	NR		
3/13/02		254.5	7.2%	866	5.39E+12	NR		
3/13/02		254.5	7.2%	10	6.23E+10	NR		
1/6/05		237.9	7.8%	1,920	1.12E+13	**51.0**		
12/9/98		202.2	8.6%	2,419.2	1.20E+13	**61.1**		
7/15/05		169.2	9.4%	255	1.06E+12	NR		
1/30/06		156.4	9.9%	1,100	4.21E+12	**14.5**	**28.1**	**31.0**
4/24/01	Moist Conditions	101.0	13.4%	80,000	1.98E+14	**98.8**		
1/11/06		96.20	13.8%	3,800	8.94E+12	**75.2**		
4/21/04		84.26	14.9%	300	6.18E+11	NR		
5/29/08		77.84	15.7%	2,400	4.57E+12	**60.8**		
7/19/01		69.18	16.5%	6,000	1.02E+13	**84.3**		
5/18/04		68.57	16.6%	400	6.71E+11	NR		
10/11/04		62.12	17.5%	7,000	1.06E+13	**86.6**		
12/11/03		53.99	18.9%	3,000	3.96E+12	**68.6**		
4/29/08		52.55	19.2%	800	1.03E+12	NR		
3/6/01		51.67	19.5%	130	1.64E+11	NR		
11/9/00		49.20	20.1%	2,500	3.01E+12	**62.4**		
2/14/08		48.58	20.3%	1,600	1.90E+12	**41.2**		
2/15/05		36.97	22.9%	530	4.79E+11	NR		
1/24/08		28.82	25.5%	520	3.67E+11	NR		

Table E-14 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
2/15/05	Moist Conditions	36.97	22.9%	530	4.79E+11	NR	20.9	21.7
1/24/08		28.82	25.5%	520	3.67E+11	NR		
3/18/04		25.26	26.8%	214	1.32E+11	NR		
1/9/02		23.88	27.2%	570.4	3.33E+11	NR		
1/9/02		23.88	27.2%	140	8.18E+10	NR		
10/15/03		23.02	27.7%	4,400	2.48E+12	78.6		
9/18/02		22.91	27.8%	5	2.80E+09	NR		
1/24/07		20.70	29.1%	560	2.84E+11	NR		
5/14/02		20.00	29.6%	50	2.45E+10	NR		
10/17/07		19.21	30.2%	417	1.96E+11	NR		
12/4/01		17.34	31.5%	10	4.24E+09	NR		
12/11/01		17.38	31.5%	488.4	2.08E+11	NR		
4/3/01		15.02	33.3%	10	3.67E+09	NR		
12/19/07		14.65	33.5%	2,000	7.17E+11	53.0		
4/10/02		14.27	33.8%	650	2.27E+11	NR		
2/7/06		12.89	35.1%	200	6.31E+10	NR		
12/20/00		12.13	36.0%	40	1.19E+10	NR		
3/5/09		10.89	37.2%	320	8.53E+10	NR		
4/23/09		10.83	37.3%	60	1.59E+10	NR		
10/15/02		10.27	38.1%	60	1.51E+10	NR		
5/10/05		10.18	38.2%	236	5.88E+10	NR		
2/24/09		9.36	39.9%	5	1.15E+09	NR		
7/10/01	Mid-Range Flows	8.73	41.1%	31	6.62E+09	NR		
2/22/01		8.62	41.3%	310	6.54E+10	NR		
1/24/01		8.40	41.7%	10	2.06E+09	NR		
6/12/03		7.81	43.1%	5,400	1.03E+12	NR		

Table E-14 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
2/13/03	Mid-Range Flows (cont'd)	7.53	44.0%	5	9.22E+08	NR		
11/20/00		7.28	44.7%	50	8.91E+09	NR		
3/21/01		6.94	45.9%	10	1.70E+09	NR		
1/22/04		6.85	46.2%	152	2.55E+10	NR		
2/12/02		6.80	46.4%	10	1.66E+09	NR		
5/16/06		6.71	46.8%	73	1.20E+10	NR		
1/8/03		6.66	46.9%	10	1.63E+09	NR		
8/8/01		6.50	47.5%	231	3.67E+10	NR		
11/8/04		6.21	48.8%	109	1.66E+10	NR		
3/11/03		6.18	48.9%	9	1.36E+09	NR		
8/19/08		6.11	49.2%	310	4.63E+10	NR		
3/15/05		6.10	49.3%	33	4.92E+09	NR		
2/13/02		5.98	49.9%	47.4	6.94E+09	NR		
6/12/02		5.93	50.1%	325.5	4.72E+10	NR		
9/20/06		5.91	50.2%	2,000	2.89E+11	**53.0**		
4/2/03		5.76	50.9%	755	1.06E+11	NR		
1/25/05		5.65	51.7%	66.7	9.21E+09	NR		
11/21/06		5.65	51.7%	100	1.38E+10	NR		
11/21/06		5.65	51.7%	400	5.52E+10	NR		
6/11/01		5.61	51.9%	120	1.65E+10	NR		
1/22/09		5.48	52.7%	5	6.71E+08	NR		
3/12/08		5.46	52.8%	280	3.74E+10	NR		
5/8/02		5.44	53.0%	85.7	1.14E+10	NR		
6/7/05		5.35	53.8%	37,000	4.84E+12	**97.5**		
8/8/05		5.18	54.9%	145	1.84E+10	NR		

Table E-14 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
12/2/02	Mid-Range Flows (cont'd)	5.04	55.5%	70	8.64E+09	NR	6.5	6.7
2/24/04		4.92	56.3%	2	2.41E+08	NR		
6/17/04		4.83	57.1%	2	2.36E+08	NR		
4/12/06		4.67	57.9%	55	6.29E+09	NR		
6/17/09		4.65	58.1%	180	2.05E+10	NR		
8/7/02		4.61	58.4%	1	1.13E+08	NR		
2/6/01		4.53	59.1%	10	1.11E+09	NR		
10/10/01	Dry Conditions	4.36	60.2%	2,247	2.40E+11	**58.1**		
2/21/07		4.34	60.5%	25	2.65E+09	NR		
2/21/07		4.34	60.5%	78	8.28E+09	NR		
4/20/05		4.24	61.2%	345	3.58E+10	NR		
2/25/99		4.09	62.3%	31.4	3.14E+09	NR		
3/8/06		3.96	63.1%	10	9.69E+08	NR		
8/6/03		3.94	63.3%	6,000	5.79E+11	**84.3**		
6/19/08		3.85	64.1%	5	4.70E+08	NR		
4/18/02		3.74	64.8%	20	1.83E+09	NR		
11/20/08		3.73	64.9%	5	4.57E+08	NR		
5/20/09		3.73	64.9%	200	1.82E+10	NR		
9/16/03		3.65	65.4%	260	2.32E+10	NR		
5/2/01		3.54	66.0%	30	2.60E+09	NR		
3/21/07		3.42	66.8%	36	3.01E+09	NR		
6/24/02		3.29	67.6%	10	8.05E+08	NR		
10/22/08		3.25	67.8%	5	3.97E+08	NR		
1/10/01		3.17	68.4%	10	7.75E+08	NR		
4/23/07		3.15	68.5%	160	1.23E+10	NR		

Table E-14 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
12/12/05	Dry Conditions (cont'd)	3.13	68.7%	273	2.09E+10	NR		
7/22/02		3.09	68.9%	1	7.57E+07	NR		
7/10/03		2.81	70.7%	900	6.19E+10	NR		
12/6/00		2.57	72.4%	10	6.29E+08	NR		
10/5/05		2.58	72.4%	25	1.58E+09	NR		
5/9/07		2.53	72.7%	1,120	6.94E+10	**16.0**		
5/9/07		2.53	72.7%	20	1.24E+09	NR		
9/25/08		2.50	72.8%	30	1.83E+09	NR		
10/23/01		2.43	73.3%	10	5.94E+08	NR		
9/25/01		2.24	74.7%	10	5.49E+08	NR		
6/19/00		2.18	75.2%	400	2.13E+10	NR		
12/7/06		2.01	77.0%	36	1.77E+09	NR		
6/7/06		1.99	77.1%	40	1.95E+09	NR		
7/15/08		1.99	77.1%	30	1.46E+09	NR		
6/20/01		1.97	77.4%	110	5.31E+09	NR		
9/12/01		1.86	78.4%	305	1.38E+10	NR		
11/7/01		1.75	79.5%	10	4.28E+08	NR		
11/20/07		1.73	79.7%	2,100	8.91E+10	**55.2**		
11/14/01		1.68	80.4%	31.8	1.31E+09	NR		
7/22/04		1.66	80.6%	114	4.63E+09	NR		
7/13/06		1.48	82.5%	20	7.23E+08	NR		
11/11/03		1.38	84.1%	200	6.74E+09	NR		
11/9/05		1.21	85.6%	1	2.95E+07	NR		
8/18/04		1.05	87.5%	133	3.40E+09	NR		
9/15/04		0.97	88.4%	1,400	3.32E+10	**32.8**		
8/10/06		0.95	88.6%	4	9.34E+07	NR		
8/10/06		0.95	88.6%	20	4.67E+08	NR	**5.5**	**6.2**

Table E-14 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM20.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/29/01	Low Flows	0.77	91.4%	10	1.89E+08	NR	**NR**	**NR**
6/13/07		0.71	92.5%	1	1.73E+07	NR		
7/24/00		0.66	93.2%	280	4.49E+09	NR		
9/21/05		0.60	94.6%	127	1.86E+09	NR		
10/12/06		0.57	95.1%	60	8.38E+08	NR		
10/16/00		0.50	96.4%	30	3.64E+08	NR		
10/24/00		0.46	96.9%	10	1.13E+08	NR		
9/20/00		0.39	98.0%	10	9.44E+07	NR		
7/19/07		0.34	98.2%	80	6.71E+08	NR		
9/19/07		0.34	98.2%	20	1.67E+08	NR		
8/27/07		0.08	99.4%	440	8.61E+08	NR		
8/23/00		0.05	99.6%	10	1.30E+07	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-15. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 1T0.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/21/06	High Flows	52.72	4.9%	2,400	3.10E+12	**60.8**	**60.8**	**64.7**
8/22/06	Moist Conditions	10.69	15.2%	6,500	1.70E+12	**85.5**		
2/14/07		2.98	25.4%	1,300	9.47E+10	**27.6**		
10/8/02		2.66	26.3%	2,419.2	1.57E+11	**61.1**		
1/8/02		2.48	26.8%	2,419.2	1.47E+11	**61.1**		
2/12/07		2.09	28.6%	190	9.71E+09	NR		

Table E-15 (cont'd). Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 1T0.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
4/9/02	Moist Conditions (cont'd)	1.70	30.6%	2,987	7.40E+10	**68.5**		
2/15/07		1.17	33.6%	690	1.35E+10	NR		
1/24/07		0.91	36.1%	2,400	3.58E+10	**60.8**	**45.6**	**48.5**
2/28/07	Mid-Range Flows	0.57	42.1%	260	2.17E+09	NR		
4/18/07		0.50	43.4%	600	4.43E+09	NR		
4/28/03		0.49	43.8%	228.2	1.68E+09	NR		
10/18/06		0.42	45.4%	1,600	8.61E+09	**41.2**		
7/11/01		0.40	46.3%	2,419.2	5.15E+09	**61.1**		
2/4/03		0.25	53.9%	1,203.3	8.52E+08	**21.8**		
2/20/07		0.19	60.1%	260	7.52E+09	NR		
3/21/07		0.14	64.3%	1,200	3.26E+09	**21.6**	**18.2**	**21.4**
12/19/06	Low Flows	0.08	73.3%	93	1.23E+08	NR		
5/23/07		0.06	77.2%	110	1.43E+08	NR		
7/9/02		0.04	81.7%	331	3.24E+08	NR		
11/28/06		0.04	81.7%	49	5.65E+07	NR		
7/12/06		0.04	83.5%	70	3.84E+07	NR		
10/9/01		0.03	87.0%	759	2.19E+08	NR		
6/12/07		0.03	87.0%	345	3.90E+08	NR		
8/2/06		0.02	89.9%	28	1.16E+07	NR		
8/10/06		0.02	90.7%	460	1.58E+08	NR		
8/16/06		0.01	92.2%	220	5.92E+07	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-16. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 4T0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/21/06	High Flows	14.54	8.8%	2,400	8.54E+11	**60.8**	**60.8**	**64.7**
8/22/06	Moist Conditions	7.11	14.1%	930	1.62E+11	NR	**NR**	**NR**
1/24/07		0.84	34.3%	240	4.94E+09	NR		
2/28/07	Mid-Range Flows	0.49	40.8%	66	7.85E+08	NR	**0.8**	**3.2**
4/18/07		0.44	42.4%	58	6.22E+08	NR		
10/18/06		0.34	45.8%	870	7.28E+09	NR		
3/21/07		0.14	63.5%	31	1.05E+08	NR		
8/23/06		0.10	67.9%	980	2.40E+09	**4.0**		
12/19/06	Low Flows	0.07	72.6%	86	1.51E+08	NR	**9.1**	**10.2**
5/23/07		0.06	76.9%	79	1.06E+08	NR		
11/28/06		0.04	81.3%	410	4.01E+08	NR		
6/12/07		0.03	86.7%	1,733	1.06E+09	**45.7**		
8/16/06		0.01	92.1%	250	6.12E+07	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-17. Calculated Load Reduction Based on Daily Loading – UT to Nonconnah Creek – 5T0.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/21/06	High Flows	16.70	6.2%	2,400	9.81E+11	**60.8**	**60.8**	**64.7**
4/4/07	Moist Conditions	3.14	18.5%	2,400	1.84E+11	**60.8**		
8/22/06		2.24	21.8%	1,500	8.22E+10	**37.3**		
2/14/07		1.82	23.5%	2,000	8.92E+10	**53.0**		
5/16/07		0.93	30.0%	6,867	1.56E+11	**86.3**		
1/10/07		0.52	35.0%	82	1.04E+09	NR	**47.5**	**50.7**
11/8/06	Mid-Range Flows	0.24	43.7%	550	3.24E+09	NR		
3/7/07		0.12	57.2%	10	3.01E+07	NR	**NR**	**NR**
8/23/06	Low Flows	0.038	77.6%	270	2.51E+08	NR		
6/20/07		0.038	77.6%	794	7.38E+08	NR		
7/19/06		0.022	84.9%	530	2.85E+08	NR		
8/16/06		0.008	91.6%	22	4.31E+06	NR		
10/11/06		0.001	96.1%	19	4.65E+05	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-18. Calculated Load Reduction Based on Daily Loading – Black Bayou – RM0.2

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/21/06	High Flows	70.20	5.2%	24,000	4.12E+13	**96.1**	**96.1**	**96.4**
4/4/07	Moist Conditions	9.14	19.1%	2,400	5.36E+11	**60.8**		
8/22/06		6.79	21.8%	5,500	9.13E+11	**82.9**		
2/14/07		4.95	24.6%	1,200	1.45E+11	**21.6**		
5/16/07		4.15	26.0%	24,196	2.46E+12	**96.1**		
2/12/07		2.71	30.3%	10	6.62E+08	NR		
2/15/07		2.06	32.6%	1,200	6.05E+10	**21.6**		
1/24/07		1.60	35.0%	2,400	9.38E+10	**60.8**		
1/10/07		1.40	36.3%	2,800	9.60E+10	**66.4**	**51.3**	**54.1**
11/8/06	Mid-Range Flows	0.74	43.9%	2,400	4.37E+10	**60.8**		
3/7/07		0.34	57.7%	63	5.26E+08	NR		
2/20/07		0.32	58.9%	27	2.11E+08	NR	**20.3**	**21.3**
8/23/06	Low Flows	0.15	70.5%	3,100	1.14E+10	**69.6**		
6/20/07		0.15	70.9%	24,196	8.64E+10	**96.1**		
12/6/06		0.09	79.3%	2,200	4.74E+09	**57.2**		
7/19/06		0.05	85.2%	78	9.92E+07	NR		
8/10/06		0.02	90.6%	50	2.94E+07	NR		
8/16/06		0.02	92.0%	2,400	9.39E+08	**60.8**		
9/13/06		0.00	96.1%	2,400	5.87E+07	**60.8**		
10/11/06		0.00	96.1%	100	2.45E+06	NR	**43.1**	**44.6**

