

DRAFT
March 2005

Total Maximum Daily Load Bowie River

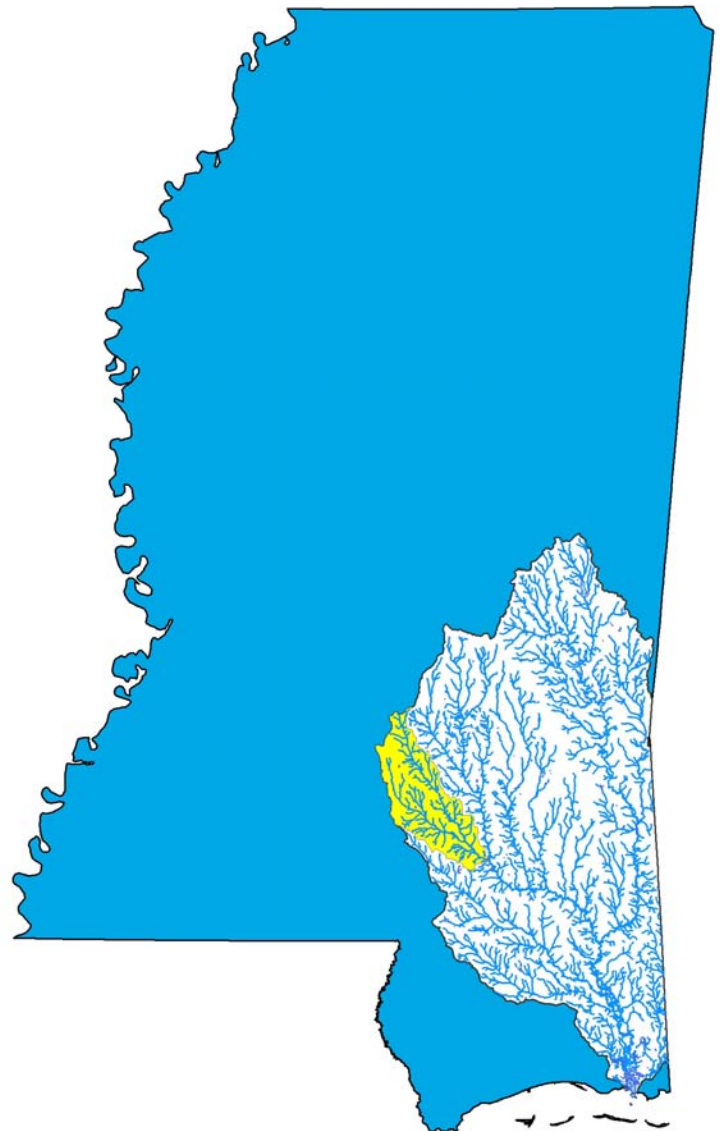
For Total Toxicity

Pascagoula River Basin

Prepared By

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FOREWORD

This report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Conversion Factors

To convert from	To	Multiply by	To convert from	To	Multiply by
mile ²	acre	640	acre	ft ²	43560
km ²	acre	247.1	days	seconds	86400
m ³	ft ³	35.3	meters	feet	3.28
ft ³	gallons	7.48	ft ³	gallons	7.48
ft ³	liters	28.3	hectares	acres	2.47
cfs	gal/min	448.8	miles	meters	1609.3
cfs	MGD	0.646	tonnes	tons	1.1
m ³	gallons	264.2	µg/l * cfs	gm/day	2.45
m ³	liters	1000	µg/l * MGD	gm/day	3.79

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10 ⁻¹	deci	d	10	deka	da
10 ⁻²	centi	c	10 ²	hecto	h
10 ⁻³	milli	m	10 ³	kilo	k
10 ⁻⁶	micro	:	10 ⁶	mega	M
10 ⁻⁹	nano	n	10 ⁹	giga	G
10 ⁻¹²	pico	p	10 ¹²	tera	T
10 ⁻¹⁵	femto	f	10 ¹⁵	peta	P
10 ⁻¹⁸	atto	a	10 ¹⁸	exa	E

