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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

JUN 2 8 2001

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

Dear Mr. Davis:

The Environmental Protection Agency (EPA) has concluded a review of the South Fork Forked Deer/Johnson Creek/North Fork Forked Deer Total Maximum Daily Load (TMDL) Report, as submitted by your office. Based on our review, we have determined that the statutory requirements of the Clean Water Act, Section 303(d) have been met. The enclosed Decision Document summarizes the elements of the review which were found to support EPA's approval of the TMDLs included in the report.

If you have any comments or questions relating to the approval of the TMDLs or the enclosed Decision Document, please contact Stephanie Fulton, Life Scientist at 404-562-9413 or Ron Mikulak, Chief, Water Quality Assessment Section, at 404-562-9233.

Sincerely,

Gail Mitchell

Gail Mitchell, Chief
Water Quality Planning and Assessment Branch

Enclosure

DECISION DOCUMENT
SOUTH FORK FORKED DEER RIVER
JOHNSON CREEK
NORTH FORK FORKED DEER RIVER
OBION-FORKED DEER BASIN

Element 1. Waterbody Name and Location

1. State, city and county: Tennessee; Jackson; Lauderdale, Haywood, and Madison counties

2. Name of the 303(d) listed waterbody: three segments of the South Fork Forked Deer River (SFFDR); Johnson Creek; and the North Fork of the South Fork Forked Deer River

3. Waterbody segment and location as identified from 303(d) list: three segments of the South Fork Forked Deer River: 1) confluence of Sumrow Creek to confluence with Nixon Creek, 2) confluence of Nixon Creek to Mud Creek, and 3) confluence of Mud Creek to Meridian Creek, plus Panther Creek; Johnson Creek from mouth to origin; and the North Fork of the South Fork Forked Deer River

4. Watershed(s) 8-digit hydrologic cataloging unit code: 08010205

5. 3-digit EPA reach file number(s):
   TN08010205003
   TN08010205010
   TN08010205012
   TN08010205015
   TN08010205028B

6. Water use classification: Fish and Aquatic Life, Recreation, Livestock Watering and Wildlife, Irrigation, and Navigation; Recreation is the most stringent use classification

7. Primary source of impairment: Model results indicate that non-point sources related to agricultural and urban land uses are the largest sources of fecal coliform bacteria loading in the SFFDR watershed. Direct inputs of fecal coliform bacteria from "other sources" (i.e., animal access to streams, illicit discharges of fecal coliform bacteria, failing septic systems, and leaking sewer collection lines) are also shown to have an impact on bacteria loading in the watershed. However, two NPDES facilities in the watershed, Wilhite's 76 Truck Stop (TN0022519) and Econolodge (TN0023230), have discharges above permit limits and contribute to impairment of SFFDR between the confluence of Mud Creek to Meridian Creek.

8. Length and area of impairment(s):

Reach File No.	Length of Impairment (mi)	Beneficial Use Status	Watershed Acreage (mi^2)
TN08010205003	40.6	Partially Supporting	1065
TN08010205010	86.7	Partially Supporting	828
TN08010205012	238.3	Partially Supporting	696
TN08010205015	55	Partially Supporting	36
TN08010205028B	17.5	Partially Supporting	163

9. Boundary or interstate water: No

10. Federal land: No

Element 2. Identifying Pollutant Load (TMDL Calculation)

1. Pollutant of concern: Fecal coliform

2. Water quality standard violated: The concentration of the fecal coliform group shall not exceed 200 per 100 ml, nor shall the concentration of the *E. coli* group exceed 126 per 100 ml, as a geometric mean based on a minimum of 10 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 a fecal coliform group or *E. coli* concentration of less than 1 per 100 ml shall be considered as having a concentration of 1 per 100 ml. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 1,000 per 100 ml.

