Total Maximum Daily Load

Evaluation

for

Sandy Run Creek

in the

Ocmulgee River Basin

for

Copper

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 Environmental Protection Division of the Georgia Department of Natural Resources (Georgia EPD) 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* (GAEPD, 2000-2001).

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) established 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 in-stream water quality conditions. This allows water quality based controls to be developed to reduce pollution and restore and maintain water quality.

The State of Georgia has identified five miles of the Sandy Run Creek, from Bay Gall Creek to its confluence with the Little Ocmulgee River near the City of Warner Robins in Houston County, as not supporting its designated uses for the parameter copper. In addition, the same segment is listed as not supporting its use for dissolved oxygen. A separate TMDL is being proposed for dissolved oxygen.

1.2 Watershed Description

The Sandy Run Creek watershed is located in the Ocmulgee River Basin in Houston County (see Figure 1). The water use classification of Sandy Run Creek from Bay Gall Creek to its confluence with the Little Ocmulgee River is "Fishing." The watershed is part of the Southeastern Plains Ecoregion. It is in the Coastal Plain Physiographic Province. The watershed is mostly urban and residential. The City of Warner Robins Water Pollution Control Plant (WPCP) has a point source discharge to the listed segment. Table 1 lists the land cover distribution and associated percent land cover for each watershed.

Table 1. Sandy Run Creek Land Cover Distribution, Acres (Percentage)

Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/Industrial/ Transportation	Bare Rock/Sand/Clay	Quarries/Strip Mines/Gravel Pits	Forest	Row Crops	Pasture/Hay	Other Grasses (Urban/Recreational ;e.g. parks/lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
85	6,915	4,725	1,690	9	70	9,620	3,935	3,355	2,664	1,233	146	34,447
(0.2)	(20.1)	(13.7)	(4.9)	(0.0)	(0.2)	(27.9)	(11.4)	(9.7)	(7.7)	(3.6)	(0.4)	(100.0)

The 1-day, 10-year minimum (1Q10) statistical flow value associated with this segment of Sandy Run Creek is 7.4 cubic feet per second (cfs). The 7-day, 10-year minimum (7Q10) statistical flow value associated with Sandy Run Creek is 8.2 cfs.

1.3 Water Quality Standard

The water use classification for this segment of Sandy Run Creek is Fishing. The fishing classification, as stated in Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(6)(a), is established to protect "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(5)(e)(ii) of Georgia's Rules and Regulations establishes criteria for metals that apply to all waters in the State. The established chronic criterion and acute criterion for dissolved copper are as follows:

$$\text{acute criteria for dissolved copper} = \left(e^{(0.9422[\ln(\text{hardness})] - 1.700)}\right)(0.96)\ \mu g/L$$

