TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT

For

Total Mercury

In the

Ochlockonee Watershed

Including Listed Segments of the Ochlockonee River:

Oquina Creek to Stateline

State Route 37 Downstream Moultrie to Upstream CR222

Bridge Creek to Big Creek

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 Ochlockonee 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 Ochlockonee River in Georgia:

Oquina Creek to Stateline

State Route 37 Downstream Moultrie to Upstream CR222

Bridge Creek to Big Creek

The calculated allowable load of mercury that may come into the identified segments of the Ochlockonee River without exceeding the applicable water quality standard is 1.22 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. Based on a current estimated loading of 5.00 kilograms per year, an estimated 76% reduction in mercury loading is needed for the identified sections of the Ochlockonee River to meet the applicable water quality standard of 1.6 nanograms per liter (ng/l).

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

Table of Contents

1. Introduction 1
2. Phased Approach to the TMDL 1
2.1. Phased Approach to Atmospheric Sources 2
2.2. Phased Approach to Water Point Sources 2
3. Problem Definition 4
4. Applicable Water Quality Standard 5
5. TMDL Target 6
6. Background 7
6.1. Source Assessment 9
6.2. Watershed Background Load 10
6.2.1. RELMAP Mercury Deposition Rates 10
6.2.2. Mercury Deposition Network 12
6.3. Available Monitoring Data 13
6.3.1. EPA Region 4 Data 14
6.3.2. Water Column Data 14
6.3.3. Sediment/Soil Data 15
6.3.4. Fish Tissue Data 15
7. Numeric Targets and Sources - Model Development 16
7.1. Watershed Hydrologic and Sediment Loading Model 16
7.2. Water Quality Fate and Transport Model 17
8. Total Maximum Daily Load (TMDL) 18
8.1. Critical Condition Determination 18
8.2. Seasonal Variation 18
8.3. Margin of Safety 18
9. TMDL Development 19
9.1. Model Results 19
9.1.1. Nonpoint Source 19

9.1.2. Water Quality Model 21
9.2. TMDL Determination 23
10. Allocation of Loads 24
10.1. Atmospheric Reductions 25
10.2. Allocation to NPDES Point Sources 25
11. Implementation 32
12. References 34
13. Appendix A. Analysis of Atmospheric Deposition of Mercury 36

Table of Figures

Figure 1 Ochlockonee Watershed 7

Figure 2 Ochlockonee Watershed Delineation 8

Figure 3 Ochlockonee Watershed Landuses 9

Figure 4 Mercury Dry Deposition Rates as Reported in the Mercury Report to Congress..... 11

Figure 5 Mercury Wet Deposition Rates as Reported in the Mercury Report to Congress 12

Figure 6 Mercury Deposition Network Sampling Locations 13

Figure 7 Ochlockonee Watershed Sample Locations 14

Figure 8 Mercury Load Distribution 20

Table of Tables

Table 1 Georgia Department of Natural Resources Fish Consumption Guideline 4

Table 2 Permitted Facilities in Ochlockonee Watershed 10

Table 3 Water Column Mercury Concentrations 15

Table 4 Sediment/Soil Mercury Concentrations 15

Table 5 Fish Tissue Mercury Data 16

Table 6 Annual Average Total Mercury Load from each Sub Basin 20

Table 7 Specified and Calculated Reaction Rates and Coefficients 22

Table 8 Flows, Depths, Velocities and Volumes used in WASP Model 22

Table 9 Predicted and Observed Mercury Concentrations under Annual Average Load and Flow 23

Table 10 NPDES Permitted Facilities and Assigned Wasteload Allocation at 1.6 ng/l 27

1. Introduction

The U.S. Environmental Protection Agency (EPA) Region 4 is proposing this Total Maximum Daily Load (TMDL) for total mercury for three listed segments of the Ochlockonee River Basin. The listed segments are as follows:

- Oquina Creek to Stateline
- State Route 37 Downstream Moultrie to Upstream CR222
- Bridge Creek to Big Creek

These segments are 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 State's guidelines.

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 individual sources or categories of pollution sources through wasteload allocations (WLAs) for point sources regulated by the National Pollutant Discharge Elimination System (NPDES) program and through load allocations (LAs) for all other sources. The WLAs and LAs in the TMDL provide a basis for states to reduce pollution from both point and nonpoint sources that will lead to restoration of the quality of the impaired waterbody. The purpose of this TMDL is to identify the allowable load of mercury that will result in attainment of the applicable water quality standard, and the unrestricted use of the identified segments for fish consumption.

This TMDL satisfies a consent decree obligation established in Sierra Club, et. al. v. EPA, Civil Action: 94-CV-2501-MHS. The Consent Decree requires TMDLs to be developed for all waters on Georgia's current Section 303 (d) list consistent with the schedule established by Georgia for its rotating basin management approach. The State of Georgia requested EPA to develop this TMDL, and as such, EPA is proposing this TMDL for Georgia for the 3 segments of the Ochlockonee River.

2. Phased Approach to the TMDL

EPA recognizes that it may be appropriate to revise this TMDL based on information gathered and analyses performed after August 2001. With such possible revisions in mind, this TMDL is characterized as a phased TMDL. In a phased TMDL, EPA or the state uses the best information available at the time to establish the TMDL at levels necessary to implement applicable water quality standards and to make the allocations to the pollution sources. However, the phased TMDL approach recognizes that additional data and information may be necessary to validate the assumptions of the TMDL and to provide greater certainty that the TMDL will achieve the applicable water quality standard. Thus, the Phase 1 TMDL identifies data and information to be collected after the first phase TMDL is established that would then be assessed and would form the basis for a Phase 2 TMDL. The

Phase 2 TMDL may revise the needed load reductions or the allocation of the allowable load or both. EPA intends to gather new information and perform new analyses so as to produce a revised or Phase 2 TMDL for mercury for the identified segments of the Ochlockonee River, if necessary, in 2012. The phased approach is appropriate for this TMDL because information on the actual contributions of mercury to the Ochlockonee River from both point and nonpoint sources will be much better characterized in the future.

2.1. Phased Approach to Atmospheric Sources

The impairment of the Ochlockonee River by mercury is largely due to the deposition of mercury from the atmosphere. This TMDL estimates that over 99 percent of the pollutant loads to the River come from the atmosphere (Section 6.1). An analysis of atmospheric deposition to the watershed is included in this TMDL as Appendix A. Mercury is emitted into the atmosphere by a large number of different sources. The mercury that reaches the watershed comes from nearby sources (local sources) as well as sources much farther away, both within the United States (national sources) and outside of the United States (international sources). Only a small part, less than 1 percent, of the mercury loading is due to discharges from water point sources (e.g., pipes) into the River or its tributaries.

In Appendix A, EPA has made its best attempt to characterize the air sources of mercury to the watershed, given the time available to the Agency for establishing the TMDL. The analysis of deposition of mercury from the atmosphere to the watershed depends heavily on modeling conducted for the Mercury Study Report to Congress (EPA, 1997). This Study was based on the Regional Lagrangian Model of Air Pollution (RELMAP) modeling, which has several areas of uncertainty, and assumptions that could affect the level of reductions projected by the analysis. Many of these uncertainties are not unique to the analysis of atmospheric deposition prepared for this Mercury TMDL. Some of these uncertainties include the estimates of the amount of the chemical form or species of mercury emitted by each source category; the projected level of reductions from each source category subject to the Clean Air Act (CAA) Section 129 or 111 or Maximum Achievable Control Technology (MACT); the definition of local sources contributing deposition to the watershed; the contribution from global sources; and other aspects of the modeling. While it is not possible to quantify the net effect of these factors, EPA believes the assumptions made to address these uncertainties are reasonable and consistent with the state-of-the art mercury modeling available at the time this TMDL was prepared. EPA expects that a combination of ongoing and future activities under the Clean Air Act will achieve reductions in air deposition of mercury that will enable achievement of water quality standards. These activities include promulgated MACT standards, MACT standards under development, and new legislation to control multiple air pollutants from electric utilities. The activities underway to address mercury are described further in Appendix A. EPA is soliciting comments on this aspect of the proposed TMDL.

2.2. Phased Approach to Water Point Sources

At this time, there is relatively little data on the actual loading of mercury from NPDES point

sources in the basin. Because, until recently, EPA's published method for the analysis of mercury was not sensitive enough to measure mercury at low trace level concentrations, most NPDES facilities have not detected mercury during their required priority pollutant monitoring. EPA assumes, however, that all facilities discharge some mercury into the River with their effluent because mercury is pervasive in the environment and is present in rainwater.

Recently, in 1998, EPA adopted a new analytical procedure that detects mercury at low trace level concentrations (0.5 nanograms/liter) (See EPA Method 1631, Revision B, 40 C.F.R. 136.3(a)). A sampling by EPA of a small subset of the NPDES dischargers in South Georgia using the trace level Method 1631 analytical technique verifies EPA's assumption that all facilities are discharging some mercury. As NPDES permits are reissued, dischargers will be required to use the version of Method 1631 then in effect for analyzing mercury. (Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.06). Therefore, in the Phase 2 TMDL, data on the concentration of mercury in point source discharges using the more sensitive analytical technique will be available to characterize the actual loading of mercury into the River. This will allow EPA, as appropriate, to refine wasteload allocations provided in the TMDL.

Because the impairment of the listed waterbodies by mercury is due predominantly to air deposition, the complete elimination or significant reduction of mercury from water point source discharges would produce little benefit in the quality of the River. In addition, the elimination or significant reduction of mercury would likely be expensive and possibly technically infeasible for point sources to implement. Since many of the NPDES facilities in the basin affected by this TMDL are municipal wastewater treatment plants that are funded through the taxpayers, EPA chooses to move cautiously before implementing wasteload allocations that may cause significant economic hardship in a situation where, as here, EPA expects most of the needed mercury reductions to be achieved through Clean Air Act reductions in mercury emissions from air sources. In this Phase 1 TMDL, EPA expects point source loadings of mercury will be reduced primarily through mercury minimization programs developed and implemented by some point sources.

