Total Maximum Daily Load

Evaluation

for

Three Stream Segments

of the

Ocmulgee River

for

PCBs in Fish Tissue

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

January 2007

Table of Contents

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. These water bodies are considered to be water quality limited and cannot meet their designated use standards. 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 TMDL establishes the allowable loadings to the water body, thereby providing the basis for addressing the water quality impairment.

1.2 Watershed Description

On the draft 2006 303(d) list, the State of Georgia has identified the following segments in the Ocmulgee River Basin as partially supporting their designated use due to the issuance of fish consumption guidelines because of polychlorinated biphenyl (PCB) contamination (see Figure 1):

- Ocmulgee River –11 miles- from Walnut Creek to Tobesofkee Creek (Bibb County)
- Ocmulgee River – 7 miles - from Tobesofkee Creek to Echeconnee Creek (Bibb/Twiggs Counties)
- Ocmulgee River –10 miles – from Echeconnee Creek to Sandy Run Creek (Twiggs/Houston Counties)

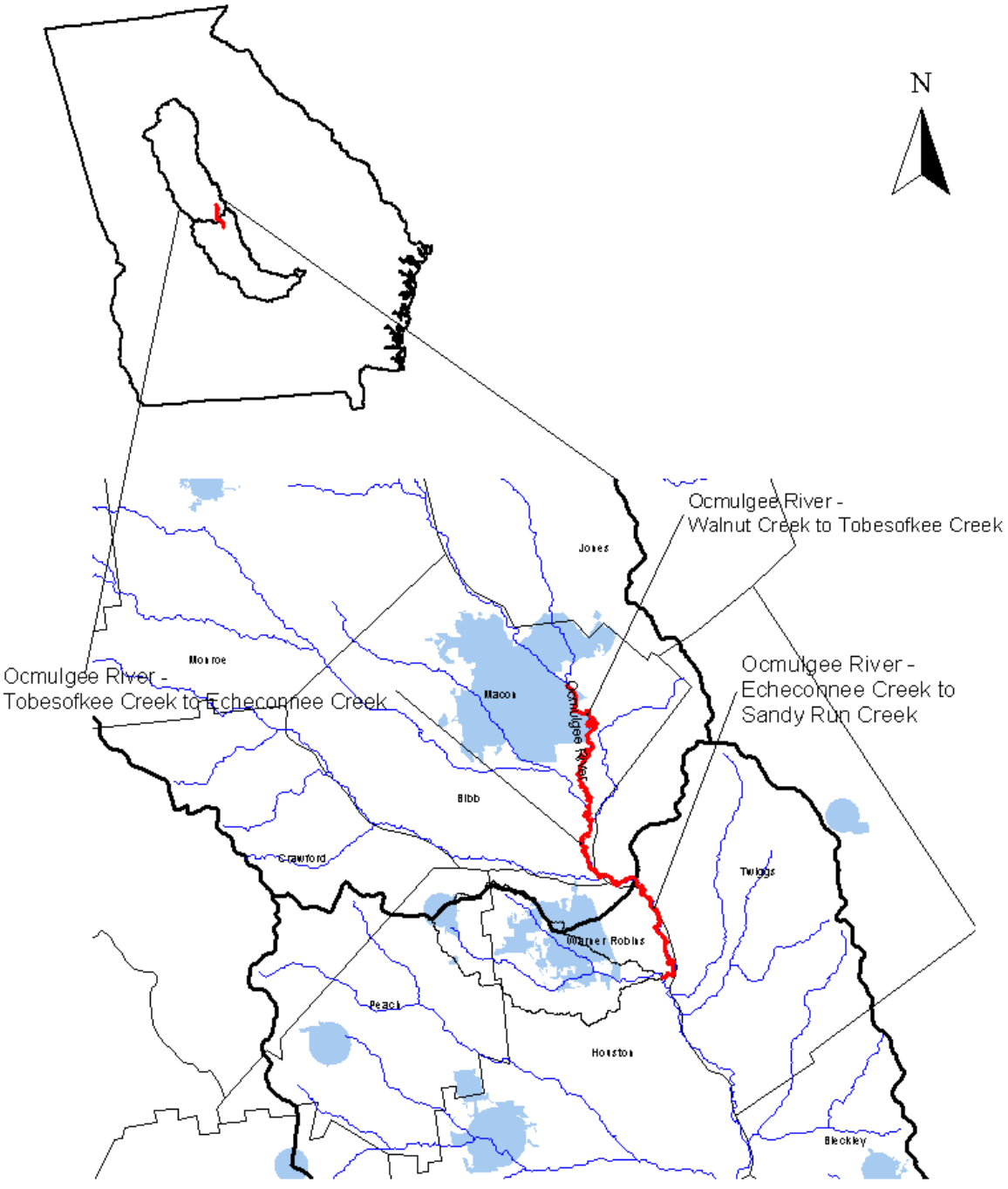
PCBs have been detected in fish tissue in the middle segment at a location approximately 6 miles below Tobesofkee Creek. Because there is a lack of specific data on the source of the contamination, the above three segments have been listed.
The watershed is highly developed and is continuing to grow.