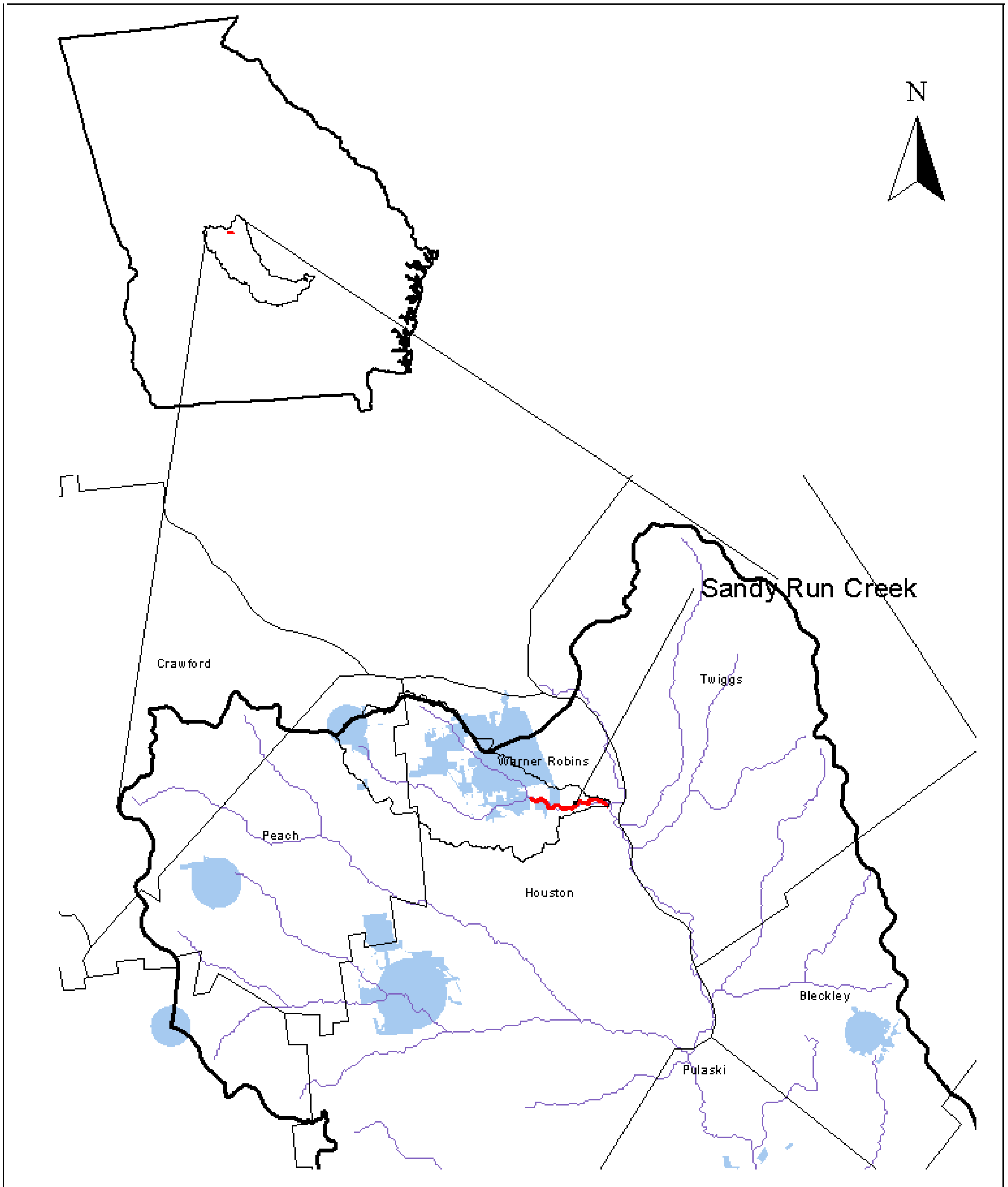
$$\text{chronic criteria for dissolved copper} = \left(e^{(0.8545[\ln(\text{hardness})] - 1.702)}\right)(0.96)\ \mu g/L$$

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 $CaCO_3$.

The regulation cited above requires that instream concentrations of dissolved copper shall not exceed the acute criteria indicated above, under 1Q10 or higher stream flow conditions and shall not exceed the chronic criteria indicated above, under 7Q10 or higher stream flow conditions.

In accordance with Georgia Rules and Regulations for Water Quality Control 391-3-6-.03(5)(e)(ii), guidance found in EPA's "Guidance Document of Dynamic Modeling and Translators August 1993" may be used to determine the relationship between the total recoverable concentration of a metal and the dissolved form of a metal. 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, Georgia Regulation 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 copper that will be protective of the dissolved copper chronic criterion and the total maximum daily load of total recoverable copper that will be protective of the dissolved copper acute criterion.



TMDL Evaluation - Copper Ocmulgee River Basin	Figure 1. Sandy Run Creek Watershed

2.0 WATER QUALITY ASSESSMENT

Sandy Run Creek's use support determination was made for copper based on past water quality samples taken downstream of the Warner Robins WPCP. Two instream samples were collected at Georgia Highway 247, in Warner Robins. One sample was collected in April 2004 and one in August 2004. Copper was detected in both samples. The data are provided in Table 2.

A review of 2004 meteorological data of rainfall at Warner Robbins Airport indicate there was 1.2 inches of precipitation on August 10, 2004. This event was proceeded by only 0.5 inches of rain in the previous 40 days. It is likely that the high Total Suspended Solids and associated high level of copper in the sample collected on August 11th was associated with this storm event.

Table 2. Copper Data Collected from Sandy Run Creek

Date	Measured Total Recoverable Copper Concentration (μg/L)	Calculated Translator (total recoverable to dissolved)	Calculated Dissolved Copper Concentration (μg/L)	Total Hardness (mg/L)	Total Suspended Solids (mg/L)	Acute criterion (μg/L)	Chronic Criterion (μg/L)
4/14/04	4	3.1	1.3	34	14	6.2	4.5
8/11/04	160	6.8	23.4	38	830	7.6	5.3

3.0 SOURCE ASSESSMENT

A source assessment characterizes the known and suspected sources of copper in the watershed for use in a water quality model and the development of the TMDL. The general sources of copper are point and nonpoint sources. Nonpoint sources of copper are diffuse sources that cannot be identified as entering the water body at a single location.

