TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Total Mercury in Fish Tissue Residue

In

Altamaha River
Including Listed Segments

Altamaha River: Confluence of Oconee and Ocmulgee Rivers to ITT Rayonier

Altamaha River: ITT Rayonier to Penholoway Creek

EPA United States Environmental Protection Agency

Region 4 serving the southeast

TOTAL MAXIMUM DAILY LOAD (TMDL)

Total Mercury in Fish Tissue Residue

In the

In the Altamaha River 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 the following segments of the Altamaha River in Georgia:

Altamaha River: Confluence of Oconee and Ocmulgee Rivers to ITT Rayonier

Altamaha River: ITT Rayonier to Penholoway Creek

The calculated allowable load of mercury that may come into the identified segments of the Altamaha River without exceeding the applicable water quality standard is 53.10 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.

_____

Beverly H. Banister, Director
Water Management Division

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1. Introduction

The U.S. Environmental Protection Agency (EPA) Region 4 is establishing this Total Maximum Daily Load (TMDL) for total mercury for two listed segments of the Altamaha River in Tombs, Appling, Wayne and Long Counties, Georgia. The Altamaha River 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 which 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 the Altamaha River, it appears that the Altamaha River 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.

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 the Altamaha River 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, the Altamaha River 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 the Altamaha River 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 propose 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 the Altamaha River 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

These two segments of the Altamaha River are on the State of Georgia's 2000 Section 303(d) list. The Altamaha River was listed because mercury in the tissue of largemouth bass and catfish 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 of 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 of 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 the Altamaha River: largemouth bass and catfish– no more than one meal per week.

The methodology used by the State of Georgia in the development of the fish consumption guidelines targets specific species and size of fish, and uses a conservative risked-based approach in determining whether consumption guidance is warranted for a particular waterbody. EPA supports the State of Georgia's approach to establishing consumption guidelines as an appropriate way to 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 numeric criterion for the protection of human health from methylmercury. The State's regulations provide a narrative water quality standard, free from toxics. Since mercury may cause toxicity in humans, a numeric "interpretation" of the narrative water quality standard is necessary to assure that a TMDL will protect human health. EPA defers to the State water quality standard or criterion as the applicable water quality standard for development of the TMDL. States may establish (or interpret) their applicable water quality standards for protection of human health at a numeric concentration different from their fish consumption guidelines. The State of Georgia has made a numeric interpretation of their narrative water quality standard for toxic substances at a numeric concentration of no more than 0.3 mg/kg methylmercury in fish tissue. (See the July 2001 letter from the State to EPA.) This numeric interpretation protects the "general population" which is the population that consumes 17.5 grams per day or less of freshwater fish. This approach is consistent with EPA's recently adopted guidance value for the protection of human health from methylmercury described in the document entitled, "Water Quality Criterion for the Protection of Human Health: Methylmercury". (EPA 2001) Using this methodology, it is determined that the general population is consuming 17.5 grams of fish per day, the waterbody is determined to be impaired and will be included on future State Section 303(d) lists when the weighted fish consumption concentration is greater than 0.3 mg/kg. The methodology uses a "weighted consumption" approach that assumes that 8 grams per day (58.4%) of the total fish consumption is trophic level 3 fish (e.g., catfish and sunfish), and 5.7 grams per day (41.6%) are trophic level 4 fish (e.g., largemouth bass). See Equation 3-1 below.

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 = 0.4 mg/kg

Avg. Trophic Level 3 Concentration = 0.1 mg/kg

EPA collected site-specific data from the Altamaha River on ambient mercury in fish tissue and in the water column in March/April 2001 at 2 locations, upper and lower Altamaha River. Using Equation 3-1, site-specific fish tissue concentration date collected in the Altamaha River yields a weighted fish tissue concentration of 0.25 mg/kg which is less than the State's current, applicable water quality criterion of 0.3 mg/kg.

