TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Total Mercury in Fish Tissue Residue

In

Lake Oconee

EPA United States Environmental Protection Agency

Region 4 serving the southeast

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In the

In the Lake Oconee Watershed

Under the authority of Section 303(d) of the Clean Water Act, 33 U.S.C. 1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the U.S. Environmental Protection Agency is hereby establishing a TMDL for total mercury for the protection of public health associated with the consumption of fish taken from Lake Oconee in Georgia.

The calculated allowable load of mercury that may come into the identified segments of the Lake Oconee without exceeding the applicable water quality standard is 2.70 kilograms per year. The applicable water quality standard is the State of Georgia's numeric interpretation of their narrative water quality standard for protection of human health from toxic substances. This interpretation indicates that the consumption of fish by the general population is not to exceed 0.3 mg/kg mercury in fish tissue.

This TMDL shall become effective immediately, and is incorporated into the Continuing Planning Process for the State of Georgia under Sections 303(d)(2) and 303(e) of the Clean Water Act.

Signed this _____ day of_____, 2002.

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Beverly H. Banister, Director
Water Management Division

1. Introduction

The U.S. Environmental Protection Agency (EPA) Region 4 is establishing this Total Maximum Daily Load (TMDL) for total mercury for Lake Oconee, Georgia. Lake Oconee is included on the State of Georgia's 2000 Section 303(d) list of impaired waters because mercury in certain species of fish tissue exceeds the Georgia Department of Natural Resources (GDNR) Fish Consumption Guidelines. GDNR's Fish Consumption Guidelines are established using a "risked-based" approach based on conservative assumptions to determine whether an advisory is issued for a particular fish species in a particular waterbody. For the current Section 303(d) list, the State included waters where the fish consumption guideline value was exceeded.

The State of Georgia recently provided a letter to EPA in July 2001, which provides a numeric interpretation of the Georgia narrative water quality standard for mercury (GAEPD, 2001). The numeric interpretation states that fish tissue is not to exceed 0.3 mg/kg, is consistent with EPA's recently adopted guidance value for Methylmercury (USEPA, 2000). The same letter also provides a State methodology for determining when a waterbody is impaired and is to be listed on the State's future Section 303(d) lists, as well as a methodology for calculating the site-specific allowable water column concentration to protect the general population from the accumulation of mercury in fish tissue. Using the State's methodology provided in the July 2001 letter, and EPA's recently collected site-specific data for mercury for Lake Oconee, indicated that Lake Oconee is attaining the applicable water quality standard for mercury and a TMDL is not needed. However, the Consent Decree in the case of Sierra Club v. EPA, 1:94-cv-2501-MHS (N.D. Ga.) requires the State or EPA to develop TMDLs for all waterbodies on the State of Georgia's current 303(d) list. Since Lake Oconee is on the current Section 303(d) list, EPA is establishing this TMDL.

As described above, the State of Georgia has recently interpreted its narrative water quality standard for mercury in a manner that is consistent with EPA's recently adopted criterion document for residual mercury in fish tissue. Using the State's methodology and the data recently collected by Region 4, it appears that Lake Oconee is attaining the applicable water quality standard for mercury.

Georgia submitted a supplement to its 2000 303(d) List to EPA for review on June 8, 2001. This supplement, approved by EPA in June 2001, was meant to update the State's List for the Oconee, Ocmulgee and Altamaha River Basins based on the State's most recent water quality monitoring data. However, the EPA data and the State's recent interpretation of its narrative standard for mercury were not available for consideration before the State's supplemental list was submitted and approved. Therefore, Lake Oconee remains on the Section 303(d) list despite evidence that it is attaining the applicable water quality standard for mercury.

The Consent Decree in the case of Sierra Club v. EPA, 1:94-cv-2501-MHS (N.D. Ga.) requires the State or EPA to develop TMDLs for all waterbodies on the State of Georgia's current 303(d) list. Since Lake Oconee remains on the State's current 303(d) List, EPA is establishing this TMDL despite the recent data and information demonstrating that the water

is currently attaining the applicable water quality standard for mercury. In the absence of the Consent Decree, EPA would not establish this TMDL because the water no longer needs the TMDL.