In summary, during implementation of the Phase 1 TMDL, EPA expects the following activities to occur:

- 3 NPDES facilities will monitor for mercury and characterize it in their influent and effluent for mercury using the more sensitive analytical technique (the version of Method 1631 then in effect). These facilities consist of 2 municipal facilities, and 1 industrial facility. (See Section 10.2.)
- Where appropriate, NPDES point sources will develop and implement mercury minimization plans;
- Air point sources will continue to reduce emissions of mercury through implementation of the Clean Air Act Section 112 MACT requirements and Section 129 Solid Waste Combustion requirements;
- EPA and the regulated community will improve the mercury air emissions inventory;
- EPA will refine and revise the mercury air deposition modeling to better characterize

sources of mercury; and

- EPA and the State will collect additional ambient data on mercury concentrations in water, sediment and fish.

EPA intends to use the data and information collected and developed during the next ten years to revise the Phase 1 TMDL, as necessary, to assure that the allowable load will be achieved by implementation of the TMDL. EPA's intention to revise the TMDL is consistent with the State of Georgia's Rotating Basin Management Program (RBMP) schedule. Under Georgia's current RBMP schedule, NPDES permits in the Ochlockonee River Basin will be reissued in 2012. Therefore, EPA intends to revise the TMDL one year prior to reissuance of permits in the Basin.

3. Problem Definition

The Ochlockonee River is on the State of Georgia's 2000 Section 303(d) list. The Ochlockonee River was listed because mercury in the tissue of largemouth bass and sunfish 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 Ochlockonee River: largemouth bass (once a month) and sunfish (once a 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.

4. 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 titled, "Water Quality Criterion for the Protection of Human Health: Methylmercury". (EPA 2001) Using this methodology, it is determined that the general population is consuming greater than 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. When only trophic level 3 and 4 fish have been collected the methodology 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 4-1 below.)

Equation 4-1 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 3 Concentration = 0.2 mg/kg
Avg. Trophic Level 4 Concentration = 1.0 mg/kg

EPA collected site-specific data from the Ochlockonee River on ambient mercury in fish tissue and in the water column in the summer of 2000 and in March/April 2001 at 2 locations. Using Equation 4-1, site-specific fish tissue concentration date collected in the Ochlockonee River yields a weighted fish tissue concentration of 0.6 mg/kg which is greater than the State's current, applicable water quality criterion of 0.3 mg/kg.

5. 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 level. 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 5-1):

Equation 5-1 Water Quality Standard Calculation

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

where:

WQS = 0.2 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 = 1,063,270
Fraction of the Total Mercury as Methylmercury = 0.17 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 Ochlockonee River collected in summer of 2000 and March/April of 2001. (See Section 6.3.) 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 median measured fraction methylmercury of 0.17. Using this approach, an allowable concentration of total mercury in the ambient water of Ochlockonee River for the protection of human health is 0.2 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 during the monitoring in 2000 and 2001 was 1.4 ng/l to 10.9 ng/l.

6. Background

The Ochlockonee watershed is located in Southwestern Georgia. The entire drainage area of the Ochlockonee watershed (USGS Hydrologic Unit Code (HUC) 3120002) is approximately 2378 square kilometers. The Ochlockonee watershed is presented in Figure 1.

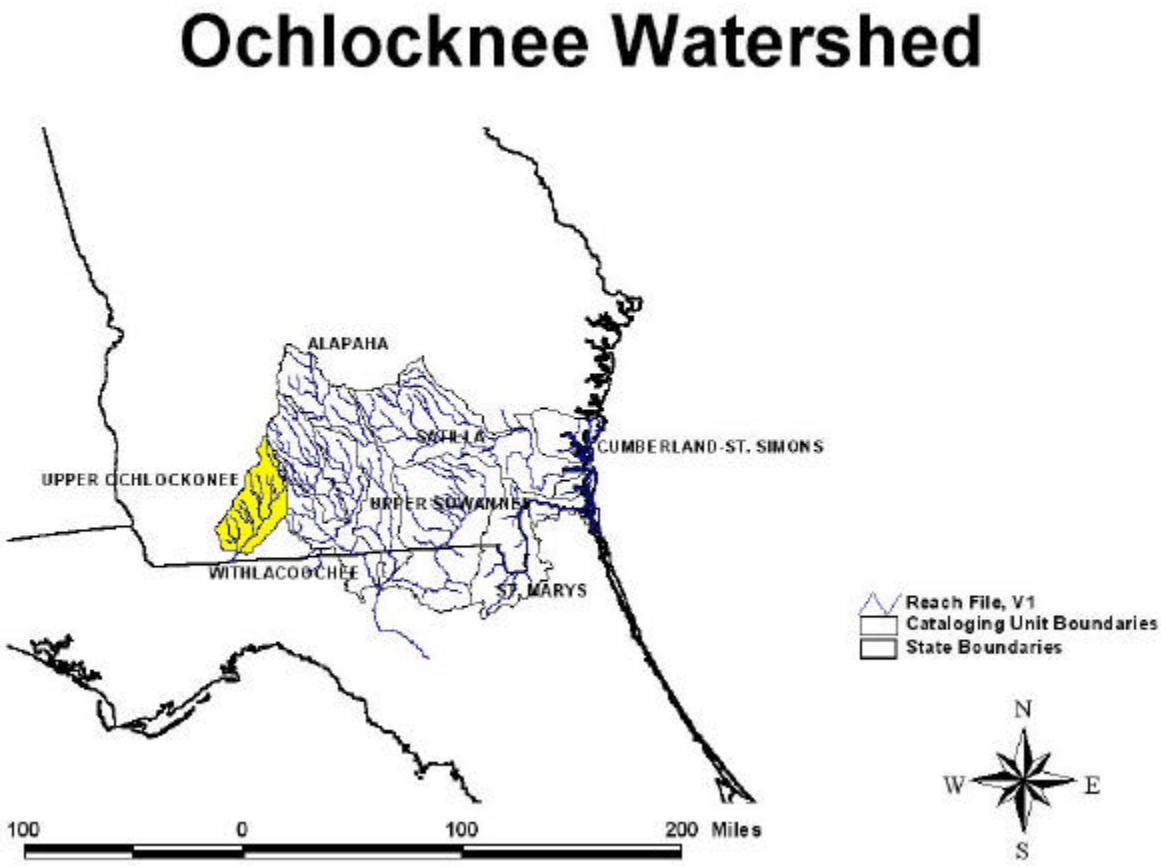

Figure 1 Ochlockonee Watershed

The Ochlockonee watershed has been divided into 9 subwatersheds (Figure 2) for this TMDL, representing all of the major tributaries to the Ochlockonee River. A total mercury load will be determined for each of these subwatersheds to determine the impact of atmospheric deposition on the Ochlockonee River.

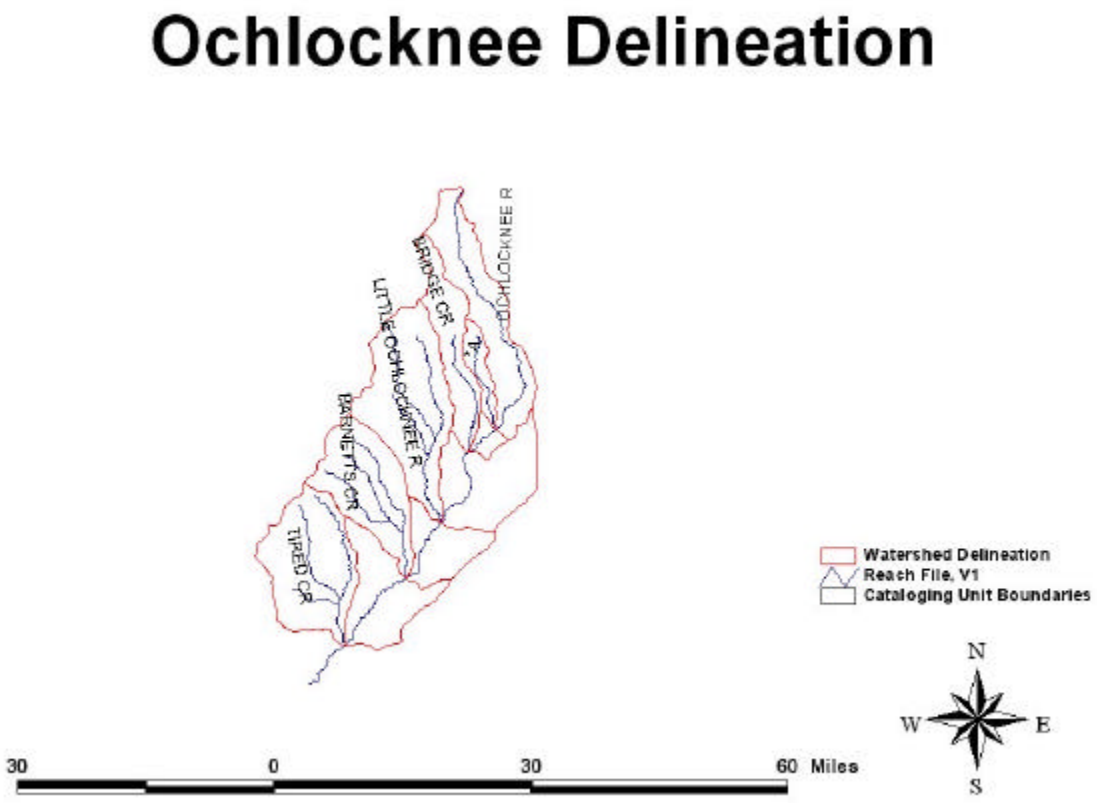

Figure 2 Ochlockonee Watershed Delineation

The watershed contains several different types of landuses. The landuses for the Ochlockonee watershed are given in Figure 3. Different landuses collect and distribute mercury at different rates as a function of runoff and erosion.