   For this TMDL evaluation, the water quality standard of the 30-day geometric mean fecal coliform concentration of 200 counts/100 ml defines the target endpoint. Data were not available to evaluate water quality with respect to *E. coli* in the SFFDR watershed. The State of Tennessee now routinely collects *E. coli* samples concurrently with fecal coliform and will consider both in future evaluations. Currently, evaluation of fecal coliform only is in accordance with EPA's guidance.

3. Critical Conditions Evaluated (high/low flows): Yes. A 10-year simulation was modeled and the results were compared to the geometric mean standard. Critical conditions for non-point fecal coliform sources are a dry period followed by a rainfall runoff event. Critical conditions for point sources occur during low streamflows. Critical conditions in the model are defined as the 30-day period resulting in the largest peak on the 10-year geometric mean curve excluding those caused by abnormal weather conditions (i.e., drought or floods). Allocations were simulated until the critical peak was less than the standard. By reducing loadings to bring critical conditions within the water quality standard, all other time periods were also brought into compliance.

4. Developmental Tool(s):

   1. Water Quality Model(s): The Non-Point Source Model (NPSM), a dynamic hydrologic and water quality computer model, was selected to simulate the time varying behavior of fecal coliform bacteria from both point and non-point sources.

      The Watershed Characterization System was used to display and analyze Geographic Information System (GIS) information including land use, point source discharges, soil types, population, livestock distribution, and stream characteristics.

      Monthly fecal coliform loading rates estimated from data derived from the WCS were included in the NPSM project. The model ran from January 1, 1988 through December 31, 1998. Results from the first year of simulation were used to allow the model to stabilize. Simulated in-stream concentrations from the 10-year simulation (1989-1998) were used to calculate the 30-day geometric mean from which the TMDL was developed.

   2. Mass balance equation(s): Not applicable to this TMDL.

5. Supporting documentation/name of models(s): Watershed Characterization System (WCS), Non-Point Source Model (NPSM)/Hydrologic Simulation Program Fortran (HSPF)

6. TMDL target, units, and value: The target for this TMDL is the water quality standard of 200 counts/100 ml expressed as the 30-day geometric mean less an explicit Margin of Safety (MOS) of 20 counts/100 ml; therefore, the TMDL is expressed in units of counts per 30 days. TMDL values for all five segments are listed below:

Waterbody Name	Waterbody ID	TMDL
South Fork Forked Deer River, confluence of Sumrow Creek to confluence with Nixon Creek	TN08010205003	2.60×10^{14} counts/30days; 180 counts/100ml
South Fork Forked Deer River, confluence of Nixon Creek to Mud Creek	TN08010205010	1.83×10^{14} counts/30days; 180 counts/100ml
South Fork Forked Deer River, confluence of Mud Creek to Meridian Creek, plus Panther Creek	TN08010205012	1.64×10^{14} counts/30days; 180 counts/100ml
Johnson Creek from mouth to origin	TN08010205015	2.39×10^{12} counts/30days; 180 counts/100ml
North Fork of the South Fork Forked Deer River	TN08010205028B	8.99×10^{12} counts/30days; 180 counts/100ml

7. Identification of data sources(s): USGS streamflow gages in the South Fork Forked Deer watersheds were used to calibrate the hydrologic component of the model. All physical parameters were adjusted accordingly and best professional judgment was used to adjust other parameters as necessary. The hydrology portion of the model was calibrated using

two continuous USGS flow gages on the South Fork Forked Deer River: Station No. 07027500 at Jackson, Tennessee during the period from May 1, 1988 through September 30, 1990 and Station No. 07027800 located near Gates, Tennessee during the period from January 1, 1970 through December 31, 1981. Precipitation data for hydrologic calibration from the Memphis, TN meteorological station were available for the time period from January 1970 through December 1998 and were used for all simulations.