TMDLs are required for waters on a state's Section 303(d) list by Section 303(d) of the Clean Water Act (CWA) and the associated regulations at 40 CFR Part 130. A TMDL establishes the maximum amount of a pollutant a waterbody can assimilate without exceeding the applicable water quality standard. The TMDL allocates the total allowable pollutant load to wasteload allocations (WLAs) for point sources regulated by the National Pollutant Discharge Elimination System (NPDES) program and to load allocations (LAs) for all other sources. The WLAs and LAs in the TMDL provide a basis for states to limit the amount of pollution from both point and nonpoint sources to restore or protect the waterbody from exceeding the applicable water quality standard. This TMDL will provide the maximum annual average load of mercury that can enter Lake Oconee without exceeding the applicable water quality standard. An allocation of the maximum annual average load will be provided to both point sources and to nonpoint sources, primarily air deposition. Because of the significant uncertainties associated with the attainable reduction of the nonpoint source loading of mercury (i.e., atmospheric deposition) and the persistent bioaccumlative nature of mercury, this TMDL will establish that current NPDES permitted discharges be held at their current loading of mercury.

2. Problem Definition

Lake Oconee is on the State of Georgia's 2000 Section 303(d) list. Lake Oconee was listed because mercury in the tissue of largemouth bass above 16 inches exceeded the Fish Consumption Guidelines (FCG) established by the State of Georgia. (See Georgia Department of Natural Resources, 2000.) The Fish Consumption Guidelines establish limits on the amount of fish that should be consumed over a given time frame (a week or a month) in order to protect human health.

The Georgia Department of Natural Resources (DNR) uses a risk-based approach to determine how often contaminated fish may be consumed at different levels of fish tissue contamination assuming a consumption rate of approximately 32.5 grams per day. Table 1 provides the frequency of consumption for three different levels of fish tissue contaminated with mercury.

Table 1 Georgia Department of Natural Resources Fish Consumption Guideline

Mercury Fish Tissue Threshold (mg/kg)	Frequency of Consumption
0.23	Once a Week
0.70	Once a Month
2.3	Do Not Eat

If fish tissue contains 0.23 mg/kg (parts per million) or more mercury, the State's FCG

indicates that the fish should not be consumed more than once a week. If fish tissue contains 0.70 mg/kg (parts per million) or more mercury, the State's FCG indicates the fish should not be consumed more than once a month, and if the fish tissue contains 2.30 mg/kg (parts per million) or greater of mercury, the State issues a "Do Not Eat" guideline. The following FCG are in place for Lake Oconee: largemouth bass over 16 inches – no more than one meal per week.

EPA's guidance allows States to develop fish consumption advisories that are more stringent than applicable water quality standards to be more protective of human health. The methodology used by the State of Georgia in the development of the fish consumption guidelines targets species specific and size of fish, and uses a conservative risked based approach in determining whether consumption guidance is warranted for a particular waterbody. EPA believes that State of Georgia should continue to develop its consumption guidelines in the same manner, and inform the public of the potential risks in eating certain size and species of fish.

3. Applicable Water Quality Standard

TMDLs are established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards. (See 40 CFR Section 130.7(c)(1)). The State of Georgia's Rules and Regulations for Water Quality Control do not include a numerical water quality standard for human health for methyl mercury. The only mercury criterion provided in the State of Georgia's regulations are 12 ng/l total mercury for protection of aquatic life. EPA recognizes that the derivation of a human health criterion for mercury is more complex than most metals because of the methylation of mercury that occurs in the aquatic environment (See Ambient Water Quality Criteria for Mercury Document, EPA, 1986). Like the current criteria guidance, the 1986 criterion document recommends that fish tissue be analyzed to determine whether the concentration of methylmercury exceeds the level necessary to protect human health. The document acknowledges that a 12 ng/l aquatic life criterion, while protecting the health of the fish themselves, may not prevent the unacceptable bioaccumulation of mercury in fish tissue, which would adversely affect the health of humans consuming the fish.

EPA collected site-specific data on ambient mercury in the water column and fish tissue from Lake Oconee in March/April 2001, at 7 locations in each of the major arms, middle and dam pools of Lake Oconee. Total mercury concentrations in the water ranged from 2.3 ng/l to 5.2 ng/l. These concentrations of mercury are well below the State's 12 ng/l aquatic life criterion.

