Total Maximum Daily Load

Evaluation

for

Suwannoochee Creek

in the

Suwannee River Basin

(Cadmium)

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* 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) 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 11 miles of Suwannoochee Creek, from Lees Bay to its confluence with the Suwannee River, as not supporting its designated uses for the parameter cadmium. This segment, and the 30 mile segment of Suwannoochee Creek directly upstream of this segment, are not supporting the water's designated use for dissolved oxygen. The listing of cadmium resulted from the assessment of water quality data from Suwannoochee Creek measured at the SR 94 bridge crossing near Fargo, approximately 2 miles upstream of the Suwannee River.

1.2 Watershed Description

The Suwannoochee Creek watershed is located in the Suwannee River basin in the southeastern part of the state within Clinch and Echols Counties. The watershed is part of the Okefenokee Plains of the Southern Coastal Plain Ecoregion. Suwannoochee Creek extends 52 miles upstream of the Suwannee River and flows predominantly through wetland and forested areas. There are no point source discharges of wastewater within this watershed.

The 1-day, 10-year minimum (1Q10) statistical flow value associated with Suwannoochee Creek is 0.150 cubic feet per second (cfs). In addition, the 7-day, 10-year minimum (7Q10) statistical flow value associated with Suwannoochee Creek is 0.163 cfs.

1.3 Water Quality Standard

The water use classification for Suwannoochee 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(5)(e)(ii) of Georgia's Rules and Regulations establishes criteria for metals which apply to all waters in the State. The established chronic criterion and acute criterion for dissolved cadmium are as follows:

acute criteria for dissolved cadmium = $(e^{(1.128[\ln(\text{hardness})] - 3.828)})(1.136672-[(\ln \text{hardness})(0.041838)])$ µg/l

chronic criteria for dissolved cadmium = $(e^{(0.7852[\ln(\text{hardness})] - 3.490)})(1.101672-[(\ln \text{hardness})(0.041838)])$ µg/l

The hardness used in the above equations are 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 cadmium 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 cadmium that will be protective of the dissolved cadmium chronic criterion and the total maximum daily load of total recoverable cadmium that will be protective of the dissolved cadmium acute criterion.

2.0 WATER QUALITY ASSESSMENT

Suwannoochee Creek's use support determination was made for cadmium based on two water quality samples that were measured in 1999 from Suwannoochee Creek at the SR 94 bridge crossing near Fargo, approximately 2 miles upstream of the Suwannee River.

Table 1. Cadmium Data Collected From Suwannoochee Creek

Date	Measured total recoverable cadmium concentration (ug/l)	Assumed Translator (total recoverable to dissolved)	Assumed dissolved cadmium concentration (ug/l)	Measured Total Hardness (mg/l as $CaCO_3$)	Acute criterion (ug/l)	Chronic Criterion (ug/l)
2/10/99	2.1	1	2.1	7.5	0.82	0.37
7/15/99	< 0.5	1	< 0.5	19.5	0.82	0.37

3.0 SOURCE ASSESSMENT

There are no point sources dischargers in the Suwannoochee Creek watershed.

In addition, there are no known non-point sources of cadmium within the watershed. It should be noted that between 1990 and 1991, Lee Engineering and Construction Company (LEC) conducted an operation within the Suwannoochee Creek watershed reclaiming copper and lead components from communication cable through incineration. The operation site is in the upper portion of the watershed approximately 1.5 miles west of Suwannoochee Creek near Dupont, Georgia (approximately 25 miles upstream of the impaired segment). LEC was cited by Georgia EPD for solid waste and air quality violations pertaining to lead contamination. Cadmium was measured in groundwater and soils throughout the area surrounding the site, but it was ruled out as a pollutant of concern. There are no other known potential sources of cadmium within the watershed.

4.0 TMDL DEVELOPMENT APPROACH

For TMDL purposes, 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 upstream 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.

