

TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT

For Toxicity

In the

BUCK CREEK

In the Savannah River Basin

(HUC 3060109)

Screven County, Georgia



APPROVAL PAGE

for the TOXICITY TMDL for

Buck Creek in the Savannah River Basin, GA

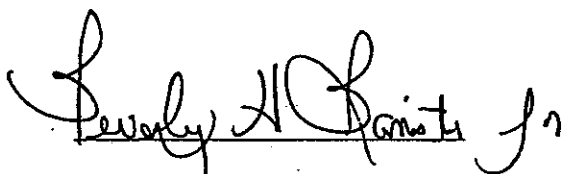
Georgia's final 1998 303(d) list identified Buck Creek as not supporting its designated use, with the parameter of concern being toxicity. This Total Maximum Daily Load (TMDL) is being established pursuant to the 1998 Georgia 303(d) list and the Consent Decree in the Georgia TMDL Lawsuit.

The Total Maximum Daily Load for Buck Creek is given below.

$$\text{TMDL} = 1.0 \text{ TU}_c$$

In order to meet this TMDL, the Sylvania Water Pollution Control Plant should not exhibit chronic toxicity greater than 1.0 TU_c .

APPROVED BY:



Robert F. McGhee, Director

Water Management Division

EPA-Region 4

3/7/00

Date

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Introduction

Section 303(d) of the Clean Water Act (CWA) as Amended by the Water Quality Act of 1987, Public Law 100-4, and the United States Environmental Protection Agency's (USEPA/EPA) Water Quality Planning and Management Regulations [Title 40 of the Code of Federal Regulation (40 CFR), Part 130] require each State to identify those waters within its boundaries not meeting water quality standards applicable to the waters' designated uses. The identified waters are prioritized based on the severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants violating or causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991a).

Problem Definition

Georgia's final 1998 Section 303(d) list identified six miles of Buck Creek, downstream of the City of Sylvania Water Pollution Control Plant (WPCP), as not supporting its designated use as a fishing water. Concentrations of cyanide and zinc in excess of the water quality standard and toxicity were identified as the criteria violated while the potential cause of impairment was identified as the municipal facility. The object of this document is to establish the toxicity TMDL for Buck Creek (HUC 03060109), Screven County, Savannah River Basin, Georgia (GA).

The TMDL is being established pursuant to EPA commitments in the October 1997 Consent Decree in the Georgia TMDL lawsuit. The TMDL will be calculated under low flow summer time conditions, which represents lowest level of available dilution, and critical condition.

Target Identification

Protection against toxic releases is called for under the CWA Section 101(a)(3), which states that “it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited.” In addition, CWA Section 303(c) requires States to develop water quality standards to protect the public health or welfare, enhance the quality of water, and serve the purposes of the CWA. In turn, water quality standards are composed of the designated use of the receiving water, water quality criteria (numeric or narrative) to protect the designated use, and an antidegradation statement.

Georgia’s narrative criterion for toxicity is established for all waters and is deemed to be necessary and applicable to all waters of the State. Georgia’s Water Quality Standard for toxicity is expressed in Georgia’s Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised July 6, 1999. Georgia regulations state that “All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.”

For an effluent dominated stream such as the water quality limited segment of Buck Creek, protection against chronic toxicity will inherently provide protection against acute toxicity. In accordance with EPA’s Technical Support Document For Water Quality-based Toxics Control (TSD), an instream chronic toxicity not exceeding 1.0 chronic toxic units (TU_c) is representative of no chronic toxic effects (USEPA, 1991b). Therefore, this TMDL is being developed such that the chronic toxicity of Buck Creek does not exceed 1.0 TU_c during critical conditions.

Background

Buck Creek originates less than one mile from the center of Sylvania, Georgia and it drains into the Savannah River approximately 8 miles downstream of Brier Creek. The Georgia Environmental Protection Division (GAEPD) has identified the impairment of Buck Creek to include the six-mile segment which flows downstream of the discharge from the City of Sylvania’s WPCP, which is the only point source discharger in the Buck Creek watershed. This facility treats both municipal and

industrial wastewater using an activated sludge system with a design capacity of 1.51 million gallons per day (MGD) or 0.06615 cubic meters per second (cms) of treated wastewater.

Buck Creek is an effluent dominated stream with an instream waste concentration (IWC) of 100 percent at critical 7-day/10-year (7Q10) low flow conditions. Whole effluent toxicity (WET) data for *Ceriodaphnia dubia* are tabulated below:

Table 1. WET Test Data

Test Date	No Observed Effect Concentration (NOEC) Effluent (%)	Type of Sample
2/92	80 %	dechlorinated samples
12/95	100 %	dechlorinated samples

Numeric Targets and Sources

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 permit limits that protect water quality during critical conditions will be protective for the large majority of environmental conditions that occur.