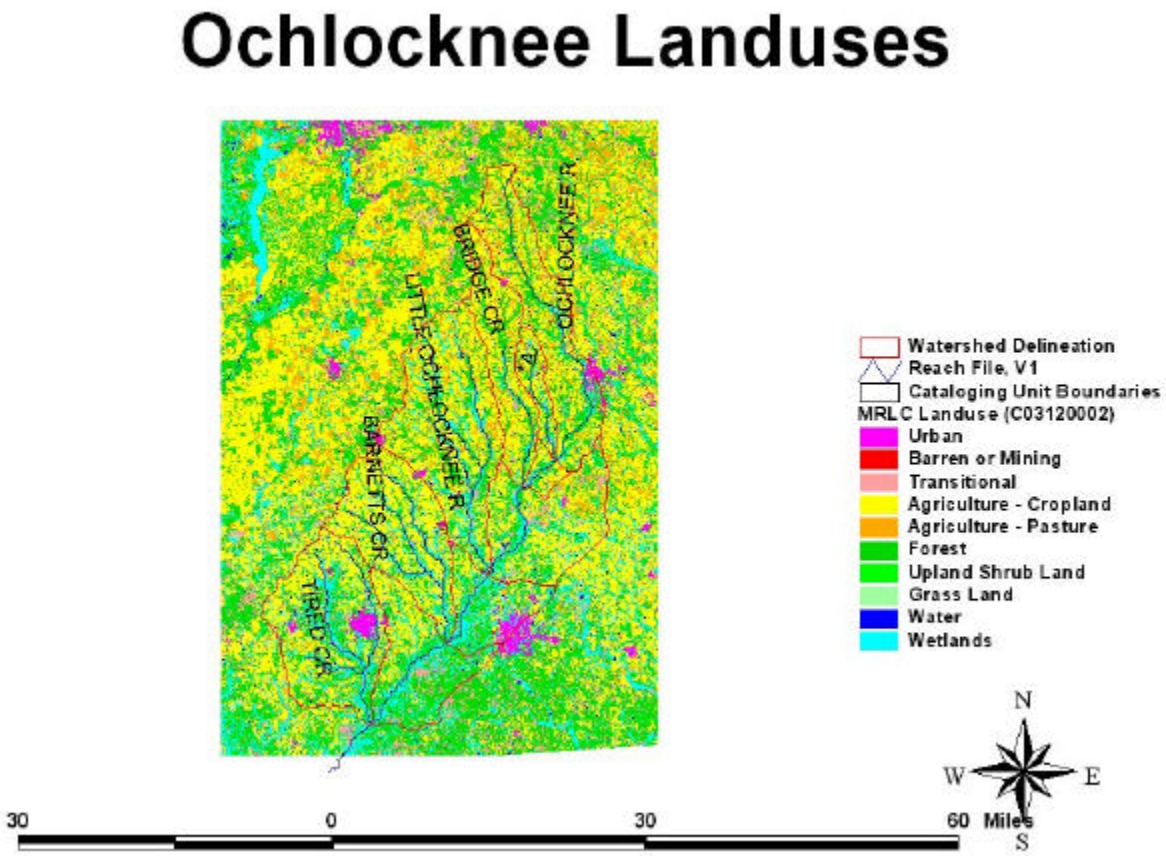

Figure 3 Ochlockonee Watershed Landuses

This TMDL covers all waterbodies in the Ochlockonee watershed. Because the spatial distribution of mercury contamination is not completely known in the streams and creeks throughout the watershed, and fish move throughout the watershed, this TMDL is developed to protect all streams and creeks in the entire watershed from unacceptable accumulations of mercury in fish tissue. As discussed in previous sections of this document, the State of Georgia has issued a Fish Consumption Guideline for various segments of the Ochlockonee River and tributaries. This guideline was issued due to elevated levels of mercury found in fish flesh collected in the watershed.

6.1. Source Assessment

A TMDL evaluation must examine all known potential sources of the pollutant in the watershed, including point sources, nonpoint sources, and background levels. The source assessment is used as the basis of development of a model and the analysis of TMDL allocation options. This TMDL analysis includes contributions from point sources, nonpoint sources and background levels. The point sources in the Ochlockonee River watershed, which could potentially have mercury in their discharge, are listed in Table 2.

Table 2 Permitted Facilities in Ochlockonee Watershed

NPDES	Facility
GA0033715	Boston Pond
GA0021717	Doerun Pond
GA0001678	Engelhard Corp. Decatur
GA0046124	Engelhard Corp. Thomas
GA0046744	Engelhard Specialty Chemical
GA0047520	Floridin C. Thor Mine
GA0048178	Meigs WPCP
GA0046736	Milwhite Co.
GA0024660	Moultrie WPCP
GA0046370	Ochlockonee WPCP
GA0047511	Oil-Dri Corp of America
GA0001279	Sunnyland Inc.
GA0024082	Thomasville WPCP
GA0001660	WB Roddenbery Company
GA0032409	Waverly Mineral Products
GA0034509	Whigham Health and Rehab

6.2. Watershed Background Load

Significant atmospheric sources of mercury often cause locally elevated areas of atmospheric deposition downwind. Mercury emitted from man-made sources usually contains both gaseous elemental mercury (Hg (0)) and divalent mercury (Hg(II)). Hg (II) forms, because of their solubility and their tendency to attach to particles, redeposit relatively close to their source (probably within a few hundred miles) whereas Hg (0) remains in the atmosphere much longer.

Based on a review of the Mercury Study Report to Congress, significant potential point sources of airborne mercury include coal-fired power plants, waste incinerators, cement and limekilns, smelters, pulp and paper mills, and chlor-alkali factories (USEPA, 1997).

Atmospheric deposition is a major source of mercury in many parts of the country. In a study of trace metal contamination in reservoirs in New Mexico, it was found that 80 percent of mercury found in surface waters was coming from atmospheric deposition (Popp et al., 1996). In other remote areas (Wisconsin, Sweden, and Canada) atmospheric deposition has been identified as the primary (or possibly only) contributor of mercury to the waterbodies (Watras et al., 1994; Burke et al., 1995; Keeler et al., 1994).

6.2.1. RELMAP Mercury Deposition Rates

As part of the Mercury Report to Congress, a national airshed model (RELMAP) was applied to the continental United States. This model provides a distribution of both wet and dry deposition of mercury as function of air emissions and global sources. Figure 4 and Figure 5 illustrate the dry and wet deposition rates for South Georgia as derived by RELMAP. The

RELMAP model, which was used to predict these deposition rates, was based upon an outdated emissions inventory and did not include other foreign airsheds (i.e. Mexico and others). Other data, presented below, has been relied on for this TMDL.

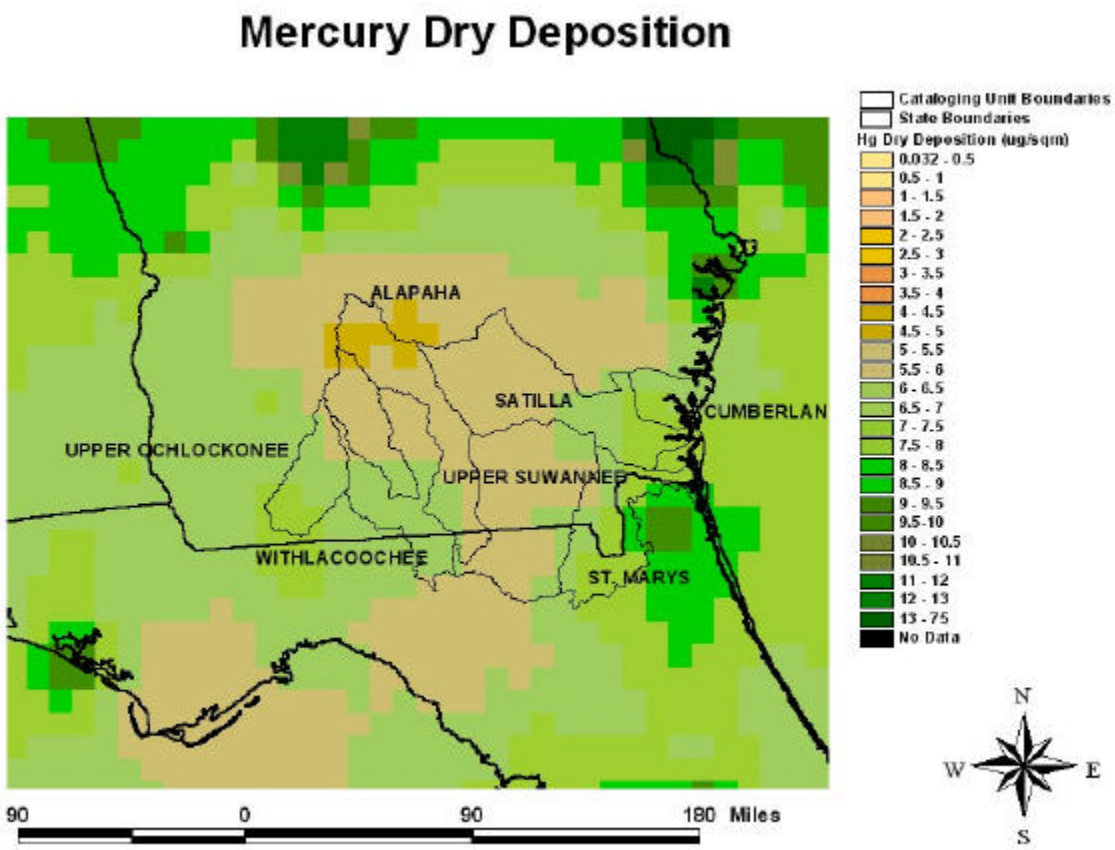

Figure 4 Mercury Dry Deposition Rates as Reported in the Mercury Report to Congress