The State of Georgia has recently informed EPA that the State will interpret its narrative standard for total mercury through application of EPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (EPA 2000) (referred to as EPA's Human Health Methodology) and the Water Quality Criterion for the Protection of Human Health: Methylmercury (EPA 2001) (referred to as EPA's Methylmercury Criteria). EPA has, therefore, applied this approach to derive the applicable water quality standard for this

TMDL. This methodology will also be the method that GAEPD uses to assess whether a waterbody should be placed on future 303(d) lists due to excessive mercury concentrations in fish tissue.

Using EPA's Human Health Methodology and Methylmercury Criteria, EPA determined that a 0.3 mg/kg fish tissue residue value will protect the general population from the adverse health effects of mercury due to the consumption of freshwater fish. Georgia's interpretation of its narrative leads to a water quality standards calculation that protects the general population that consumes 17.5 grams per day consisting of 9.9 grams per day of trophic level 3 fish e.g., catfish and sunfish, and 7.6 grams per day of trophic level 4 fish e.g., Largemouth bass. Which is equivalent to 41.6% of fish from trophic level 4 fish and 58.4% from trophic level 3 (Equation 3-1). EPA is using 0.3 mg/kg in fish tissue as the appropriate "end point" upon which to base the interpretation of the applicable water quality standard. To determine whether a waterbody should be placed on the 303(d) list the calculation would yield a trophic level weighted fish tissue concentration greater than the 0.3 mg/kg.

Equation 3-1 Weight Fish Tissue Calculation to Determine Impairment

$$Weighted\ Fish\ Tissue\ Concentration = (Avg\ Trophic\ 4\ Conc.* 41.6\%) + (Avg\ Trophic\ 3* 58.4\%)$$

where:

Avg. Trophic 4 Concentration = 0.1 mg/kg

Avg. Trophic Level 3 Concentration = 0.0 mg/kg

Application of this calculation to the fish collected in Lake Oconee yields a weighted fish tissue concentration of 0.1 mg/kg, which is considerably less than the 0.3 mg/kg needed to demonstrate the water quality standard is being exceeded.

To calculate the maximum water column concentration that will not allow mercury to bioaccumulate in fish tissue to above 0.3 mg/kg, the EPA Human Health Methodology and Methylmercury Criteria were is again applied. The methodologies are expressed below (Equation 3-2):

Equation 3-2 Water Quality Standard Calculation

$$WQS = \frac{((ReferenceDose - RSC) * BodyWeight * UnitsConversion)}{(ConsumptionRate * Weighted\ BAF * FractionMeHg)}$$

where:

Calculated WQS = 17.8 ng/l; State's aquatic life criterion = 12 ng/l
Reference Dose = 0.0001 mg/kg/day MeHg
RSC = 0.000027mg/kg/day MeHg (Relative Source Contribution from Saltwater Species)
Body Weight = 70 kg
Units Conversion = 1.0E6
Consumption Rate = 0.0175 kg/day Fish
Weighted Bioaccumulation Factor = 1,710,972

Fraction of the Total Mercury as Methylmercury = 0.01 as measured

In the calculation, EPA used the recommended national values for the factors in the Human Health Methodology, including the reference dose of 0.0001-mg/k/day methylmercury; a standard average adult body weight of 70 kg; and the consumption rate for the general population of 17.5 grams per day. (Note that a recent report by the National Academy of Sciences confirms that methylmercury is a potent toxin, and concludes that EPA's reference dose of 0.0001 mg/kg/day is appropriate (See NAS, Toxicological Effects of Methylmercury, July 2000)). For the other factors in the calculation, bioaccumulation and fraction methylmercury, EPA collected site-specific data from the Lake Oconee sampling effort (See Section 4.2.) From this site-specific data, EPA determined a representative "weighted" bioaccumlation factor (BAF). This Weighted BAF value was calculated by taking the average calculated BAF from each of the two trophic levels to determine a weighted BAF based upon the different consumption rates for trophic levels and a measured fraction methylmercury of 0.01. Using the procedures outlined in Georgia's interpretation of its narrative, as represented in the equation above, the calculated applicable water quality standard for total mercury in the ambient water of the Lake Oconee is 17.8 (parts per trillion), however, for this TMDL, EPA will use the State's more stringent aquatic life criterion of 12 ng/l.