EPA's TSD defines the TU_c associated with an effluent discharge as being equal to 100 divided by the NOEC. For example, an effluent discharge with a No Observed Effects Concentration (NOEC) of 50% reflects a TU_c of 2.0. In addition, EPA's TSD suggests that the TU_c associated with a stream that exhibits no toxicity before it receives any wastewater is equal to zero (i.e., $TU_c = 0$). Therefore, a simple mass-balance equation reflecting critical flow conditions can be used for the TMDL development.

Critical Condition Determination

For this TMDL, an effluent discharge to a receiving stream flow of 0.0 cfs (7Q10 flow) represents critical conditions.

Total Maximum Daily Load (TMDL)

A TMDL is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels for a given watershed. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving 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(s)." 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 the toxicity TMDL for Buck Creek, the Total Maximum Daily Load is expressed in terms of chronic toxicity units (TU_{cs}).

Margin of Safety

The margin of safety (MOS) is part of the TMDL development process. There are two basic methods for incorporating the MOS (USEPA, 1991a):

1. Implicitly incorporating the MOS using conservative model assumptions to develop allocations,
or

2. Explicitly specifying a portion of the total TMDL as the MOS; using the remainder for allocations.

The MOS is incorporated implicitly into this modeling process by selecting the critical low flow.

TMDL Calculation

The TMDL calculation will utilize the conservation of mass principle, where the load can be calculated by using the following relationship:

$$\text{Concentration} = \text{Load} / \text{Flow}$$

The receiving water concentration (C_{rec}) for chronic toxicity is calculated using a mass-balance equation:

$$C_{rec} = \frac{(C_{eff} \times Q_{eff}) + (C_{bgd} \times Q_{bgd})}{Q_{eff} + Q_{bgd}}$$

Whereby:

- C_{eff} = effluent concentration in TUc
- C_{bgd} = background concentration in TUc
- Q_{eff} = effluent flowrate at design capacity in MGD
- Q_{bgd} = background flowrate during critical conditions in MGD

Knowing that C_{rec} should not exceed 1.0 TUc and that Q_{bgd} is 0.0 MGD, the equation can be restated as:

$$1.0 \text{ TUc} = \frac{C_{eff} \times 1.51 \text{ MGD}}{1.51 \text{ MGD}}$$

Therefore, C_{eff} must be 1.0 TUc in order that the receiving stream concentration does not exceed 1.0 TUc.

Table 2. TMDL Calculation

Pollutant	TMDL (TU _c)	WLA (TU _c)	LA (TU _c)	MOS
Toxicity	1.0	1.0	0.0	Implicit

Seasonal Variation

The low flow condition represents the most critical design condition and will provide year round protection.

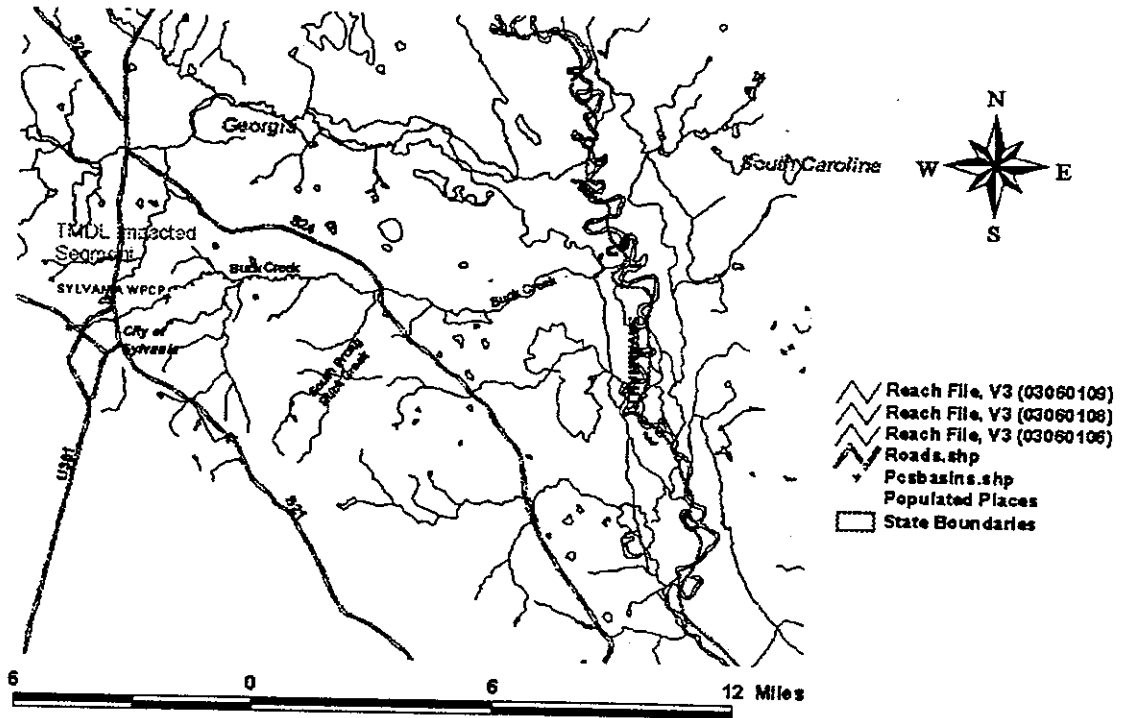
Allocation of Responsibility and Recommendations