Fecal coliform grab samples, collected monthly by TDEC at sampling stations in South Fork Forked Deer River (STORET station SFKFKDEER019.1 at Highway 88 [RM 19.7]; STORET Station No 002500 at Highway 54 [RM 30.6]; and STORET Station No. 002487 at Roberts Station Road [RM 43.2]), Johnson Creek at Lower Brownsville Road, and North Fork of the South Fork Forked Deer River at Mifflin Road were used for comparison with the simulated daily model results. Additional samples were collected at STORET Stations 002472 at Ozier Road and 002487 at Roberts Station Road from 1985 to 1997; however, only from the data at Station 002472 is it possible to identify seasonal trends. NPDES facilities located in modeled subwatersheds are represented as point sources of constant flow and concentration based on the facility's average flow and effluent fecal coliform concentration as reported on Discharge Monitoring Reports (DMRs). The Tennessee Wildlife Resources Agency (TWRA) provided deer population data for the State of Tennessee. Nonpoint source fecal loading rates are calculated from spreadsheet data provided in the WCS, including livestock populations, animal waste fecal coliform concentrations, and land use percentages.

Element 3. Deviation From Pollutant Load

1. Current nonpoint source loadings (counts/30 days) and in-stream concentration reductions (%) to achieve the TMDL values:

Subwatershed	Runoff from All Lands	Other Direct Sources	In-stream Fecal Coliform Bacteria Concentration[1]	Percent Reduction[2]
	[Counts / 30 days]	[Counts / 30 days]	[Counts / 100 ml]	(%)
SFFDR @ confluence of Sumrow Cr. (includes all modeled areas)	1.20×10^{15}	1.69×10^{13}	274.05	34
SFFDR @ confluence of Nixon Cr.	1.04×10^{15}	1.62×10^{13}	272.33	34
SFFDR @ confluence of Mud Cr.	1.00×10^{15}	1.59×10^{13}	563.24	67
Johnson Creek	1.44×10^{13}	6.26×10^{11}	682.15	74
North Fork of the SFFDR	2.48×10^{13}	7.61×10^{12}	478.06	62

1. Fecal coliform bacteria concentrations represent the maximum simulated geometric mean concentration during the critical period (see Section 8.1).
2. Percent reduction of in-stream concentration required to achieve water quality standard.

2. Current point source loadings (counts/30 days) and end-of-pipe reductions to achieve the TMDL values:

Facility Name	NPDES Permit No.	Discharge Monitoring Reports		NPDES Permit	
		Flow	Fecal Coliform Loading[a]	Design Flow	Fecal Coliform Loading[b]
		[cfs]	[counts/hr]	[cfs]	[counts/hr]
Beech Bluff School	TN0023272	0.0035	3.540×10^4	0.008	1.577×10^6
Pinson UD STP	TN0067083	0.0232	2.367×10^6	0.062	1.262×10^7
Henderson North Lagoon	TN0064220	0.1052	5.579×10^6	0.727	1.483×10^8
Henderson South Lagoon	TN0064238	0.2135	1.198×10^7	0.928	1.893×10^8
Henderson East Lagoon	TN0026026	0.0511	2.627×10^6	0.309	6.309×10^7
West Sr. High School	TN0023311	0.0144	1.465×10^5	0.019	3.943×10^6
Denmark School	TN0056472	0.0013	1.335×10^4	0.025	5.047×10^6
Jackson UD STP	TN0024813	15.68	1.572×10^8	26.92	5.489×10^9
Bells Lagoon	TN0026247	0.1533	3.118×10^7	4.254	8.675×10^8
Wilhite's 76 Truck Stop	TN0022519	0.022	1.580×10^7	0.033	6.813×10^6
Econolodge	TN0023230	0.011	5.248×10^7	0.031	6.309×10^6 [c]
Ports Petroleum	TN0060151	0.006	1.220×10^6	0.018	3.722×10^6
Maury City Lagoon	TN0065218	0.024	4.877×10^6	0.232	4.732×10^7
Brownsville STP (Future)	Planning Limits	NA	NA	3.527	7.192×10^8

a Loadings based on average fecal coliform concentration and mean flow reported on DMRs.
b Loading based on Monthly Average permit limit (200 counts/ 100 ml) at design flow.
c Loading based on average concentration reported on 1995 permit application.