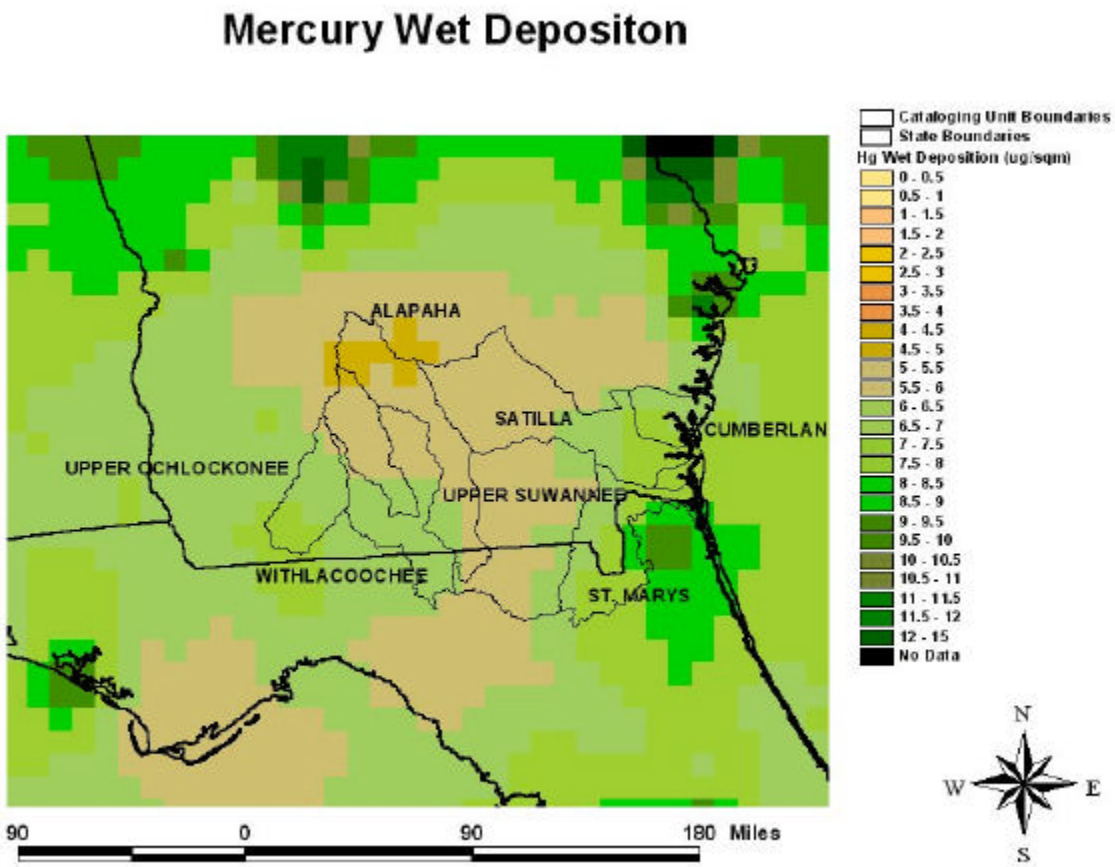

Figure 5 Mercury Wet Deposition Rates as Reported in the Mercury Report to Congress

6.2.2. Mercury Deposition Network

The objective of the Mercury Deposition Network (MDN) is to develop a national database of weekly concentrations of total mercury in precipitation and the seasonal and annual flux of total mercury in wet deposition. The data will be used to develop information on spatial and seasonal trends in mercury deposited to surface waters, forested watersheds, and other sensitive receptors. Locations of the MDN sampling stations are shown on Figure 6.

The EPA Region 4 Air Program reviewed the MDN data for sampling station GA09. This data was compared with the RELMAP deposition predictions and was found to be substantially higher. Using the MDN data, the average annual wet deposition rate was determined to be 12.75 ì g/sq. meter and the dry deposition rate was determined to be 6.375 ì g/sq. meter.

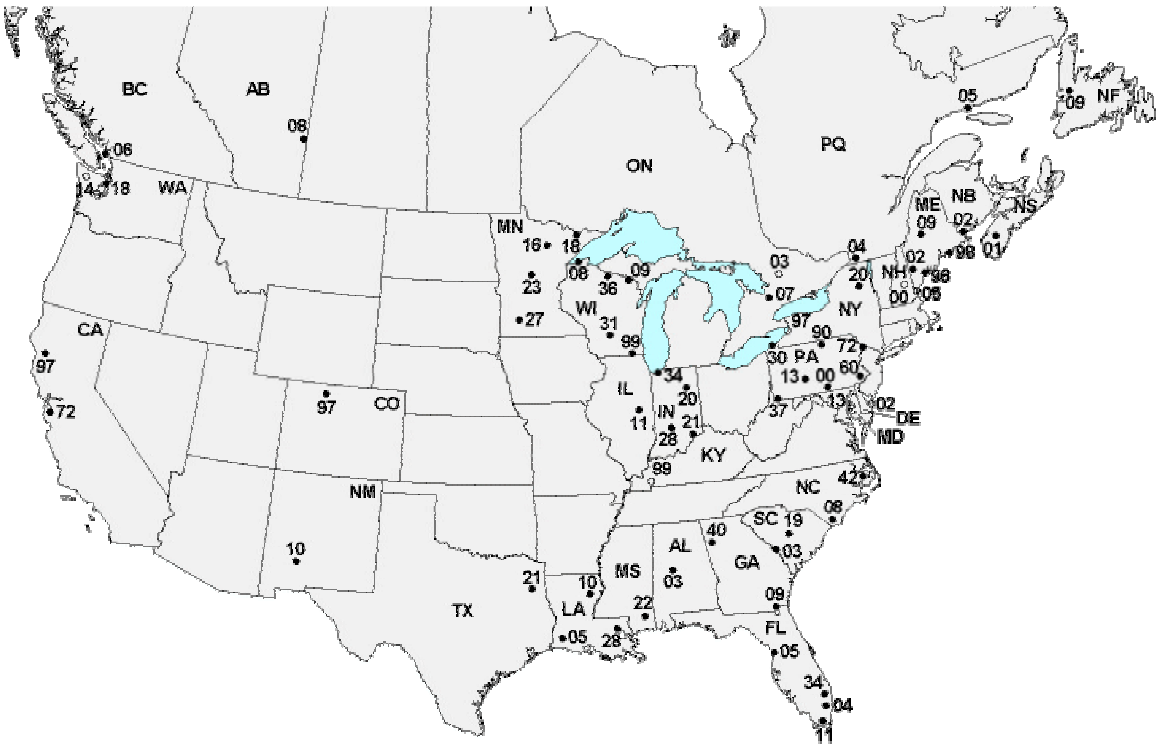

Figure 6 Mercury Deposition Network Sampling Locations

6.3. Available Monitoring Data

The State of Georgia's Environmental Protection Division and the Wildlife Resources Division routinely monitor water and fish tissue in State waters. Focused monitoring for the Ochlockonee River, in accordance with the Georgia river basin planning cycle, was conducted in 1988. The metals sampling and analysis work is done by contract with the United States Geologic Survey (USGS). Water samples were collected and analyzed for metals including mercury by the USGS in the Ochlockonee River basin. Mercury analysis methodology for water samples at that time had a detection limit of 200 ng/l (parts per trillion). This methodology was used by EPA, the USGS and the states in their environmental monitoring programs at that time. Mercury was not detected in water samples from the Ochlockonee River prior to1998.

In June of 1998 EPA promulgated Method 1631 for mercury in water for data gathering and compliance monitoring under the Clean Water Act and Safe Drinking Water Act. (See 64 CFR 30417.) This method has a detection limit of 0.5 ng/l (parts per trillion.) The availability of this methodology has made detection of mercury in the water column possible. Since low concentrations of mercury in water can lead to significant accumulation of mercury in fish tissue, it was necessary for EPA to sample the Ochlockonee River using Method 1631 to determine the ambient concentration in the River.

6.3.1. EPA Region 4 Data

Because little ambient mercury data exists for the Ochlockonee watershed, EPA Region 4 sampled the Ochlockonee River watershed in June 2000 & March/April 2001. The purpose of this data collection effort was to collect data needed for the development of this mercury TMDL. The sample locations for the watershed are illustrated in Figure 7. Water column, sediment and fish tissue samples were taken from the mainstem of the Ochlockonee River. The following sections provide the results of the field sampling for mercury.

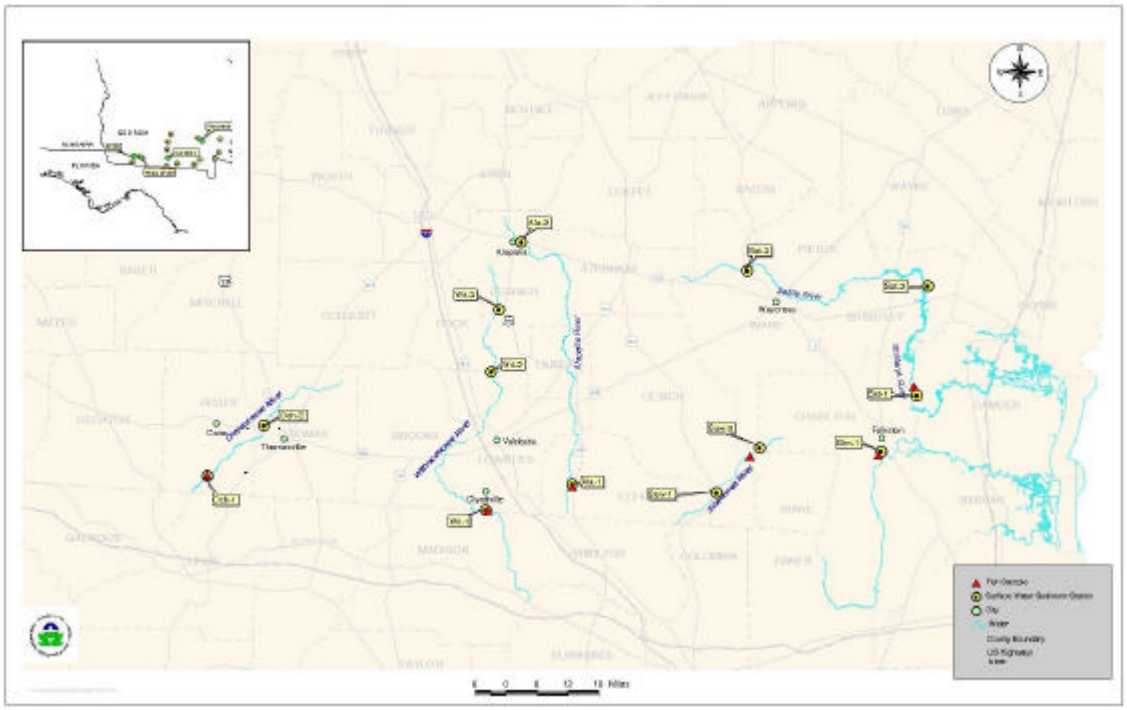

Figure 7 Ochlockonee Watershed Sample Locations

6.3.2. 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 detection limit 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 in the receiving waterbodies of the Ochlockonee watershed.