4. Background

Lake Oconee is located in north/central Georgia (USGS Hydrologic Unit Code (HUC) 3070101). Lake Oconee is presented in Figure 1.

Figure 1 Map of Lake Oconee

4.1. Source Assessment

A TMDL evaluation examines the known potential sources of the pollutant in the watershed, including point sources, nonpoint sources, and background levels. There are no NPDES permitted facilities that discharge directly to Lake Oconee.

4.2. Available Monitoring Data

EPA Region 4 sampled Lake Oconee in April and May of 2001. Since even low concentrations of mercury in water can lead to significant accumulation of mercury in fish tissue, EPA sampled Lake Oconee using the most sensitive sampling and analytical techniques. The samples were collected using the "clean hands" method (EPA, November 2000), and analyzed using the ultra-trace level analytical technique, EPA Method 1631 (USEPA, 1999). EPA adopted this method in June of 1999 for mercury in water for data gathering and compliance monitoring under the Clean Water Act and Safe Drinking Water Act. This method can reliably measure mercury to 0.5 ng/l (parts per trillion).

The purpose of this data collection effort was to collect data needed for the development of this mercury TMDL and determining use support. The sample locations for the water column are illustrated in

Figure 2 and Figure 3. Water column, sediment and soil samples (taken adjacent to the water column samples outside the flood plain) were taken from 7 locations in Lake Oconee.