With the exception of Wilhite's 76 Truck Stop and Econolodge, existing loads for all facilities are significantly lower than the load at the permit limits. Reductions of 81% from Wihlite's 76 Truck Stop and Econolodge, corresponding to discharges at design flow and permit limits, are required as part of the TMDL.

Element 4. Source(s) of Impairment

1. Point sources: There are 13 NPDES permitted dischargers for fecal coliform bacteria located in the watershed. In general, point source loads from NPDES facilities do not significantly contribute to the impairment of the listed stream segments since discharges from these facilities are required to be treated to levels corresponding to in-stream water quality criteria. However, two NPDES facilities in the watershed, Wilhite's 76 Truck Stop (TN0022519) and Econolodge (TN0023230), have discharges above permit limits and contribute to impairment of SFFDR between the confluence of Mud Creek to Meridian Creek.

2. Non-point sources: In the model the following sources based on land uses in the watershed were considered: wildlife, land application of animal manure, grazing animals, animal access to streams, and urban development (which includes leaking septic systems, leaking sewer collection systems, illicit connections to the storm sewer system and straight pipes to the stream, and improper disposal of wastes). Model results indicate that non-point sources related to agricultural and urban land uses are the largest sources of fecal coliform bacteria loading in the SFFDR watershed. Direct inputs of fecal coliform bacteria from "other sources" (i.e., animal access to streams, illicit discharges of fecal coliform bacteria, failing septic systems, and leaking sewer collection lines) are also shown to have an impact on bacteria loading in the watershed.

3. Background: In-stream loadings from forested and cropland areas were considered background.

4. Air Deposition: Not applicable to this TMDL.

Element 5. Waste Load Allocation (WLA)

1. Methodology provided: Existing NPDES permitted facilities and one known future facility (Brownsville STP) discharges were assumed to discharge at design flows and the fecal coliform permit limit of 200 counts/100 ml. Wilhite's 76 Truck Stop and Econolodge were assumed to have reduced discharge loading so as to be in compliance with their permits.

2. WLA:

Watershed	ΣWLAs [counts/30 day]
SFFDR at confluence of Sumrow Cr. (includes all areas)	5.45×10^{12}
SFFDR at confluence of Nixon Cr.	5.45×10^{12}
SFFDR at confluence of Mud Cr.	4.89×10^{12}
Johnson Creek	6.47×10^{9}
North Fork of the SFFDR	1.14×10^{9}

Element 6. Load Allocation (LA)

1. Methodology provided: Nonpoint fecal coliform bacteria sources in the model have two transportation modes: (1) direct in-stream sources (i.e., animals in streams, leaking sewer collection lines, and leaking septic systems); and (2) fecal coliform applied to land that is transported to the stream after a rainfall event. Direct in-stream sources are modeled as point sources of constant flow (cfs) and concentration (counts/hr). Loading rates were calculated for the various sources using literature values included in the WCS for fecal

coliform concentrations.

Cattle spend time grazing on pastureland and deposit feces onto the land. Contributions from grazing animals is based on percentage of time animals are in pasture (year-round access). During storm events, a portion of this material containing fecal coliform bacteria is transported to streams. Beef cattle are assumed to spend all their time in pasture. In Madison County, cattle also have access to forestland. Wildlife contributions, using the upper limit of deer population per square mile (16-32) plus a margin of safety (13 animals per square mile) to account for other wildlife sources of fecal coliform in the watershed, accounts for the fecal coliform load from all wildlife. Wildlife populations are assumed to be evenly distributed throughout the watershed on all land classified in the MRLC database as forest, pasture, cropland, and wetlands.