Note: NR = No reduction required
NA = Not applicable

Table E-19. Calculated Load Reduction Based on Geomean Data – Black Bayou – RM0.2

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
8/10/06	0.02	90.6%	50			
8/16/06	0.02	92.0%	2,400			
8/21/06	70.20	5.2%	24,000			
8/22/06	6.79	21.8%	5,500			
8/23/06	0.15	70.5%	3,100	2,178.8	**94.2**	**94.8**
1/24/07	1.60	35.0%	2,400			
2/12/07	2.71	30.3%	10			
2/14/07	4.95	24.6%	1,200			
2/15/07	2.06	32.6%	1,200			
2/20/07	0.32	58.9%	27	247.7	**49.1**	**54.4**
3/7/07	0.34	57.7%	63	119.6	**NR**	**NR**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-20. Calculated Load Reduction Based on Daily Loading – Black Bayou – RM1.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/8/02	Moist Conditions	9.14	19.1%	24,192	1.14E+12	**96.1**		
1/8/02		1.60	35.0%	80.8	3.73E+09	NR		
4/9/02		1.40	36.3%	24,192	6.69E+11	**96.1**	**64.1**	**64.3**
4/28/03	Mid-Range Flows	0.74	43.9%	2,419.2	1.78E+10	**61.1**		
2/4/03		0.34	57.7%	2,419.2	1.15E+10	**61.1**		
7/11/01		0.32	58.9%	2,419.2	1.01E+10	**61.1**	**61.1**	**64.2**
7/9/02	Low Flows	0.15	70.5%	2,419.2	2.25E+09	**61.1**		
10/9/01		0.00	96.1%	2,063	1.06E+09	**54.4**	**57.7**	**61.1**

Note: NR = No reduction required
NA = Not applicable

Table E-21. Calculated Load Reduction Based on Daily Loading – Cane Creek – RM0.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/10/01	Moist Conditions	36.58	10.8%	820	7.34E+11	NR		
7/10/01		17.82	14.9%	556	2.42E+11	NR		
3/13/02		13.78	16.6%	2,419.2	8.16E+11	**61.1**		
4/4/07		6.25	23.4%	2,400	3.67E+11	**60.8**		
2/14/07		4.70	25.6%	1100	1.27E+11	**14.5**		
5/16/07		4.28	26.2%	24,196	2.53E+12	**96.1**		
1/9/02		1.67	34.1%	131.3	5.37E+09	NR		
1/10/07		1.25	37.1%	1,900	5.79E+10	**50.5**		
12/11/01		1.20	37.3%	461.1	1.35E+10	NR		
4/10/02		1.01	39.1%	836	2.07E+10	NR	**28.3**	**30.0**
11/8/06	Mid-Range Flows	0.63	43.7%	2,400	3.67E+10	**60.8**		
2/13/02		0.40	51.1%	137.4	1.33E+09	NR		
8/8/01		0.30	57.6%	11,192	8.24E+10	**91.6**		
3/7/07		0.29	58.3%	86	6.16E+08	NR		
5/8/02		0.29	58.6%	1,541	1.09E+10	**38.9**		
6/12/02		0.20	65.8%	2,613	1.27E+10	**64.0**	**42.6**	**44.5**
6/20/07	Low Flows	0.094	77.9%	3,654	8.40E+09	**74.2**		
11/14/01		0.082	79.8%	110.6	2.22E+08	NR		
12/6/06		0.081	79.9%	2,400	4.76E+09	**60.8**		
7/19/06		0.055	84.6%	40	5.38E+07	NR		
9/12/01		0.029	89.1%	816.4	5.79E+08	NR		
8/16/06		0.013	91.9%	730	2.32E+08	NR		
10/5/99		0.001	95.8%	307.6	7.53E+06	NR		
9/13/06		0.001	95.8%	84	2.06E+06	NR		
10/11/06		0.001	95.8%	50	1.22E+06	NR	**15.0**	**15.6**

Note: NR = No reduction required
NA = Not applicable

Table E-22. Calculated Load Reduction Based on Daily Loading – Cane Creek – RM1.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
9/4/07	Mid-Range Flows	0.632	41.3%	46	7.11E+08	**NR**	**NR**	**NR**
8/7/07	Low Flows	0.076	79.0%	14	2.60E+07	NR		
8/14/07		0.001	95.8%	411	1.01E+07	NR		
8/21/07		0.001	95.8%	2,420	5.92E+07	**61.1**		
8/28/07		0.001	95.8%	3,873	9.48E+07	**75.7**	**34.2**	**35.5**

Note: NR = No reduction required
NA = Not applicable

Table E-23. Calculated Load Reduction Based on Geomean Data – Cane Creek – RM1.4

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
8/7/07	0.076	79.0%	14			
8/14/07	0.001	95.8%	411			
8/21/07	0.001	95.8%	2,420			
8/28/07	0.001	95.8%	3,873			
9/4/07	0.632	41.3%	46	301.2	**58.2**	**62.5**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-24. Calculated Load Reduction Based on Daily Loading – Cane Creek – RM2.8

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
10/8/02	Moist Conditions	1.80	26.8%	2,419.2	1.07E+11	**61.1**		
1/8/02		1.68	27.2%	2,419.2	9.94E+10	**61.1**		
4/9/02		0.99	31.7%	15,531	3.75E+11	**93.9**	**72.0**	**74.3**
4/28/03	Mid-Range Flows	0.23	45.6%	529.8	3.02E+09	NR		
2/4/03		0.18	51.6%	5,794	2.51E+10	**83.8**		
7/11/01		0.10	63.4%	2,419.2	6.16E+09	**61.1**	**48.3**	**49.8**
7/9/02	Low Flows	0.044	79.1%	270	2.91E+08	NR		
10/9/01		0.020	87.8%	2,419.2	1.18E+09	**61.1**	**30.6**	**32.1**

Note: NR = No reduction required
NA = Not applicable

Table E-25. Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
5/14/03	High Flows	297.70	1.6%	6,000	4.37E+13	**84.3**		
4/21/04		247.60	2.1%	3,100	1.88E+13	**69.6**		
7/15/05		219.70	2.6%	5,400	2.90E+13	**82.6**		
10/11/04		111.20	5.8%	7,000	1.90E+13	**86.6**		
7/19/01		101.60	6.3%	80,000	1.99E+14	**98.8**		
10/17/07		63.74	8.6%	800	1.25E+12	NR		
10/10/01		57.70	9.2%	537	7.58E+11	NR		
1/6/05		55.56	9.5%	1,600	2.17E+12	**41.2**	**57.9**	**59.3**

Table E-25 (cont'd). Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
9/12/00	Moist Conditions	36.92	11.6%	26,000	2.35E+13	**96.4**		
12/1/04		25.98	13.5%	9,000	5.72E+12	**89.5**		
3/18/04		24.85	13.7%	3,600	2.19E+12	**73.9**		
7/10/01		22.55	14.3%	7,270	4.01E+12	**87.1**		
12/11/08		18.23	15.6%	930	4.15E+11	NR		
3/13/02		16.01	16.8%	2,419.2	9.48E+11	**61.1**		
3/13/02		16.01	16.8%	10	3.92E+09	NR		
6/24/02		12.80	18.0%	10	3.13E+09	NR		
11/9/00		10.99	18.9%	4,100	1.10E+12	**77.0**		
1/30/06		8.82	20.5%	2,340	5.05E+11	**59.8**		
2/13/03		5.63	24.3%	6	8.26E+08	NR		
11/11/02		5.26	24.7%	2,900	3.73E+11	**67.6%**		
1/11/06		5.35	24.7%	11,600	1.52E+12	**91.9%**		
4/24/01		5.03	24.9%	12,000	1.48E+12	**92.2%**		
7/10/03		4.87	25.1%	5,700	6.78E+11	**83.5%**		
5/18/04		3.83	26.9%	3,400	3.19E+11	**72.3%**		
3/6/01		3.35	28.1%	10	8.20E+08	NR		
5/29/08		3.06	28.7%	1,900	1.42E+11	**50.5%**		
2/14/08		2.99	28.9%	260	1.90E+10	NR		
12/11/03		2.96	29.0%	1,300	9.42E+10	**27.6%**		
7/13/06		2.69	29.8%	1,960	1.29E+11	**52.0%**		
4/29/08		2.57	30.3%	6,800	4.27E+11	**86.2%**		
2/15/05		2.39	31.0%	109	6.36E+09	NR		
1/24/08		1.95	32.3%	40	1.91E+09	NR		
1/9/02		1.80	33.0%	58.3	2.57E+09	NR		
1/9/02		1.80	33.0%	190	8.38E+09	NR		

Table E-25 (cont'd). Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/15/03	Moist Conditions (cont'd)	1.66	33.6%	5,700	2.31E+11	**83.5**	**38.0**	**39.4**
1/24/07		1.60	33.8%	480	1.88E+10	NR		
9/18/02		1.36	35.3%	7	2.33E+08	NR		
12/4/01		1.35	35.4%	10	3.30E+08	NR		
5/14/02		1.32	35.6%	110	3.56E+09	NR		
12/11/01		1.22	36.4%	2,419.2	7.24E+10	**61.1**		
4/10/02		1.06	37.6%	425	1.11E+10	NR		
12/19/07		1.03	37.9%	440	1.11E+10	NR		
4/3/01		1.00	38.2%	350	8.55E+09	NR		
2/7/06		0.908	39.3%	2,100	4.67E+10	**55.2**		
12/20/00	Mid-Range Flows	0.838	40.1%	320	6.56E+09	NR		
10/15/02		0.791	40.7%	120	2.32E+09	NR		
3/5/09		0.770	40.9%	800	1.51E+10	NR		
4/23/09		0.684	42.0%	700	1.17E+10	NR		
2/24/09		0.671	42.2%	5,100	8.37E+10	**81.5**		
2/22/01		0.651	42.5%	300	4.78E+09	NR		
1/8/03		0.599	43.7%	90	1.32E+09	NR		
1/24/01		0.589	44.0%	610	8.79E+09	NR		
5/10/05		0.584	44.2%	1,800	2.57E+10	**47.7**		
3/11/03		0.561	45.1%	9	1.24E+08	NR		
2/12/02		0.528	46.0%	40	5.17E+08	NR		
1/25/05		0.527	46.1%	93	1.20E+09	NR		
1/22/09		0.519	46.5%	5	6.35E+07	NR		
3/21/01		0.512	46.8%	10	1.25E+08	NR		
2/13/02		0.485	47.9%	261.3	3.10E+09	NR		
2/24/04		0.838	40.1%	500	5.68E+09	NR		

Table E-25 (cont'd). Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
3/15/05	Mid-Range Flows (cont'd)	0.455	49.4%	5,500	6.12E+10	**82.9**		
1/22/04		0.444	50.0%	40	4.35E+08	NR		
3/12/08		0.445	50.0%	2,000	2.18E+10	**53.0**		
12/2/02		0.433	50.8%	570	6.04E+09	NR		
4/2/03		0.415	52.1%	580	5.89E+09	NR		
5/16/06		0.397	53.2%	36	3.50E+08	NR		
4/18/02		0.379	54.6%	50	4.64E+08	NR		
3/8/06		0.367	55.5%	127	1.14E+09	NR		
2/21/07		0.362	55.9%	3,400	3.01E+10	**72.3**		
2/21/07		0.362	55.9%	3,400	3.01E+10	**72.3**		
5/20/09		0.360	56.1%	680	5.99E+09	NR		
5/8/02		0.356	56.3%	24,192	2.11E+11	**96.1**		
11/20/00		0.351	56.6%	10	8.59E+07	NR		
4/20/05		0.350	56.7%	364	3.12E+09	NR		
2/6/01		0.340	57.6%	100	8.32E+08	NR		
5/2/01		0.334	57.9%	1,500	1.23E+10	**37.3**		
6/12/03		0.321	58.9%	4,600	3.61E+10	**79.5**		
3/21/07		0.318	59.1%	360	2.80E+09	NR		
6/11/01		0.298	60.3%	1,000	7.29E+09	**5.9**		
4/12/06		0.294	60.6%	345	2.48E+09	NR		
11/8/04		0.287	61.2%	99	6.95E+08	NR		
8/19/08		0.285	61.4%	40	2.79E+08	NR		
1/10/01		0.281	61.8%	400	2.75E+09	NR		
6/17/09		0.260	63.0%	220	1.40E+09	NR		
11/20/08		0.259	63.1%	30	1.90E+08	NR		
6/19/08		0.255	63.4%	130	8.11E+08	NR		

Table E-25 (cont'd). Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
4/23/07	Mid-Range Flows (cont'd)	0.252	63.6%	340	2.10E+09	NR	16.9	18.0
6/12/02		0.231	64.8%	6,488	3.67E+10	**85.5**		
6/17/04		0.214	66.2%	1,100	5.76E+09	**14.5**		
6/20/01		0.211	66.4%	510	2.63E+09	NR		
5/9/07		0.210	66.5%	1,664	8.55E+09	**43.4**		
5/9/07		0.210	66.5%	740	3.80E+09	NR		
6/9/99		0.204	67.1%	488.4	2.44E+09	NR		
6/7/06		0.199	67.8%	63	3.07E+08	NR		
9/20/06		0.199	67.8%	2,000	9.74E+09	**53.0**		
11/21/06		0.199	67.8%	2,400	1.17E+10	**60.8**		
11/21/06		0.199	67.8%	2,200	1.07E+10	**57.2**		
12/6/00		0.196	68.3%	1,000	4.80E+09	**5.9**		
9/25/08		0.194	68.6%	630	2.99E+09	NR		
10/22/08		0.187	69.7%	60	2.75E+08	NR		
7/15/08	Low Flows	0.176	70.8%	90	3.88E+08	NR		
8/6/03		0.174	71.0%	6,000	2.55E+10	**84.3**		
7/22/04		0.154	73.7%	700	2.64E+09	NR		
6/7/05		0.146	74.6%	1,500	5.36E+09	**37.3**		
6/19/00		0.128	77.0%	800	2.51E+09	NR		
10/23/01		0.128	77.0%	170	5.32E+08	NR		
7/22/02		0.120	78.0%	1	2.94E+06	NR		
11/7/01		0.114	78.8%	10	2.79E+07	NR		
8/8/05		0.113	78.9%	1,460	4.04E+09	**35.5**		
8/8/01		0.112	79.1%	1,110	3.04E+09	**15.2**		
11/14/01		0.103	80.2%	1,986.3	5.01E+09	**52.6**		
8/7/02		0.096	81.1%	1	2.35E+06	NR		

Table E-25 (cont'd). Calculated Load Reduction Based on Daily Loading – Days Creek – RM0.5