4.1 Critical Conditions

The lack of understanding regarding the source of the cadmium makes the determination of appropriate critical conditions impossible. Until there is a better understanding of the source of cadmium, it is assumed that critical conditions occur during low flows. Therefore, the critical conditions are defined as follows:

Table 2. Critical Flow Conditions for Suwannoochee Creek

Source of Flow	Flow value (MGD / cfs)
Suwannoochee Creek (during 7Q10 conditions)	0.105 / 0.163
Suwannoochee Creek (during 1Q10 conditions)	0.097 / 0.150

Based on the available hardness data measured in Suwannoochee Creek, the hardness value used is 25 mg/l (i.e., the lowest hardness value that can be used for water quality criterion calculations). This hardness value corresponds to a dissolved cadmium chronic criterion of 0.37 ug/l and a dissolved cadmium acute criterion of 0.82 ug/l.

5.0 ALLOCATION

5.1 Total Maximum Daily Load

A TMDL is the sum of the individual WLAs for point sources and load allocations (LA) for nonpoint sources and natural background (40 CFR 130.2). The sum of these components may not result in an exceedence of water quality standards for that water body. To protect against exceedences, 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. Conceptually, a TMDL can be expressed as follows:

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

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while maintaining water quality standards. For pollutants such as metals, 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."

5.2 Waste Load Allocations

Based on the absence of any point source dischargers to this watershed, the wasteload allocation is equal to 0.0 kg/day.

5.3 Load Allocations

Based on the fact that there are no known non-point sources of cadmium which contribute to the impairment of Suwannoochee Creek, the load allocation represents the allowable dissolved cadmium loading during 1Q10 and 7Q10 flow conditions. This loading is calculated using the dissolved cadmium criteria as follows:

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

allowable loading = dissolved chronic criterion x 7Q10 flow x units conversion factor

= 0.37 ug/l x 0.105 $*10^{6}$gallons/day x $3.785*10^{-9}$ L*kg/(µg*gallons)

= 0.000147 kg/day

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

allowable loading = dissolved acute criterion x 1Q10 flow x units conversion factor

= 0.82 ug/l x 0.097 $*10^{6}$gallons/day x $3.785*10^{-9}$ L*kg/(µg*gallons)

= 0.000301 kg/day

5.4 TMDL Results

This TMDL can be summarized as follows:

Table 3. TMDL SUMMARY FOR SUWANNOOCHEE CREEK

Parameter	Criterion	WLA	LA	MOS	TMDL
Dissolved Cadmium	Chronic	0.0 kg/day	0.000147 kg/day	Implicit	0.000147 kg/day
Dissolved Cadmium	Acute	0.0 kg/day	0.000301 kg/day	Implicit	0.000301 kg/day

5.5 Seasonal Variation

The low flow critical conditions incorporated in this TMDL are assumed represent the most critical design condition and are anticipated to provide year-round protection of water quality.

5.6 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 Suwannoochee Creek through the use of critical low-flow conditions.

6.0 POINT AND NONPOINT SOURCE APPROACHES

Based on the absence of any point source dischargers within the watershed, there will be no allocation made through the NPDES permitting program. The load allocation cannot be attributed to a specific non-point source until a potential nonpoint source of cadmium has been identified.

7.0 PUBLIC PARTICIPATION

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

REFERENCES

GAEPD, *Rules and Regulations For Water Quality Control, Chapter 391-3-6, April 2000*, Georgia Department of Natural Resources, Environmental Protection Division.

Rindt-McDuff Associates, Inc. 1992. Monitoring Report: Phase 1 – Sampling Event: Surface Sample Results: performed for Lee Engineering and Construction Company, April 1992.

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USEPA. 1991. *Guidance for Water Quality –based Decisions: The TMDL Process.* U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-440/4-91-001, April 1991.

USEPA, 1998. Better Assessment Science Integrating Point and Nonpoint Sources (BASINS), Version 2.0 User's Manual, U.S. Environmental Protection Agency, Office of Water, Washington D.C.