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TMDL INFORMATION PAGE

Table i. Listing Information

Name	ID	County	HUC	Cause	Mon/Eval
Bowie River	MS085E	Lamar Forrest	03170004	Total Toxics	Evaluated
Near Hattiesburg: From confluence with Okatoma Creek to mouth at Leaf River					

Table ii. Water Quality Standard

Parameter	Beneficial use	Narrative Water Quality Criteria
Total Toxics	Aquatic Life Support	Waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

Table iii. Total Maximum Daily Load

Segment	MOS	TMDL
MS085E	Implicit	1 TUa*, 1 TUc*

* (This expression of zero toxicity in the receiving water is applicable to each discharger and runoff area separately.)

EXECUTIVE SUMMARY

The Bowie River (MS085E) is on the Mississippi 2002 Section 303(d) List of Water Bodies as an evaluated listing for total toxics (MDEQ, 2002a). This TMDL is being completed for total toxics.

The target for the Total Toxicity TMDL is that waters shall be free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations, which are toxic or harmful to humans, animals, or aquatic life. Specific requirements for toxicity are found in Section II.10. State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters – 2002.

For some pollutants, TMDLs are expressed on a mass-loading basis (e.g., pounds per day). In accordance with 40CFR Part 130.2(i), “TMDLs can be expressed in terms of ...mass per time, toxicity, or other appropriate measure.” In addition, NPDES permitting regulations in 40CFR 122.45(f) state that, “All pollutants limited in permits shall have limitations...expressed in terms of mass except...pollutants which cannot appropriately be expressed by mass.” For the toxicity TMDL, the TMDL is expressed in terms of toxicity units (TUs).

To evaluate other potential sources, such as nonpoint source runoff impacts on the Bowie River, EPA Region 4 and MDEQ conducted toxicity tests on surface water samples from the water body. The freshwater fathead minnow were used on samples with less than 2 parts salinity. Sampling occurred in May 2001. This is a representative time of springtime nonpoint source runoff and fairly high water temperature (25 to 27 degrees C). The results of the samples in Bowie River showed no mortality in the 40 organisms tested, therefore no toxicity is believed present from nonpoint sources.

Because of the limited data available, MDEQ is proposing a phased approach for TMDL development. In a phased TMDL, MDEQ uses the best information available at the time to establish the TMDL at levels necessary to implement applicable water quality standards and to make allocations to pollution sources. The phased TMDL approach recognizes that additional data, information, and modeling may be necessary to validate the assumptions of the TMDL and to provide greater certainty that the TMDL will achieve the applicable water quality standard. Thus, Phase 1 identifies levels needed to protect the water body at the present time based on existing data and information. In Phase 2, additional data and information are collected to determine the specific cause and effect relationships that exist and the appropriate levels of pollutant reduction needed to achieve the applicable water quality standards.

EPA guidance states that TMDLs under the phased approach include allocations that confirm existing limits or would lead to new limits or new controls while allowing for additional data collection to more accurately determine assimilative capacities and pollution allocations. (USEPA, 1991) Therefore, no new or additional loading of potentially toxic pollutants shall be introduced into these segments until:

- actual impairment status is known;
- specific pollutants causing impairment are determined; and
- the Phase 2 TMDLs are developed for individual pollutants in these segments; or
- these segments are determined not to be impaired based on the biological, toxicity, or water quality monitoring to be conducted.

INTRODUCTION

Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act (CWA) and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. The pollutant of concern for this TMDL is total toxicity.

The listed segment of the Bowie River is within United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 03170004. The Bowie River watershed is located in Simpson, Smith, Jefferson Davis, Covington, Jones, Lamar, and Forrest Counties (Figure 1). The entire watershed is 427,939 acres and contains many landuse types including agricultural land, pastureland, and urban areas. However, the dominant land uses within the watershed are forest and pasture/grass. The location of the §303(d) listed segment is shown in Figure 2.