4. TMDL Target

In order to establish the TMDL, the maximum allowable concentration of total mercury in the ambient water must be determined that will prevent accumulation of methylmercury in fish tissue above the applicable water quality standard of 0.3 mg/kg. To determine this allowable ambient water concentration, EPA referred to the "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health" (EPA 2000). The methodology is expressed below (Equation 4-1):

Equation 4-1 Water Quality Standard Calculation

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

where:

WQS = 4.0 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 = 1,020,247
Fraction of the Total Mercury as Methylmercury = 0.07 as measured

In the determination of the allowable ambient water concentration, EPA used the recommended national values from 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 used site-specific data from the Altamaha River collected in March/April of 2001. (See Section 5.2.) From this site-specific data, EPA determined a representative "weighted" bioaccumulation factor (BAF). This BAF 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 0.07. Using this approach, an allowable

concentration of total mercury in the ambient water of the Altamaha River for the protection of human health is 4.0 nanograms per liter (parts per trillion). This concentration or less in the ambient water will prevent the bioaccumulation of mercury in fish tissue above 0.3 mg/kg. The site-specific data for total mercury in the water column collected in March/April 2001 ranged from 0.2 ng/l to 6.5 ng/l.

5. Background

The Altamaha River is located in central Georgia (USGS Hydrologic Unit Code (HUC) 3070106). Altamaha River basin is presented in Figure 1.

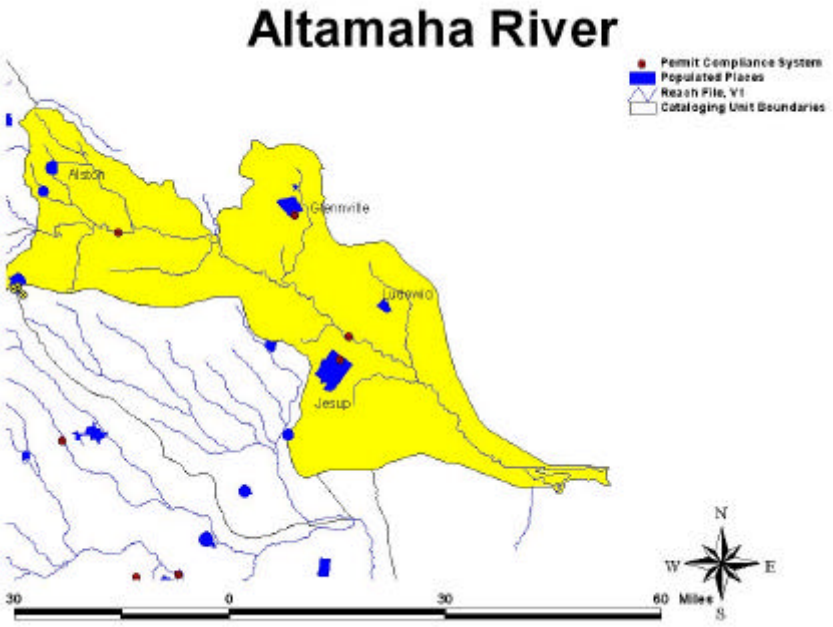

Figure 1 Map of Altamaha River

5.1. 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 4 NPDES (Table 2) permitted facilities that discharge to the listed segments of the Altamaha River.

Table 2 NPDES Permitted Facilities in Listed Segment

Facility	NPDES #	Flow (MGD)
Rayonier Inc. Jesup	GA0003620	67
Georgia Power Hatch	GA0004120	43.4
Jesup WPCP	GA0026000	2.5
Glennville	GA0031836	0.88

5.2. Available Monitoring Data

EPA Region 4 sampled the Altamaha River in March and April of 2001. Since even low concentrations of mercury in water can lead to significant accumulation of mercury in fish tissue, EPA sampled the Altamaha River 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. The sample locations for the water column are illustrated in Figure 2. Water column, sediment and soil samples (taken adjacent to the water column samples outside the flood plain) were taken from 2 locations in the Altamaha River.

