Total Maximum Daily Load

Evaluation

for

Spring Creek

in the

Flint River Basin

(Lead)

Submitted to:

The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

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1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into three categories, supporting, partially supporting, or not supporting their designated uses, depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* every two years.

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

The State of Georgia has identified two miles of Spring Creek, from a swampy point two miles upstream to its confluence with Lake Blackshear as partially supporting its designated uses for the parameter lead.

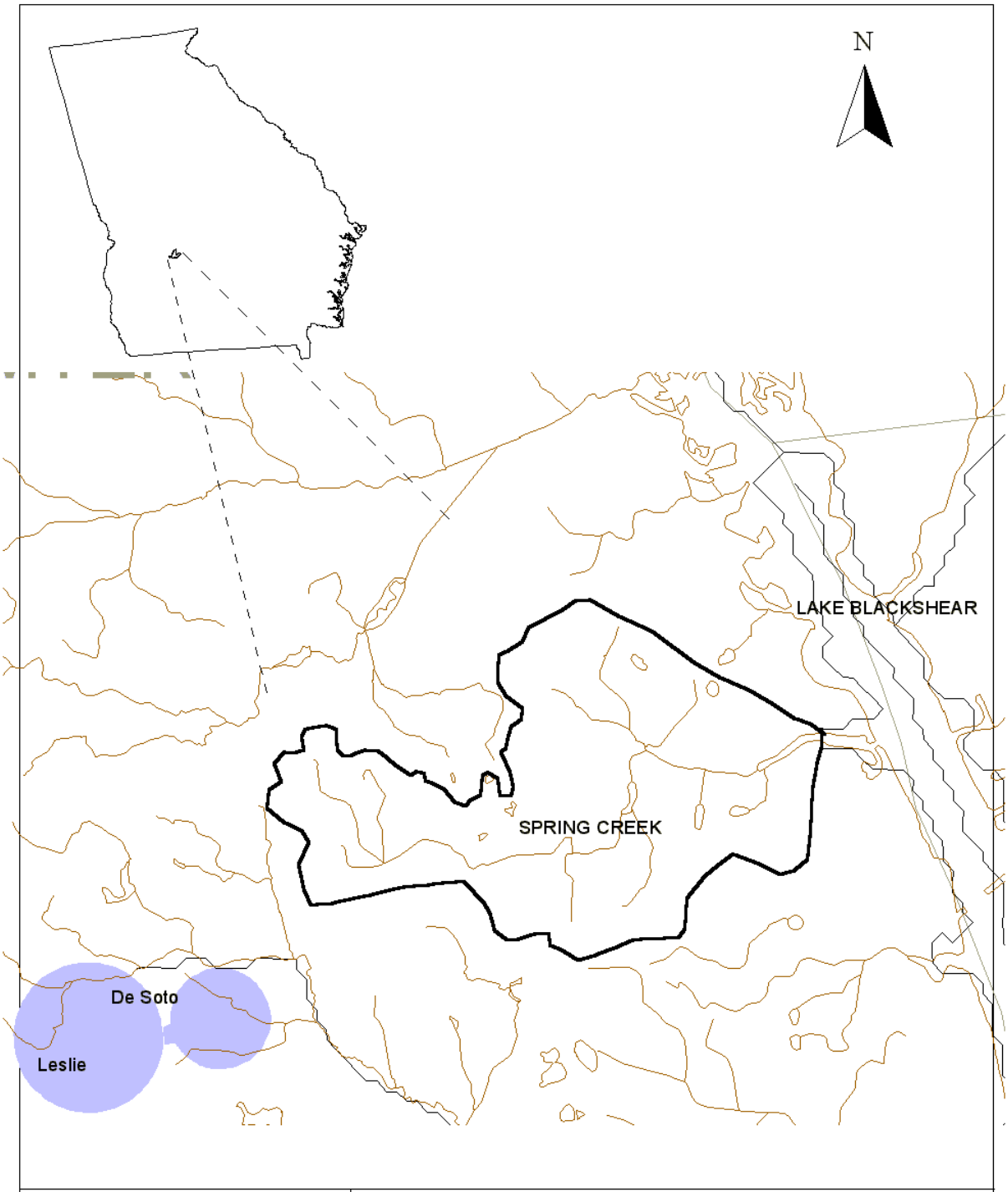
1.2 Watershed Description

The Spring Creek watershed is located in the Flint River basin in southeastern Georgia in Sumter County (see Figure 1). The watershed is part of the Southeastern Plains Ecoregion and is in the Southern Coastal Plain Soil Province. The watershed is approximately 11 square miles in area. The land use for the Spring Creek drainage basin is predominantly agricultural. The area surrounding the creek is a wetland. The watershed is beginning to be developed.

1.3 Water Quality Standard

The water use classification for Spring Creek is fishing. The fishing classification, as stated in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(6)(c), is established to protect the "propagation of fish, shellfish, game and other aquatic life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality."

Chapter 391-3-6-.03 of Georgia's Rules and Regulations, Revised-October 2001, establishes criterion for metals that apply to all waters in the State. This section provides the following definitions for acute and chronic criteria: "Acute criteria" corresponds to EPA's definition for Criteria Maximum Concentration, which is defined in 40 CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1-hour average) without deleterious effects. "Chronic criteria" corresponds to EPA's definition for Criteria Maximum Concentration, which is defined in 40 CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects.



TMDL Evaluation - Lead Flint River Basin	Figure 1. Spring Creek Watershed

The established acute criterion and chronic criterion for dissolved lead are as follows:

acute criteria for dissolved lead:

$$(e^{(1.273[\ln(\text{hardness})] - 1.460)})(1.46203-[(\ln \text{hardness})(0.145712)]) \text{ µg/L}$$

chronic criteria for dissolved lead:

$$(e^{(1.273[\ln(\text{hardness})] - 4.705)})(1.46203-[(\ln \text{hardness})(0.145712)]) \text{ µg/L}$$