The only source affected by this TMDL will be the City of Sylvania WPCP which is the point source of toxic effluent contributing to instream toxicity. The recommendation for TMDL implementation is a reduction in whole effluent toxicity (WET) for the City of Sylvania WPCP effluent to levels at which WET limits are protective of instream toxicity during 7Q10 low flow conditions. The WET limit to meet this objective has been determined to be 1.0 TU_c (NOEC = 100%). The NPDES permit requirements for this facility should be consistent with this TMDL and Georgia's NPDES Reasonable Potential Procedures.

An internal GAEPD memorandum dated February 13, 1991 from Mark Wolfe to Jim Chandler indicates that ammonia toxicity had been documented in the stream. However, there is no data available to determine how much of a problem this was or whether it still potentially may be a problem. Since ammonia toxicity was not and is not a 303(d)-listed parameter and was not part of GAEPD's administrative record for listing Buck Creek for toxicity, this TMDL does not specifically address ammonia toxicity. In the event that the City of Sylvania WPCP has difficulty in the future passing the WET limit of 1.0 TU_c, GAEPD should consider whether ammonia is a contributor to this problem and take appropriate action.

Appendix A – Site Map

Buck Creek TMDL Location Map



Appendix B – Units Conversion Table

From	To	Multiply by:
Million Gallons per Day (MGD)	Cubic Meters per Second (cms)	0.04381
Cubic Feet per Second (cfs)	Cubic Meters per Second (cms)	0.02832

Administrative Record Index

1. EarthJustice Legal Defense Fund. Letter from Eric E. Huber to EPA Region 4. December 7, 1999.
2. Environmental Protection Division of the Georgia Department of Natural Resources. Internal memorandum from Mark Wolfe to Jim Chandler regarding a Wasteload Allocation for the City of Sylvania. February 13, 1991.
3. Environmental Protection Division of the Georgia Department of Natural Resources. Aquatic Biomonitoring Testing Log 1992. printed on October 2, 1993.
4. Environmental Protection Division of the Georgia Department of Natural Resources. NPDES Reasonable Potential Procedures. January 1995.
5. Environmental Protection Division of the Georgia Department of Natural Resources. Final version of the 1998 §303(d) list. December 22, 1998.
6. Environmental Protection Division of the Georgia Department of Natural Resources. Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03, Water Use Classifications and Water Quality Standards. July 6, 1999.
7. Environmental Protection Division of the Georgia Department of Natural Resources. WLA Summary Form (for the City of Sylvania WPCP). March 1996.
8. Georgia Legal Watch. Letter from Douglas P. Haines to EPA Region 4. December 22, 1999.
9. Hydrologic Laboratories, Inc. Laboratory Results for City of Sylvania Wastewater Treatment Plant: Aquatic Toxicity Testing performed from December 05, 1995 to December 12, 1995. December 20, 1995.
10. Sierra Club v. EPA & Hankinson USDC-ND-GA Atlanta Div. #1: 94-CV-2501-MHS
11. USEPA. Guidance for Water Quality-based Decisions: The TMDL Process. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA-440/4-91-001. April 1991.
12. USEPA. Technical Support Document For Water Quality-based Toxics Control. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA/505/2-90-001. March 1991.
13. USEPA Region 4 Water Management Division. Proposed Total Maximum Daily Load

(TMDL) Development for Toxicity in Buck Creek. November 3, 1999.

Response to Public Comment on the Proposed TMDL

COMMENT

Commenter expects that EPA will ensure that the State makes a reduction in the Sylvania NPDES permit limit for whole effluent toxicity at the soonest practicable time and thereafter ensure that the new permit limit is met.

Mr. Eric E. Huber, EarthJustice Legal Defense Fund, 400 Magazine Street, Suite 401, New Orleans, Louisiana 70130-2453, December 7, 1999

RESPONSE

Through its oversight authority of the State's NPDES permitting program, EPA Region 4 will use best efforts to ensure that the NPDES permit issued for the Sylvania WPCP is consistent with the toxicity TMDL for Buck Creek and the State's NPDES Reasonable Potential Procedures.