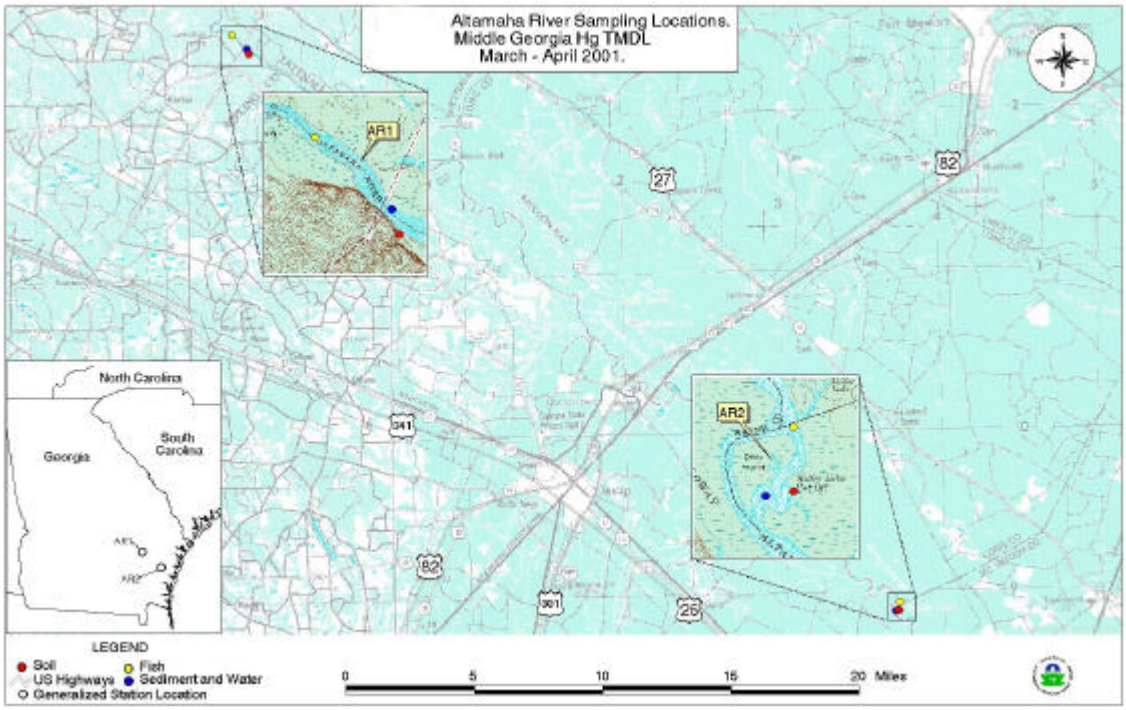

Figure 2 Altamaha River Sampling Station Locations

Sample locations for the fish collection are illustrated in Figure 2. The fish collection consisted of approximately 10 fish per sampling location, 5 - trophic level 3 fish (sunfish, catfish, etc.) and 5 - trophic level 4 fish (largemouth bass).

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

5.2.1. 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 3 provides the measured mercury concentrations in the water column of the Altamaha River.

Table 3 Water Column Mercury Concentrations

Station	Waterbody	Mercury, Total (THg, ng/L)	Mercury, Methyl (MeHg, ng/L)	Fraction MeHg
AR1	Altamaha River	0.20	0.01	0.06
AR2	Altamaha River	6.47	0.46	0.07

5.2.2. Sediment/Soil Data

Samples of river 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 4 provides the mercury concentrations associated with soils collected during the summer of 2001.

Table 4 Sediment/Soil Mercury Concentrations

		Total Mercury		Methylmercury	
Station	Waterbody	Sediment	Surface Soil	Sediment	Surface Soil
AR1	Altamaha River	0.0077	0.0323	0.00426U	0.0352
AR2	Altamaha River	0.0271	0.0151	0.00852	0.00822U

5.2.3. Fish Tissue Data

Samples of fish were taken from the Altamaha River (from the upper and lower sections of the listed segment) 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 5 provides the individual fish data.