The City of Warner Robins Water Pollution Control Plant (WPCP) discharges to the listed segment of Sandy Run Creek. In addition, Sandy Run Creek runs along the southern border of Robins Air Force Base. Although the Base does not have a direct point source discharge to the Creek, the Base does discharge stormwater to the Creek. A large portion of the City of Warner Robins, which is covered under the Phase II MS4 Stormwater General Permit, is also in the watershed.

It is unknown whether any nonpoint sources potentially cause or contribute to excursions of the water quality standard for copper. There is no information available that indicate any specific nonpoint source of copper.

Properties such as malleability, ductility, conductivity, corrosion resistance, alloying qualities and pleasing appearance make copper's use universal in the electrical, construction and automotive industries (Moore and Ramamoorthy, 1981). However, the relationship of these potential sources and water quality is not well understood or documented at this time.

4.0 TMDL DEVELOPMENT APPROACH

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

4.1 Steady-State Approach

Steady-state models are applied for "critical" environmental conditions that represent extremely low assimilative capacity. For effluent-dominated riverine systems where there are no known sources of nonpoint source pollution, critical environmental conditions correspond to drought 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 model the critical conditions and calculate allocations.

4.2 Critical Conditions

The critical flow conditions for these TMDLs occur when the ratio of effluent or contaminated stormwater to stream flow is the greatest. The TMDLs are 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 the listed segments.

Table 3. Critical Flow Conditions for Sandy Run Creek

Source of Flow	Flow value (MGD / cfs)
Sandy Run Creek (during 7Q10 conditions)	5.3 / 8.2
Sandy Run Creek (during 1Q10 conditions)	4.8 / 7.4

Second, the TMDLs are 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 acute and chronic water quality criteria for copper in the Creek. A lower hardness results in a higher proportion of metal in the dissolved form, resulting in a more conservative criterion.

In order to convert measured total recoverable copper concentrations to estimated dissolved copper concentrations, a translator is calculated. This translator is dependent on the instream TSS concentration. 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 (USEPA, 1993). 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 copper (L/kg)
TSS = total suspended solids concentration (mg/L)

The partition coefficient for copper:

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

Where: K_{po} * = 1.04×10^6
a * = -0.7436

* 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.

Based on the available data, the hardness values used for critical conditions in the listed segments are shown in Table 4. In addition, Table 4 shows the Instream TSS data measured for the listed segments and the corresponding translator.

Table 4. Critical Condition Hardness and TSS

Listed Segment	Date	Total Hardness (mg/L as $CaCO_3$)	TSS (mg/L)	Translator
Sandy Run Creek	4/14/04	34	14	3.1
Sandy Run Creek	8/11/04	38	830	6.8

5.0 ALLOCATIONS

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 copper, 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 whether adequate data exists 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 (USEPA TMDL Guidelines). A phased TMDL requires that 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 segments' water quality will then be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

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.

The City of Warner Robins has an individual NPDES permit to discharge in this watershed. They currently do not have a limitation for copper. The need for a permit limit for any discharger is determined using EPD's Reasonable Potential Procedure. If there are any permitted sources of copper to the Sandy Run Creek Watershed in the future, the WLA loads will be calculated using the effluent design flow. Since some NPDES permits do not have a flow limitation, a TMDL, expressed only in mass per day is not appropriate. It is more accurate and conservative to assign a wasteload allocation as a concentration. The mass limit for any value of flow (Q) will then be calculated by multiplying flow times concentration. The WLA requires that the effluent concentration from each point source not exceed the allowable instream copper concentration at the end of pipe without any dilution.

Based on critical flows shown in Table 3, Table 5 shows the dissolved copper chronic and acute criteria and the allowable instream copper concentrations to protect against chronic and acute effects are given as dissolved and total recoverable.

Table 5. Allowable Instream Copper Concentrations

Listed Stream	Copper (μg/L)			
	Dissolved Acute Criterion	Dissolved Chronic Criterion	Total Acute Concentration	Total Chronic Concentration
Sandy Run Creek	6.2	4.5	19	14

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 silivicultural
- Mines
- Construction
- Saltwater intrusion
- Urban storm water (non-permitted)

It is not known how much of the copper comes from nonpoint sources. Based on a review of 2004 meteorological data of rainfall at Warner Robbins Airport, there was 1.2 inches of precipitation on August 10, 2004. This event was proceeded by only 0.5 inches of precipitation in the previous 40 days. It is likely that the high Total Suspended Solids and associated high level of copper in the sample collected on August 11th was associated with this storm event.