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
12/7/06	Low Flows	0.093	81.5%	309	7.03E+08	NR	12.2	13.2
8/18/04		0.082	83.2%	667	1.34E+09	NR		
9/16/03		0.074	84.5%	270	4.89E+08	NR		
11/11/03		0.074	84.5%	500	9.05E+08	NR		
6/13/07		0.074	84.5%	100	1.81E+08	NR		
11/20/07		0.064	85.8%	250	3.91E+08	NR		
8/29/01		0.058	86.5%	10	1.42E+07	NR		
7/24/00		0.050	87.4%	1,200	1.47E+09	**21.6**		
9/25/01		0.050	87.4%	10	1.22E+07	NR		
9/12/01		0.046	87.9%	547.5	6.16E+08	NR		
12/12/05		0.046	87.9%	1,540	1.73E+09	**38.9**		
10/5/05		0.040	88.6%	150	1.47E+08	NR		
9/15/04		0.037	89.0%	660	5.97E+08	NR		
9/21/05		0.031	89.9%	236	1.79E+08	NR		
8/10/06		0.030	90.1%	60	4.40E+07	NR		
8/10/06		0.030	90.1%	60	4.40E+07	NR		
9/11/07		0.005	93.9%	40	4.89E+06	NR		
8/21/07		0.002	94.8%	290	1.42E+07	NR		
8/13/00		0.001	95.3%	12,000	2.94E+08	**92.2**		
10/13/00		0.001	95.3%	120	2.94E+06	NR		
10/13/00		0.001	95.3%	10	2.45E+05	NR		
11/9/05		0.001	95.3%	660	1.61E+07	NR		
10/8/06		0.001	95.3%	2,400	5.87E+07	**60.8**		
7/19/07		0.001	95.3%	352	8.61E+06	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-26. Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM0.4

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
5/14/03	High Flows	224.00	1.4%	6,000	3.29E+13	**84.3**	**58.5**	**60.5**
7/15/05		138.40	2.8%	760	2.57E+12	NR		
4/21/04		129.00	3.1%	1,800	5.68E+12	**47.4**		
10/11/04		66.44	6.2%	8,000	1.30E+13	**88.2**		
7/19/01		64.96	6.3%	9,000	1.43E+13	**89.5**		
1/6/05		48.72	7.8%	1,600	1.91E+12	**41.2**		
12/1/04	Moist Conditions	30.62	10.7%	1200	8.99E+11	**21.6**		
10/10/01		26.45	11.8%	512	3.31E+11	NR		
12/11/08		18.87	14.0%	410	1.89E+11	NR		
3/13/02		17.07	14.8%	2,419.2	1.01E+12	**61.1**		
3/13/02		17.07	14.8%	10	4.18E+09	NR		
7/10/01		12.73	16.7%	1,376	4.29E+11	**31.6**		
3/18/04		12.39	16.9%	1,700	5.15E+11	**44.6**		
1/30/06		10.82	18.2%	2,340	6.19E+11	**59.8**		
11/9/00		10.43	18.7%	2,200	5.61E+11	**57.2**		
1/11/06		7.85	21.5%	15,600	2.99E+12	**94.0**		
6/24/02		7.47	22.0%	10	1.83E+09	NR		
4/24/01		7.12	22.4%	80,000	1.39E+13	**98.8**		
11/11/02		6.00	24.1%	200	2.94E+10	NR		
5/18/04		4.99	25.8%	2,100	2.56E+11	**55.2**		
3/6/01		3.99	27.8%	20	1.95E+09	NR		
2/14/08		4.00	27.8%	6,400	6.26E+11	**85.3**		
4/29/08		3.76	28.3%	3,100	2.85E+11	**69.6**		
12/11/03		3.33	29.4%	1,800	1.47E+11	**47.7**		
5/29/08		3.29	29.5%	800	6.44E+10	NR		
2/15/05		3.26	29.7%	610	4.86E+10	NR		
7/10/03		3.06	30.3%	9,500	7.11E+11	**90.1**		

Table E-26 (cont'd). Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM0.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/24/08	Moist Conditions	2.55	31.8%	10,800	6.73E+11	**91.3**	36.5	38.1
1/9/02		2.07	33.3%	10	5.07E+08	NR		
10/15/03		2.06	33.4%	190	9.55E+09	NR		
9/18/02		1.91	34.0%	4	1.87E+08	NR		
1/24/07		1.76	34.8%	345	1.48E+10	NR		
5/14/02		1.67	35.3%	90	3.67E+09	NR		
7/13/06		1.63	35.6%	940	3.76E+10	NR		
12/4/01		1.51	36.5%	10	3.70E+08	NR		
4/3/01		1.30	38.0%	13,000	4.13E+11	**92.8**		
4/10/02		1.24	38.4%	9,804	2.98E+11	**90.4**		
2/7/06		1.07	39.7%	4,100	1.07E+11	**77.0**		
12/20/00	Mid-Range Flows	0.949	41.1%	10	2.32E+08	NR		
3/5/09		0.889	41.8%	680	1.48E+10	NR		
10/15/02		0.863	42.1%	240	5.07E+09	NR		
2/13/03		0.861	42.2%	8	1.69E+08	NR		
5/10/05		0.793	43.0%	16,800	3.26E+11	**94.4**		
4/23/09		0.783	43.1%	280	5.36E+09	NR		
2/24/09		0.763	43.6%	1,200	2.24E+10	**21.6**		
2/22/01		0.694	44.8%	1,300	2.21E+10	**27.6**		
1/24/01		0.666	45.3%	10	1.63E+08	NR		
6/12/03		0.619	46.1%	6,000	9.09E+10	**84.3**		
1/8/03		0.590	46.8%	10	1.44E+08	NR		
3/11/03		0.547	48.1%	10	1.34E+08	NR		
2/12/02		0.542	48.3%	50	6.63E+08	NR		
3/21/01		0.540	48.4%	10	1.32E+08	NR		
1/25/05		0.526	49.2%	107	1.38E+09	NR		
1/22/09		0.512	49.7%	6,400	8.02E+10	**85.3**		

Table E-26 (cont'd). Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM0.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/7/02	Mid-Range Flows (cont'd)	0.507	50.0%	1	1.24E+07	NR		
1/22/04		0.479	51.2%	7,100	8.32E+10	**86.7**		
3/15/05		0.463	51.9%	115	1.30E+09	NR		
11/20/00		0.442	52.7%	150	1.62E+09	NR		
5/16/06		0.442	52.7%	640	6.92E+09	NR		
2/24/04		0.438	52.9%	900	9.64E+09	NR		
3/12/08		0.437	52.9%	560	5.99E+09	NR		
12/2/02		0.428	53.6%	370	3.87E+09	NR		
4/2/03		0.420	54.0%	340	3.49E+09	NR		
5/8/02		0.359	57.6%	648.8	5.70E+09	NR		
3/8/06		0.353	58.1%	400	3.45E+09	NR		
4/18/02		0.346	58.6%	70	5.93E+08	NR		
2/21/07		0.346	58.6%	400	3.39E+09	NR		
2/21/07		0.346	58.6%	2,667	2.26E+10	**64.7**		
11/8/04		0.344	58.8%	780	6.56E+09	NR		
6/11/01		0.337	59.4%	230	1.90E+09	NR		
2/6/01		0.333	59.6%	10	8.15E+07	NR		
4/20/05		0.333	59.6%	200	1.63E+09	NR		
5/20/09		0.332	59.6%	480	3.90E+09	NR		
5/2/01		0.307	61.2%	50	3.76E+08	NR		
4/12/06		0.296	61.8%	840	6.08E+09	NR		
6/7/05		0.294	61.9%	11,200	8.06E+10	**91.6**		
3/21/07		0.294	61.9%	200	1.44E+09	NR		
1/10/01		0.272	63.3%	10	6.65E+07	NR		
11/21/06		0.257	64.4%	2,400	1.51E+10	**60.8**		
11/21/06		0.257	64.4%	17,800	1.12E+11	**94.7**		
6/17/09		0.257	64.4%	200	1.26E+09	NR		

Table E-26 (cont'd). Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM0.4

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
9/20/06	Mid-Range Flows (cont'd)	0.249	65.0%	2,000	1.22E+10	**53.0**	**17.2**	**17.8**
6/12/02		0.242	65.3%	776	4.59E+09	NR		
8/8/01		0.240	65.5%	583	3.42E+09	NR		
6/19/08		0.236	65.8%	360	2.08E+09	NR		
4/23/07		0.229	66.1%	100	5.60E+08	NR		
6/17/04		0.199	68.1%	2,800	1.36E+10	**66.4**		
12/6/00		0.185	69.4%	80,000	3.62E+11	**98.8**		
6/7/06		0.185	69.4%	210	9.50E+08	NR		
5/9/07		0.184	69.5%	426	1.92E+09	NR		
5/9/07		0.184	69.5%	600	2.70E+09	NR		
6/20/01		0.180	69.9%	490	2.16E+09	NR		
9/25/08	Low Flows	0.178	70.1%	360	1.57E+09	NR		
6/9/99		0.176	70.3%	2,419.2	1.04E+10	**61.1**		
8/6/03		0.159	72.5%	6,000	2.33E+10	**84.3**		
8/8/05		0.131	76.2%	760	2.44E+09	NR		
7/22/04		0.128	76.5%	1,200	3.76E+09	**21.6**		
10/23/01		0.120	77.5%	200	5.87E+08	NR		
11/7/01		0.112	78.6%	10	2.74E+07	NR		
7/22/02		0.107	79.1%	1	2.62E+06	NR		
6/19/00		0.106	79.2%	2,100	5.45E+09	**55.2**		
11/14/01		0.101	79.9%	396.8	9.81E+08	NR		
12/7/06		0.091	81.3%	667	1.49E+09	NR		
9/16/03		0.074	83.9%	7,200	1.30E+10	**86.9**		
11/11/03		0.069	84.8%	12,000	2.03E+10	**92.2**		
8/18/04		0.067	85.1%	33.3	5.46E+07	NR		
9/25/01		0.058	86.2%	170	2.41E+08	NR		
6/13/07		0.053	86.8%	200	2.59E+08	NR		

Table E-26 (cont'd). Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM0.4

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
8/29/01	Low Flows	0.047	87.6%	10	1.15E+07	NR		
10/5/05		0.045	87.7%	1750	1.93E+09	**46.2**		
7/24/00		0.040	88.4%	3000	2.94E+09	**68.6**		
9/12/01		0.039	88.7%	1726	1.65E+09	**45.5**		
9/15/04		0.037	89.0%	860	7.79E+08	NR		
8/10/06		0.031	90.0%	380	2.88E+08	NR		
8/10/06		0.031	90.0%	300	2.28E+08	NR		
9/21/05		0.021	91.3%	19800	1.02E+10	**95.2**		
9/20/00		0.006	93.9%	40	5.87E+06	NR		
11/9/05		0.003	94.6%	3800	2.79E+08	**75.2**		
8/23/00		0.001	95.9%	1400	3.43E+07	**32.8**		
10/12/06		0.001	95.9%	400	9.79E+06	NR	**27.3**	**28.6**

Note: NR = No reduction required
NA = Not applicable

Table E-27. Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM2.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
10/8/02	Moist Conditions	1.80	26.8%	2,750	1.79E+11	**65.8**		
1/8/02		1.68	27.2%	2,419.2	1.50E+11	**61.1**		
4/9/02		0.99	31.7%	24,192	8.56E+11	**96.1**	**74.3**	**76.4**
4/28/03	Mid-Range Flows	0.23	45.6%	58.3	4.81E+08	NR		
2/4/03		0.18	51.6%	20	1.23E+08	NR		
7/11/01		0.10	63.4%	2,419.2	6.16E+09	**61.1**	**20.4**	**21.4**
7/9/02	Low Flows	0.044	79.1%	2,419.2	3.55E+09	**61.1**		
10/9/01		0.020	87.8%	257	2.07E+08	NR	**30.6**	**32.1**

Note: NR = No reduction required
NA = Not applicable

Table E-28. Calculated Load Reduction Based on Daily Loading – Hurricane Creek – RM3.8

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
4/4/07	Moist Conditions	2.39	20.4%	5,200	3.03E+11	**81.9**		
2/14/07		2.22	21.0%	160	8.67E+09	NR	**41.0**	**41.7**
5/16/07	Mid-Range Flows	0.301	41.5%	15,531	1.14E+11	**93.9**		
11/8/06		0.284	42.4%	550	3.82E+09	NR		
3/7/07		0.158	56.1%	16	6.18E+07	NR	**31.3**	**31.5**
12/6/06	Low Flows	0.042	81.2%	17	1.75E+07	NR		
7/19/06		0.036	83.3%	550	4.84E+08	NR		
6/20/07		0.025	87.2%	41	2.51E+07	NR		
8/16/06		0.011	91.4%	17	4.58E+06	NR		
10/11/06		0.001	95.9%	34	8.32E+05	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-29. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/5/99	High Flows	14120.0	0.1%	2,419.2	8.36E+14	**61.1**		
5/14/03		4748.0	1.3%	6,000	6.97E+14	**84.3**		
4/21/04		2027.0	4.0%	300	1.49E+13	NR		
9/23/09		1464.0	5.7%	2,420	8.67E+13	**61.1**		
10/11/04		1265.0	6.7%	4,000	1.24E+14	**76.5**		
12/1/04		1140.0	7.5%	3,300	9.20E+13	**71.5**		
7/19/01		1129.0	7.6%	5,000	1.38E+14	**81.2**		
2/5/08		993.4	8.6%	959	2.33E+13	**1.9**		
1/6/05		983.6	8.7%	1,600	3.85E+13	**41.2**	**53.2**	**56.8**

Table E-29 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
11/11/02	Moist Conditions	739.10	11.0%	3,200	5.79E+13	**70.6**		
12/11/08		620.30	12.3%	3,600	5.46E+13	**73.9**		
10/17/07		617.50	12.4%	560	8.46E+12	NR		
3/13/02		580.40	12.9%	2,419.2	3.44E+13	**61.1**		
3/13/02		580.40	12.9%	10	1.42E+11	NR		
10/25/04		533.40	13.6%	2,419.2	3.16E+13	**61.1**		
10/10/01		448.80	14.9%	1,723	1.89E+13	**45.4**		
1/30/06		363.80	16.8%	4,200	3.74E+13	**77.6**		
2/8/05		315.20	18.1%	2,382	1.84E+13	**60.5**		
4/24/01		312.40	18.2%	80,000	6.11E+14	**98.8**		
1/11/06		285.60	18.9%	6,600	4.61E+13	**85.7**		
11/9/00		256.20	20.0%	21,000	1.32E+14	**95.5**		
3/18/04		253.60	20.1%	500	3.10E+12	NR		
4/4/07		246.40	20.3%	2,400	1.45E+13	**60.8**		
7/10/01		223.60	21.2%	220	1.20E+12	NR		
2/14/07		178.60	23.0%	1,100	4.81E+12	**14.5**		
11/7/02		170.20	23.7%	2,419.2	1.01E+13	**61.1**		
5/18/04		170.60	23.7%	60	2.50E+11	NR		
12/11/03		143.80	25.1%	4,800	1.69E+13	**80.4**		
4/23/08		129.60	26.5%	62	1.97E+11	NR		
3/6/01		128.60	26.6%	100	3.15E+11	NR		
3/22/00		127.10	26.8%	1,203.3	3.74E+12	**21.8**		
1/31/06		126.10	26.9%	870	2.68E+12	NR		
5/16/07		126.90	26.9%	24,196	7.51E+13	**96.1**		
6/24/02		122.10	27.2%	10	2.99E+10	NR		
11/28/07		116.00	28.0%	411	1.17E+12	NR		