Table 3 Water Column Mercury Concentrations

Station	Year	Total Mercury (ng/l)	MeHg (ng/l)	Percent Methyl
Ochlockonee 1	2000	1.41	0.207	15
Ochlockonee 2	2000	1.57	0.253	14
Ochlockonee 1	2001	10.90	2.13	20
Ochlockonee 2	2001	7.25	1.04	14

6.3.3. 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. 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 (ng/g)		Methyl Mercury (ng/g)	
Year	Waterbody	Sediment	Surface Soil	Sediment	Surface Soil
2000	Ochlockonee 1	3	73.6	0.043	0.3
2000	Ochlockonee 2	8	74.7	1.01	0.3
2001	Ochlockonee 1	1.4		0.02	
2001	Ochlockonee 2	22		0.12	

6.3.4. Fish Tissue Data

Samples of fish were taken from the Ochlockonee River within the same area as the water column and sediment samples. Trophic level four fish (largemouth bass) and trophic level 3 (sunfish) were targeted in the collection. The fish filets obtained during EPA's sampling effort were analyzed for total mercury. Table 5 provides the individual fish data. The fish tissue mercury concentration will be used to determine a site-specific weighted bioaccumulation factor (BAF) for trophic level 3 and 4, and to determine the appropriate target for the TMDL.

Table 5 Fish Tissue Mercury Data

Fish Type	Year	Fish Length (mm)	Fish Weight (g)	Total Mercury (mg/kg)
Largemouth Bass	2000	321	473	1.49
Largemouth Bass	2000	420	1055	0.9
Largemouth Bass	2000	358	636	0.81
Largemouth Bass	2000	412	866	0.89
Suwannee Bass	2000	358	819	0.84
Spotted Gar	2001	595	835	0.92
Spotted Gar	2001	595	835	0.96
Spotted Gar	2001	520	683	1.10
Spotted Gar	2001	443	362	0.94
Spotted Gar	2001	443	362	0.78
Spotted Gar	2001	425	283	0.85
Spotted Gar	2001	435	271	1.30
Redear Sunfish	2001	198	154	0.29
Redear Sunfish	2001	190	116	0.08
White Crappie	2001	185	80	0.23
Warmouth	2001	148	60	0.28
Bluegill	2001	167	121	0.16

7. Numeric Targets and Sources - Model Development

The link between the fish tissue end-point and the identified sources of mercury is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators, the fish tissue end-point and identified sources. This provides the basis for estimating total assimilative capacity of the river and any needed load reductions. In this TMDL, models of watershed loading of mercury are combined with a model of mercury cycling and bioaccumulation in the water. This enables a translation between the end-point for the TMDL (expressed as a fish tissue concentration of mercury) and the mercury loads to the water. The loading capacity is then determined by the linkage analysis as a mercury-loading rate that is consistent with meeting the end-point fish tissue concentration.

7.1. Watershed Hydrologic and Sediment Loading Model

An analysis of watershed loading could be conducted at various levels of complexity, ranging from a simplistic gross estimate to a dynamic model that captures the detailed runoff from the watershed to the receiving waterbody. Because of the limited amount of data available for the watershed to calibrate a detailed dynamic watershed runoff model, a more simplistic approach is taken to determine the mercury contributions to the River from the surrounding watershed and atmospheric components. Therefore, a scoping-level analysis of the watershed mercury load, based on an annual mass balance of water and sediment loading

from the watershed is used for the TMDL development.

Watershed-scale loading of water and sediment was simulated using the Watershed Characterization System (WCS). The complexity of this loading function model falls between that of a detailed simulation model, which attempts a mechanistic, time-dependent representation of pollutant load generation and transport, and simple export coefficient models, which do not represent temporal variability. The WCS provides a mechanistic, simplified simulation of precipitation-driven runoff and sediment delivery, yet is intended to be applicable without calibration. Solids load, runoff, can then be used to estimate pollutant delivery to the receiving waterbody from the watershed. This estimate is based on pollutant concentrations in wet and dry deposition and processed by soils in the watershed and ultimately delivered to the receiving waterbody by runoff, erosion and direct deposition.

7.2. Water Quality Fate and Transport Model

WASP5 (Ambrose, et al., 1993) was chosen to simulate mercury fate in the Ochlockonee River. WASP5 is a general dynamic mass balance framework for modeling contaminant fate and transport in surface waters. Based on the flexible compartment modeling approach, WASP can be applied in one, two, or three dimensions with advective and dispersive transport between discrete physical compartments, or segments. A body of water is represented in WASP as a series of discrete computational elements or segments. Environmental properties and chemical concentrations are modeled as spatially constant within segments. Each variable is advected and dispersed among water segments, and exchanged with surficial benthic segments by diffusive mixing. Sorbed or particulate fractions may settle through water column segments and deposit to or erode from surficial benthic segments. Within the bed, dissolved variables may migrate downward or upward through percolation and pore water diffusion. Sorbed variables may migrate downward or upward through net sedimentation or erosion.

Two WASP models are provided with WASP5. The toxics WASP model, TOXI5, combines a kinetic structure adapted from EXAMS2 with the WASP5 transport structure and simple sediment balance algorithms to predict dissolved and sorbed chemical concentrations in the bed and overlying waters. TOXI5 simulates the transport and transformation of one to three chemicals and one to three types of particulate material. The three chemicals may be independent, such as isomers of PCB, or they may be linked with reaction yields, such as a parent compound-daughter product sequence. Each chemical exists as a neutral compound and up to four ionic species. The neutral and ionic species can exist in five phases: dissolved, sorbed to dissolved organic carbon (DOC), and sorbed to each of the up to three types of solids. Local equilibrium is assumed so that the distribution of the chemical between each of the species and phases is defined by distribution or partition coefficients. The model, then, is composed of up to six systems, three chemical and three solids, for which the general WASP5 mass balance equation is solved.

The WASP model was parameterized to simulate the fate and transport of mercury for the development of this TMDL. Site specific and literature values were used to predict water column concentrations as a function of flow.

8. Total Maximum Daily Load (TMDL)

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while achieving the water quality target protective of human health through fish consumption. This TMDL determines the maximum load of total mercury that can enter the Ochlockonee watershed within a year and still achieve a water column concentration for total mercury at or below the 1.6 ng/l target concentration as determined in the Target Identification Section.

8.1. Critical Condition Determination

EPA's derivations of human health criteria assume that effects of mercury are a long-term exposure to water column concentrations that lead to the accumulation of mercury in the fish tissue. The TMDL utilizes an average annual flow to determine the TMDL. Furthermore, the period of record for climate data stations in the watershed are used to calculate an annual average load of mercury to the system.

8.2. Seasonal Variation

Wet deposition is greatest in the winter and spring seasons. Mercury is expected to fluctuate based on the amount and distribution of rainfall, and variability of localized and distant atmospheric sources. While a maximum daily load is established in this TMDL, the average annual load is of greatest significance since mercury bioaccumulation and the resulting risk to human health that results from mercury consumption is a long-term process. Thus, daily or weekly inputs are less meaningful than total annual loads over many years. The use of an annual load allows for integration of short-term or seasonal variability.

Methylation of mercury is expected to be highest during the summer. High temperatures and static conditions result in hypoxic and/or conditions that promote methylation. Based on this enhanced methylation and high predator feeding activity during the summer, mercury bioaccumulation is expected to be greatest during the summer. However, based on the refractory nature of mercury, seasonal changes in body burden would be expected to be slight. Inherent variability of mercury concentrations between individual fish of the same and/or different size categories is expected to be greater than seasonal variability.

Because the water quality target was determined using data from a one-time sampling event under a single condition, the water quality target calculation could be re-visited when more data is available to determine the annual average condition.

8.3. 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 a variety of ways. These

include:

- Selecting the highest predicted water column concentration of mercury in the entire stretch of river to determine the load reduction needed to achieve Georgia's water quality standard. This approach conservatively assumes that fish are exposed to the highest water column concentration and accounts for uncertainties associated with identifying the precise locations where the fish take in mercury.
- Assigning a load reduction to point sources. While EPA believes that such reductions, considered together with reductions from air sources, are necessary to achieve water quality standards, EPA also recognizes that future studies of mercury emissions from air sources may indicate that water quality standards can be achieved solely by controlling air sources. By assigning this load reduction to point sources, EPA accounts for the possibility that air source reductions are insufficient. Thus, in addition to reflecting what EPA believes today are necessary load reductions from point sources, these reductions help account for EPA's lack of precise knowledge concerning the relationship between the effects of Clean Air Act controls and water quality.
- Incorporating a number of conservative assumptions in deriving the estimate of anticipated reductions in emissions to the air. These are described in the Analysis of Atmospheric Deposition of Mercury to the Ochlockonee River Watershed (2000). In addition, the resulting estimate does not take into account reductions resulting from voluntary control measures or new regulations. Therefore, reductions from air sources may possible be greater than presently estimated.

9. TMDL Development

The TMDL development will integrate the watershed loading with receiving water fate and transport of mercury. Annual average loads and flows will be used to evaluate current loading conditions and to determine what the loads would have to be to achieve the water quality target.

9.1. Model Results

Both the nonpoint source runoff model and the receiving waterbody model were used to determine the maximum load that could occur and protect fish from accumulating mercury to unacceptable levels. This section provides detailed information on how the models were applied, how the watershed and waterbody were broken down into segments (computational boxes) and how the mercury was transported throughout the watershed.

9.1.1. Nonpoint Source

The main driving force for the WCS mercury model is the input of the appropriate wet and dry deposition rates for mercury. The wet and dry deposition rates that were used in the watershed model were determined by a comparison between the RELMAP model results as reported in the Mercury Report to Congress and the Mercury Deposition Network sample collection site located in the Okefenokee Swamp. Yearly average dry deposition rates of

6.375 ìg/sqm and wet deposition rates of 12.75 ìg/sqm are used in the model. These deposition rates were interpreted from the MDN data. The WCS model was used to calculate the total load of mercury entering the mainstem portion of the River from the sub basins delineated in Figure 2. The predicted annual loads are given in Table 6.