The hardness used in the above equations is expressed as mg/L as $CaCO_3$. The minimum hardness allowed for use in these equations shall not be less than 25 mg/L as $CaCO_3$, and the maximum shall not be greater than 400 mg/L as $CaCO_3$.

This regulation requires that instream concentrations of dissolved lead shall not exceed the acute criteria at 1Q10 or higher stream flow conditions, and shall not exceed the chronic criteria at 7Q10 or higher stream flow conditions. This is consistent with 40 CFR 131.36 regarding applicability. For protection of aquatic life, States are required to use a flow value not less than the 1Q10 for the acute criteria and not less than the 7Q10 for the chronic criteria. The 1Q10 is the lowest one-day flow with a recurrence of once in 10 years determined hydrologically. The 7Q10 is the minimum average flow for seven consecutive days with a 10- year recurrence interval determined hydrologically.

In accordance with 391-3-6-.03(5)(e)(ii), EPA's "Guidance Document of Dynamic Modeling and Translators" (August 1993) may be used to determine the relationship between the total recoverable metal concentration and the dissolved form. The metals translator is determined using default linear partition coefficient values found in an EPA document entitled, "Technical Guidance Manual for Performing Waste Load Allocations – Book II: Streams and Rivers."

In addition, 391-3-6-.06(4)(d)5.(ii)(b)(2) allows methods from this EPA guidance document to be used to translate dissolved criteria concentrations into total recoverable permit limits. Metals effluent permit limitations are required to be expressed as total recoverable metal per 40 CFR §122.45(c). Therefore, the TMDL will be expressed as both the total maximum daily load of total recoverable lead that will be protective of the dissolved lead chronic criterion and the total maximum daily load of total recoverable lead that will be protective of the dissolved lead acute criterion.

2.0 WATER QUALITY ASSESSMENT

The Spring Creek listing for lead resulted from water quality assessment data collected in 1992 and 1993. The Lake Blackshear Clean Lakes Report did not provide a specific value for the lead concentration detected. The report just indicated that one Spring Creek sample had elevated lead values. This segment of Spring Creek was first listed in the Georgia 1994 303(d) list. The Clean Lakes Report did provide Total Suspended Solids (TSS) and hardness concentration for Spring Creek. This information was used to calculate the translator, and acute and chronic criteria for those conditions that are used to develop this TMDL. These are listed in Table 1.