Table E-29 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
2/15/05	Moist Conditions (cont'd)	90.78	30.3%	550	1.22E+12	NR	39.3	41.6
3/14/01		85.68	30.9%	4,106	8.61E+12	**77.1**		
9/18/02		67.78	32.7%	19	3.15E+10	NR		
10/15/03		65.14	33.1%	6,500	1.04E+13	**85.5**		
1/9/02		60.13	33.7%	1,553.1	2.28E+12	**39.4**		
1/9/02		60.13	33.7%	10	1.47E+10	NR		
5/14/02		60.13	33.7%	40	5.88E+10	NR		
4/23/09		55.15	34.6%	548	7.39E+11	NR		
1/10/07		50.14	35.8%	1,100	1.35E+12	**14.5**		
7/10/03		47.27	36.3%	5,800	6.71E+12	**83.8**		
2/11/03		45.15	36.8%	4,352	4.81E+12	**78.4**		
2/3/99		44.36	36.9%	1,119.9	1.22E+12	**16.0**		
12/11/01		43.87	37.1%	1,732.9	1.86E+12	**45.7**		
2/13/03		42.61	37.6%	7	7.30E+09	NR		
5/10/05		41.90	37.9%	2,800	2.87E+12	**66.4**		
4/3/01		38.86	38.7%	230	2.19E+11	NR		
4/10/02		38.42	38.9%	3,448	3.24E+12	**72.7**		
6/12/03		37.24	39.2%	6,000	5.47E+12	**84.3**		
2/7/06	Mid-Range Flows	34.29	40.3%	600	5.03E+11	NR		
12/20/00		32.54	41.0%	30	2.39E+10	NR		
8/8/01		32.35	41.1%	2,492	1.97E+12	**62.2**		
10/15/02		28.53	42.7%	170	1.19E+11	NR		
11/8/06		28.14	42.9%	1,100	7.57E+11	**14.5**		
6/7/05		26.67	43.9%	20,400	1.33E+13	**95.4**		
6/12/02		24.40	45.5%	1,421	8.48E+11	**33.8**		
8/7/02		24.27	45.6%	1	5.94E+08	NR		

Table E-29 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
7/13/06	Mid-Range Flows (cont'd)	23.99	45.9%	840	4.93E+11	NR		
2/22/01		23.60	46.1%	170	9.82E+10	NR		
1/24/01		23.32	46.4%	40	2.28E+10	NR		
8/20/02		22.68	46.8%	934	5.18E+11	NR		
8/8/05		20.09	48.8%	3,400	1.67E+12	**72.3**		
11/20/00		19.83	48.9%	90	4.37E+10	NR		
12/17/08		18.98	49.9%	866	4.02E+11	NR		
1/22/04		17.64	51.3%	44	1.90E+10	NR		
6/17/04		17.70	51.3%	600	2.60E+11	NR		
3/21/01		17.51	51.5%	10	4.28E+09	NR		
5/16/06		17.31	51.7%	520	2.20E+11	NR		
12/8/03		17.29	51.8%	2,481	1.05E+12	**62.1**		
9/20/06		17.29	51.8%	2,000	8.46E+11	**53.0**		
2/12/02		17.08	52.1%	10	4.18E+09	NR		
6/20/07		16.65	52.5%	443	1.80E+11	NR		
1/8/03		16.36	52.7%	40	1.60E+10	NR		
8/19/08		16.08	53.0%	150	5.90E+10	NR		
11/8/04		16.04	53.1%	270	1.06E+11	NR		
5/27/03		15.81	53.5%	45.5	1.76E+10	NR		
3/11/03		15.23	54.1%	10	3.73E+09	NR		
3/15/05		15.11	54.2%	49	1.81E+10	NR		
2/13/02		14.58	54.9%	579.4	2.07E+11	NR		
4/2/03		14.44	55.2%	330	1.17E+11	NR		
6/8/04		14.04	56.0%	10	3.44E+09	NR		
6/11/01		13.91	56.4%	130	4.42E+10	NR		
5/8/02		13.48	57.2%	310	1.02E+11	NR		

Table E-29 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
3/7/07	Mid-Range Flows (cont'd)	12.28	59.3%	25	7.51E+09	NR	**10.9**	**12.1**
12/2/02		12.18	59.5%	530	1.58E+11	NR		
2/24/04	Dry Conditions	11.86	60.0%	1,043	3.03E+11	**9.8**		
2/24/04		11.86	60.0%	1,100	3.19E+11	**14.5**		
4/12/06		10.78	62.2%	364	9.60E+10	NR		
2/6/01		10.52	62.8%	60	1.54E+10	NR		
8/25/03		9.99	64.1%	1,413.6	3.45E+11	**33.4**		
4/20/05		9.72	64.7%	127	3.02E+10	NR		
8/6/03		9.65	64.8%	6,000	1.42E+12	**84.3**		
9/16/03		9.17	65.8%	1,600	3.59E+11	**41.2**		
3/8/06		9.15	65.8%	200	4.48E+10	NR		
4/18/02		8.63	67.1%	40	8.45E+09	NR		
11/20/08		8.20	68.1%	5	1.00E+09	NR		
5/2/01		8.00	68.4%	14,000	2.74E+12	**93.3**		
3/21/07		7.72	68.9%	24	4.53E+09	NR		
7/22/02		7.51	69.3%	1	1.84E+08	NR		
1/10/01		7.16	70.2%	2,500	4.38E+11	**62.4**		
10/22/08		6.88	70.7%	90	1.52E+10	NR		
12/12/05		6.61	71.4%	1,180	1.91E+11	**20.3**		
5/24/06		6.05	72.6%	62	9.18E+09	NR		
12/6/00		5.41	74.2%	2,100	2.78E+11	**52.2**		
6/29/05		5.33	74.4%	1,455	1.90E+11	**35.3**		
10/5/05		5.34	74.4%	200	2.61E+10	NR		
12/6/06		4.88	75.4%	75	8.95E+09	NR		
10/23/01		4.76	75.8%	160	1.86E+10	NR		

Table E-29 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
6/19/00	Dry Conditions	4.46	76.8%	1,500	1.64E+11	**37.3**	**13.0**	**14.7**
9/30/08		4.34	77.3%	520	5.52E+10	NR		
6/20/01		4.28	77.5%	410	4.29E+10	NR		
6/7/06		4.29	77.5%	700	7.35E+10	NR		
9/25/01		4.26	77.6%	10	1.04E+09	NR		
9/12/01		3.88	78.9%	770.1	7.31E+10	NR		
11/9/05		3.49	80.0%	127	1.08E+10	NR		
11/7/01		3.27	80.9%	20	1.60E+09	NR		
7/22/04		3.17	81.6%	1,400	1.09E+11	**32.8**		
11/20/07		3.14	81.7%	10	7.69E+08	NR		
11/14/01		3.06	82.0%	55.4	4.15E+09	NR		
6/30/09		2.77	83.2%	37	2.51E+09	NR		
9/15/04		2.52	84.3%	520	3.20E+10	NR		
11/11/03		2.28	85.4%	200	1.11E+10	NR		
8/18/04		1.59	88.0%	203	7.89E+09	NR		
8/10/06		1.19	89.7%	220	6.42E+09	NR		
8/10/06		1.19	89.7%	640	1.87E+10	NR		
8/29/01	Low Flows	0.914	90.9%	30	6.71E+08	NR		
12/1/99		0.894	91.2%	172.5	3.77E+09	NR		
6/13/07		0.839	91.7%	160	3.28E+09	NR		
7/24/00		0.643	92.8%	40,000	6.29E+11	**97.6**		
9/21/05		0.398	94.7%	111.2	1.08E+09	NR		
9/21/05		0.398	94.7%	255	2.48E+09	NR		
11/5/98		0.362	95.0%	148.3	1.31E+09	NR		
10/11/06		0.192	96.3%	17	7.99E+07	NR		

Table E-29. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM1.8

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
9/13/06	Low Flows	0.100	97.1%	1,700	4.16E+09	**44.6**		
10/16/00		0.080	97.4%	70	1.37E+08	NR		
9/1/99		0.058	97.6%	95.9	1.36E+08	NR		
7/19/07		0.057	97.6%	180	2.51E+08	NR		
10/24/00		0.052	97.7%	90	1.15E+08	NR		
9/20/00		0.028	98.3%	50	3.43E+07	NR		
9/19/07		0.013	98.8%	100	3.18E+07	NR		
7/25/07		0.004	99.3%	27	2.64E+06	NR		
8/23/00		0.001	99.6%	150	3.67E+06	NR		
8/27/07		0.001	99.6%	4,000	9.79E+07	**76.5**	**12.2**	**12.6**

Note: NR = No reduction required
NA = Not applicable

Table E-30. Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/5/99	High Flows	11510.0	0.1%	2,419.2	6.81E+14	**61.1**		
5/14/03		3875.0	1.3%	6,000	5.69E+14	**84.3**		
7/15/05		1702.0	3.8%	1,100	4.58E+13	**14.5**		
4/21/04		1352.0	5.0%	1,400	4.63E+13	**32.8**		
12/1/04		1050.0	6.8%	6,100	1.57E+14	**84.6**		
10/11/04		927.0	7.4%	11,000	2.49E+14	**91.4**		
1/6/05		804.1	8.4%	2,670	5.25E+13	**64.8**		
7/19/01		795.3	8.6%	80,000	1.56E+15	**98.8**		
11/11/02		718.5	9.5%	2,100	3.69E+13	**55.2**	**65.3**	**68.7**

Table E-30 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
12/11/08	Moist Conditions	553.40	11.6%	210	2.84E+12	NR		
3/13/02		519.60	12.1%	2,419.2	3.08E+13	**61.1**		
3/13/02		519.60	12.1%	10	1.27E+11	NR		
12/9/98		513.90	12.2%	2,419.2	3.04E+13	**61.1**		
10/17/07		416.10	14.0%	210	2.14E+12	NR		
1/30/06		319.60	16.3%	2,440	1.91E+13	**61.4**		
4/24/01		295.80	16.9%	68,000	4.92E+14	**98.6**		
1/11/06		264.30	18.0%	5,800	3.75E+13	**83.8**		
10/10/01		260.10	18.1%	1,723	1.10E+13	**45.4**		
11/9/00		214.50	20.0%	17,000	8.92E+13	**94.5**		
3/18/04		198.30	20.7%	1,400	6.79E+12	**32.8**		
7/10/01		170.90	21.8%	218	9.12E+11	NR		
5/18/04		143.20	23.4%	120	4.20E+11	NR		
5/29/08		142.20	23.5%	1,900	6.61E+12	**50.5**		
12/11/03		119.40	25.4%	4,900	1.43E+13	**80.8**		
3/6/01		113.30	26.0%	130	3.60E+11	NR		
4/29/08		107.40	26.6%	1,800	4.73E+12	**47.7**		
2/14/08		106.10	26.8%	1,800	4.67E+12	**47.7**		
6/24/02		80.55	29.8%	10	1.97E+10	NR		
2/15/05		80.82	29.8%	1,060	2.10E+12	**11.2**		
1/24/08		63.40	31.9%	640	9.93E+11	NR		
10/15/03		57.29	32.9%	1,900	2.66E+12	**50.5**		
9/18/02		56.06	33.1%	21	2.88E+10	NR		
1/9/02		53.13	33.4%	1,732.9	2.25E+12	**45.7**		
1/9/02		53.13	33.4%	80	1.04E+11	NR		
5/14/02		50.27	33.8%	70	8.61E+10	NR		

Table E-30 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/24/07	Moist Conditions (cont'd)	46.24	34.9%	980	1.11E+12	**4.0**	33.2	35.8
12/4/01		39.47	36.7%	10	9.66E+09	NR		
12/11/01		39.11	36.9%	866.4	8.29E+11	NR		
5/10/05		37.76	37.4%	13,600	1.26E+13	**93.1**		
2/13/03		35.26	38.1%	7	6.04E+09	NR		
4/3/01		35.01	38.2%	150	1.28E+11	NR		
6/12/03		35.14	38.2%	5,800	4.99E+12	**83.8**		
4/10/02		34.36	38.5%	1,112	9.35E+11	**15.4**		
12/19/07		34.11	38.6%	4,400	3.67E+12	**78.6**		
7/10/03		32.71	39.1%	5,400	4.32E+12	**82.6**		
2/7/06		30.91	39.9%	900	6.81E+11	NR		
12/20/00	Mid-Range Flows	29.39	40.5%	20	1.44E+10	NR		
8/8/01		29.19	40.7%	2,419.2	1.73E+12	**61.1**		
3/5/09		26.84	41.9%	5	3.28E+09	NR		
4/23/09		26.52	42.1%	160	1.04E+11	NR		
10/15/02		25.79	42.5%	140	8.83E+10	NR		
6/7/05		25.14	43.0%	15,600	9.60E+12	**94.0**		
8/7/02		24.06	43.9%	1	5.89E+08	NR		
2/24/09		23.66	44.3%	90	5.21E+10	NR		
2/22/01		21.54	45.9%	330	1.74E+11	NR		
1/24/01		21.39	46.1%	60	3.14E+10	NR		
6/12/02		20.05	47.2%	2,310	1.13E+12	**59.3**		
11/20/00		18.59	48.5%	100	4.55E+10	NR		
8/8/05		17.23	49.8%	3,400	1.43E+12	**72.3**		
1/22/04		16.21	51.2%	420	1.67E+11	NR		
9/20/06		16.16	51.3%	2,000	7.91E+11	**53.0**		

Table E-30 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/16/06	Mid-Range Flows (cont'd)	16.01	51.5%	1,000	3.92E+11	**2.9**	12.0	13.1
3/21/01		15.91	51.6%	10	3.89E+09	NR		
6/17/04		15.88	51.7%	2,300	8.94E+11	**59.1**		
7/13/06		15.61	52.0%	60	2.29E+10	NR		
2/12/02		15.45	52.2%	10	3.78E+09	NR		
11/8/04		15.05	52.6%	960	3.53E+11	**2.0**		
8/19/08		15.08	52.6%	210	7.75E+10	NR		
1/8/03		14.58	53.3%	10	3.57E+09	NR		
3/15/05		13.70	54.4%	460	1.54E+11	NR		
3/11/03		13.57	54.7%	8	2.66E+09	NR		
11/21/06		13.52	54.8%	63	2.08E+10	NR		
11/21/06		13.52	54.8%	100	3.31E+10	NR		
4/2/03		13.14	55.3%	150	4.82E+10	NR		
2/13/02		13.12	55.4%	325.5	1.04E+11	NR		
6/11/01		12.92	55.9%	170	5.37E+10	NR		
5/8/02		12.37	56.9%	344.8	1.04E+11	NR		
3/12/08		12.12	57.4%	340	1.01E+11	NR		
1/25/05		12.10	57.6%	187	5.54E+10	NR		
1/22/09		11.78	58.3%	40	1.15E+10	NR	**12.0**	**13.1**
12/2/02	Dry Conditions	10.89	60.1%	1,030	2.74E+11	**8.6**		
2/24/04		10.50	60.7%	300	7.71E+10	NR		
6/17/09		10.47	60.8%	460	1.18E+11	NR		
4/12/06		9.90	62.2%	182	4.41E+10	NR		
2/6/01		9.51	63.2%	40	9.30E+09	NR		
8/6/03		9.05	64.4%	6,000	1.33E+12	**84.3**		
2/21/07		8.95	64.5%	16	3.50E+09	NR		
2/21/07		8.95	64.5%	57	1.25E+10	NR		