1.3 Impacts of PCBs

The following general background on the impact of PCBs on fish consumption is taken from EPA fact sheet entitled "Fact Sheet; PCBs Update: Impact on Fish Advisories" (EPA-823-F-99-019) (EPA, 1999).

> PCBs are a group of synthetic organic chemicals that contain 209 possible individual chlorinated biphenyl compounds. These chemically related compounds are called congeners and vary in their physical and chemical properties and toxicity. There are

no known natural sources of PCBs. Although banned in the United States from



TMDL Evaluation - PCBs Ocmulgee River Basin	Figure 1. Ocmulgee River Watershed

further production in 1979, PCBs are distributed widely in the environment because of their persistence and widespread use. PCB mixtures found in the environment are different from the commercially produced PCB mixtures (known as Aroclors in the United States) because of differences in chemical properties, persistence, and bioaccumulation among the different congeners. The most common analytical method used to detect PCBs in the environment is based on Aroclor analysis; however, congener-specific methods have been developed and currently are being tested. PCB exposure is associated with a wide array of adverse health effects in experimental animals. Experimental animal studies have shown toxic effects to the liver, gastrointestinal system, blood, skin, endocrine system, immune system, nervous system, and reproductive system. In addition, developmental effects and liver cancer have been reported. Skin rashes and a severe form of acne have been documented in humans; however, other effects of PCB exposure in humans are not well understood. EPA has classified PCBs as probable human carcinogens (Group B2). As of 1998, 37 states have issued 679 fish advisories for PCBs. These advisories inform the public that high concentrations of PCBs have been found in local fish at levels of public health concern. State advisories recommend either limiting or avoiding consumption of certain fish from specific waterbodies or, in some cases, from specific waterbody types (e.g., all freshwater lakes or rivers).

1.4 Water Quality Standard

The water use classification for the listed segments of the Ocmulgee River 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."

Georgia's in-stream criterion for polychlorinated biphenyls (PCBs) 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 PCBs is expressed in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised November 2005. Georgia Regulation 391-3-6-.03(5)(e)(iv) states that "Instream concentrations of the following chemical constituents listed by the U. S. Environmental Protection Agency as toxic priority pollutants pursuant to Section 307(a)(1) of the Federal Clean Water Act (as amended) shall not exceed criteria indicated below under annual average or higher stream flow conditions". The State water quality in-stream target of 0.00017μg/L is protective of the DNR fish consumption advisory action level of 0.1mg/kg as well as the FDA action level for fish consumption 2.0mg/kg.

2.0 AVAILABLE MONITORING DATA

Fish tissue analyzed in 1991and 1999 triggered fish consumption guidelines in the Ocmulgee River. In the 2006 Guidelines for Eating Fish from Georgia's Waters (Georgia Department of Natural Resources, 2006), there is only one location on the Ocmulgee River with a fish advisory for PCBs. The site tested is 6 miles downstream of Tobesofkee Creek in Bibb County. The only species with a recommendation for restricted consumption based on PCBs is Flathead Catfish. Largemouth Bass and Channel Catfish were also tested at this site but did not result in restrictions based on PCBs.

The recommendation is to limit consumption of Flathead Catfish to one meal per month. The fish tissue data that was used for that listing was collected in 1991 and 1999 and the average PCB concentration of the 2 composites collected in 1999 was 0.26 mg/kg. This value will be used in the TMDL development.

3.0 SOURCE ASSESSMENT

A source assessment characterizes the known and suspected sources of PCB in the watershed for use in a water quality model and the development of the TMDL. The sources of PCB in this watershed are unknown, but may be either from point sources or nonpoint sources. Both will be addressed in this TMDL.

PCBs are priority toxic pollutants and their use and discharge is not permitted in any of the listed segments. There are no permitted point source dischargers with existing allocation for PCBs.

PCB contamination in the listed segments has been attributed to contamination from urban runoff from Metropolitan Macon. Other possible sources could include movement of contaminated bedload sediment, soil erosion, air deposition, and other nonpoint source discharges.

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.

Georgia has a human health based water quality standard for PCB, which is based on the average stream flow. This standard if met, should protect against contaminated fish tissue. This standard is several orders of magnitude less than the detection limit. A mass balance equation is used in Section 5 to calculate the TMDL. The TMDL for the Ocmulgee River equals the annual average flow times the water quality standard. The load for any specific day would be calculated based on a ratio of that days flow to the annual average flow times the TMDL.

Water column PCB concentration data does not exist or is not measurable because it is below the detection limit. However, the fish tissue concentration is known and there is a published bioaccumulation factor for PCBs in fish tissue (EPA 4440/5-80-068, October 1980). The water column concentration that resulted in the fish tissue contamination can be estimated using the equation shown below.

$$WC = TC/BCF$$

Where: WC = Water column concentration (mg/L)
TC= Fish tissue concentration (mg/kg)
BCF = EPA bioaccumulation factor (31,200 L/kg)

$$WC = (0.26 \text{ mg/kg}) / (31{,}200 \text{ L/kg})$$
$$WC = 8.3 \times 10^{-3} \mu g/L$$

This calculated concentration is used to calculate an estimated current load. The calculated load is compared to the TMDL to determine the percent reduction required.