Figure 1. Location of the Bowie River Watershed

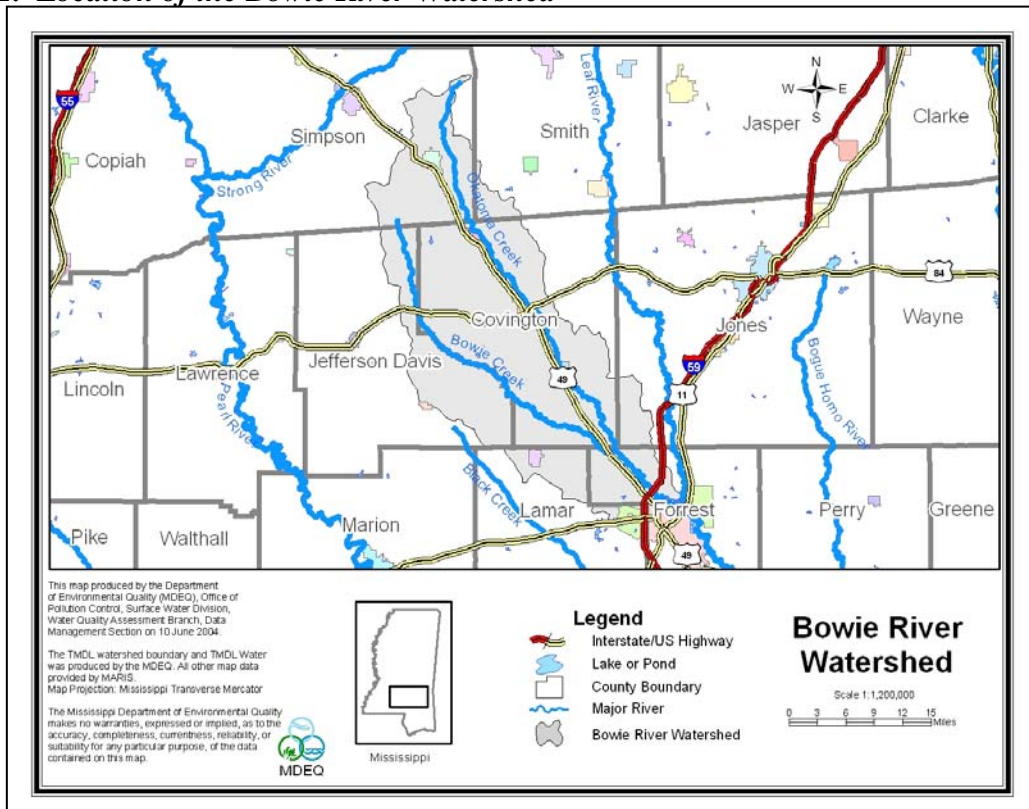
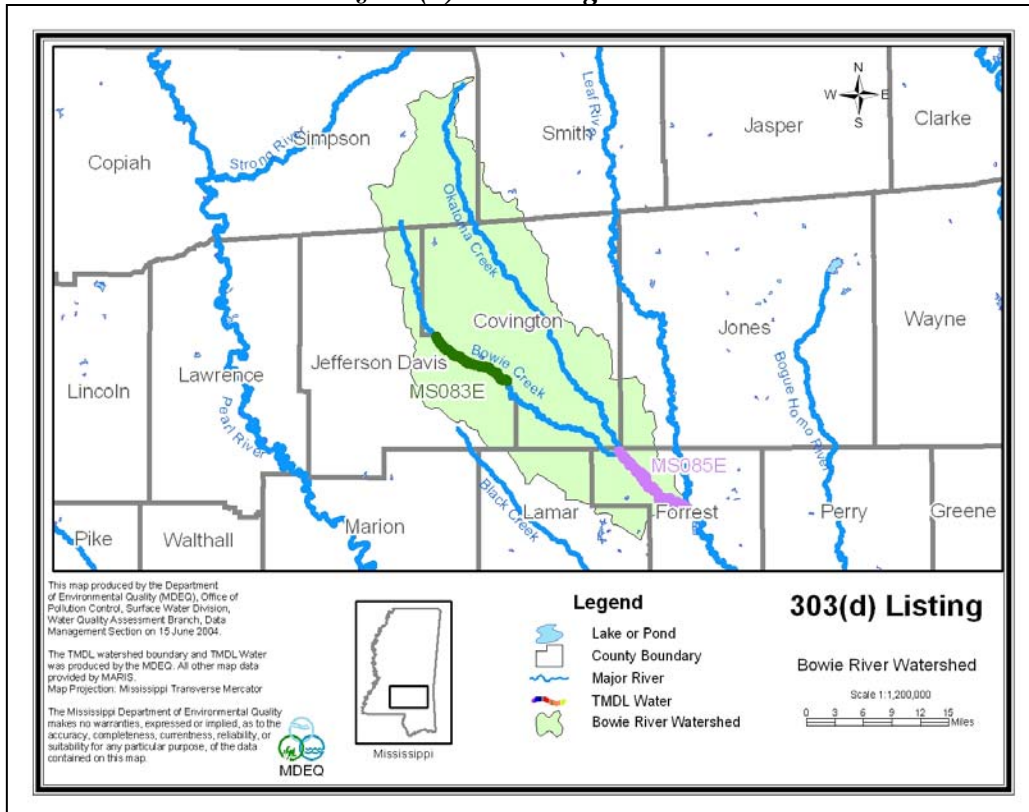