Table E-30 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
9/16/03	Dry Conditions (cont'd)	8.79	64.9%	1,600	3.44E+11	**41.2**		
4/20/05		8.72	65.1%	127	2.71E+10	NR		
2/25/99		8.31	66.0%	125.9	2.56E+10	NR		
3/8/06		8.11	66.4%	7,600	1.51E+12	**87.6**		
6/19/08		7.81	67.2%	10	1.91E+09	NR		
4/18/02		7.58	67.8%	30	5.57E+09	NR		
5/20/09		7.53	68.0%	650	1.20E+11	NR		
11/20/08		7.43	68.2%	5	9.09E+08	NR		
7/22/02		7.11	68.8%	1	1.74E+08	NR		
5/2/01		7.07	68.9%	120	2.07E+10	NR		
3/21/07		6.83	69.3%	36	6.01E+09	NR		
1/10/01		6.35	70.5%	200	3.11E+10	NR		
12/12/05		6.30	70.5%	1,640	2.53E+11	**42.6**		
10/22/08		6.29	70.6%	150	2.31E+10	NR		
4/23/07		6.06	71.2%	228	3.38E+10	NR		
10/5/05		5.01	73.8%	250	3.06E+10	NR		
12/6/00		4.81	74.3%	20	2.35E+09	NR		
5/9/07		4.67	74.6%	30	3.43E+09	NR		
5/9/07		4.67	74.6%	88	1.01E+10	NR		
9/25/08		4.55	75.0%	150	1.67E+10	NR		
10/23/01		4.30	75.7%	230	2.42E+10	NR		
6/19/00		3.95	76.8%	3,800	3.67E+11	**75.2**		
9/25/01		3.94	76.8%	10	9.64E+08	NR		
6/7/06		3.76	77.6%	63	5.79E+09	NR		
6/20/01		3.68	78.0%	180	1.62E+10	NR		
9/12/01		3.54	78.4%	770.1	6.67E+10	NR		

Table E-30 (cont'd). Calculated Load Reduction Based on Daily Loading – Nonconnah Creek – RM6.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/15/08	Dry Conditions (cont'd)	3.50	78.5%	70	5.99E+09	NR		
12/7/06		3.44	78.9%	27	2.27E+09	NR		
11/9/05		3.22	79.6%	420	3.31E+10	NR		
11/7/01		2.96	80.7%	10	7.23E+08	NR		
11/20/07		2.86	81.2%	40	2.79E+09	NR		
11/14/01		2.78	81.6%	23.5	1.60E+09	NR		
7/22/04		2.74	81.9%	600	4.03E+10	NR		
9/15/04		2.29	84.1%	1,730	9.68E+10	**45.6**		
11/11/03		2.07	85.1%	4	2.03E+08	NR		
8/18/04		1.40	87.9%	333	1.14E+10	NR		
8/10/06		1.14	89.4%	1	2.78E+07	NR		
8/10/06		1.14	89.4%	10	2.78E+08	NR	**8.4**	**9.1**
8/29/01	Low Flows	0.812	91.2%	10	1.99E+08	NR		
6/13/07		0.702	92.1%	8	1.37E+08	NR		
7/24/00		0.571	92.9%	130	1.82E+09	NR		
9/21/05		0.346	94.9%	309	2.62E+09	NR		
10/12/06		0.337	95.0%	20	1.65E+08	NR		
10/16/00		0.087	97.3%	90	1.92E+08	NR		
10/24/00		0.064	97.5%	10	1.57E+07	NR		
7/19/07		0.042	98.1%	140	1.44E+08	NR		
9/20/00		0.027	98.5%	70	4.62E+07	NR		
9/19/07		0.015	98.8%	20	7.34E+06	NR		
8/23/00		0.001	99.8%	10	2.45E+05	NR		
8/27/07		0.001	99.8%	2,000	4.89E+07	**53.0**	**4.4**	**4.8**

Note: NR = No reduction required
NA = Not applicable

Table E-31. Calculated Load Reduction Based on Daily Loading – Tenmile Creek – RM0.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
3/13/02	Moist Conditions	16.59	17.4%	2,419.2	9.82E+11	**61.1**	**45.0**	**46.8**
4/4/07		14.77	18.1%	2,400	8.67E+11	**60.8**		
5/16/07		11.47	20.1%	24,196	6.79E+12	**96.1**		
2/14/07		5.51	26.7%	700	9.43E+10	NR		
9/9/99		3.43	30.7%	2,419.2	2.03E+11	**61.1**		
1/9/02		1.85	35.7%	1,413.6	6.39E+10	**33.4**		
8/8/01		1.53	37.5%	12,997	4.87E+11	**92.8**		
1/10/07		1.44	38.1%	660	2.33E+10	NR		
12/11/01		1.37	38.7%	123.6	4.13E+09	NR		
4/10/02	Mid-Range Flows	1.18	40.3%	259	7.50E+09	NR	**29.6**	**30.4**
11/8/06		0.80	44.4%	2,400	4.69E+10	**60.8**		
2/13/02		0.43	53.8%	56.5	5.89E+08	NR		
6/12/02		0.41	55.0%	7,270	7.20E+10	87.1		
5/8/02		0.30	60.8%	613.1	4.53E+09	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-32. Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM1.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/7/05	High Flows	299.60	1.2%	16,400	1.20E+14	**97.0**	**82.1**	**83.9**
1/13/05		194.50	2.2%	20,000	9.52E+13	**97.6**		
1/3/05		65.82	7.1%	1,060	1.71E+12	**54.1**		
4/13/04		61.87	7.3%	2,419.2	3.66E+12	**79.9**		
12/9/03	Moist Conditions	41.17	10.5%	22.3	2.25E+10	NR	**41.8**	**44.9**
7/20/05		33.84	11.9%	2,419.2	2.00E+12	**79.9**		
6/27/02		17.62	16.8%	218	9.40E+10	NR		
5/23/01		15.59	18.3%	2,419.2	9.23E+11	**79.9**		
2/9/04		11.90	20.6%	191.8	5.58E+10	NR		
1/5/05		11.88	20.7%	1,240	3.60E+11	**60.7**		
1/25/06		11.76	20.8%	2,000	5.75E+11	**75.7**		
6/15/04		11.37	21.0%	209.8	5.84E+10	NR		
4/24/02		10.02	22.2%	24,192	5.93E+12	**98.0**		
1/10/05		6.92	25.2%	1,100	1.86E+11	**55.7**		
1/31/01		6.63	25.9%	770.1	1.25E+11	**36.8**		
6/24/02		5.91	27.2%	547.5	7.92E+10	**11.1**		
7/15/02		5.59	27.9%	38,730	5.29E+12	**98.7**		
6/25/02		2.60	34.7%	866.4	5.52E+10	**43.8**		
5/31/06		2.44	35.4%	2,400	1.43E+11	**79.7**		
2/28/01		2.43	35.5%	517.2	3.08E+10	**5.8**		
1/17/05		1.82	38.9%	667	2.97E+10	**27.0**		
4/26/01		1.82	39.0%	313	1.39E+10	NR		
12/5/01	Mid-Range Flows	1.31	43.9%	159.7	5.12E+09	NR		
1/18/05		1.30	44.1%	257	8.16E+09	NR		
3/10/04		0.90	49.7%	101	2.23E+09	NR		
1/20/05		0.90	49.8%	218	4.79E+09	NR		

Table E-32 (cont'd). Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM1.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/16/02	Mid-Range Flows (cont'd)	0.87	50.5%	1,730	3.67E+10	**71.8**		
1/24/05		0.79	52.6%	291	5.60E+09	NR		
4/26/06		0.78	53.0%	580	1.10E+10	**16.0**		
1/16/02		0.75	53.7%	1,203.3	2.19E+10	**59.5**		
3/28/01		0.74	53.9%	42.6	7.70E+08	NR		
1/27/05		0.74	53.9%	55	9.96E+08	NR		
3/1/06		0.67	56.1%	18	2.93E+08	NR		
12/28/05		0.55	60.2%	57	7.70E+08	NR		
3/28/06		0.54	60.5%	68	9.00E+08	NR	**14.6**	**15.8**
6/26/02		0.50	61.8%	6,131	7.50E+10	**92.1**		
1/13/04		0.50	61.8%	40.2	4.92E+08	NR		
6/20/06		0.49	62.1%	440	5.31E+09	NR		
9/28/05		0.37	66.8%	250	2.26E+09	NR		
5/11/04		0.36	67.3%	203	1.78E+09	NR		
7/25/01		0.29	69.6%	790	5.64E+09	**38.4**	**18.5**	**20.0**
6/17/02	Low Flows	0.22	73.1%	253	1.34E+09	NR		
10/30/01		0.20	74.1%	4,106	2.03E+10	**88.1**		
6/19/01		0.19	74.9%	2,419.2	1.12E+10	**79.9**		
10/29/03		0.19	75.1%	52.9	2.43E+08	NR		
6/18/02		0.18	75.4%	191.8	8.63E+08	NR		
6/19/02		0.16	76.7%	191.8	7.65E+08	NR		
6/20/02		0.15	78.1%	686.7	2.49E+09	**29.1**		
7/12/04		0.12	80.2%	547.5	1.65E+09	**11.1**		
7/9/02		0.09	83.5%	126.1	2.71E+08	NR		
8/10/04		0.08	85.1%	920.8	1.71E+09	**47.1**		

Table E-32 (cont'd). Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM1.1

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
9/8/03	Low Flows (cont'd)	0.06	86.8%	162.4	2.34E+08	NR		
8/29/01		0.05	88.5%	2,419.2	2.78E+09	**79.9**		
10/2/01		0.03	90.5%	2,350	1.95E+09	**79.3**		
8/24/05		0.03	91.1%	16.9	1.28E+07	NR		
12/7/05		0.03	91.7%	30	1.98E+07	NR		
10/26/05		0.02	93.2%	96	3.76E+07	NR	**25.9**	**27.7**

Note: NR = No reduction required
NA = Not applicable

Table E-33. Calculated Load Reduction Based on Geomean Data – Cypress Creek – RM1.1

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
6/17/02	0.22	73.1%	253			
6/18/02	0.18	75.4%	191.8			
6/19/02	0.16	76.7%	191.8			
6/20/02	0.15	78.1%	686.7			
6/24/02	5.91	27.2%	547.5	322.7	**61.0**	**65.0**
6/25/02	2.60	34.7%	866.4	412.8	**69.5**	**72.6**
6/26/02	0.50	61.8%	6,131	825.4	**84.7**	**86.3**
6/27/02	17.62	16.8%	218	846.8	**85.1**	**86.7**
7/9/02	0.09	83.5%	126.1	603.3	**79.1**	**81.3**
7/15/02	5.59	27.9%	38,730	1414.1	**91.1**	**92.0**
1/3/05	65.82	7.1%	1,060			
1/5/05	11.88	20.7%	1,240			
1/7/05	299.60	1.2%	16,400			
1/10/05	6.92	25.2%	1,100			
1/13/05	194.50	2.2%	20,000	3429.2	**96.3**	**96.7**
1/17/05	1.82	38.9%	667	3125.8	**96.0**	**96.4**
1/18/05	1.30	44.1%	257	2281.7	**94.5**	**95.0**
1/20/05	0.90	49.8%	218	961.6	**86.9**	**88.2**
1/24/05	0.79	52.6%	291	737.0	**82.9**	**84.7**
1/27/05	0.74	53.9%	55	226.6	**44.4**	**50.1**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-34. Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM2.9

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
1/7/05	High Flows	208.50	1.2%	16,700	8.52E+13	**97.1**		
1/13/05		129.80	2.2%	24,200	7.69E+13	**98.0**		
12/29/03		70.89	4.4%	148	2.57E+11	NR		
1/3/05		55.60	5.7%	660	8.98E+11	**26.2**		
4/13/04		33.01	8.4%	2,419.2	1.95E+12	**79.9**	**60.2**	**62.2**
6/27/02	Moist Conditions	13.95	14.3%	241,920	8.26E+13	**99.8**		
6/15/04		9.61	17.1%	2,419.2	5.68E+11	**79.9**		
5/23/01		8.20	18.8%	2,419.2	4.85E+11	**79.9**		
2/9/04		8.21	18.8%	344.8	6.92E+10	NR		
7/20/05		7.72	19.3%	2,419.2	4.57E+11	**79.9**		
1/5/05		7.35	19.8%	540	9.71E+10	**9.8**		
1/25/06		6.83	20.8%	1,400	2.34E+11	**65.2**		
6/24/02		4.98	23.5%	2,214.2	2.70E+11	**78.0**		
1/10/05		4.05	25.3%	900	8.91E+10	**45.9**		
5/31/06		2.22	31.1%	2,400	1.30E+11	**79.7**		
6/25/02		1.02	38.5%	2,419.2	6.04E+10	**79.9**		
1/17/05		1.02	38.5%	680	1.70E+10	**28.4**	**60.5**	**63.7**
1/18/05	Mid-Range Flows	0.681	42.8%	218	3.63E+09	NR		
12/5/01		0.660	43.1%	410.6	6.63E+09	NR		
1/20/05		0.505	46.6%	420	5.19E+09	NR		
1/24/05		0.465	48.3%	182	2.07E+09	NR		
3/10/04		0.453	49.1%	159.7	1.77E+09	NR		
1/27/05		0.442	49.5%	55	5.95E+08	NR		
7/15/02		0.415	50.9%	14390	1.46E+11	**96.6**		
5/16/02		0.396	51.7%	579.4	5.61E+09	**15.9**		
3/1/06		0.367	53.5%	68	6.11E+08	NR		

Table E-34 (cont'd). Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM2.9

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
4/26/06	Mid-Range Flows (cont'd)	0.354	54.4%	290	2.51E+09	NR	10.3	11.9
3/28/06		0.301	58.5%	20	1.47E+08	NR		
1/13/04		0.298	58.8%	84	6.12E+08	NR		
5/11/04		0.256	61.8%	754	4.72E+09	**35.4**		
9/28/05		0.254	61.9%	520	3.23E+09	**6.3**		
12/28/05		0.207	65.6%	80	4.05E+08	NR		
6/17/02	Low Flows	0.156	70.3%	222.4	8.49E+08	NR	28.4	29.5
6/18/02		0.152	70.8%	162.4	6.04E+08	NR		
6/19/02		0.147	71.5%	770.1	2.77E+09	**36.8**		
6/20/06		0.146	71.7%	370	1.32E+09	NR		
6/20/02		0.143	72.1%	2,419.2	8.46E+09	**79.9**		
6/26/02		0.140	72.5%	2,4192	8.29E+10	**79.9**		
7/12/04		0.117	76.0%	325.5	9.32E+08	NR		
10/29/03		0.094	79.2%	2,419.2	5.56E+09	**79.9**		
7/9/02		0.092	79.8%	1,000	2.25E+09	**51.3**		
8/10/04		0.078	82.0%	2,419.2	4.62E+09	**79.9**		
9/8/03		0.059	85.3%	130.9	1.89E+08	NR		
8/29/01		0.045	87.4%	193.5	2.13E+08	NR		
8/24/05		0.025	90.5%	63	3.85E+07	NR		
12/7/05		0.016	91.8%	40	1.57E+07	NR		
10/26/05		0.011	92.7%	84	2.26E+07	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-35. Calculated Load Reduction Based on Geomean Data – Cypress Creek – RM2.9