5.0 ALLOCATION

A TMDL is the sum of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) 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."

5.1 Waste Load Allocations

There are no permitted point source dischargers with existing allocation for PCBs. Thus, the WLA is essentially zero pounds per day. There are however, several point sources, as well as permitted stormwater discharges in this watershed. It is known that wastewaters can contain trace levels of chemicals, including PCBs. However, the current detection limit for PCBs is below the current water quality standard. There may come a time when PCBs in a discharges or stormwater can be measured.

If individual WLAs for PCBs are needed for specific permits, they can be calculated by multiplying the design flows (Q in table1) by the human health criteria of 0.00017μg/L.

5.2 Load Allocations

The nonpoint sources are diffuse and can include air deposition, stormwater runoff, movement from sediment bedload into the water column, and decaying aquatic organisms. These mechanisms are very complicated and difficult to quantify.

Nonpoint source should be at concentrations equivalent to or less than the water quality standard for PCBs. Thus, the LA allows for no loads that cause or contribute to an in-stream mixed water column PCBs concentration above 0.00017 μg/l.

5.3 Seasonal Variation

Seasonal variation is not applicable to this TMDL because there is no known point or nonpoint sources. The water quality standard is based on human health guidelines and is targeted to be met at flows greater than or equal to the annual average flow. PCBs will accumulate in fish tissue throughout the year. The mechanism causing higher concentration of a pollutant in the water column during low flows, could be offset by the suspension of particles during heavy flows and rain.

5.4 Margin of Safety

Water column data for PCBs does not exist or has not been detected in the Ocmulgee River. The State was very conservative in listing all segments upstream of the points listed in Georgia's *Guidelines for Eating Fish from Georgia Waters* all the way up to Macon. It is also very conservative to develop a TMDL based on fish tissue concentration of 0.26 mg/kg, which is far below the FDA action level of 2.0 mg/kg. This TMDL will use this conservative assumption that the water column throughout all listed segments has no assimilative capacity for PCB loadings at concentrations above the water quality standard of 0.00017 μg/L.

5.5 TMDL Results

The TMDL for the Ocmulgee River equals the annual average flow near Macon (approximately 2700 cfs) times the water quality standard (0.00017 mg/L). This TMDL can be summarized in Table 1 as follows:

Table 1. TMDL Allocation

Parameter	WLA	LA	MOS	TMDL
PCBs	Σ(Q*0.00017 μg/L)	$1.1x10^{-3}$ kg/day - Σ(Q*0.00017 μg/L)	Implicit	$1.1x10^{-3}$ kg/day

5.6 Load Reduction

The average fathead catfish fish tissue concentration in 1999 was 0.26 mg/kg. Georgia's fish consumption guidelines are triggered at concentrations above 0.1 mg/kg. Therefore a reduction of at least 62% in the tissue concentration is required. Based on the EPA published bioaccumulation factor, this can be accomplished at water concentrations less than 0.0032 μg/L. If all point and non-point sources are reduced to meet the TMDL, which is based on the human health criteria of 0.00017 μg/L, the fish tissue concentrations are expected to decline over time. This will result in the removal of the fish consumption guideline, and the attainment of the fishing classification for PCBs.

6.0 RECOMMENDATIONS

6.1 Monitoring

The State should continue with its monitoring program of fish tissue in Georgia's waters. Atmospheric sources of PCBs are still being studied and quantified. Hazardous waste incinerators are suspected of being some of the larger sources of atmospheric PCBs on a national level.

As detection limits for PCBs in the water column become smaller, laboratory analysis of point and nonpoint source loads should be conducted in those cases where reasonable potential and best management practices do not achieve the final TMDL.

6.2 Reasonable Assurance

An allocation to an individual point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, Georgia will determine whether each of the permitted dischargers to the Ocmulgee River watershed has a reasonable potential of discharging PCB 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 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 be included in the permit.

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		_							
	4. Operation and Maintenance-									

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

REFERENCES

EPA, 1999. *Fact Sheet: Polychlorinated Biphenyls (PCBs) Update: Impact on Fish Advisories.* USEPA Office of Water, September 1999. EPA-823-F-99-019.

GAEPD, 2000-2001. Water Quality in Georgia, (2000-2001), Georgia Department of Natural Resources, Environmental Protection Division.

Georgia Department of Natural Resources, 2006. *Guidelines for Eating Fish from Georgia Waters - 2006 Update.*

GAEPD, *Rules and Regulations For Water Quality Control, Chapter 391-3-6, November 2005*, Georgia Department of Natural Resources, Environmental Protection Division.

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.

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, 1980. 440/5-80-068, October 1980.