Table 6 Annual Average Total Mercury Load from each Sub Basin

Watershed Name	**Area (ha)**	**Total Hg Load (mg)**	**Load (mg) /ha**	**Impervious Surface (mg/yr)**	**Sediment (mg/yr)**	**Runoff (mg/yr)**	**Deposition on Water (mg/yr)**
Barnett Creek	30711.46	786098.4	25.6	116614.69	422879.88	177553.9	68850
Middle/Lower Ochloclonee	14501.21	307965.8	21.24	125771.73	89440.3	54786.29	37867.5
Tired Creek	37555.84	827172.8	22.03	252386.89	317969.16	194751.7	61965
Lower Ochlockonee	23007.54	359317.5	15.62	100125.11	130407.68	97802.16	30982.5
Little Ochlockonee	43936.87	873773.4	19.89	140023.69	433136.75	219614.2	80898.75
Bridge Creek	19659.75	454417.5	23.11	53496.45	261042.44	98468.66	41310
Upper/Middle Ochlockonee	30371.17	627746.1	20.67	152881.42	254746.48	182250.7	37867.5
Upper Ochlockonee	38131.12	766396.8	20.1	164465.44	320337	186825.6	94668.75

For each of the sub basins, the total load is presented in mg/yr, and the percentage of the contribution of mercury from soil/erosion, runoff, direct deposition and impervious soil are presented. A summary of the distribution of the total mercury load to the basin is provided in Figure 8. The loads from each of the sub basins are passed onto the water quality model as an annual load.

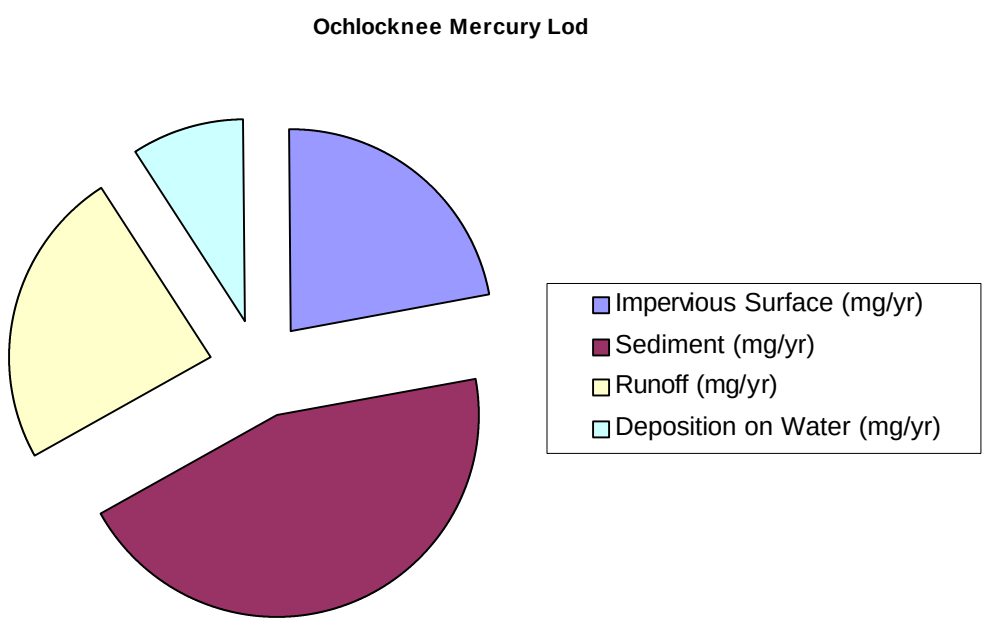

Figure 8 Mercury Load Distribution

9.1.2. Water Quality Model

The WASP5 toxic chemical program TOXI5 was set up to simulate mercury in the mainstem of the Ochlockonee River. The mainstem of the river was divided into reaches. Each reach was further divided into 2 vertical compartments representing surface water and surficial sediment. The 2 cm deep surficial sediment layer actively exchanges silt and clay-sized solids as well as chemicals within the water column. In addition, this layer is the site for active microbial transformation reactions. Sediment-water column diffusion coefficients were set at 10^{-5} cm^2/sec.

Two solids classes were simulated sand and silt. Sand makes up most of the benthic sediment compartments, which have a dry bulk density of 0.5 g/ml. Given a particle density of 2.7 g/ml, the sediment porosity is about 0.8 and the bulk density is 1.3 g/ml. Silt is found both suspended in the water column and in the sediment. These simulations assumed that 10 mg/L of silt enters the mainstem from the subwatersheds, settling out at an assumed velocity of 0.3 m/day. Silt in the surficial sediment compartments is assumed to resuspend at a velocity of 0.006 m/day, giving a concentration of about 0.005 g/ml, or about 1% of the surficial sediment. The exchanging silt carries sorbed mercury between the water column and surficial sediment.

Mercury was simulated as 3 components B elemental mercury, Hg^0; inorganic divalent mercury, Hg(II); and monomethylmercury, MeHg. Hg(II) and MeHg partition to solids and dissolved organic carbon (DOC). These are represented as equilibrium reactions governed by specified partition coefficients. The three mercury components are also subject to several transformation reactions, including oxidation of Hg^0 in the water column, reduction and methylation of Hg(II) in the water column and sediment layer, and demethylation of MeHg in the water column and sediment layer. These are represented as first-order reactions governed by specified rate constants. Reduction and demethylation are driven by sunlight, and the specified surface rate constants are averaged through the water column assuming a light extinction coefficient (here, 0.5 m^{-1}). In addition to these transformations, Hg^0 is subject to volatile loss from the water column. This reaction is governed by a transfer rate calculated from velocity and depth, and by Henry's Law constant, which was set to 7.1 H 10^{-3} L-atm/mole-K. Under average flow conditions, velocity ranges from 0.2 to 0.3 m/sec, while depth ranges from 0.37 to 0.69 m. The specified and calculated reaction coefficients used here are summarized in Table 7.

Table 7 Specified and Calculated Reaction Rates and Coefficients

Component	Reaction	Compartment	Coefficient Value
Hg^0	Volatilization	Water	1.0 - 3.9 day^{-1} (calc)
	Oxidation	Water	0.001 day^{-1}
Hg(II)	Reduction	Water	0.05 day^{-1} (surface) 0.074 - 0.090 (calc)
	Methylation	Water	0.001 day^{-1}
	Methylation	Sediment	0.00002 day^{-1}
	Partitioning to silt	Water, Sediment	2 H 10^5 L/kg
	Partitioning to sand	Water, Sediment	4.8 H 10^4 L/kg
	Partitioning to DOC	Water, Sediment	2 H 10^4 L/kg
MeHg	Demethylation to Hg(II)	Sediment	0.0001 day^{-1}
	Demethylation to Hg^0	Water	0.1 day^{-1} (surface) 0.074 - 0.090 (calc)
	Partitioning to silt	Water, Sediment	2 H 10^5 L/kg
	Partitioning to sand	Water, Sediment	1 H 10^3 L/kg
	Partitioning to DOC	Water, Sediment	2 H 10^5 L/kg

The Ochlockonee River simulation was conducted using annual average flow and load. The average flow simulation was run for 20 years, so that steady-state conditions are achieved in the water and surficial sediment. The flows, depths, velocities, and volumes used for annual average conditions are summarized in Table 8.

Table 8 Flows, Depths, Velocities and Volumes used in WASP Model

From	To	Length (m)	Depth (m)	Width (m)	Volume (cm)	Flow (cms)
Headwater	A Creek	57752.01	0.37	24.71	533674.09	3.58
A Creek	Bridge Creek	7883.41	0.39	30.09	93471.80	5.45
Bridge Creek	Little Ochlocknee	18429.21	0.38	31.82	223848.17	8.23
Little Ochlocknee	Barnetts Creek	14515.38	0.59	52.21	449770.63	14.69
Barnetts Creek	Tired Creek	20278.94	0.70	59.75	843559.07	19.29
Tired Creek	State Line	12266.37	1.07	105.15	1373769.15	26.03

The Watershed Characterization System calculates mercury loadings to each reach. These values are specified as constant Hg(II) and MeHg loadings for each surface water compartment. Loadings for average flow conditions reflect both wet and dry deposition throughout the watershed, followed by runoff and erosion to the tributary stream network. These loadings to the tributary network are subject to reduction and volatilization losses in transport to the mainstem. Average reduction factors were calculated for each tributary inflow using a reduction rate constant of 0.001 day^{-1} along with that subwatershed's flow, water surface area, and assumed depth:

$$reduction\ \ factor = (1 - e^{-k_r \bullet T_{max}}) \ / \ k_r \bullet T_{max}$$

where k_r is the reduction rate constant in day^{-1} and T_{max} is the travel time for the tributary in days. The travel time is calculated as the total tributary surface area times its average depth

divided by its average flow.

Table 9 provides the predicted water column concentrations under annual average load and flow for the Ochlockonee River. The highest predicted water column concentration is used in the TMDL calculation to determine the maximum annual average load that could occur and still achieve the target.

Table 9 Predicted and Observed Mercury Concentrations under Annual Average Load and Flow

Calculated Concentrations	River Reach					
Total Mercury	1	2	3	4	5	6
Water Column (ng/l)	6.33	5.84	5.55	5.76	5.65	5.17
Sediment (ng/g)	7.05	9.07	9.81	8.17	7.63	6.97
Methylmercury (ng/l)						
Water Column	0.90	0.82	0.77	0.79	0.77	0.71

9.2. TMDL Determination

To determine the total maximum load that can come into the Ochlockonee River the current loading conditions are evaluated and instream concentration is determined using the modeling approach described above. This allows the development of a relationship between load and instream mercury concentrations. Using this developed relationship, the total maximum load can be determined. Because the water column mercury concentration response is linear with respect to changes in load a proportion can be developed to calculate the total maximum mercury load from the watershed that would achieve the derived water quality target of 1.9 ng/l. The TMDL is calculated as given below:

$$\frac{HighestSegmentConcentration}{CurrentAnnualAverageLoad} \cdot \frac{WaterQualityTarget}{TMDLLoad}$$

where:

Highest Segment Concentration = 6.3 ng/l
Current Annual Average Load= 5.00 kg/year
Water Quality Target= 0.2 ng/l

TMDL Load is calculated as 1.22 **kg/year total mercury**.