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
6/17/02	0.156	70.3%	222.4			
6/18/02	0.152	70.8%	162.4			
6/19/02	0.147	71.5%	770.1			
6/20/02	0.143	72.1%	2,419.2			
6/24/02	4.975	23.5%	2,214.2	683.3	**81.6**	**83.5**
6/25/02	1.021	38.5%	2,419.2	1101.4	**88.6**	**89.7**
6/26/02	0.140	72.5%	2,4192	2996.1	**95.8**	**96.2**
6/27/02	13.950	14.3%	241,920	9462.0	**98.7**	**98.8**
7/9/02	0.092	79.8%	1,000	7929.5	**98.4**	**98.6**
7/15/02	0.415	50.9%	14,390	11529.6	**98.9**	**99.0**
1/3/05	55.60	5.7%	660			
1/5/05	7.350	19.8%	540			
1/7/05	208.50	1.2%	16,700			
1/10/05	4.045	25.3%	900			
1/13/05	129.80	2.2%	24,200	2645.7	**95.2%**	**95.7%**
1/17/05	1.019	38.5%	680	2661.6	**95.3%**	**95.8%**
1/18/05	0.681	42.8%	218	2220.0	**94.3%**	**94.9%**
1/20/05	0.505	46.6%	420	1062.8	**88.1%**	**89.4%**
1/24/05	0.465	48.3%	182	772.0	**83.7%**	**85.4%**
1/27/05	0.442	49.5%	55	228.5	**44.9%**	**50.6%**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-36. Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM4.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/7/05	High Flows	156.90	1.2%	8,000	3.07E+13	**93.9**	**73.2**	**73.9**
1/13/05		98.03	2.2%	21,600	5.18E+13	**97.7**		
1/3/05		41.89	5.7%	9,000	9.22E+12	**94.6**		
12/9/03		41.70	5.8%	410	4.18E+11	NR		
4/13/04		24.36	8.5%	2,419.2	1.44E+12	**79.9**		
6/27/02	Moist Conditions	11.28	14.0%	241,920	6.68E+13	**99.8**	**47.7**	**50.1**
6/15/04		7.927	16.4%	328.2	6.37E+10	NR		
2/9/04		6.615	18.0%	410.6	6.65E+10	NR		
5/23/01		5.998	19.1%	2,481	3.64E+11	**80.4**		
1/5/05		5.619	19.7%	1,740	2.39E+11	**72.0**		
7/20/05		5.596	19.7%	2,419.2	3.31E+11	**79.9**		
1/25/06		4.861	20.9%	1,200	1.43E+11	**59.4**		
6/24/02		4.288	22.1%	307.6	3.23E+10	NR		
1/10/05		2.740	26.1%	720	4.83E+10	**32.4**		
1/31/01		2.210	28.1%	2,419.2	1.31E+11	**79.9**		
5/31/06		1.881	29.4%	250	1.15E+10	NR		
2/28/01		0.980	35.1%	1,203.3	2.89E+10	**59.5**		
1/17/05		0.724	37.9%	940	1.67E+10	**48.2**		
4/26/01		0.678	38.7%	1,119.9	1.86E+10	**56.5**		
3/28/01	Mid-Range Flows	0.512	41.6%	34.5	4.32E+08	NR		
1/18/05		0.494	41.9%	660	7.98E+09	**26.2**		
12/5/01		0.470	42.6%	2000	2.30E+10	**75.7**		
9/28/05		0.408	44.7%	730	7.29E+09	**33.3**		
1/20/05		0.374	45.9%	460	4.21E+09	NR		
1/24/05		0.346	47.4%	90.9	7.69E+08	NR		

Table E-36 (cont'd). Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM4.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/16/02	Mid-Range Flows (cont'd)	0.334	48.3%	10.9	8.91E+07	NR		
3/10/04		0.333	48.3%	365.4	2.98E+09	NR		
6/25/02		0.330	48.5%	2419.2	1.95E+10	**79.9**		
1/27/05		0.329	48.6%	91	7.32E+08	NR		
5/16/02		0.288	51.6%	2210	1.56E+10	**78.0**		
3/1/06		0.271	53.0%	240	1.59E+09	NR		
4/26/06		0.257	54.4%	2400	1.51E+10	**79.7**		
3/28/06		0.223	58.2%	100	5.46E+08	NR		
1/13/04		0.221	58.4%	520	2.81E+09	**6.3**		
5/11/04		0.191	61.2%	110	5.14E+08	NR		
7/15/02		0.181	62.0%	1986300	8.80E+12	**100.0**		
12/28/05		0.147	65.6%	32	1.15E+08	NR		
6/19/01		0.125	68.5%	1986.3	6.07E+09	**75.5**		
7/25/01		0.119	69.5%	2141	6.23E+09	**77.3**		
6/17/02		0.117	69.8%	537	1.54E+09	**9.3**	**30.5**	**33.0**
6/18/02	Low Flows	0.114	70.4%	344.8	9.62E+08	NR		
6/19/02		0.110	71.2%	84.7	2.28E+08	NR		
6/20/02		0.107	71.9%	613.1	1.61E+09	**20.6**		
6/20/06		0.105	72.3%	2,400	6.17E+09	**79.7**		
6/26/02		0.103	72.7%	24,192	6.10E+10	**98.0**		
7/12/04		0.088	75.7%	22.6	4.87E+07	NR		
10/30/01		0.086	76.1%	2,419.2	5.09E+09	**79.9**		
7/9/02		0.070	79.3%	2,000	3.43E+09	**75.7**		
10/29/03		0.070	79.3%	2,419.2	4.14E+09	**79.9**		
8/10/04		0.059	81.8%	1,119.9	1.62E+09	**56.5**		

Table E-36 (cont'd). Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM4.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/5/06	Low Flows (cont'd)	0.047	84.5%	1,300	1.49E+09	**62.5**	**35.3**	**37.7**
9/8/03		0.044	85.3%	547.5	5.89E+08	**11.1**		
8/29/01		0.035	87.2%	770.1	6.59E+08	**36.8**		
10/2/01		0.024	89.3%	151.5	8.90E+07	NR		
8/24/05		0.021	90.0%	63	3.24E+07	NR		
12/7/05		0.012	91.8%	240	7.05E+07	NR		
10/26/05		0.008	92.8%	200	3.91E+07	NR		

Note: NR = No reduction required
NA = Not applicable

Table E-37. Calculated Load Reduction Based on Geomean Data – Cypress Creek – RM4.0

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
6/17/02	0.117	69.8%	537			
6/18/02	0.114	70.4%	344.8			
6/19/02	0.110	71.2%	84.7			
6/20/02	0.107	71.9%	613.1			
6/24/02	4.288	22.1%	307.6	312.0	**59.6**	**63.8**
6/25/02	0.330	48.5%	2,419.2	421.6	**70.1**	**73.2**
6/26/02	0.103	72.7%	24,192	986.6	**87.2**	**88.5**
6/27/02	11.280	14.0%	241,920	4845.1	**97.4**	**97.7**
7/9/02	0.070	79.3%	2,000	6137.7	**97.9**	**98.2**
7/15/02	0.181	62.0%	1,986,300	35482.8	**99.6**	**99.7**
1/3/05	41.89	5.7%	9,000			
1/5/05	5.62	19.7%	1,740			
1/7/05	156.90	1.2%	8,000			
1/10/05	2.74	26.1%	720			
1/13/05	98.03	2.2%	21,600	4549.2	**97.2%**	**97.5%**
1/17/05	0.724	37.9%	940	2895.4	**95.6%**	**96.1%**
1/18/05	0.494	41.9%	660	2385.1	**94.7%**	**95.3%**
1/20/05	0.374	45.9%	460	1347.2	**90.6%**	**91.6%**
1/24/05	0.346	47.4%	90.9	890.6	**85.9%**	**87.3%**
1/27/05	0.329	48.6%	91	298.3	**57.8%**	**62.1%**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-38. Calculated Load Reduction Based on Daily Loading – Cypress Creek – RM4.7

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/3/05	High Flows	34.69	6.0%	8,000	6.79E+12	**93.9**	**93.9**	**94.5**
1/5/05	Moist Conditions	5.006	18.6%	7,400	9.06E+11	**93.4**		
5/23/01		4.459	19.6%	2,419.2	2.64E+11	**79.9**		
1/10/05		2.071	26.2%	3,240	1.64E+11	**85.0**		
1/17/05		0.555	38.0%	1,380	1.87E+10	**64.7**	**80.7**	**82.7**
1/18/05	Mid-Range Flows	0.381	41.8%	1,220	1.14E+10	**60.1**		
12/5/01		0.362	42.4%	2,419.2	2.14E+10	**79.9**		
1/20/05		0.293	45.7%	720	5.16E+09	**32.4**		
1/24/05		0.271	47.3%	2,140	1.42E+10	**77.2**		
1/27/05		0.257	48.4%	309	1.94E+09	NR	**49.9**	**52.9**
8/29/01	Low Flows	0.029	87.0%	1,986.3	1.41E+09	**75.5**	**75.5**	**77.9**

Note: NR = No reduction required
NA = Not applicable

Table E-39. Calculated Load Reduction Based on Geomean Data – Cypress Creek – RM4.7

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
1/3/05	34.69	6.0%	8,000			
1/5/05	5.006	18.6%	7,400			
1/10/05	2.071	26.2%	3,240			
1/17/05	0.555	38.0%	1,380			
1/18/05	0.381	41.8%	1,220	3,175.6	**96.0%**	**96.4%**
1/20/05	0.293	45.7%	720	1,961.9	**93.6%**	**94.2%**
1/24/05	0.271	47.3%	2,140	1,530.8	**91.8%**	**92.6%**
1/27/05	0.257	48.4%	309	956.7	**86.8%**	**88.2%**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-40 Calculated Load Reduction Based on Daily Loading – UT to Cypress Creek – 1T0.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/7/05	High Flows	61.86	1.1%	13,600	2.06E+13	**96.4**		
1/13/05		41.34	2.1%	12,600	1.27E+13	**96.1**		
1/3/05		13.86	5.6%	110	3.73E+10	NR		
4/13/04		11.44	6.5%	2,419.2	6.77E+11	**79.9**	**68.1**	**68.8**
7/20/05	Moist Conditions	5.319	11.5%	101.7	1.32E+10	NR		
5/23/01		3.584	15.3%	2,419.2	2.12E+11	**79.9**		
1/5/05		2.757	17.6%	420	2.83E+10	NR		
1/25/06		2.705	17.9%	170	1.13E+10	NR		
2/9/04		2.290	19.6%	298.7	1.67E+10	NR		
1/10/05		1.606	22.4%	367	1.44E+10	NR		
6/15/04		1.200	26.0%	2,419.2	7.10E+10	**79.9**		
1/17/05		0.410	37.0%	143	1.43E+09	NR	**20.0**	**20.5**
1/18/05	Mid-Range Flows	0.298	41.0%	314	2.29E+09	NR		
12/5/01		0.285	41.9%	387.3	2.70E+09	NR		
5/31/06		0.257	43.5%	2,400	1.51E+10	**79.7**		
1/20/05		0.217	45.9%	127	6.74E+08	NR		
1/24/05		0.199	47.8%	164	7.98E+08	NR		
3/10/04		0.198	48.0%	64.4	3.12E+08	NR		
1/27/05		0.189	48.9%	109	5.04E+08	NR		
5/16/02		0.174	50.8%	1,119.9	4.77E+09	**56.5**		
4/26/06		0.159	52.7%	440	1.71E+09	NR		
7/15/02		0.155	53.3%	34,360	1.30E+11	**98.6**		
3/1/06		0.154	53.6%	3	1.13E+07	NR		
3/28/06		0.129	57.6%	410	1.29E+09	NR		
1/13/04		0.126	58.4%	31	9.56E+07	NR		

Table E-40 (cont'd) Calculated Load Reduction Based on Daily Loading – UT to Cypress Creek – 1T0.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/11/04	Mid-Range Flows (cont'd)	0.099	62.9%	1,333	3.23E+09	**63.5**		
12/28/05		0.091	64.2%	9.5	2.12E+07	NR		
9/28/05		0.081	65.9%	730	1.45E+09	**33.3**	**20.7**	**21.8**
6/20/06	Low Flows	0.06	71.7%	3,700	5.16E+09	**86.8**		
10/29/03		0.04	79.2%	2,419.2	2.25E+09	**79.9**		
9/8/03		0.02	85.4%	26.9	1.58E+07	NR	**55.6**	**56.7**

Note: NR = No reduction required
NA = Not applicable

Table E-41. Calculated Load Reduction Based on Geomean Data – UT to Cypress Creek – 1T0.6

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
1/7/05	61.86	1.1%	13,600			
1/10/05	1.606	22.4%	367			
1/13/05	41.34	2.1%	12,600			
1/17/05	0.410	37.0%	143			
1/18/05	0.298	41.0%	314	**1230.7**	**89.8%**	**90.8%**
1/20/05	0.217	45.9%	127	483.3	73.9%	76.6%
1/24/05	0.199	47.8%	164	411.4	69.4%	72.5%
1/27/05	0.189	48.9%	109	159.1	20.8%	29.0%

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-42. Calculated Load Reduction Based on Daily Loading – UT to Cypress Creek – 2T0.2

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
1/7/05	High Flows	41.89	1.3%	13700	1.40E+13	**96.4**	**54.8**	**56.3**
1/13/05		28.79	2.3%	21200	1.49E+13	**97.7**		
12/29/03		15.79	4.4%	365.4	1.41E+11	NR		
1/3/05		11.39	6.0%	460	1.28E+11	NR		
4/13/04		6.786	8.8%	2419.2	4.02E+11	**79.9**		
6/27/02	Moist Conditions	3.446	13.1%	57,940	4.88E+12	**99.2**	**48.4**	**51.1**
6/15/04		2.449	15.6%	2,419.2	1.45E+11	**79.9**		
2/9/04		1.936	17.0%	111.2	5.27E+09	NR		
1/5/05		1.542	19.0%	1,060	4.00E+10	**54.1**		
5/23/01		1.419	19.7%	1,732.9	6.02E+10	**71.9**		
7/20/05		1.317	20.4%	1,553.1	5.00E+10	**68.6**		
6/24/02		1.307	20.5%	125.9	4.03E+09	NR		
1/25/06		1.137	21.8%	350	9.74E+09	NR		
1/10/05		0.662	26.4%	540	8.75E+09	**9.8**		
5/31/06		0.552	28.1%	2,400	3.24E+10	**79.7**		
9/28/05		0.314	32.9%	1,100	8.45E+09	**55.7**		
1/17/05		0.177	38.2%	1,270	5.50E+09	**61.7**		
1/18/05	Mid-Range Flows	0.126	42.0%	1,200	3.70E+09	**59.4**		
12/5/01		0.121	42.5%	547.8	1.62E+09	**11.1**		
1/20/05		0.094	46.3%	540	1.24E+09	**9.8**		
1/24/05		0.086	48.1%	291	6.12E+08	NR		
3/10/04		0.084	48.7%	172.3	3.54E+08	NR		
1/27/05		0.082	49.2%	327	6.56E+08	NR		
5/16/02		0.072	51.8%	1,986.3	3.50E+09	**75.5**		
6/25/02		0.069	52.8%	2,419.2	4.08E+09	**79.9**		

Table E-42 (cont'd). Calculated Load Reduction Based on Daily Loading – UT to Cypress Creek – 2T0.2

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
3/1/06	Mid-Range Flows (cont'd)	0.067	53.8%	2,400	3.93E+09	**79.7**		
4/26/06		0.066	54.0%	5,200	8.40E+09	**90.6**		
1/13/04		0.055	58.3%	20	2.69E+07	NR		
3/28/06		0.055	58.3%	41	5.52E+07	NR		
7/15/02		0.051	59.9%	19,180	2.39E+10	**97.5**		
5/11/04		0.044	62.7%	1,198	1.29E+09	**59.3**		
12/28/05		0.039	64.7%	2,400	2.29E+09	**79.7**	**42.8**	**45.2**
6/17/02	Low Flows	0.027	70.8%	980.4	6.48E+08	**50.3**		
6/18/02		0.026	71.7%	727	4.62E+08	**33.0**		
6/19/02		0.025	72.4%	547.5	3.35E+08	**11.1**		
6/20/02		0.025	72.4%	344.8	2.11E+08	NR		
6/26/02		0.025	72.4%	24,192	1.48E+10	**98.0**		
6/20/06		0.024	73.4%	6,100	3.58E+09	**92.0**		
7/12/04		0.020	76.7%	1,299.7	6.36E+08	**62.5**		
7/9/02		0.016	80.1%	630	2.47E+08	**22.7**		
8/10/04		0.014	81.9%	1,203.3	4.12E+08	**59.5**		
9/8/03		0.010	86.0%	325.5	7.96E+07	NR		
8/29/01		0.008	87.7%	344.1	6.73E+07	NR		
8/24/05		0.005	90.4%	2,419.2	2.96E+08	**79.9**		
12/7/05		0.003	92.2%	43	3.16E+06	NR		
10/26/05		0.002	93.3%	320	1.57E+07	NR	**36.4**	**39.2**

Note: NR = No reduction required
NA = Not applicable

Table E-43. Calculated Load Reduction Based on Geomean Data – UT to Cypress Creek – 2T0.2

Sample Date	Flow	PDFE	Concentration	Geometric Mean	Calculated Reduction to Target GM (126 CFU/100 ml)	Calculated Reduction to Target – MOS (113 CFU/100 ml)
	[cfs]	[%]	[CFU/100 ml]	[CFU/100 ml]	[%]	[%]
6/17/02	0.027	70.8%	980.4			
6/18/02	0.026	71.7%	727			
6/19/02	0.025	72.4%	547.5			
6/20/02	0.025	72.4%	344.8			
6/24/02	1.307	20.5%	125.9	442.4	**71.5**	**74.5**
6/25/02	0.069	52.8%	2,419.2	530.0	**76.2**	**78.7**
6/26/02	0.025	72.4%	24,192	1068.2	**88.2**	**89.4**
6/27/02	3.446	13.1%	57,940	2713.8	**95.4**	**95.8**
7/9/02	0.016	80.1%	630	3061.5	**95.9**	**96.3**
7/15/02	0.051	59.9%	19,180	8365.7	**98.5**	**98.6**
1/3/05	11.39	6.0%	460			
1/5/05	1.542	19.0%	1,060			
1/7/05	41.89	1.3%	13,700			
1/10/05	0.662	26.4%	540			
1/13/05	28.79	2.3%	21,200	2380.7	**94.7%**	**95.3%**
1/17/05	0.177	38.2%	1,270	2916.8	**95.7%**	**96.1%**
1/18/05	0.126	42.0%	1,200	2990.1	**95.8%**	**96.2%**
1/20/05	0.094	46.3%	540	1566.1	**92.0%**	**92.8%**
1/24/05	0.086	48.1%	291	1384.0	**90.9%**	**91.8%**
1/27/05	0.082	49.2%	327	600.8	**79.0%**	**81.2%**

Note: Geometric Mean is calculated whenever 5 or more samples are collected over a period of not more than 30 consecutive days.