Figure 2. Bowie River Watershed §303(d) Listed Segments



Applicable Water Body Segment Use

The water use classification for the listed segment of the Bowie River, as established by the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters regulation, is Recreation (MDEQ, 2002b). Waters with this classification must meet the Fish and Wildlife Support criteria described above as well as be suitable for recreational purposes including water contact activities such as swimming and water skiing.

Applicable Water Body Segment Standard

The narrative standard is that waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

TMDL DEVELOPMENT

Selection of a TMDL Endpoint and Critical Condition



One of the major components of a TMDL is the establishment of target endpoints, which are used to evaluate the attainment of acceptable water quality. Target endpoints, therefore, represent the water quality goals that are to be achieved by meeting the load and wasteload allocations specified in the TMDL. The endpoints allow for a comparison between observed conditions and conditions that are expected to restore designated uses.

Source Assessment and Load Estimation

Because of the limited data available for total toxics, MDEQ is proposing a phased approach for TMDL development for total toxics. In a phased TMDL, MDEQ uses the best information available at the time to establish the TMDL at levels necessary to implement applicable water quality standards and to make allocations, as needed, to pollution sources. The phased TMDL approach recognizes that additional data, information, and modeling may be necessary to validate the assumptions of the TMDL and to provide greater certainty that the TMDL will achieve the applicable water quality standard. Thus, Phase 1 identifies levels needed to protect the water body at the present time based on existing data and information. In Phase 2, additional data and information is collected to determine the specific cause and effect relationships that exist and the appropriate levels of pollutant reduction needed to achieve the applicable water quality standards.

EPA guidance states that TMDLs under the phased approach include allocations that confirm existing limits or would lead to new limits or new controls while allowing for additional data collection to more accurately determine assimilative capacities and pollution allocations (USEPA, 1991). Therefore, no new or additional loading of toxic pollutants shall be introduced into these segments until:

- Actual impairment status is known;
- Specific pollutants causing impairment are determined; and
- The Phase 2 TMDLs are developed for individual pollutants in these segments; or
- These segments are determined not to be impaired based on the biological, toxicity, or water quality monitoring to be conducted.