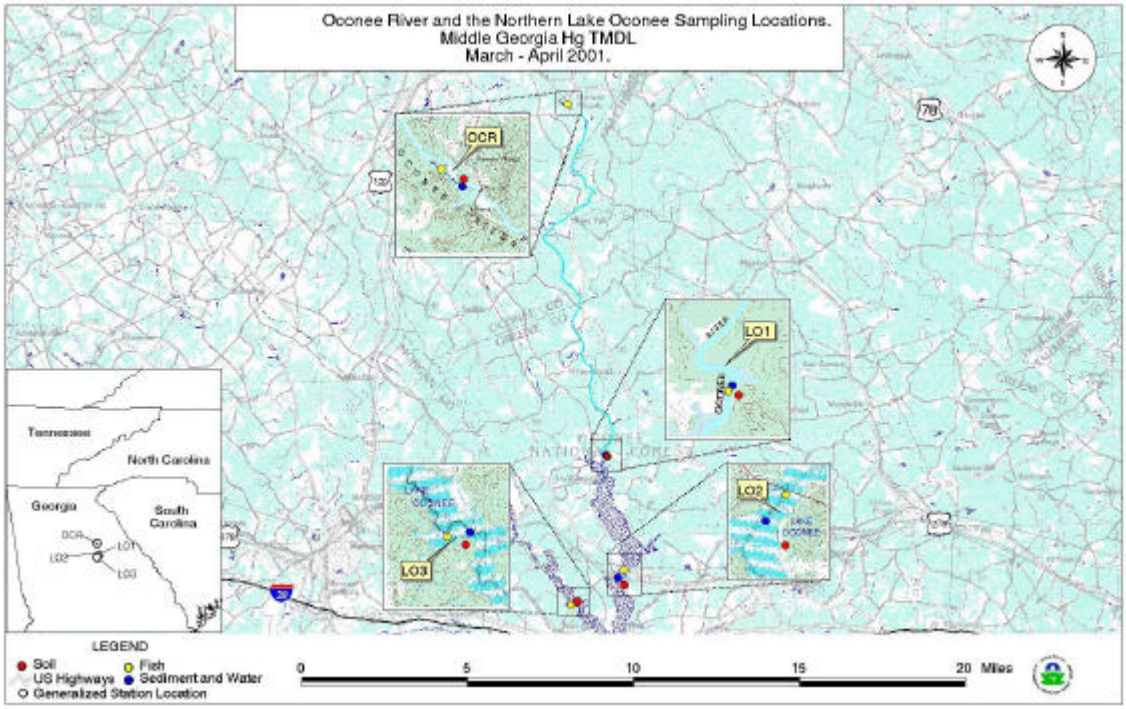

Figure 2 Lake Oconee (North) Sampling Station Locations

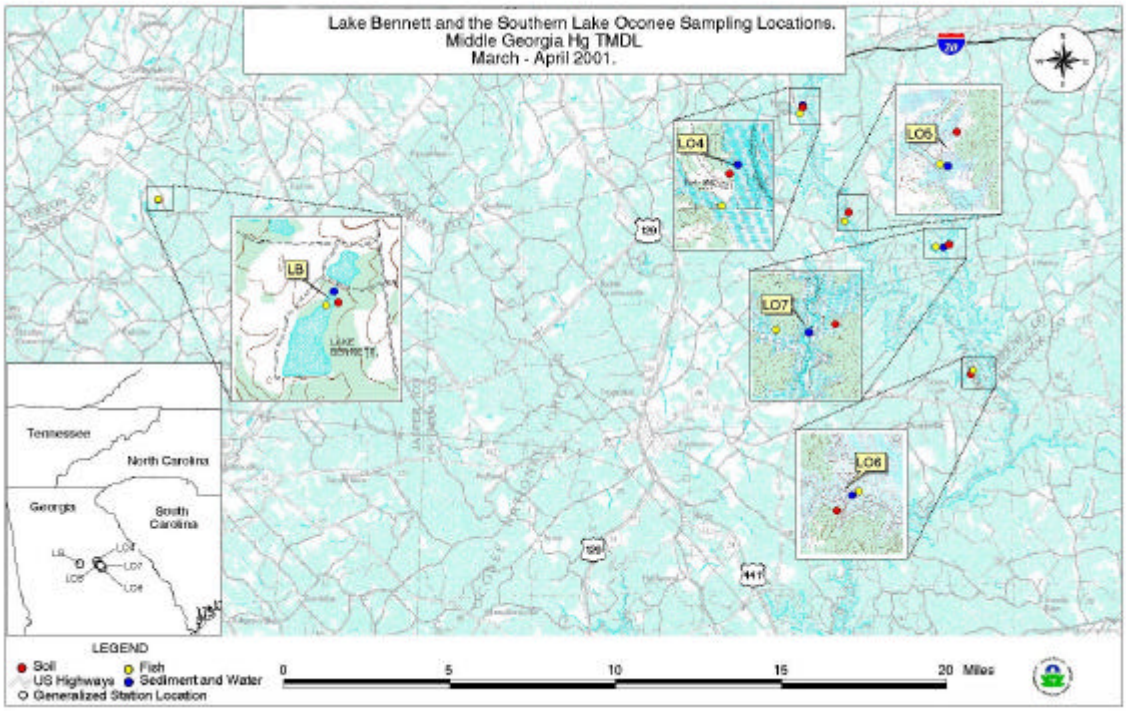

Figure 3 Lake Oconee (South) Sampling Station Locations

Sample locations for the fish collection are illustrated in

Figure 2 and Figure 3.

The 7 collection sites are located throughout the main arms, the middle and dam pool areas of Lake Oconee. The fish collection consisted of approximately 10 fish per sampling location, 5 - trophic level 3 fish (sunfish, catfish, etc.) and 5 - trophic level 4 (largemouth bass, bowfin).

The following sections provide the results of the field sampling for mercury.

4.2.1. Water Column Data

Water column samples were taken to determine the ambient concentration of mercury in the water column using Method 1631, an ultra-trace level clean sampling and analytical technique with a quantification level of 0.5 ng/l. The water column samples were analyzed for both total mercury and methylmercury. Because methylmercury is the primary form of mercury taken up in the food chain, it was important to quantify the fraction of the total mercury in the methyl form. Table 2 provides the measured mercury concentrations in the water column of Lake Oconee.

Table 2 Water Column Mercury Concentrations

Station	Waterbody	Mercury, Total (THg, ng/L)	Mercury, Methyl (MeHg, ng/L)	Fraction MeHg
LO1-1	Lake Oconee	2.34	0.03	0.01
LO1-2	Lake Oconee	2.29	NA	
LO2	Lake Oconee	4.41	0.02	0.00
LO3-1	Lake Oconee	3.69	0.07	0.02
LO3-2	Lake Oconee	3.65	NA	
LO4	Lake Oconee	2.38	0.02	0.01
LO5	Lake Oconee	5.23	0.05	0.01
LO5D	Lake Oconee	5.18	0.06	0.01
LO6	Lake Oconee	3.09	0.02	0.01
LO7	Lake Oconee	2.85	0.02	0.01

4.2.2. Sediment/Soil Data

Samples of river and tributary sediments were gathered at the same locations as the water samples to determine the amount of mercury associated with the sediments and porewater. This data provides important information that can be used to parameterize the water quality model by providing evidence of the effects of mercury in the sediments on the total mercury water column concentration. Soil samples were collected from the surrounding watershed where the other samples were taken. EPA collected the soil samples to be used in the calibration of the watershed model. Table 3 provides the mercury concentrations associated with soils collected during the summer of 2001.