Table 1. Data Collected From Spring Creek

Date	Measured TSS (mg/L)	Measured Total Hardness (mg/L as $CaCO_3$)
4/25/92	6.4	114
6/13/92	30.5	63
11/7/92	8.5	127
2/4/93	2.8	79

The validity of this historical data is suspect due to the potential for contamination during sampling. In November 2000 and June 2001, water quality data was collected in Lake Blackshear at Midlake and the Dam Forebay using clean sampling techniques. The sample results showed no violations of the lead standards and resulted in the delisting of the Lake Blackshear listed segments. However, Spring Creek, an embayment to Lake Blackshear, was not sampled and therefore was not reassessed.

3.0 SOURCE ASSESSMENT

A source assessment characterizes the known and suspected sources of lead in the watershed for use in a water quality model and the development of the TMDL. The potential sources of lead in this watershed are from both point sources and nonpoint sources. Both will be addressed in this TMDL.

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES permit program requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States" (40 CFR 122.1). Basically, there are two categories of NPDES permits: 1) municipal and industrial wastewater treatment facilities and 2) regulated storm water discharges.

In general, industrial and municipal wastewater treatment facilities have NPDES permits with effluent limits. These permit limits are either based on federal and state effluent guidelines (technology-based limits) or on water quality standards (water quality-based limits). Municipal and industrial wastewater treatment facilities' discharges may contribute lead to receiving waters. There are no NPDES permitted discharges identified in this watershed.

Some storm water runoff is covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe limits, storm water NPDES permits establish controls. Currently, regulated storm water discharges include those associated with industrial activities, including construction sites five acres or greater, and large and medium municipal separate storm sewer systems (MS4s). There are no regulated storm water discharges in this watershed.

Nonpoint sources of lead are diffuse and cannot be identified as entering the water body at a single location. It is unknown whether any nonpoint sources potentially cause or contribute to excursions of the water quality standard for lead. There are no data available that indicate any specific nonpoint sources of lead. Lead is used in piping, building materials, solders, paint, ammunition, castings, storage batteries, metal products and pigments (Moore and Ramamoorthy, 1983). However, the nature of these potential sources is not well understood or documented at this time.

4.0 TMDL DEVELOPMENT APPROACH

An important component of TMDL development is to establish the relationships between loadings and instream water quality. In this section, the numerical modeling techniques used to develop the TMDL are discussed.

4.1 Steady-State Mass Balance Approach

Steady-state models are applied for "critical" environmental conditions that represent extremely low assimilative capacity. For effluent-dominated riverine systems, critical environmental conditions correspond to low flows. The assumption behind steady-state modeling is that effluent concentrations that protect water quality during critical conditions will be protective for the large majority of environmental conditions that occur. A mass balance equation is used to calculate allowable lead allocations under critical conditions in order to protect the stream.

4.2 Critical Conditions

The critical flow conditions for this TMDL occur when the ratio of effluent or contaminated stormwater to stream flow is the greatest. The TMDL is presented two ways. First, a total daily mass load for the low flow conditions of 7Q10 and 1Q10 is given. It is assumed that these are the critical conditions for aquatic life. The 7Q10 and chronic criteria provide protection of the chronic standard and the 1Q10 and the acute criteria provide protection of the acute standard. Table 3 provides the critical flow data for Spring Creek.

Table 2. Critical Flow Conditions for Spring Creek

Condition	Flow (MGD/cfs)
7Q10	1.4/2.2
1Q10	1.3/2.0

Second, the TMDL is also expressed as an equation that shows the load as a function of the total flow at any given time. Since instantaneous samples are used to evaluate compliance with the standards, as well as the need for a TMDL, this flow dependent load, or concentration approach, is more meaningful. This approach takes into account seasonable variability and makes it easier to evaluate compliance with the TMDL.