Other Potential Sources

To evaluate the combined effect of all potential sources significant at high flows, especially wet-weather, nonpoint source runoff impacts on the Bowie River, EPA Region 4 and MDEQ conducted toxicity tests on surface water samples from the water body. The freshwater fathead minnow were used on samples with less than 2 parts salinity. Sampling occurred in May 2001. This is a representative time of springtime nonpoint source runoff and fairly high water temperature (25 to 27 degrees C). The results of the samples in the Bowie River showed no mortality in the 40 organisms tested, therefore no toxicity is believed present from the nonpoint sources or from point sources at these high flows.

TMDL Pollutants of Concern

Based on the TMDL source assessment and the May 2001 toxicity tests in the Bowie River, no specific pollutants could be identified with toxicity problems, therefore this TMDL will not address specific pollutants but will address the general problem of toxicity through the development of a TMDL for Total Toxicity.

Critical Conditions

The freshwater 7Q10 low flow is the critical condition for water bodies where the major pollutant contributors are point sources. The 7Q10 is the minimum freshwater flow expected for seven consecutive days during a period of ten years. The flow in the Bowie River system at critical conditions is based on data available from the USGS (Telis, 1992). There are several partial record flow gauging stations located in the Bowie River Watershed. The stations and their 7Q10 flows are given in Table 1.

Table 1. 7Q10 Flow Data for the Bowie River Watershed

Station	Location	Drainage Area (square miles)	7Q10 Flow (cfs)
02472850	Okatoma Creek at Sanford	257.0	90
02472900	Big Creek near Hattiesburg	31.9	2
02472500	Bowie Creek near Hattiesburg (above confluence of Okatoma Creek)	304.0	100
02472940	Bowie Creek near Hattiesburg (below the confluence of Okatoma Creek)	646.0	182