Table 3 Sediment/Soil Mercury Concentrations

		Total Mercury		Methyl Mercury	
Station	Waterbody	Sediment	Surface Soil	Sediment	Surface Soil
L01	Lake Oconee	0.0831	0.0674	0.452	0.141
L02	Lake Oconee	0.0318	0.0301	0.143	0.159
L03	Lake Oconee	0.0635	0.0543	0.159	0.129
L04	Lake Oconee	0.0153	0.0994	0.0288	0.0825
L05	Lake Oconee	0.00085U	0.0318	0.0051	0.0164
L05D	Lake Oconee	0.00086U	0.0316	0.00802	0.0547
L06	Lake Oconee	0.0742	0.086	0.115	0.512
L07-1	Lake Oconee	0.0377	0.074	0.123	0.0863
L07-2	Lake Oconee	0.0389	NA	NA	NA

4.2.3. Fish Tissue Data

Samples of fish were taken from Lake Oconee (from the arms, mid lake stations and dam pool) within the same area as the water column and sediment samples. Trophic level three (sunfish, catfish) and four fish (largemouth bass) were targeted in the collection because they represent the fish that are caught and kept by anglers and consumed as a source of food. The fish filets obtained during EPA's sampling effort were analyzed for total mercury. Table 4 provides the individual fish data.

Table 4 Fish Tissue Mercury Data

Station	Waterbody	Trophic Level	Species	Total Length (mm)	Whole Wt (gm)	Filet Wt (gm)	Total Hg, (mg/kg) Wet Weight
LO1	Lake Oconee	3	Bluegill	182	124	45	0.04
LO1	Lake Oconee	3	Bluegill	161	73	26	0.04
LO1	Lake Oconee	3	Bluegill	134	42	16	0.05
LO1	Lake Oconee	3	Bluegill	184	124	48	0.04
LO1	Lake Oconee	3	Bluegill	180	109	41	0.04
LO1	Lake Oconee	3	Black Crappie	205	111	43	0.03
LO2	Lake Oconee	3	Bluegill	151	58	23	0.03
LO2	Lake Oconee	3	Bluegill	157	66	25	0.03
LO2	Lake Oconee	3	Bluegill	182	97	34	0.04
LO2	Lake Oconee	3	Black Crappie	346	740	303	0.05
LO2	Lake Oconee	3	Redbreast Sunfish	162	64	25	0.03
LO3	Lake Oconee	3	Brown Bullhead	455	770	285	0.07
LO3	Lake Oconee	3	Black Crappie	319	498	206	0.04
LO3	Lake Oconee	3	Black Crappie	295	397	156	0.05
LO3	Lake Oconee	3	Bluegill	151	50	18	0.05