The estimated current loading of mercury to the Ochlockonee River basin is 1,500 grams/year.

The percent reduction from atmospheric sources is calculated using the following equation:

$$\%\,\mathrm{Re}\,duction = \frac{TMDL}{CurrentLoadings} * 100$$

where:

TMDL = Total allowable Annual Load derived in TMDL Calculation

Current Loadings = Sum of all loads from the Watershed

In order to achieve this TMDL, a 76% reduction of mercury from all sources is needed.

10. Allocation of Loads

In a TMDL assessment, the total allowable load is divided and allocated to the various pollutant sources. This allocation is provided as a Load Allocation (LA) to the nonpoint sources, defined in this TMDL as the air sources, and as a Wasteload Allocation (WLA) to the point source facilities with NPDES permits. The difference between the current load and the allowable load is the amount of pollutant reduction the sources need to achieve in order for the waterbody to ultimately achieve the applicable water quality standards, in this TMDL expressed as a water quality target of 1.6 ng/l.

The calculated allowable load of mercury that can come into the Ochlockonee River without exceeding the applicable water quality target of 1.6 ng/l is 1.22 kilograms/year. Because EPA's assessment indicates that over 99% of the current loading of mercury is from atmospheric sources, 99% of the allowable load is being assigned to the Load Allocation, and 1% of the allowable load is being assigned to the Wasteload Allocation. Therefore, the Load Allocation and the Wasteload Allocation for the Ochlockonee River are:

Load Allocation (atmospheric sources) = 1.16 kilograms/year

Wasteload Allocation (NPDES sources) = 0.06 kilograms/year

The estimated current loading of mercury to the Ochlockonee River from the surrounding watershed is 5.00 kilograms/year. This load was determined by adding the predicted mercury load for each of the subwatersheds taking into account delivery times and volatilization that occurs in the tributaries. The difference between the estimated current mercury load (5.00 kg/year) and the calculated allowable load (1.22 kg/year) is 3.8 kilograms/year. Since 1.22 kg/year is 24% of the estimated current loading of mercury, EPA estimates that a 76% reduction in total mercury loading is needed for the Ochlockonee River to achieve a water column concentration of 1.6 ng/l.

This TMDL satisfies the requirements of Section 303(d) and EPA's implementing regulations. The calculated allowable load (1.22 kg/year) is the level necessary to achieve water applicable water quality standards. This satisfies Section 303(d)(1)(C) and 40 C.F.R. § 130.7(c)(1). (See section 8.2 below for a discussion of seasonal variation and margin of safety.) In addition, the sum of the Load Allocation and the Wasteload Allocation is equal to

the calculated allowable load, i.e., the greatest amount of mercury loading that the Ochlockonee River can receive without exceeding water quality standards. This satisfies 40 C.F.R. § 130.2(f) & (i). In addition, although not required by the statute or regulations, the TMDL compares the calculated allowable load to the estimated current loading and identifies the extent to which mercury loadings in the form of atmospheric deposition need to be reduced in order for the Ochlockonee River to achieve the allowable load and, therefore, the applicable water quality standard. In this way, the TMDL functions as a important planning tool -- particularly by quantifying the atmospheric reduction target -- that federal, state and local authorities can use in identifying the need for and imposing regulatory and non-regulatory control measures on air deposition sources.

10.1. Atmospheric Reductions

EPA estimates that over 99% of current mercury loadings to the River are from atmospheric deposition; therefore, significant reductions in atmospheric deposition will be necessary if the applicable water quality standard is to be attained. Based on the total allowable load of 1.22 kilograms per year, a 76% reduction of mercury loading is needed to achieve the applicable water quality standard. An analysis conducted by the EPA Region 4 Air Program (Appendix A) concludes that an estimated 31% to 41% reduction in mercury deposition to the Ochlockonee River watershed can be achieved by 2010 through full implementation of existing Clean Air Act (CAA) requirements. In addition, as described in Appendix A, there are a number of activities planned or underway to address remaining sources of mercury, and EPA expects that there will be further reductions in mercury loadings over time as a result of these activities. EPA is not able at this time to estimate the reductions in mercury deposition to the Ochlockonee River watershed that will be achieved from future activities. However, as contemplated by Section 303(d)(1)(C), this TMDL quantifies the water quality problem facing the Ochlockonee River watershed and identifies the loadings from atmospheric deposition that would need to be reduced – by CAA initiatives or under other authorities -- in order for the watershed to achieve applicable standards for mercury. In addition, as EPA collects additional data and information for the Ochlockonee River watershed and as new legal requirements are imposed under the CAA, EPA will continue to evaluate the effectiveness of regulatory and non-regulatory air programs in achieving the TMDL's water quality target.

10.2. Allocation to NPDES Point Sources

The analysis of NPDES point sources in the watershed indicates that the cumulative loading of mercury from these facilities is less than 1% of the total estimated current loading. (For a discussion of EPA's basis for this estimate, see Section 8.2.2.) Even if this TMDL were to allocate none of the calculated allowable load to NPDES point sources (i.e., a wasteload allocation of zero), the applicable water quality standards for mercury would not be attained in the waterbody because of the very high mercury loadings from atmospheric deposition. At the same time, however, EPA recognizes that mercury is an environmentally persistent bioaccumulative toxic with detrimental effects to human fetuses even at minute quantities, and as such, should be eliminated from discharges to the extent practicable. Taking these

two considerations into account, this TMDL therefore provides a cumulative wasteload allocation applicable to all Georgia NPDES facilities in the watershed in the amount of 0.06 kg/year. As discussed in more detail below, the TMDL contemplates that this cumulative wasteload allocation will be achieved by all NPDES-permitted facilities either through the discharge of mercury at concentrations below the applicable water quality standard of 1.6 ng/l or through the implementation of a pollutant minimization plan.

Within the cumulative wasteload allocation of 0.06 kg/year, the TMDL assigns individual wasteload allocations to each of the 3 NPDES point sources in the watershed identified by the State of Georgia as a potential significant discharger of mercury. Two of these facilities were identified by the State of Georgia as "major" facilities because they discharge more than 1 million gallons per day. EPA is assigning individual wasteload allocations to them because, based on the volume of their flow and the ubiquity of mercury in the environment (including rainwater), they are likely to discharge mercury to the Ochlockonee River watershed. The third facility – Sunnyland Inc. – was identified by the State of Georgia as a "significant minor" because, among other reasons, it is considered to have the potential to discharge mercury. Data collected by EPA at facilities in April/May 2001 indicate that mercury is present in their effluent at concentrations about the applicable water quality standard of 1.6 ng/l. Table 10 below identifies the NPDES point sources for which EPA has assigned individual wasteload allocations.

The cumulative wasteload allocation is assigned collectively to the approximately 13 other NPDES permitted facilities in Georgia located within the watershed. (See Table 2 for a list of all NPDES facilities in the watershed of the Ochlockonee River Basin provided to EPA by the Georgia Environmental Protection Division.) These facilities have flows of less than 1 million gallons per day. EPA has no data indicating that any of these facilities discharge mercury at concentrations above the 1.6 ng/l applicable water quality standard or that they are adding mercury at concentrations above that in the source water. In addition, they are not characterized by the State of Georgia as "major" or "significant minor" facilities. Accordingly, EPA believes that the portion of the cumulative wasteload allocation available to these facilities (after subtracting the individual wasteload allocations to the facilities discussed above) is sufficient to account for any mercury that actually is present in their effluent. However, as the new more sensitive EPA Method 1631 mercury analytical procedure is implemented in the NPDES program, these "minor" facilities must verify through monitoring whether or not they are significant contributors of mercury (State of Georgia Rules and Regulations for Water Quality Control, April 2000, Chapter 391-3-6-.06, and January 1995 Reasonable Potential Procedures). If it appears, based on this future monitoring data, that mercury is present in a facility's effluent at levels above the amount present in their source water, EPA can assign individualized wasteload allocations to such facilities. EPA has no reason to believe at this time that there would be a need to revise the cumulative wasteload allocation itself.

For each of the 3 facilities identified as potential significant contributors of mercury, EPA is providing a specific or individual wasteload allocation (WLA). This WLA is expressed in two different forms. The first is described as Option A below, and the second is described as Option B. The NPDES permitting authority is authorized by this TMDL to apply either

option to the NPDES point sources affected by this TMDL. In the context of this TMDL, EPA believes it is reasonable to offer this choice to the permitting authority for the following reasons. First, based on EPA's analysis, either wasteload allocation option, in the aggregate, is expected to result in point source mercury loadings less than the cumulative wasteload allocation. Second, EPA believes this flexibility is the best way of ensuring that the necessary load reductions are achieved without causing significant social and economic disruption. EPA recognizes that NPDES point sources contribute only a minute share of the total mercury contributions to the Ochlockonee River. However, EPA also recognizes that mercury is a highly persistent toxic pollutant that can bioaccumulate in fish tissue at levels harmful to human health. Therefore, EPA has determined, as a matter of policy, that NDPES point sources known to discharge mercury at levels above the amount present in their source water should reduce their loadings of mercury using appropriate, cost-effective mercury minimization measures in order to ensure that the total point source discharges are at a level equal to or less than the cumulative wasteload allocation specified in this TMDL. The point sources' WLA will be applied to the increment of mercury in their discharge that is above the amount of mercury in their source water. EPA recommends that the permitting authority make this choice between Option A and Option B in consultation with the affected discharger because EPA is not able to make the case-by-case judgments in this TMDL that EPA believes are appropriate.

Option A: Criteria end-of-pipe

Under Option A, the wasteload allocation is equivalent to applying the TMDL water quality target to the discharger's effluent at the outfall point. For this TMDL, EPA has determined this water quality target to be 1.6 ng/l. Therefore, under this option, the wasteload allocation for each NPDES point source identified in this TMDL would be the product of multiplying 1.6 ng/l by the permitted or design flow rate of each identified NPDES point source. The result would be the maximum mass loading of mercury from that point source. Under Option A, each NPDES point source affected by this TMDL is identified in Table 10.