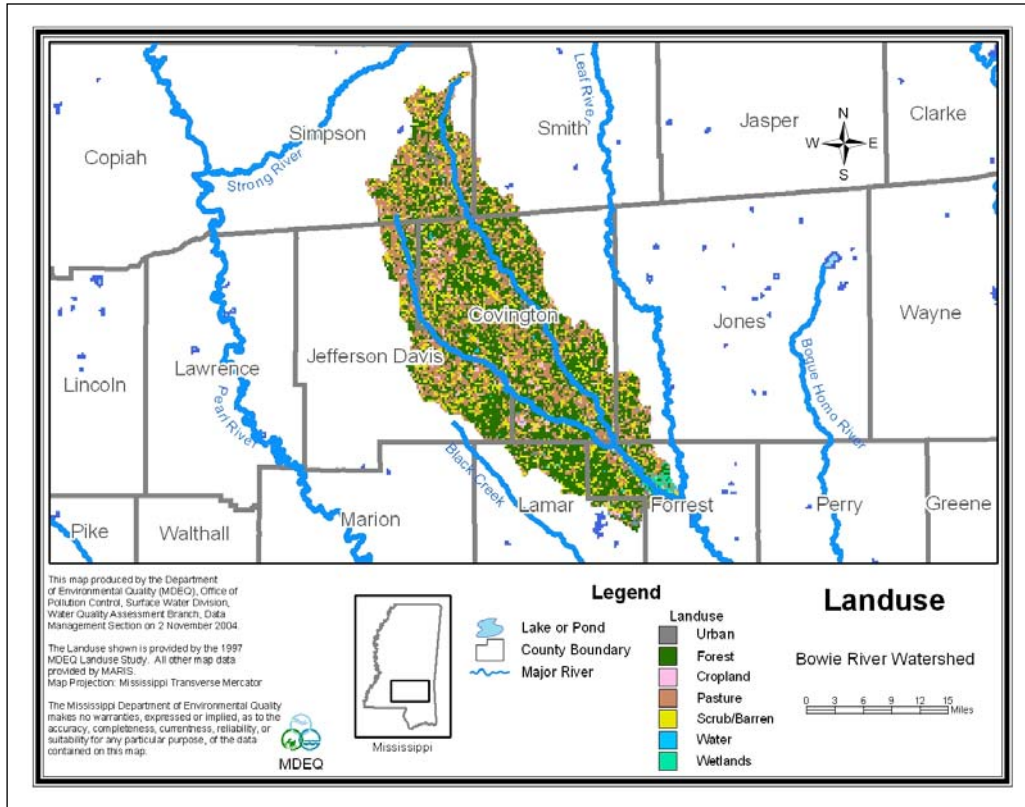
Landuse in the Watershed

The 427,939 acre drainage area of the Bowie River watershed contains many different landuse types, including forest, cropland, pasture, barren, and wetlands as shown in Table 2 and Figure 3. The dominant landuses within the watershed are forest and pasture. The landuse information for the watershed is based on the State of Mississippi's Automated Resource Information System (MARIS), 1997. This data set is based on Landsat Thematic Mapper digital images taken between 1992 and 1993. The MARIS data are classified on a modified Anderson level one and two system with additional level two wetland classifications.

Table 2. Bowie River Watershed Landuse Distribution

	Urban	Forest	Cropland	Pasture	Scrub/Barren	Water	Wetland	Total
Acres	6,910	197,20	16,940	125,468	74,809	2,602	4,009	427,93
Percentag	1.6%	46.1%	4.0%	29.3%	17.5%	0.6%	0.9%	100.0

Figure 3. Bowie River Watershed Landuse Distribution



Seasonal Variation

The low flow is protective of all seasons.

Allocation Watershed/Stream Reach

The load (LA) and wasteload (WLA) allocations are set to zero chronic and zero acute toxicity, which is equivalent to one chronic toxic unit from each source or one acute toxic unit, with any future potential LA or WLA also being set at 1 chronic or 1 acute toxic unit. (These units are not additive.) The LA includes the contributions from surface runoff, also set at 1 chronic toxic unit. The TMDL expression, for chronic toxicity:

$$\text{TMDL} = 1 \text{ TUc: WLA} = 1 \text{ TUc: LA} = 1 \text{ TUc: MOS is implicit}$$

The TMDL expression, in terms of acute toxicity:

$$\text{TMDL} = 1 \text{ TUa: WLA} = 1 \text{ TUa: LA} = 1 \text{ TUa: MOS is implicit}$$

TOTAL TOXICITY TMDL

The target for this total toxicity TMDL is that waters shall be free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations, which are toxic or harmful to humans, animals or aquatic life. Specific requirements for toxicity are found in Section II. 10, State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters - 2002.



The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while maintaining water quality standards. For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). In accordance with 40 CFR Part 130.2(i), “TMDLs can be expressed in terms of ... mass per time, toxicity, or other appropriate measure.” In addition, NPDES permitting regulations in 40 CFR 122.45(f) state that, “All pollutants limited in permits shall have limitations...expressed in terms of mass except...pollutants which cannot appropriately be expressed by mass.” For this toxicity TMDL for the Bowie River, the TMDL is expressed in terms of chronic and acute toxicity units (TUCs and TUAs).

Through its National Pollutant Discharge Elimination System (NPDES) permitting process, MDEQ will determine whether any permitted dischargers to these segments have a reasonable potential of discharging chronically toxic effluent. An allocation to an individual point source discharger does not automatically result in a permit limit or a monitoring requirement. MDEQ’s Environmental Permits Division (EPD) will use its professional judgment to determine whether a reasonable potential exists for these facilities to discharge chronically or acutely toxic effluent. If EPD determines that such a reasonable potential exists, effluent monitoring requirements or limitations will be established as appropriate.