COMMENT

The draft TMDL uses 7Q10 as the basis for toxicity calculations. However, it is unclear, from the Georgia toxicity criteria, if the chronic and acute criteria are to be based on this flow. The use of this flow for an implicit margin of safety is questioned, especially where the low flow is zero. While both acute and chronic criterion are given, the TMDL calculations are only done for chronic. If this also assures compliance with acute, it needs to be justified.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

The 7Q10 flow used in this TMDL is equal to 0.0 cubic feet per second (cfs). As a result, there is no dilution of the effluent during chronic toxicity testing. Based on its best professional judgement, EPA is comfortable that the use of the 7Q10 flow of 0.0 cfs in this toxicity TMDL sufficiently accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality.

The basis for the 303(d) listing of Buck Creek for toxicity was the results of chronic toxicity tests. Therefore, the TMDL was developed. The final TMDL report includes a statement that clarifies that protection of chronic toxicity in this TMDL inherently results in protection of acute toxicity.

COMMENT

It is preferable that the TMDL identify the cause of the toxicity and set the load based on the acceptable amount of the identified parameter of concern.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

Consistent with the 303(d) listing of Buck Creek for toxicity, a toxicity TMDL for Buck Creek was developed. If specific pollutants were determined to cause impairment to Buck Creek, these pollutants would need to be identified on the 303(d) list before pollutant-specific TMDLs are developed.

COMMENT

There is also a draft TMDL for this same water for cyanide and zinc. If these pollutants are related to or the cause of the toxicity, it should be mentioned in this TMDL.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

It is currently unknown how cyanide and zinc are specifically linked to the toxicity in Buck Creek. Therefore, EPA Region 4 did not attempt to speculate on the specific relationship between toxicity and zinc and cyanide.

COMMENT

The last sentence on page 2 is repeated as the first sentence on page 3.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

This redundancy has been corrected.

COMMENT

With a low flow of zero, there may be no dilution at times in the stream. The concept of using low flow as an implicit margin of safety (MOS) is inadequate. In Buck Creek, the critical flow can occur more often than once in 10 years, at which time there would be no MOS.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

By the use of a 7Q10 flow of 0.0 cubic feet per second (cfs), the TMDL requires that an undiluted effluent sample (i.e., 100% effluent) must not exhibit any observable effect on test organisms during a chronic toxicity test. The use of an undiluted effluent sample for chronic toxicity tests represents the most critical of any potential environmental conditions. As a result, this implicit margin of safety sufficiently accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality.

COMMENT

It is stated that the permit should be changed, but not when or how.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

Through its oversight authority of the State's NPDES permitting program, EPA Region 4 will use best efforts to ensure that the NPDES permit issued for the Sylvania STP is consistent with the toxicity TMDL for Buck Creek and the State's NPDES Reasonable Potential Procedures.

COMMENT

In 1991, the State documented in-stream ammonia toxicity and that should have been addressed when the last permit was issued, but the TMDL does not indicate whether the permit has ammonia limits. It is unclear why this hasn't been dealt with sooner, or how this relates to problems with cyanide and zinc.

Mr. Douglas P. Haines, Executive Director, Georgia Legal Watch, 264 North Jackson Street, Athens, Georgia 30601, December 22, 1999

RESPONSE

Since ammonia toxicity was not and is not a 303(d) listed parameter and was not part of GAEPD's administrative record for listing Buck Creek for toxicity, this TMDL does not specifically address ammonia toxicity. If data becomes available which indicates that Buck Creek is impaired for ammonia toxicity, this should be addressed through the State's 303(d) listing process.

References:

- Environmental Protection Division of the Georgia Department of Natural Resources. 1991. Internal memorandum from Mark Wolfe to Jim Chandler regarding a Wasteload Allocation for the City of Sylvania. Atlanta, Georgia. February 13, 1991.
- Environmental Protection Division of the Georgia Department of Natural Resources. 1998. Final version of the Georgia 1998 303(d) list. Atlanta, Georgia. December 22, 1998.
- Environmental Protection Division of the Georgia Department of Natural Resources. 1999. *Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03; Water Use Classifications and Water Quality Standards*, Revised July 6, 1999. Atlanta, Georgia. July 6, 1999.
- Sierra Club v. EPA & Hankinson. 1998. USDC-ND-GA Atlanta Div. #1: 94-CV-2501-MHS.
- USEPA. 1991a. 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. 1991b. Technical Support Document for Water Quality Based Toxics Control. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-505/2-90-001, March 1991.