Table E-44 Calculated Load Reduction Based on Daily Loading – UT to Cypress Creek – 3T0.6

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
5/23/01	Moist Conditions	1.75	19.5%	9,804	4.20E+11	**95.0**	**95.0**	**95.5**
12/5/01	Mid-Range Flows	0.15	42.3%	2,419.2	8.58E+09	**79.9**	**79.9**	**81.9**

Note: NR = No reduction required
NA = Not applicable

Table E-45 Calculated Load Reduction Based on Daily Loading – Horn Lake Creek – RM4.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/20/05	Moist Conditions	93.49	15.6%	2,419.2	5.53E+12	**61.1**	**35.8**	**38.9**
5/23/01		89.24	16.1%	5,475	1.20E+13	**82.8**		
1/25/06		70.77	18.1%	690	1.19E+12	NR		
1/31/01		30.24	26.4%	1,119.1	8.28E+11	**15.9**		
4/24/02		17.72	31.8%	2,419.2	1.05E+12	**61.1**		
2/28/01		13.32	34.9%	158.4	5.16E+10	NR		
9/9/99		12.98	35.2%	2,419.2	7.68E+11	**61.1**		
4/26/01		9.46	38.5%	980.4	2.27E+11	**4.0**		
5/31/06	Mid-Range Flows	6.90	42.1%	20	3.38E+09	NR	**NR**	**NR**
12/5/01		6.23	43.4%	165.8	2.53E+10	NR		
1/16/02		3.68	51.2%	39.7	3.57E+09	NR		
4/26/06		3.34	53.5%	520	4.25E+10	NR		
3/28/01		3.33	53.6%	27.5	2.24E+09	NR		
3/1/06		3.13	54.7%	55	4.21E+09	NR		
3/28/06		2.58	59.5%	50	3.15E+09	NR		

Table E-45 (cont'd) Calculated Load Reduction Based on Daily Loading – Horn Lake Creek – RM4.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
12/28/05	Dry Conditions	2.27	62.5%	520	2.89E+10	NR		
6/20/06		1.96	65.2%	2,400	1.15E+11	**60.8**		
7/25/01		1.71	67.5%	275.3	1.15E+10	NR		
9/28/05		1.34	71.6%	610	2.00E+10	NR		
6/19/01		1.24	72.9%	68.6	2.08E+09	NR		
10/30/01		1.12	74.9%	63.1	1.72E+09	NR		
8/29/01		0.251	89.5%	10.7	6.57E+07	NR	**8.7**	**9.1**
10/2/01	Low Flows	0.201	90.3%	79.4	3.90E+08	NR		
12/7/05		0.197	90.4%	84	4.05E+08	NR		
8/24/05		0.092	92.5%	0	0.00E+00	NR		
10/26/05		0.070	93.1%	24	4.11E+07	NR		
9/9/98		0.053	93.8%	15.8	2.05E+07	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-46 Calculated Load Reduction Based on Daily Loading – Horn Lake Creek – RM0.0

Sample Date	Flow Regime	Flow	PDFE	Concentration	Load	% Reduction to Achieve TMDL	Average of Load Reductions	% Reduction to TMDL – MOS
		[cfs]	[%]	[CFU/100 ml]	[CFU/day]	[%]	[%]	[%]
7/20/05	Moist Conditions	93.49	15.6%	2,419.2	7.70E+12	**61.1**		
5/23/01		89.24	16.1%	2,909	8.19E+12	**67.7**		
1/25/06		70.77	18.1%	1,200	2.69E+12	**21.6**		
1/31/01		30.24	26.4%	866.4	8.39E+11	NR		
4/24/02		17.72	31.8%	1,553.1	7.18E+11	**39.4**		
2/28/01		12.98	35.2%	86.7	3.65E+10	NR		
4/26/01		9.46	38.5%	151.5	4.56E+10	NR	**27.1**	**29.5**

Table E-46 (cont'd) Calculated Load Reduction Based on Daily Loading – Horn Lake Creek – RM0.0

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
12/5/01	Mid-Range Flows	8.02	43.0%	248.1	4.87E+10	NR		
5/31/06		7.380	44.0%	110	1.99E+10	NR		
1/16/02		4.86	50.8%	39.7	4.72E+09	NR		
4/26/06		4.347	53.2%	610	6.49E+10	NR		
3/28/01		4.31	53.4%	41.9	4.42E+09	NR		
3/1/06		4.120	54.4%	37	3.73E+09	NR		
3/28/06		3.417	59.0%	100	8.36E+09	NR	**NR**	**NR**
4/21/99	Dry Conditions	3.18	60.8%	131.7	1.03E+10	NR		
12/28/05		2.983	62.3%	460	3.36E+10	NR		
4/18/00		2.96	62.5%	148.3	1.07E+10	NR		
6/20/06		2.49	65.8%	1,100	6.70E+10	**14.5**		
7/25/01		2.28	67.2%	866.4	4.83E+10	NR		
6/19/01		1.66	72.6%	83.2	3.39E+09	NR		
9/28/05		1.60	73.2%	730	2.85E+10	NR		
10/30/01		1.49	74.6%	461.1	1.68E+10	NR		
10/21/99		0.856	82.6%	135.4	2.84E+09	NR		
8/29/01		0.338	89.3%	68.3	5.65E+08	NR	**1.4**	**2.1**
10/2/01	Low Flows	0.274	90.1%	67.6	4.53E+08	NR		
12/7/05		0.249	90.7%	260	1.59E+09	NR		
8/24/05		0.130	92.4%	100	3.18E+08	NR		
10/26/05		0.094	93.1%	150	3.44E+08	NR	**NR**	**NR**

Note: NR = No reduction required
NA = Not applicable

Table E-47 Calculated Load Reduction Based on Daily Loading – Horn Lake Cutoff – RM0.0

Sample Date	Flow Regime	Flow [cfs]	PDFE [%]	Concentration [CFU/100 ml]	Load [CFU/day]	% Reduction to Achieve TMDL [%]	Average of Load Reductions [%]	% Reduction to TMDL – MOS [%]
7/20/05	Moist Conditions	36.55	10.3%	980.4	8.77E+11	**50.3**		
5/23/01		25.90	12.7%	829	5.25E+11	**41.3**		
1/25/06		20.84	14.4%	870	4.44E+11	**44.0**		
1/31/01		9.32	20.5%	28.8	6.57E+09	NR		
2/28/01		3.88	28.7%	10.1	9.58E+08	NR		
4/26/01		2.84	31.8%	6.2	4.31E+08	NR		
12/5/01		1.79	36.8%	56.3	2.47E+09	NR	**19.4**	**21.7**
1/16/02	Mid-Range Flows	1.18	44.2%	26.5	7.67E+08	NR		
4/26/06		1.01	48.2%	870	2.15E+10	**44.0**		
3/1/06		0.993	48.7%	100	2.43E+09	NR		
3/28/01		0.984	49.0%	0	0.00E+00	NR		
3/28/06		0.842	53.6%	120	2.47E+09	NR		
4/21/99		0.791	55.5%	22.6	4.37E+08	NR		
4/18/00		0.730	57.8%	82.6	1.48E+09	NR		
12/28/05		0.710	58.3%	1,700	2.95E+10	**71.4**		
7/25/01		0.570	63.3%	18.3	2.55E+08	NR		
6/20/06		0.526	64.6%	820	1.06E+10	**40.6**		
6/19/01		0.421	69.3%	6.3	6.49E+07	NR	**14.2**	**15.5**
10/30/01	Low Flows	0.369	72.2%	160.7	1.45E+09	NR		
9/28/05		0.257	78.6%	920	5.77E+09	**47.1**		
8/29/01		0.087	88.1%	5.2	1.11E+07	NR		
10/2/01		0.073	88.9%	30.5	5.43E+07	NR		
12/7/05		0.052	90.4%	130	1.67E+08	NR		
10/21/99		0.018	93.5%	73.3	3.21E+07	NR	**7.8**	**8.7**

Note: NR = No reduction required
NA = Not applicable

Table E-48 Summary of TMDLs, WLAs, & LAs expressed as daily loads for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

Waterbody Description (TN08010211__)	Hydrologic Condition			Flow[a]	PLRG	TMDL	MOS	WLAs			LAs
	Flow Regime	PDFE Range	Flow Range					WWTFs [c]	CS	MS4s	
		[%]	[cfs]	[cfs]	[%]	[CFU/d]	[CFU/d]	[CFU/d]		[CFU/d/ac]	[CFU/d/ac]
Nonconnah Crk Waterbody ID: **720 – 3000** HUC-12: 0101	High Flows	0 – 10	18.07 – 178.0	43.20	NA	9.936×10^{11}	9.936×10^{10}	NA	NA	2.345×10^{8}	2.345×10^{8}
	Moist	10 – 40	0.92 – 18.07	3.58	23.3	8.234×10^{10}	8.234×10^{9}			1.943×10^{7}	1.943×10^{7}
	Mid-Range	40 – 70	0.19 – 0.92	0.45	12.2	1.024×10^{10}	1.024×10^{9}			2.416×10^{6}	2.416×10^{6}
	Low Flows	70 – 100	0 – 0.19	0.06	NR	1.403×10^{9}	1.403×10^{8}			3.311×10^{5}	3.311×10^{5}
UT2 to Nonconnah Crk Waterbody ID: **720 – 0410** HUC-12: 0101	High Flows	0 – 10	35.30 – 351.7	87.96	61.8[b]	2.023×10^{12}	2.023×10^{11}	1.913×10^{10}	NA	2.363×10^{8}	2.363×10^{8}
	Moist	10 – 40	2.58– 35.30	7.88		1.812×10^{11}	1.812×10^{10}			1.889×10^{7}	1.889×10^{7}
	Mid-Range	40 – 70	1.18 – 2.58	1.69		3.887×10^{10}	3.887×10^{9}			2.080×10^{6}	2.080×10^{6}
	Low Flows	70 – 100	0.64 – 1.18	0.92		2.111×10^{10}	2.111×10^{9}	6.019×10^{9} [d]		1.703×10^{6} [d]	1.703×10^{6} [d]
UT3 to Nonconnah Crk Waterbody ID: **720 – 0400** HUC-12: 0101	High Flows	0 – 10	66.38 – 578.6	168.0	NR	2.189×10^{12}	2.189×10^{11}	NA	NA	1.126×10^{8}	1.126×10^{8}
	Moist	10 – 40	3.25 – 66.38	10.71	51.5	8.073×10^{11}	8.073×10^{10}			4.151×10^{7}	4.151×10^{7}
	Mid-Range	40 – 70	0.75 – 3.25	1.78	NR	3.255×10^{11}	3.255×10^{10}			1.673×10^{7}	1.673×10^{7}
	Low Flows	70 – 100	0 – 0.75	0.17	15.3	1.102×10^{11}	1.102×10^{10}			5.665×10^{6}	5.665×10^{6}
UT6 to Nonconnah Crk Waterbody ID: **720 – 0300** HUC-12: 0101	High Flows	0 – 10	4.51 – 50.40	11.43	NA	2.629×10^{11}	2.629×10^{10}	NA	NA	2.248×10^{8}	2.248×10^{8}
	Moist	10 – 40	0.22 – 4.51	0.84	NR	1.932×10^{10}	1.932×10^{9}			1.652×10^{7}	1.652×10^{7}
	Mid-Range	40 – 70	0.05 – 0.22	0.11	13.8	2.622×10^{9}	2.622×10^{8}			2.242×10^{6}	2.242×10^{6}
	Low Flows	70 – 100	0 – 0.05	0.02	NR	4.600×10^{8}	4.600×10^{7}			3.933×10^{5}	3.933×10^{5}
John's Creek Waterbody ID: **176 – 1000** HUC-12: 0102	High Flows	0 – 10	85.62 – 665.6	199.9	NA	4.597×10^{12}	4.597×10^{11}	NA	NA	3.358×10^{8}	3.358×10^{8}
	Moist	10 – 40	2.78 – 85.62	13.11	62.0	3.015×10^{11}	3.015×10^{10}			2.202×10^{7}	2.202×10^{7}
	Mid-Range	40 – 70	0.46 – 2.78	1.06	29.6	2.438×10^{10}	2.438×10^{9}			1.781×10^{6}	1.781×10^{6}
	Low Flows	70 – 100	0 – 0.46	0.16	62.4	3.703×10^{9}	3.703×10^{8}			2.705×10^{5}	2.705×10^{5}
Nonconnah Crk Waterbody ID: **711 – 3000** HUC-12: 0102	High Flows	0 – 10	456.7 – 3250	979.4	57.3	2.253×10^{13}	2.253×10^{12}	1.913×10^{10}	NA	2.834×10^{8}	2.834×10^{8}
	Moist	10 – 40	25.24 – 456.7	95.84	44.7	2.204×10^{12}	2.204×10^{11}			2.749×10^{7}	2.749×10^{7}
	Mid-Range	40 – 60	9.52 – 25.24	15.04	12.6	3.459×10^{11}	3.459×10^{10}			4.088×10^{6}	4.088×10^{6}
	Dry	60 – 90	0.89 – 9.52	3.95	18.8	9.085×10^{10}	9.085×10^{9}			8.763×10^{5}	8.763×10^{5}
	Low Flows	90 – 100	0 – 0.89	0.33	6.6	7.590×10^{9}	7.590×10^{8}	6.019×10^{9} [d]		1.136×10^{4} [d]	1.136×10^{4} [d]
Nonconnah Crk Waterbody ID: **720 – 1000** HUC-12: 0102	High Flows	0 – 10	292.5 – 2229	663.7	61.1	1.527×10^{13}	1.527×10^{12}	1.913×10^{10}	NA	2.688×10^{8}	2.688×10^{8}
	Moist	10 – 40	17.29 – 292.5	63.04	NA	1.450×10^{12}	1.450×10^{11}			2.519×10^{7}	2.519×10^{7}
	Mid-Range	40 – 60	7.05 – 17.29	10.17	NA	2.339×10^{11}	2.339×10^{10}			3.749×10^{6}	3.749×10^{6}
	Dry	60 – 90	0.93 – 7.05	3.21	NR	7.383×10^{10}	7.383×10^{9}			9.269×10^{5}	9.269×10^{5}
	Low Flows	90 – 100	0.01 – 0.93	0.46	NA	1.053×10^{10}	1.053×10^{9}	6.019×10^{9} [d]		6.781×10^{4} [d]	6.781×10^{4} [d]