Note on Toxic Units (chronic or acute)

Chronic and acute toxic units are not additive, they both must be met separately. Toxicity (see EPA 1991) involves an inverse relation to the Effective Concentration (EC), which is the lowest percentage (greatest dilution) of effluent or runoff that would still cause the minimum specified effect upon a given fraction of the test organisms, (e.g. EC10 or EC50). The lower the EC, the higher the toxicity. The number of toxic units in an effluent (or runoff) is defined as 100 divided by the EC (expressed as a percentage):

$$\text{TUa} = 100/\text{LC50}$$
$$\text{TUc} = 100/\text{NOEC}$$

where:

TUa = toxic unit acute

TUc = toxic unit chronic

LC50 = the concentration that is lethal to 50% of the test organisms

NOEC = No Observed Effect Concentration = the highest tested concentration (%) of an effluent or a toxicant (or of runoff) at which no adverse effects are observed on the aquatic test organisms at a specific time of observation

A toxic unit chronic of 1 means that a 100% concentration of the runoff has no observed effect on the organisms tested. If the runoff has to be diluted to produce no observed effect, it is toxic.

Note: The terms TUa and TUc are indicated as the plural simply by adding an « s », as in TUas and TUcs.

Chronic Toxicity

Based on MDEQ's mixing zone policy, the dilution in the water body has been established at a ratio of six to one (6:1). The chronic toxicity wasteload allocation (WLA) for any discharger to this segment will be determined as follows:

$$\text{Toxicity from each point source} = 6 \text{ TUcs (max)} / 6 = 1 \text{ TUc in the receiving water.}$$

Based on the previously described surface water toxicity testing, nonpoint toxicity which includes surface runoff, is believed to be absent and therefore the LA for total toxicity is zero, or 1 TUc, or 1 TUa.

The load (LA) and wasteload (WLA) allocations are set to zero chronic toxicity in the receiving water, which is equivalent to 6 chronic toxic units at the end-of-the-pipe from each source, with any future potential LA or WLA also being set at 1 chronic toxic unit in the receiving water.

The TMDL expression, in terms of chronic toxicity at the end of the mixing zone, then becomes:

$$\text{TMDL} = 1 \text{ TUc: WLA} = 1 \text{ TUc: LA} = 1 \text{ TUc: MOS is implicit}$$

Acute Toxicity

Acute toxicity limits, where no dilution factor is applicable, must be met at the end-of-the-pipe. The load (LA) and wasteload (WLA) allocations are set to zero acute toxicity, both in the receiving water and at the end-of-the-pipe from each source, with any future potential LA or WLA also being set at 1 acute toxic unit.

The TMDL expression, in terms of acute toxicity, then becomes:

TMDL = 1 TUa: WLA = 1 TUa: LA = 1 TUa: MOS is implicit

Margin of Safety and Seasonality

The 7Q10 flow and 6:1 dilution for chronic toxicity and end of pipe criteria for acute toxicity values are reasonable worst case assumptions and are consistent with the "conservative assumptions" that are used as a basis of a Margin of Safety (MOS). Seasonality and MOS are addressed by establishing the limits at the 7Q10 low flow and conservative dilution mixing.

Reasonable Assurance

This component of TMDL development does not apply to this TMDL report. There are no point sources (WLA) requesting a reduction based on promised LA components and reductions.

CONCLUSION

This is a Phase 1 TMDL based on limited information, yet on sufficient information to suggest that toxicity is not a problem. If future monitoring demonstrates toxicity at any flow, then a source assessment study should be conducted and attempts should be made to identify the particular pollutant(s) involved. If the compliance program is not sufficient to correct the problem, then additional TMDLs should be developed to set limits on the individual toxicants involved.

Future Activities

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Pascagoula River Basin, the Bowie River watershed may receive additional monitoring to identify any changes or improvements in water quality. For land disturbing activities related to silviculture, construction, and agriculture, it is recommended that practices, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), be followed, respectively.

Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in a statewide and local newspaper. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or by email at: Greg_Jackson@deq.state.ms.us.

Please send any comments on this TMDL to Greg Jackson at PO Box 10385, Jackson MS, 39289-0385. You may also send comments by email at: Greg_Jackson@deq.state.ms.us.

At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting. All comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval.

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