The receiving water's hardness is a critical condition in calculating the dissolved fraction of lead in the creek. A lower hardness results in a higher proportion of metal in the dissolved form, resulting in a more conservative criterion. Based on the available data for Spring Creek, the hardness used for critical conditions is 63 mg/L as $CaCO_3$.

In order to convert measured total recoverable lead concentrations to estimated dissolved lead concentrations, a translator is calculated. This translator is dependent on the instream TSS. As the TSS concentration increases, a smaller percent of the metal is in the dissolved form. The equations used to calculate the translator are taken from EPA guidance. The ratio of the total measured metal concentration (C_t) to the calculated dissolved concentration (C_d) is the translator. The equations are provided below for reference.

$$C_t/C_d = 1 + K_d \times TSS \times (10^{-6}\ kg/mg)$$

Where: K_d = partition coefficient for lead in L/kg
TSS = total suspended solids concentration in mg/L

The partition coefficient for lead:

$$K_d = K_{po} \times TSS^a$$

Where: K_{po} * = 2.8×10^6
a * = -0.8

* Note: It is important to note that the authors of EPA's "Technical Guidance Manual" derived the above values for the 'K_{po}' coefficient and the 'a' exponent based on the statistical analysis of 2,253 data records collected from rivers and streams distributed throughout the United States.

Instream TSS data is available for Spring Creek. The average TSS for Spring Creek is 12 mg/L. Applying this value to the above relationship, the expected ratio of total lead to dissolved lead (i.e., the translation factor) is 5.6.

5.0 ALLOCATION

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard. A TMDL is the sum of the individual waste load allocations (WLAs) and load allocations (LAs) for nonpoint sources and natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For lead, the TMDLs are expressed as mass per day and as a concentration.

A TMDL is expressed as follows:

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

The TMDL calculates the WLAs and LAs with margins of safety to meet the stream's water quality standards. The allocations are based on estimates that use the best available data and provide the basis to establish or modify existing controls so that water quality standards can be achieved. In developing a TMDL, it is important to consider if adequate data are available to identify the sources, fate, and transport of the pollutant to be controlled.

TMDLs may be developed using a phased approach. Under a phased approach, the TMDL includes: 1) WLAs that confirm existing limits and controls or lead to new limits, and 2) LAs that confirm existing controls or include implementing new controls (EPA TMDL Guidelines). A phased TMDL requires additional data be collected to determine if load reductions required by the TMDL lead to the attainment of water quality standards.

The TMDL Implementation Plan will establish a schedule or timetable for the installation and evaluation of point and nonpoint source control measures, data collection, assessment of water quality standard attainment, and if needed, additional modeling. Future monitoring of the listed segment water quality will then be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

Based on the critical conditions established in Section 4.2, the dissolved lead chronic criterion is equal to 1.5 μg/L and the dissolved lead acute criterion is equal to 38 μg/L. Using a translation factor equal to 5.6, the allowable instream total recoverable lead concentrations are 8.4 μg/L and 213 μg/L to protect against chronic and acute effects of lead, respectively. The following sections describe the various lead TMDL components.

5.1 Waste Load Allocations

The waste load allocation (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources. Waste load allocations are provided to the point sources from municipal and industrial wastewater treatment systems that have NPDES effluent limits.

State and Federal Rules define storm water discharges covered by NPDES permits as point sources. However, storm water discharges are from diffuse sources and there are multiple storm water outfalls. Storm water sources (point and nonpoint) are different than traditional NPDES permitted sources in four respects: (1) they do not produce a continuous (pollutant loading)

discharge; (2) their pollutant loading depends on the intensity, duration, and frequency of rainfall events, over which the permittee has no control; (3) the activities contributing to the pollutant loading may include various allowable activities of others, and control of these activities is not solely within the discretion of the permittee; and (4) they do not have wastewater treatment plants that control specific pollutants to meet numerical limits.

The intent of storm water NPDES permits is not to treat the water after collection, but to reduce the exposure of storm water to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to try to control pollutant discharges from each storm water outfall. Therefore, storm water NPDES permits require the establishment of controls or BMPs to reduce pollutants from entering the environment.