In addition, while in pasture, it is assumed that 50% of the animals have access to streams, and of those, 25% defecate in or near the stream banks for a small portion of the day, such that the percentage of time animals spend in the stream is 0.025 percent. Cattle do not have access to streams in Haywood County due to stream banks being steep and highly erodible. The resulting load, modeled as a direct input of constant flow and concentration, represents all animals (including wildlife) that may have access to streams. The livestock population in the watershed is normalized from published county livestock data based on the percent of MRLC land classified as hay/pasture in the watershed.

Land application of agricultural manure is based on monthly manure application rates, the number and type of confined animals in the watershed, and literature values for fecal coliform concentration in animal waste and decay rates. In the SFFDR watershed, manure is assumed to be applied to pastureland only since chemical fertilizer is used on cropland.

Leaking septic systems are modeled as a point source having constant flow and concentration assuming a 20% failure rate. The load allocation for urban development includes contributions from stormwater runoff, leaks and overflows from sanitary sewer systems, illicit connections, improper disposal of wastes, and domestic animals.

2. LA:

Subwatershed	Load Allocation (Counts/30 days)
South Fork Forked Deer River, confluence of Sumrow Creek to confluence with Nixon Creek	2.55×10^{14}
South Fork Forked Deer River, confluence of Nixon Creek to Mud Creek	1.78×10^{14}
South Fork Forked Deer River, confluence of Mud Creek to Meridian Creek, plus Panther Creek	1.59×10^{14}
Johnson Creek from mouth to origin	2.38×10^{12}
North Fork of the South Fork Forked Deer River	8.99×10^{12}

Element 7. Margin of Safety (MOS)

1. Explicit: Yes. The MOS is 20 counts/100 ml below the in-stream target concentration of 200 counts/100 ml on all reaches.

2. Implicit: Yes

3. Methodology provided: In these TMDLs, both an explicit and implicit MOS were used The explicit MOS is 20 counts/100 ml below the in-stream target concentration on all reaches. The implicit MOS includes the use of conservative modeling assumptions and a 10-year continuous simulation that incorporates a range of meteorological events. Conservative modeling assumptions used include: 1) septic systems discharging directly into the streams; 2) development of the TMDL using loads based on the design flow and fecal coliform permit limits of NPDES facilities; 3) all land uses connected directly to streams; 4) negligible decay of fecal coliform bacteria once manure is applied on the land; and 5) a conservative estimate of in-stream decay of fecal coliform bacteria in the waterbodies.

Element 8. Seasonal Variation Considered

1. Annual: A 10-year simulation covering a wide range of seasonal events was used to develop this TMDL.

2. Summer/Winter: Included in the 10-year simulation.

3. Monthly: Fecal coliform bacteria accumulation and maximum storage rates applied to pasture and crop lands varied monthly in the model. Simulating average daily in-stream concentrations incorporates seasonal trends.

Element 9. Allowance For Future Loading

Future facilities with NPDES permits for fecal coliform bacteria will require end-of-pipe criteria equivalent to the water quality standards of 200 counts/100 ml. In addition, there is an explicit MOS of 20 counts/100 ml below the in-stream target concentration on all reaches.

Element 10. Implementation Plan Provided

This TMDL represents the first phase of a long-term restoration project to reduce fecal coliform loading to acceptable levels in the Roan Creek watershed. TDEC will revisit and revise the TMDL as appropriate during the next five-year cycle. A discussion of implementing best management practices and public education efforts to meet the TMDL is included. Suggestions include 1) NPDES permit compliance, 2) an expanded data collection program in coordination with TDA to support additional modeling and

evaluation, 3) the required development of Storm Water Quality Management Program (SWQMP) pursuant to the issuance of NPDES Municipal Separate Storm Sewer System (MS4) permits for the City of Jackson and Madison County, and 4) recommended field surveys and continued monitoring for verification and/or refinement of estimates (ground-truthing) of sources of fecal coliform to South Fork Forked Deer River, Johnson Creek, and the North Fork Forked Deer River.