Station	Waterbody	Trophic Level	Species	Total Length (mm)	Whole Wt (gm)	Filet Wt (gm)	Total Hg, (mg/kg) Wet Weight
LO3	Lake Oconee	3	Redear Sunfish	168	84	33	0.03
LO4	Lake Oconee	3	Brown Bullhead	425	754	182	0.08
LO4	Lake Oconee	3	Brown Bullhead	482	1084	211	0.07
LO4	Lake Oconee	3	Brown Bullhead	460	884	165	0.08
LO4	Lake Oconee	3	Bluegill	139	50	18	0.05
LO4	Lake Oconee	3	Redbreast Sunfish	148	46	17	0.04
LO5	Lake Oconee	3	Redbreast Sunfish	163	65	23	0.06
LO5	Lake Oconee	3	Brown Bullhead	395	593	144	0.11
LO6	Lake Oconee	3	Black Crappie	283	275	119	0.03
LO6	Lake Oconee	3	Black Crappie	243	223	100	0.03
LO6	Lake Oconee	3	Bluegill	128	28	9	0.05
LO6	Lake Oconee	3	Bluegill	132	29	9	0.10
LO6	Lake Oconee	3	Redear Sunfish	144	44	19	0.03
LO7	Lake Oconee	3	Bluegill	165	78	26	0.07
LO7	Lake Oconee	3	Bluegill	152	64	20	0.06
LO7	Lake Oconee	3	Black Crappie	300	419	173	0.03
LO7	Lake Oconee	3	Black Crappie	289	399	149	0.06
LO7	Lake Oconee	3	Black Crappie	242	208	96	0.03
LO1	Lake Oconee	4	Largemouth Bass	345	571	211	0.08
LO1	Lake Oconee	4	Largemouth Bass	282	306	116	0.04
LO2	Lake Oconee	4	Largemouth Bass				0.07
LO2	Lake Oconee	4	Largemouth Bass	447	1302	509	0.07
LO2	Lake Oconee	4	Largemouth Bass				0.07
LO2	Lake Oconee	4	Largemouth Bass				0.06
LO2	Lake Oconee	4	Largemouth Bass	338	531	223	0.06
LO2	Lake Oconee	4	Largemouth Bass	383	917	389	0.04
LO2	Lake Oconee	4	Largemouth Bass	311	410	183	0.05
LO2	Lake Oconee	4	Stripped Bass	358	543	221	0.06
LO3	Lake Oconee	4	Largemouth Bass	554	2600	955	0.31
LO3	Lake Oconee	4	Largemouth Bass				0.32
LO3	Lake Oconee	4	Largemouth Bass				0.28
LO3	Lake Oconee	4	Largemouth Bass	453	1260	453	0.12
LO3	Lake Oconee	4	Largemouth Bass	387	935	411	0.06
LO3	Lake Oconee	4	Largemouth Bass	335	486	203	0.09
LO3	Lake Oconee	4	Largemouth Bass	332	470	176	0.08
LO4	Lake Oconee	4	Largemouth Bass	425	1101	400	0.14
LO4	Lake Oconee	4	Largemouth Bass				0.14
LO4	Lake Oconee	4	Largemouth Bass	365	747	319	0.08
LO4	Lake Oconee	4	Largemouth Bass	345	559	235	0.05

Station	Waterbody	Trophic Level	Species	Total Length (mm)	Whole Wt (gm)	Filet Wt (gm)	Total Hg, (mg/kg) Wet Weight
LO4	Lake Oconee	4	Largemouth Bass	337	555	238	0.05
LO4	Lake Oconee	4	Largemouth Bass				0.03
LO4	Lake Oconee	4	Largemouth Bass	232	133	55	0.03
LO5	Lake Oconee	4	Largemouth Bass	381	928	391	0.08
LO5	Lake Oconee	4	Largemouth Bass				0.07
LO5	Lake Oconee	4	Largemouth Bass				0.06
LO5	Lake Oconee	4	Largemouth Bass	395	964	406	0.05
LO5	Lake Oconee	4	Largemouth Bass	349	539	231	0.07
LO5	Lake Oconee	4	Largemouth Bass	307	343	144	0.04
LO5	Lake Oconee	4	Largemouth Bass	440	1311	471	0.16
LO6	Lake Oconee	4	Largemouth Bass	342	783	317	0.07
LO6	Lake Oconee	4	Largemouth Bass				0.08
LO6	Lake Oconee	4	Largemouth Bass	338	520	218	0.05
LO6	Lake Oconee	4	Largemouth Bass	445	1524	534	0.08
LO6	Lake Oconee	4	Largemouth Bass				0.07
LO6	Lake Oconee	4	Largemouth Bass	274	264	108	0.04
LO6	Lake Oconee	4	Largemouth Bass	301	328	126	0.05
LO7	Lake Oconee	4	Largemouth Bass	354	660	281	0.07
LO7	Lake Oconee	4	Largemouth Bass	418	951	359	0.13
LO7	Lake Oconee	4	Largemouth Bass				0.14
LO7	Lake Oconee	4	Largemouth Bass				0.13
LO7	Lake Oconee	4	Largemouth Bass	359	583	224	0.09
LO7	Lake Oconee	4	Largemouth Bass	346	429	174	0.10
LO7	Lake Oconee	4	Largemouth Bass	222	123	47	0.07

Table 5 shows the calculated weighted fish tissue concentration using the data during March/April 2001 and applying Equation 3-1. A weighted fish tissue concentration exceeding 0.3 mg/kg would indicate impairment.