Sandy Run Creek is slow and swampy, so the first flush of a storm could cause accumulated contaminated sediment and runoff, to contribute to the high copper and TSS concentrations. The allowable instream copper concentration and wasteload allocation data is used to calculate the load allocations. The load allocation during 1Q10 and 7Q10 flow conditions is calculated using the dissolved copper criteria as follows:

<u>To protect against the chronic effects of dissolved copper:</u>

allowable loading = dissolved chronic criterion x 7Q10 flow x units conversion factor
= 4.5 μg/L x 5.3x 10^6 gallons/day x 3.785 L/gallons x 10^{-9} kg/μg
= 0.091 kg/day

<u>To protect against the acute effects of dissolved copper:</u>

allowable loading = dissolved acute criterion x 1Q10 flow x units conversion factor
= 6.2 μg/L x 4.8x10^6gallons/day x 3.785L/gallon x 10^{-9} kg/μg
= 0.11 kg/day

5.3 Seasonal Variation

The low flow critical conditions incorporated in this TMDL are assumed to represent the most critical design conditions and provide year-round protection of water quality. Seasonal variability in flow are addressed by expressing the TMDL as a concentration, as well as a load associated with different flows.

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 TMDLs for the listed segments through the use of the critical conditions established in Section 4.2 of this report. Through the use of low flow conditions, the lowest of available hardness values, the lowest available TSS data, and the methods used to develop the translators, the margin of safety for these TMDLs adequately accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality.

5.5 TMDL Results

The TMDL for any condition will be based on the flow of the Creek, as well as the discharge flow of a permitted discharger. The TMDL is summarized in Table 6.

Table 6. Copper TMDL Summary for Sandy Run Creek

Parameter	Criteria	WLA	LA	MOS	TMDL
Total Dissolved Copper	Chronic	ΣQ_{WLA} x 4.5 µg/L for all conditions and flows	0.091 kg/day for the 7Q10 ΣQ_{LA} x 4.5 µg/L for all conditions and flows	Implicit	0.091 kg/day + WLA for the 7Q10 Q_{total} x 4.5 µg/L for all conditions and flows
Total Dissolved Copper	Acute	ΣQ_{WLA} x 6.2 µg/L for all conditions and flows	0.11 kg/day for the 1Q10 ΣQ_{LA} x 3.64 µg/L for all conditions and flows	Implicit	0.11 kg/day + WLA for the 1Q10 Q_{total} x 6.2 µg/L for all conditions and flows
Total Recoverable Copper	Chronic	ΣQ_{WLA} x 14 µg/L for all conditions and flows	0.28 kg/day for the 7Q10 ΣQ_{LA} x 14 µg/L for all conditions and flows	Implicit	0.28 kg/day + WLA for the 7Q10 Q_{total} x 14 µg/L for all conditions and flows
Total Recoverable Copper	Acute	ΣQ_{WLA} x 19 µg/L for all conditions and flows	0.34 kg/day for the 1Q10 ΣQ_{LA} x 19 µg/L for all conditions and flows	Implicit	0.34 kg/day + WLA for the 1Q10 Q_{total} x 19 µg/L for all conditions and flows

* Based on the Draft EPA Interoffice Memorandum on "*Estimating Water Quality Loadings from MS4 Areas,*" dated 12/19/02: "If the critical period is a low flow event, the load from the MS4 does not have to be quantified and a WLA for the storm water sources is not necessary…"

ΣQ_{WLA} is the sum of all current, potential and future NPDES regulated point source discharges to the watershed, including both continuous and storm water discharges.

6.0 RECOMMENDATIONS

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. GA EPD 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 Ocmulgee River Basin along with the Oconee and Altamaha Basins were the basins of focused monitoring in 2004 and will again receive focused monitoring in 2009. Focused basin monitoring of these streams will be initiated, as appropriate, during the next monitoring cycle.

6.2 Reasonable Assurance

An allocation to a point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, GA EPD will determine whether the permitted dischargers to the listed watershed have a reasonable potential of discharging copper 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 GA EPD will use its EPA approved 2003 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

If effluent limitations are determined to be necessary for any or all of these 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 or all of these 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 Public Participation

A thirty-day public notice period was provided for this TMDL. During that time, the availability of the TMDL was publicly noticed, a copy of the TMDL was provided upon request, and the public was invited to provide comments on the TMDL. This TMDL was modified to address the comments received.

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 best management practices 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 best management practice (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 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 an 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 September 2009.

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 a 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 once EPD approves the Revised TMDL Implementation Plan.

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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