There are no NPDES permitted facilities with lead permit limits in the Spring Creek watershed. If there are any permitted sources of lead in the future, the WLA loads will be calculated using the effluent design flow and the critical low flow. The WLA requires the effluent concentrations from each point source not exceed the allowable instream total dissolved and total recoverable lead chronic and acute concentrations at the end of pipe with no dilution.

5.2 Load Allocations

The load allocation (LA) is the portion of the receiving water's loading capacity that is attributed to existing or future nonpoint sources or to natural background sources. Nonpoint sources are identified in 40 CFR 130.6 as follows:

- Residual waste
- Land disposal
- Agricultural and silvicultural
- Mines
- Construction
- Saltwater intrusion
- Urban storm water (non-permitted)

There are currently no known lead contributions to Spring Creek from nonpoint sources. The allowable instream lead concentration and wasteload allocation data is used to calculate the load allocations.

5.3 Seasonal Variation

The low flow critical conditions incorporated in this TMDL are assumed to represent the most critical design conditions and to provide year-round protection of water quality. This TMDL is expressed as a total load during the critical low flow period as well as a concentration. This takes into account the seasonal variability in flows and potential pollutant loads.

5.4 Margin of Safety

The MOS is a required component of TMDL development. As specified by section 303(d) of the CWA, the margin of safety must account for any lack of knowledge concerning the relationship between effluent limitations and water quality. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations.

The MOS was implicitly incorporated into the TMDL for Spring Creek through the use of critical conditions established in Section 4.2 of this report. Through the use of low flow conditions, the lowest of available hardness values, and the methods used to develop the translators, the margin of safety for this TMDL adequately accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality.

5.5 Total Maximum Daily Load

This TMDL can be summarized as follows:

Table 3. Lead TMDL Summary For Spring Creek

Parameter	Criteria	WLA	LA	MOS	TMDL
Total Dissolved Lead	Chronic	Not Applicable at this time ΣQ_{WLA}X 1.5 μg/L for all conditions and flows	$7.9X10^{-3}$ kg/day for the 7Q10 ΣQ_{LA}X 1.5 μg/L for all conditions and flows	Implicit	$7.9X10^{-3}$kg/day for the 7Q10 Q_{total} x 1.5 μg/L for all conditions and flows
Total Dissolved Lead	Acute	Not Applicable at this time ΣQ_{WLA}X 38 μg/L for all conditions and flows	0.19 kg/day for the 1Q10 ΣQ_{LA}X 38 μg/L for all conditions and flows	Implicit	0.19 kg/day for the 1Q10 Q_{total} x 38 μg/L for all conditions and flows
Total Recoverable Lead	Chronic	Not Applicable at this time ΣQ_{WLA}X 8.4 μg/L for all conditions and flows	$4.4\ 10^{-2}$ kg/day for the 7Q10 ΣQ_{LA}X 8.4 μg/L for all conditions and flows	Implicit	$4.4X10^{-2}$ kg/day for the 7Q10 Q_{total} x 8.4 μg/L for all conditions and flows
Total Recoverable Lead	Acute	Not Applicable at this time ΣQ_{WLA}X 213 μg/L for all conditions and flows	1.0 kg/day for the 1Q10 ΣQ_{LA}X 213 μg/L for all conditions and flows	Implicit	1.0 kg/day for the 1Q10 Q_{total} x 213 μg/L for all conditions and flows

6.0 RECOMMENDATIONS

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. GAEPD has adopted a basin approach to water quality management; an approach that divides Georgia's major river basins into five groups. This approach provides for additional monitoring to be focused on one of the five basin groups each year. The Flint River Basin along with the Chattahoochee River Basin were the basins of focused monitoring in 2000 and will again receive focused monitoring in 2005. Focused basin monitoring of these streams will be initiated, as appropriate, during the next monitoring cycle to determine if this stream is meeting lead water quality criteria.