Table 5 Weighted Average Fish Tissue Concentration

Trophic Level	Avg. Conc. Total Hg mg/kg	Max. Conc. Total Hg mg/kg	Min. Conc. Total Hg mg/kg	Count	Length	Total Hg mg/kg Geomean
4	0.09	0.32	0.03	45	359.38	0.08
3	0.05	0.11	0.03	33	260.40	0.04

Applying Equation 3-1 to the trophic level geometric mean concentrations yields a weighted average fish tissue concentration of 0.1 mg/kg.

5. Total Maximum Daily Load (TMDL)

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard. As determined in Section 3, the calculated water quality target for Lake Oconee is 17.8 ng/l. Because this water quality target is greater than the State's aquatic life criterion, the aquatic life criterion of 12 ng/l will be used to calculate the maximum load. This TMDL determines the maximum load of total mercury that can enter Lake Oconee within a year without exceeding 12 ng/l total mercury in the water column.

5.1. Critical Condition Determination

The 7Q10 low flow and average annual loading represents the critical conditions for this TMDL. 7Q10 low flow and average annual loading are appropriate for several reasons. First, EPA's human health methodology, which has been used to derive an appropriate numeric interpretation of Georgia's narrative water quality standard for toxic substances for this TMDL, assumes that health effects due to mercury occur as a result of long-term exposure to mercury in fish tissue through consumption of contaminated fish. The bioaccumulation of methylmercury in fish tissue is a long-term, multi-year, process. The State applies their aquatic life criterion at a flow equivalent to the 7Q10 low flow (Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(5)(e)(iv).

5.2. Seasonal Variation

Mercury is expected to fluctuate based on the amount and distribution of rainfall, and variable emissions from local and distant atmospheric sources. Since wet deposition is greatest in the spring and winter seasons, loadings of mercury are highest during these seasons. However, these seasonal impacts or other short-term variability in loadings are damped out by the biotic response of bioaccumulation, which as discussed above, is a long-term process. Therefore, since this TMDL is expressed as an average annual load, seasonal variations are not considered a significant factor.

5.3. Margin of Safety

A Margin of Safety (MOS) is a required component of a TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody. A MOS is incorporated into this TMDL by a conservative estimate of the maximum load of mercury entering Lake Oconee. Because Lake Oconee is currently meeting the applicable water quality standard, and the water quality standard to protect the accumulation of mercury in fish tissue is greater than the aquatic life standard, an additional margin of safety is include. An explicit margin of safety of 10% will be included to account for the uncertainty associated with a 1 time sampling event.

6. TMDL Development

6.1. TMDL Determination

To determine the potential total maximum load of total mercury to Lake Oconee, a conservative mass balance calculation is used. Using the aquatic life criterion, the maximum load is calculated so the resultant water column concentration does not exceed the applicable water quality standard of 12 ng/l, is given in Equation 6-1.

Equation 6-1 TMDL Determination

$$TMDL = \frac{WQT\ (ng/l) * 7Q10\ Flow * Number\ of\ Seconds/Year * 1000}{Number\ of\ ng/g}$$

where:

Aquatic Life Criterion = 12 ng/l
7Q10 Low Flow in Waterbody = 7.1 cubic meters/second
Number of Seconds/Year = 31536000
Number of ng per gram = 1E9

The potential TMDL Load is calculated as 2.70 kg/year total mercury.

7. Allocation of Loads

In a TMDL assessment, the total allowable load is divided and allocated to the various point and nonpoint pollutant sources. Since there are no point source facilities discharging to the listed segment, they will be not be given a wasteload allocation, it is clear that the predominant source of mercury loading to the waterbody is air deposition. Therefore, the total allowable load is provided as a Wasteload Allocation (allocation to NPDES permitted facilities) and Load Allocation (LA) to the nonpoint source air deposition (Table 6). The wasteload allocation is determined by multiplying the NPDES permitted flow (0 cms) by the water quality target (12.0 ng/l), if in the event a facility expands its facility and the permitted flow increase so would this wasteload allocation. (Table 6).

Table 6 TMDL Allocation

TMDL (kg/yr)	Wasteload Allocation (kg/yr)	Load Allocation (kg/yr)	Margin of Safety
2.70	0.00	2.43	0.27

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