Table 5 Fish Tissue Mercury Data

Station	Waterbody	Trophic Level	Species	Total Length (mm)	Whole Wt (gm)	Filet Wt (gm)	THg, (mg/kg) Wet Weight
AR1	Altamaha River	4	Largemouth Bass	377	787	243	0.37
AR1	Altamaha River	4	Largemouth Bass	298	353	122	0.35
AR1	Altamaha River	4	Largemouth Bass	378	797	287	0.36
AR1	Altamaha River	4	Largemouth Bass	275	341	119	0.18
AR1	Altamaha River	4	Largemouth Bass	284	280	91	0.20
AR2	Altamaha River	4	Largemouth Bass	470	1537	475	0.92
AR2	Altamaha River	4	Largemouth Bass	291	417	120	0.31
AR2	Altamaha River	4	Stripped Bass	281	286	108	0.11
AR2	Altamaha River	4	Longnose Gar	576	443	89	0.25
AR2	Altamaha River	4	Bowfin	484	1056	292	1.30
AR1	Altamaha River	3	Brown Bullhead	320	358	120	0.08
AR1	Altamaha River	3	Brown Bullhead	445	1119	343	0.14
AR1	Altamaha River	3	Redear Sunfish	263	398	125	0.24
AR1	Altamaha River	3	Bluegill	222	255	101	0.11
AR1	Altamaha River	3	Bluegill	214	307	107	0.10
AR2	Altamaha River	3	Redear Sunfish	225	271	84	0.18
AR2	Altamaha River	3	Bluegill	132	53	21	0.26
AR2	Altamaha River	3	Redbreast Sunfish	152	72	27	0.08
AR2	Altamaha River	3	White Crappie	207	127	50	0.19
AR2	Altamaha River	3	White Crappie	330	509	176	0.11

Table 6 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 6 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	0.49	1.30	0.11	15	371.4	0.39
3	0.15	0.26	0.08	10	251	0.14

Applying Equation 3-1 to the trophic level geometric mean concentrations yields a weighted average fish tissue concentration of 0.2 mg/kg.

6. 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 calculated in Section

3), for the Altamaha River the water quality standard is 4.0 ng/l to protect the accumulation of mercury in fish tissue. This TMDL determines the maximum load of total mercury that can enter the Altamaha River within a year without exceeding 4.0 ng/l total mercury in the water column.

6.1. Critical Condition Determination

The average annual flow and average annual loading represents the critical conditions for this TMDL. Average annual 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 human health criteria at a flow equivalent to the annual average flow (Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(5)(e)(iv) which requires the application of average annual load in the TMDL.

6.2. 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.

6.3. 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. The MOS is typically incorporated into the conservative assumptions used to develop the TMDL. A MOS is incorporated into this TMDL in that the maximum load is based upon a conservative representation of mercury entering the Altamaha River and the TMDL calculation does not take into account reduction/volatilization.

Because the Altamaha River is currently not impaired due to the accumulation of mercury in fish tissue, an additional margin of safety will be assigned to the background load allocation (LA) using an explicit 10%.

6.4. TMDL Determination

To determine the potential total maximum load of total mercury to the Altamaha River, a conservative mass balance calculation is used. The annual average flow and the water

quality standard as calculated in Equation 4-1 will be used to be used to determine the maximum load of mercury to the waterbody as not to exceed a water column concentration of 4.0 ng/l. (See Equation 6-1.)

Equation 6-1 TMDL Determination

$$TMDL = \frac{WQS\,(ng/l) * Annual\ Average\ Flow * Number\ of\ Seconds/Year * 10000}{Number\ of\ ng/g}$$

where:

Water Quality Standard= 4.0 ng/l
Annual Average Flow in Waterbody = 421 cubic meters/second
Number of Seconds/Year = 31536000
Number of ng per gram = 1.0E9

The potential TMDL Load is calculated as 53.10 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 point source facilities discharging to the listed segment, they will be given a gross 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 7). The wasteload allocation is determined by multiplying the NPDES permitted flow (5.0 cms) by the water quality target (4.0 ng/l), if in the event a facility expands its facility and the permitted flow increase so would this wasteload allocation.

Table 7 TMDL Allocations

TMDL (kg/yr)	Wasteload Allocation (kg/yr)	Load Allocation (kg/yr)	MOS (kg/yr)
53.10	0.63	47.22	5.20

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