6.2 Reasonable Assurance

There currently are no NPDES permitted discharges to Spring Creek. If a permit were to be issued in the future, an allocation to a point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, Georgia will determine whether the permitted dischargers to the Spring Creek watershed have a reasonable potential of discharging lead levels equal to or greater than the allocated load. The results of this reasonable potential analysis will determine the specific type of requirements in an individual facility's NPDES permit. As part of its analysis, the EPD will use its EPA-approved 2001 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

If effluent limitations are determined to be necessary for any future facilities, they should be established in accordance with Georgia Rules and Regulations for Water Quality Control, Section 391-3-6-.06(4)(d)5.(ii)(b)(2). This regulation establishes that to protect against chronic effects, an effluent limitation should be imposed as a monthly average limit. To protect against acute effects, an effluent limitation should be imposed as a daily maximum limit. Additionally, if effluent limitations or monitoring requirements are determined through a reasonable potential analysis to be necessary for any future facilities, it is recommended that concentration limits or concentration monitoring requirements should be imposed in addition to any loading limits or monitoring requirements.

6.3 Non-Point Source Management Practices

The Georgia EPD is responsible for administering and enforcing laws to protect the waters of the State. EPD is the lead agency for implementing the State's Nonpoint Source Management Program. Regulatory responsibilities that have a bearing on nonpoint source pollution include establishing water quality standards and use classifications, assessing and reporting water quality conditions, and regulating land-use activities, which may affect water quality. Georgia is working with local governments, agricultural, and forestry agencies such as the Natural Resources Conservation Service, the Georgia Soil and Water Conservation Commission, and the Georgia Forestry Commission to foster the implementation of Best Management Practices (BMPs) that address nonpoint source pollution. In addition, public education efforts are being targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality.

6.4 Public Participation

A thirty-day public notice was provided for this TMDL. During that time the availability of the TMDL was public noticed, a copy of the TMDL was provided as requested, and the public was invited to provide comments on the TMDL.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

EPD has coordinated with EPA to prepare this Initial TMDL Implementation Plan for this TMDL. EPD has also established a plan and schedule for development of a more comprehensive implementation plan after this TMDL is established. EPD and EPA have executed a Memorandum of Understanding that documents the schedule for developing the more comprehensive plans. This Initial TMDL Implementation Plan includes a list of BMPs and provides for an initial implementation demonstration project to address one of the major sources of pollutants identified in this TMDL, while State and/or local agencies work with local stakeholders to develop a revised TMDL implementation plan. It also includes a process whereby EPD and/or Regional Development Centers (RDCs), or other EPD contractors (hereinafter, "EPD Contractors"), will develop expanded plans (hereinafter, "Revised TMDL Implementation Plans").

This Initial TMDL Implementation Plan, written by EPD and for which EPD and/or the EPD Contractor are responsible, contains the following elements.

1. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some best management practices. The "Management Measure Selector Table" shown below identifies these management strategies by source category and pollutant. Nonpoint sources are the primary cause of excessive pollutant loading in most cases. Any wasteload allocations in this TMDL will be implemented in the form of water-quality based effluent limitations in NPDES permits issued under CWA Section 402. [See 40 C.F.R. § 122.44(d)(1)(vii)(B)]. NPDES permit discharges are a secondary source of excessive pollutant loading, where they are a factor, in most cases.

2. EPD and the EPD Contractor will select and implement one or more BMP demonstration projects for each River Basin. The purpose of the demonstration projects will be to evaluate by River Basin and pollutant parameter the site-specific effectiveness of one or more of the BMPs chosen. EPD intends that the BMP demonstration project be completed before the Revised TMDL Implementation Plan is issued. The BMP demonstration project will address the major pollutant categories of concern for the respective River Basin as identified in the TMDLs. The demonstration project need not be of a large scale, and may consist of one or more measures from the Table or equivalent BMP measures proposed by the EPD Contractor and approved by EPD. Other such measures may include those found in EPA's "Best Management Practices Handbook," the "NRCS National Handbook of Conservation Practices," or any similar reference, or measures that the volunteers, etc., devise that EPD approves. If for any reason the EPD Contractor does not complete the BMP demonstration project, EPD will take responsibility for doing so.