Element 11. Public Participation

1. Form of public notice: The proposed TMDL is posted on TDEC's web site. Copies of the public notice TMDL announcement were sent out to various individuals and organizations on a NPDES mailing list and the public was invited to provide comments. A Legal Notice was published in four Tennessee newspapers (The Jackson Sun, The Knoxville News-Sentinel, the Commercial Appeal, and The Tennessean). A letter was sent to NPDES point source facilities. A draft copy of the TMDL was sent to the City of Jackson and Madison County. A meeting was held in Jackson on April 19, 2001 to explain the assumptions and modeling methodologies used to develop the TMDLs. Meeting participants included personnel from EPA, Division of Water Pollution Control, NRCS, and representatives from the agricultural community.

2. Beginning/ending dates of public notification: March 5, 2001 to April 30, 2001

3. Notification explicitly mentions proposed TMDL: Yes

4. Comments received from public: Yes

5. Responsiveness summary prepared on public comments: Yes

Element 12. Other Considerations

1. Endangered species: Not applicable to this TMDL.

2. Current or pending enforcement actions: none

DECISION DOCUMENT
SOUTH FORK FORKED DEER RIVER
JOHNSON CREEK
NORTH FORK FORKED DEER RIVER
OBION-FORKED DEER BASIN

By definition: TMDL = WLA + LA + MOS

In terms of load:

Watershed	ΣWLAs	ΣLAs	Percent Reduction	TMDL
	[counts/30 day]	[counts/30 day]	(%)	[counts/30 day]
SFFDR at confluence of Sumrow Cr. (includes all areas)	5.45×10^{12}	2.55×10^{14}	34	2.60×10^{14}
SFFDR at confluence of Nixon Cr.	5.45×10^{12}	1.78×10^{14}	34	1.83×10^{14}
SFFDR at confluence of Mud Cr.	4.89×10^{12}	1.59×10^{14}	67	1.64×10^{14}
Johnson Creek	6.47×10^{9}	2.38×10^{12}	74	2.39×10^{12}
North Fork of the SFFDR	1.14×10^{9}	8.99×10^{12}	62	8.99×10^{12}

This TMDL is hereby approved as meeting the requirements of Section 303(d) of the Clean Water Act.

Technical Reviewer Stephanie Fulton Date 6/11/01
Stephanie Fulton, TMDL State Coordinator

Technical Approver Molly Davis Date 5/24/01
Molly Davis, P.E.

Approved Gale Rutherford for Date 6/26/01
Beverly Banister, Director
Water Management Division, EPA Region 4

By definition: TMDL = WLA + LA + MOS

In terms of load:

Watershed	ΣWLAs [counts/30 day]	ΣLAs [counts/30 day]	Percent Reduction (%)	TMDL [counts/30 day]
SFFDR at confluence of Sumrow Cr. (includes all areas)	5.45×10^{12}	2.55×10^{14}	34	2.60×10^{14}
SFFDR at confluence of Nixon Cr.	5.45×10^{12}	1.78×10^{14}	34	1.83×10^{14}
SFFDR at confluence of Mud Cr.	4.89×10^{12}	1.59×10^{14}	67	1.64×10^{14}
Johnson Creek	6.47×10^{9}	2.38×10^{12}	74	2.39×10^{12}
North Fork of the SFFDR	1.14×10^{9}	8.99×10^{12}	62	8.99×10^{12}

This TMDL is hereby approved as meeting the requirements of Section 303(d) of the Clean Water Act.

Technical Reviewer Stephanie Fulton Date 6/11/01
Stephanie Fulton, TMDL State Coordinator

Technical Approver Molly Davis Date 5/24/01
Molly Davis, P.E.

Approved Gwen Mitchell for Date 6/26/01
Beverly Banister, Director
Water Management Division, EPA Region 4

Concurrences:

SGF Fulton MMD Davis AM Mayo MJ 6/25 Mikulak GM Mitchell