Table E-48 (cont'd) Summary of TMDLs, WLAs, & LAs expressed as daily loads for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

Waterbody Description **(TN08010211__)**	Hydrologic Condition			Flow[a]	PLRG	TMDL	MOS	WLAs			LAs
	Flow Regime	PDFE Range	Flow Range					WWTFs [c]	CS	MS4s	
		[%]	[cfs]	[cfs]	[%]	[CFU/d]	[CFU/d]	[CFU/d]		[CFU/d/ac]	[CFU/d/ac]
Nonconnah Crk Waterbody ID: **720 – 2000** HUC-12: 0102	High Flows	0 – 10	152.8 – 1294	394.2	28.1	9.066×10^{12}	9.066×10^{11}	1.913×10^{10}	NA	2.634×10^{8}	2.634×10^{8}
	Moist	10 – 40	9.33 – 152.8	30.48	20.9	7.010×10^{11}	7.010×10^{10}			1.980×10^{7}	1.980×10^{7}
	Mid-Range	40 – 60	4.37 – 9.33	5.95	6.5	1.369×10^{11}	1.369×10^{10}			3.366×10^{6}	3.366×10^{6}
	Dry	60 – 90	0.86 – 4.37	2.20	5.5	5.060×10^{10}	5.060×10^{9}			8.546×10^{5}	8.546×10^{5}
	Low Flows	90 – 100	0.03 – 0.86	0.57	NR	1.320×10^{10}	1.320×10^{9}	6.019×10^{9} [d]		1.394×10^{5} [d]	1.394×10^{5} [d]
UT1 to Nonconnah Crk Waterbody ID: **720 – 0500** HUC-12: 0102	High Flows	0 – 10	23.05 – 155.5	51.38	76.5[b]	1.182×10^{12}	1.182×10^{11}	NA	0	3.781×10^{8}	3.781×10^{8}
	Moist	10 – 40	0.67 – 23.05	3.14		7.222×10^{10}	7.222×10^{9}			2.311×10^{7}	2.311×10^{7}
	Mid-Range	40 – 70	0.09 – 0.67	0.23		5.290×10^{9}	5.290×10^{8}			1.693×10^{6}	1.693×10^{6}
	Low Flows	70 – 100	0 – 0.09	0.03		6.210×10^{8}	6.210×10^{7}			1.987×10^{5}	1.987×10^{5}
UT4 to Nonconnah Crk Waterbody ID: **720 – 0100** HUC-12: 0102	High Flows	0 – 10	12.22 – 98.10	26.26	60.8	6.040×10^{11}	6.040×10^{10}	NA	0	2.711×10^{8}	2.711×10^{8}
	Moist	10 – 40	0.52 – 12.22	2.18	NR	5.014×10^{10}	5.014×10^{9}			2.250×10^{7}	2.250×10^{7}
	Mid-Range	40 – 70	0.08 – 0.52	0.21	0.8	4.853×10^{9}	4.853×10^{8}			2.178×10^{6}	2.178×10^{6}
	Low Flows	70 – 100	0 – 0.08	0.03	9.1	6.670×10^{8}	6.670×10^{7}			2.994×10^{5}	2.994×10^{5}
UT5 to Nonconnah Crk Waterbody ID: **720 – 0200** HUC-12: 0102	High Flows	0 – 10	9.44 – 73.10	20.60	60.8	4.738×10^{11}	4.738×10^{10}	NA	0	3.021×10^{8}	3.021×10^{8}
	Moist	10 – 40	0.33 – 9.44	1.52	47.5	3.496×10^{10}	3.496×10^{9}			2.229×10^{7}	2.229×10^{7}
	Mid-Range	40 – 70	0.06 – 0.33	0.14	NR	3.105×10^{9}	3.105×10^{8}			1.980×10^{6}	1.980×10^{6}
	Low Flows	70 – 100	0 – 0.06	0.02	NR	4.830×10^{8}	4.830×10^{7}			3.079×10^{5}	3.079×10^{5}
Black Bayou Waterbody ID: **711 – 0300** HUC-12: 0103	High Flows	0 – 10	31.38 – 240.2	71.87	94.2[b]	1.653×10^{12}	1.653×10^{11}	NA	0	3.356×10^{8}	3.356×10^{8}
	Moist	10 – 40	0.99 – 31.38	4.77		1.097×10^{11}	1.097×10^{10}			2.228×10^{7}	2.228×10^{7}
	Mid-Range	40 – 70	0.15 – 0.99	0.38		8.809×10^{9}	8.809×10^{8}			1.789×10^{6}	1.789×10^{6}
	Low Flows	70 – 100	0 – 0.15	0.05		1.196×10^{9}	1.196×10^{8}			2.428×10^{5}	2.428×10^{5}
Cane Creek Waterbody ID: **711 – 0200** HUC-12: 0103	High Flows	0 – 10	23.31 – 247.4	57.48	NA	1.322×10^{12}	1.322×10^{11}	NA	0	4.549×10^{8}	4.549×10^{8}
	Moist	10 – 40	0.40 – 23.31	2.31	72.0	5.313×10^{10}	5.313×10^{9}			1.828×10^{7}	1.828×10^{7}
	Mid-Range	40 – 70	0.07 – 0.40	0.15	48.3	3.496×10^{9}	3.496×10^{8}			1.203×10^{6}	1.203×10^{6}
	Low Flows	70 – 100	0 – 0.07	0.03	30.6	6.440×10^{8}	6.440×10^{7}			2.216×10^{5}	2.216×10^{5}
Days Creek Waterbody ID: **711 – 0600** HUC-12: 0103	High Flows	0 – 10	50.54 – 393.0	125.38	57.9	2.884×10^{12}	2.884×10^{11}	NA	0	4.364×10^{8}	4.364×10^{8}
	Moist	10 – 40	0.84 – 50.54	4.93	38.0	1.134×10^{11}	1.134×10^{10}			1.716×10^{7}	1.716×10^{7}
	Mid-Range	40 – 70	0.18 – 0.84	0.37	16.9	8.556×10^{9}	8.556×10^{8}			1.295×10^{6}	1.295×10^{6}
	Low Flows	70 – 100	0 – 0.18	0.07	12.2	1.610×10^{9}	1.610×10^{8}			2.436×10^{5}	2.436×10^{5}

Table E-48 (cont'd) Summary of TMDLs, WLAs, & LAs expressed as daily loads for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

Waterbody Description (TN08010211__)	Hydrologic Condition			Flow[a]	PLRG	TMDL	MOS	WLAs			LAs
	Flow Regime	PDFE Range	Flow Range					WWTFs [c]	CS	MS4s	
		[%]	[cfs]	[cfs]	[%]	[CFU/d]	[CFU/d]	[CFU/d]		[CFU/d/ac]	[CFU/d/ac]
Hurricane Crk Waterbody ID: **711 – 0500** HUC-12: 0103	High Flows	0 – 10	12.87 – 125.5	30.95	NA	7.119×10^{11}	7.119×10^{10}	NA	0	2.762×10^{8}	2.762×10^{8}
	Moist	10 – 40	0.49 – 12.87	2.24	74.3	5.152×10^{10}	5.152×10^{9}			1.999×10^{7}	1.999×10^{7}
	Mid-Range	40 – 70	0.10 – 0.49	0.21	20.4	4.876×10^{9}	4.876×10^{8}			1.892×10^{7}	1.892×10^{7}
	Low Flows	70 – 100	0 – 0.10	0.04	30.6	8.510×10^{8}	8.510×10^{7}			3.302×10^{6}	3.302×10^{6}
Nonconnah Crk Waterbody ID: **711 – 1000** HUC-12: 0103	High Flows	0 – 10	836.6 – 5452	1697	53.2	3.903×10^{13}	3.903×10^{12}	1.913×10^{10}	0	3.181×10^{8}	3.181×10^{8}
	Moist	10 – 40	34.82 – 836.6	144.1	39.3	3.314×10^{12}	3.314×10^{11}			2.685×10^{7}	2.685×10^{7}
	Mid-Range	40 – 60	11.84 – 34.82	18.84	10.9	4.333×10^{11}	4.333×10^{10}			3.360×10^{6}	3.360×10^{6}
	Dry	60 – 90	1.13 – 11.84	5.08	13.0	1.168×10^{11}	1.168×10^{10}			7.794×10^{5}	7.794×10^{5}
	Low Flows	90 – 100	0 – 1.13	0.36	12.2	8.234×10^{9}	8.234×10^{8}	6.019×10^{9} [d]		1.261×10^{4} [d]	1.261×10^{4} [d]
Nonconnah Crk Waterbody ID: **711 – 2000** HUC-12: 0103	High Flows	0 – 10	671.2 – 4405	1331	65.3	3.062×10^{13}	3.062×10^{12}	1.913×10^{10}	0	2.996×10^{8}	2.996×10^{8}
	Moist	10 – 40	30.44 – 671.2	121.3	33.2	2.791×10^{12}	2.791×10^{11}			2.711×10^{7}	2.711×10^{7}
	Mid-Range	40 – 60	10.89 – 30.44	17.05	12.0	3.922×10^{11}	3.922×10^{10}			3.631×10^{6}	3.631×10^{6}
	Dry	60 – 90	1.02 – 10.89	4.52	8.4	1.040×10^{11}	1.040×10^{10}			8.097×10^{5}	8.097×10^{5}
	Low Flows	90 – 100	0 – 1.02	0.33	4.4	7.682×10^{9}	7.682×10^{8}	6.019×10^{9} [d]		9.734×10^{3} [d]	9.734×10^{3} [d]
Tenmile Creek Waterbody ID: **711 – 0400** HUC-12: 0103	High Flows	0 – 10	50.91 – 329.9	118.2	NA	2.720×10^{12}	2.720×10^{11}	NA	0	4.312×10^{8}	4.312×10^{8}
	Moist	10 – 40	1.21 – 50.91	6.64	45.0	1.527×10^{11}	1.527×10^{10}			2.421×10^{7}	2.421×10^{7}
	Mid-Range	40 – 70	0.16 – 1.21	0.40	29.6	9.292×10^{9}	9.292×10^{8}			1.473×10^{7}	1.473×10^{7}
	Low Flows	70 – 100	0 – 0.16	0.05	NA	1.035×10^{9}	1.035×10^{8}			1.641×10^{6}	1.641×10^{6}
Cypress Creek Waterbody ID: **007 – 1000** HUC-12: 0201	High Flows	0 – 10	19.54 – 168.1	47.47	99.6[b]	5.696×10^{11}	5.696×10^{10}	NA	NA	1.686×10^{8}	1.686×10^{8}
	Moist	10 – 40	0.61 – 19.54	3.11		3.732×10^{10}	3.732×10^{9}			1.105×10^{7}	1.105×10^{7}
	Mid-Range	40 – 70	0.12 – 0.61	0.25		3.012×10^{9}	3.012×10^{8}			8.915×10^{5}	8.915×10^{5}
	Low Flows	70 – 100	0 – 0.12	0.04		5.280×10^{8}	5.280×10^{7}			1.563×10^{5}	1.563×10^{5}
Horn Lake Crk Waterbody ID: **001 – 2000** HUC-12: 0301	High Flows	0 – 10	167.0 – 1458	373.9	NA	8.599×10^{12}	8.599×10^{11}	NA	0	2.647×10^{8}	2.647×10^{8}
	Moist	10 – 40	8.18 – 167.0	33.87	35.8	7.790×10^{11}	7.790×10^{10}			2.398×10^{7}	2.398×10^{7}
	Mid-Range	40 – 60	2.52 – 8.18	3.87	NR	8.901×10^{10}	8.901×10^{9}			2.740×10^{6}	2.740×10^{6}
	Dry	60 – 90	0.22 – 2.52	1.11	8.7	2.553×10^{10}	2.553×10^{9}			7.858×10^{5}	7.858×10^{5}
	Low Flows	90 – 100	0 – 0.22	0.02	NR	4.140×10^{8}	4.140×10^{7}			1.274×10^{4}	1.274×10^{4}
Horn Lake Crk Waterbody ID: **001 – 1000** HUC-12: 0302	High Flows	0 – 10	204.3 – 1818	446.6	NA	1.027×10^{13}	1.027×10^{12}	NA	0	2.480×10^{8}	2.480×10^{8}
	Moist	10 – 40	10.35 – 204.3	41.08	27.1	9.448×10^{11}	9.448×10^{10}			2.282×10^{7}	2.282×10^{7}
	Mid-Range	40 – 60	3.28 – 10.35	5.00	NR	1.150×10^{11}	1.150×10^{10}			2.777×10^{6}	2.777×10^{6}
	Dry	60 – 90	0.28 – 3.28	1.45	1.4	3.335×10^{10}	3.335×10^{9}			8.053×10^{5}	8.053×10^{5}
	Low Flows	90 – 100	0 – 0.28	0.03	NR	5.980×10^{8}	5.980×10^{7}			1.444×10^{4}	1.444×10^{4}

Table E-48 (cont'd) Summary of TMDLs, WLAs, & LAs expressed as daily loads for Impaired Waterbodies in the Nonconnah Creek Watershed (HUC 08010211)

Waterbody Description (TN08010211__)	Hydrologic Condition			Flow[a]	PLRG	TMDL	MOS	WLAs			LAs
	Flow Regime	PDFE Range	Flow Range					WWTFs [c]	CS	MS4s	
		[%]	[cfs]	[cfs]	[%]	[CFU/d]	[CFU/d]	[CFU/d]		[CFU/d/ac]	[CFU/d/ac]
Horn Lake Cutoff Waterbody ID: **001 – 0100** HUC-12: 0302	High Flows	0 – 10	38.01 –362.8	86.46	NA	1.038×10^{12}	1.038×10^{11}	NA	0	1.387×10^{8}	1.387×10^{8}
	Moist	10 – 40	1.43 – 38.01	5.67	19.4	6.804×10^{11}	6.804×10^{10}			9.097×10^{7}	9.097×10^{7}
	Mid-Range	40 – 70	0.41 – 1.43	0.80	14.2	9.636×10^{10}	9.636×10^{9}			1.288×10^{6}	1.288×10^{6}
	Low Flows	70 – 100	0 – 0.41	0.15	7.8	1.776×10^{9}	1.776×10^{8}			2.375×10^{5}	2.375×10^{5}

Notes: NA = Not Applicable.
NR = No Reduction Required.
PLRG = Percent Load Reduction Goal to achieve TMDL.
CS = Collection Systems
Shaded Flow Zone for each waterbody represents the critical flow zone.

a. Flow applied to TMDL, MOS, and allocation (WLA[MS4] and LA) calculations. Flows represent the midpoint value in the respective hydrologic flow regime.
b. PRG based on geomean data.
c. WLAs for WWTFs are expressed as E. coli loads (CFU/day). All current and future WWTFs must meet water quality standards as specified in their NPDES permit.
d. For these waterbodies, the design flow of the WWTF exceeds the flow in the waterbody, which results in a negative LA and WLA for the MS4. The average flow for the WWTF for the past 12 months is approximately 30% of the design flow. For these waterbodies, the WLAs and LA are based on the average flow of the WWTP.