3. As part of the Initial TMDL Implementation Plan the EPD brochure entitled "Watershed Wisdom -- Georgia's TMDL Program" will be distributed by EPD to the EPD Contractor for use with appropriate stakeholders for this TMDL. Also, a copy of the video of that same title will be provided to the EPD Contractor for its use in making presentations to appropriate stakeholders on TMDL Implementation Plan development.

4. If for any reason the EPD Contractor does not complete one or more elements of a Revised TMDL Implementation Plan, EPD will be responsible for getting that

(those) element(s) completed, either directly or through another contractor.

5. The deadline for development of a Revised TMDL Implementation Plan is the end of August 2004.

6. The EPD Contractor helping to develop the Revised TMDL Implementation Plan, in coordination with EPD, will work on the following tasks involved in converting the Initial TMDL Implementation Plan to a Revised TMDL Implementation Plan:

   A. Generally characterize the watershed;
   B. Identify stakeholders;
   C. Verify the present problem to the extent feasible and appropriate, (e.g., local monitoring);
   D. Identify probable sources of pollutant(s);
   E. For the purpose of assisting in the implementation of the load allocations of this TMDL, identify potential regulatory or voluntary actions to control pollutant(s) from the relevant nonpoint sources;
   F. Determine measurable milestones of progress;
   G. Develop monitoring plan, taking into account available resources, to measure effectiveness; and
   H. Complete and submit to EPD the Revised TMDL Implementation Plan.

7. The public will be provided an opportunity to participate in the development of the Revised TMDL Implementation Plan and to comment on it before it is finalized.

8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan when the Revised TMDL Implementation Plan is approved by EPD.

Management Measure Selector Table

Land Use	Management Measures	Fecal Coliform	Dissolved Oxygen	pH	Sediment	Temperature	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	PCBs, toxaphene
Agriculture	1. Sediment & Erosion Control	_	_		_	_				
	2. Confined Animal Facilities	_	_							
	3. Nutrient Management	_	_							
	4. Pesticide Management		_							
	5. Livestock Grazing	_	_		_	_				
	6. Irrigation		_		_	_				
Forestry	1. Preharvest Planning				_	_				
	2. Streamside Management Areas	_	_		_	_				
	3. Road Construction &Reconstruction		_		_	_				
	4. Road Management		_		_	_				
	5. Timber Harvesting		_		_	_				
	6. Site Preparation & Forest Regeneration		_		_	_				
	7. Fire Management	_	_	_	_	_				
	8. Revegetation of Disturbed Areas	_	_	_	_	_				
	9. Forest Chemical Management		_			_				

Land Use	Management Measures	Fecal Coliform	Dissolved Oxygen	pH	Sediment	Temperature	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	PCBs, toxaphene
	10. Wetlands Forest Management	_	_	_		_		_		
Urban	1. New Development	_	_		_	_			_	
	2. Watershed Protection & Site Development	_	_		_	_		_	_	
	3. Construction Site Erosion and Sediment Control		_		_	_				
	4. Construction Site Chemical Control		_							
	5. Existing Developments	_	_		_	_			_	
	6. Residential and Commercial Pollution Prevention	_	_							
Onsite Wastewater	1. New Onsite Wastewater Disposal Systems	_	_							
	2. Operating Existing Onsite Wastewater Disposal Systems	_	_							
Roads, Highways and Bridges	1. Siting New Roads, Highways & Bridges	_	_		_	_			_	
	2. Construction Projects for Roads, Highways and Bridges		_		_	_				
	3. Construction Site Chemical Control for Roads, Highways and Bridges		_							

Land Use	Management Measures	Fecal Coliform	Dissolved Oxygen	pH	Sediment	Temperature	*Toxicity*	*Mercury*	*Metals (copper, lead, zinc, cadmium)*	PCBs, toxaphene
	4. Operation and Maintenance-Roads, Highways and Bridges	–	–			–			–	

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