Table 10 NPDES Permitted Facilities and Assigned Wasteload Allocation at 1.6 ng/l

NPDES	Facility
GA0024660	Moultrie WPCP
GA0001279	Sunnyland Inc.
GA0024082	Thomasville WPCP

Option B: Mercury Characterization or Minimization

Under Option B, the individual wasteload allocations are equivalent to the level of mercury in a point source's effluent after implementation, when appropriate, of cost-effective and appropriate mercury minimization measures. EPA assumes that feasible/achievable mercury load reductions resulting from the mercury minimization efforts will, as a cumulative amount of all 3 facilities, result in a total loading of considerably less than 0.06 kg/year. This assumption is based on information indicating wastewater treatment plants, which account

for two of the 3 the affected facilities, can attain significant mercury reductions through source reduction efforts. The effectiveness of mercury minimization efforts at industrial facilities is highly facility-specific; however, significant reductions may be attained through product substitution and other measures (See Mercury Report to Congress, 1997, Section 4, and Overview of Pollution Prevention Approaches at POTW's, EPA 1999). If implementation of mercury minimization by these 3 facilities does not result in mercury loadings that, considered together with the quantifiable mercury loadings of the other 13 NPDES permitted facilities, are equal to or less than the cumulative 0.06 kg/yr wasteload allocation, a numeric wasteload allocation will be assigned to each facility to assure that the cumulative wasteload allocation will be attained.

Affected NPDES permits would need to incorporate permit conditions or limitations as follows in order to be consistent with the assumptions of this TMDL. See 40 C.F.R. § 122.44(d)(1)(vii)(B). As the permitting authority, Georgia would also need to comply with state law in setting NPDES permit limits. For NPDES facilities identified in Table 10, this TMDL assumes that the permits will include:

- a requirement to characterize the effluent using the version of EPA Method 1631 then in effect in order to quantify the amount of mercury present in the influent and effluent, if any;

- a requirement to develop a mercury minimization plan if the monitoring data shows mercury is present in their effluent at levels greater than in their influent or source water, <u>and</u> the effluent concentration exceeds 1.6 ng/l.

- a requirement to implement appropriate cost-effective mercury minimization measures identified through any mercury minimization planning (if such planning is required as described above).

While this TMDL assumes that the State of Georgia, as the permitting authority, will determine the necessary elements of a mercury characterization/ minimization study plan, EPA would expect the plan(s) to have elements similar to the following: (1) influent/effluent monitoring with sufficient frequency to determine variability and to identify if an increased amount of mercury is present. If the facility's discharge is shown to result in an increased amount of mercury, the plan should also include the following additional elements: (2) the identification and evaluation of current and potential mercury sources; (3) monitoring to confirm current/potential sources of mercury; (3) the identification of potential methods for reducing/eliminating mercury, including housekeeping practices, material substitution, process modifications, materials recovery, spill control & collection, waste recycling, pretreatment, public education, laboratory practices, and disposal practices, and the evaluation of the feasibility of implementation; (4) implementation of cost-effective and appropriate minimization measures identified in the plan; and (5) monitoring to verify the results of waste minimization efforts. In addition, EPA expects the permit to establish a reasonable schedule for the implementation of each element and to require appropriate progress reports.

This TMDL accords the permitting authority a certain amount of discretion in incorporating these wasteload allocations into NPDES permits. The permitting authority is free to determine the appropriate frequency, duration and location of monitoring associated with the mercury characterization component of the wasteload allocation. The permitting authority also has the discretion to determine the level of oversight in connection with the development of mercury minimization plans and the discharger's choice of appropriate, cost-effective measures to implement. EPA believes that each of these decisions is heavily fact-dependant and that the permitting authority is in a better position than EPA to make them.

As discussed below, this TMDL assumes that NPDES permitted facilities in Georgia located within this watershed will not be authorized to discharge mercury above current effluent levels. Option B is predicated on the judgment that the 0.06 kg/year cumulative wasteload allocation will be achieved by applying waste minimization measures to current point source effluent conditions at the 3 facilities identified in Table 10 and by assuring that mercury discharges from the other 13 facilities remain at or below current levels. Allowing an increase in current effluent loadings of mercury could undercut the assumptions upon which this TMDL is based unless the permitting authority can demonstrate that any such increase is offset by decreases of mercury from other point source(s) in the watershed so that the cumulative wasteload allocation of 0.06 kg/year is not exceeded.

EPA recognizes that the State of Georgia's regulations authorize compliance schedules for water quality-based effluent limitations and conditions once those requirements are imposed in NPDES permits. See Rules and Regulations for Water Quality Control, Chapter 391-3-6-.06(10). Under these regulations, the Director of EPD is authorized to establish as a compliance deadline the date that he or she determines to be "the shortest reasonable period of time necessary to achieve such compliance, but in no case later that an applicable statutory deadline." Because there is no applicable statutory deadline relating to the achievement of these WLA-based limitations, point sources affected by this TMDL may be eligible for compliance schedules under this provision of Georgia's regulations. This TMDL assumes that the permitting authority will establish the shortest reasonable period of time for compliance with permit limitations and conditions based on this TMDL. This TMDL also recognizes, however, that the permitting authority is in the best position to determine the timing of mercury characterization and the compliance schedules for developing and implementing mercury minimization plans.

Regarding the compliance schedules in permits to meet permit limitations and conditions based on Option B, EPA makes the following observations. First, EPA believes that a point source with a flow of under 5 million gallons per day can develop a detailed mercury minimization plan within three to six months after the mercury characterization phase is completed and it has been determined that a minimization plan is requires. Point sources with a larger flow could develop a plan within about six to 12 months. Second, prompt characterization of the point sources' mercury discharges will assist EPA in determining whether it is necessary to adjust the individual wasteload allocations in the near future. Any unnecessary delay in obtaining this information could interfere with that effort. Third, with respect to implementation of appropriate, cost-effective mercury minimization measures, EPA believes that the permitting authority is in the best position to determine what

constitutes "the shortest reasonable period of time for compliance." EPA recognizes that the implementation of mercury minimization measures can take several years, especially when they involve small, diffuse sources discharging mercury to Publicly Owned Treatment Works (POTWs).

Other Assumptions Incorporated into this TMDL .

The wasteload allocation component of this TMDL reflects the following additional assumptions:

- The permitting authority may write permit conditions that allow the discharge of mercury at levels equal to the amount of mercury in the facility's intake water (from the Ochlockonee River or its tributaries), stormwater, and/or water drawn from the public water supply. If the permitting authority determines that mercury is present in the final effluent at levels above that level present in the influent, the permitting authority will establish permit limits consistent either Option A or Option B of this WLA. The permitting authority also should consider whether any increased mercury concentration in such discharges present potential for violation of an applicable acute standard for mercury, and include appropriate limits to protect against such violations.

- No NPDES point source will be authorized to increase its mass loadings of mercury above levels reflected in current water quality-based effluent limitations or current effluent quality, whichever is lower (in the case of facilities with such limitations) or current effluent quality (in the case of facilities subject to mercury characterization requirements).

- The permitting authority will establish the shortest reasonable period of time for compliance with permit limitations and conditions based on this TMDL.

- The State of Georgia will require those facilities rated as "minor municipal" and "minor industrial" facilities to monitor for mercury using the version of EPA Method 1631 then in effect to verify whether or not they have a added mercury. (State of Georgia Rules and Regulations for Water Quality Control, April 2000, Chapter 391-3-6-.06, and January 1995 Reasonable Potential Procedures).

EPA believes the wasteload allocations in this TMDL are reasonable in light of the following factors:

- the NPDES point sources, in the aggregate contribute less than 1% of the total current mercury loadings to the Ochlockonee River;

- eliminating the point source discharges of mercury (through a wasteload allocation of zero) will have no discernible effect on water quality and reducing them beyond the levels contemplated by the cumulative wasteload allocation is not necessary to achieve water quality standards;

- air sources are responsible for 99% of the mercury loadings to the river; therefore, water quality standards cannot be achieved under Clean Water Act authorities, but rather would need to be accomplished through federal, state, local and even, conceivably, international mechanisms.

- in recognition of the persistent, bioaccumulative, toxic nature of mercury, the TMDL expects all NPDES permitted facilities to discharge mercury at concentrations at or below the applicable water quality standards or at least (in the case of the 3 facilities identified in Table 10) to minimize their mercury loadings to the extent practicable, in accordance with Option B; the cumulative wasteload allocation of 0.06 kg/year was calculated to reflect that objective;

- based on the comparatively small flow of the other 13 NPDES permitted facilities and the fact that Georgia has not identified them as having a significant potential to discharge mercury, it is reasonable to conclude that these dischargers are already discharging mercury at concentrations well below the applicable water quality standard of 1.6 ng/l (excluding mercury present in intake or source water). Even if mercury minimization efforts employed by the 3 facilities identified in Table 10 do not result in mercury concentrations at those facilities below 1.6 ng/l, there is sufficient available loading within the cumulative wasteload allocation of 0.06 kg/year to accommodate this;

- EPA is unaware of treatment technologies or source reduction strategies that could allow the NPDES permitted facilities to achieve a wasteload allocation of zero; if such technology or strategy exists, it is likely to be very expensive and to result in substantial and widespread social and economic impacts.

- the recent adoption of EPA Method 1631 Revision B makes it difficult for EPA to state with certainty how many of the point sources identified in this TMDL actually discharge a net addition of mercury at levels exceeding 1.6 ng/l. . Under these circumstances, waste characterization is a reasonable first step.

State and Federal Responsibility

EPA intends to undertake the following responsibilities under this TMDL:

1. Review “major” NPDES permits and other identified “minor” NPDES permits for facilities located in the watershed of the segments of the Ochlockonee River that are covered by this TMDL;

2. Take the lead on further characterization of air sources; and

3. Take the lead on revising the TMDL, as necessary.

EPA expects Georgia to undertake the following responsibilities:

4. Identify the “major” NPDES facilities affected by this TMDL;

5. Identify other NPDES "minor" facilities affected by this TMDL which have the potential for a significant concentration of mercury in their effluent;

6. Modify the NPDES permits for the facilities identified in 1 and 2 above to reflect the conditions as identified in Section 10;

7. Determine the frequency and duration of the mercury characterization to be undertaken by the facilities identified in 1 and 2 above;

8. Determine the due date and objectives for the mercury minimization plan to be developed by the facilities in 1 and 2 above that are shown to be discharging mercury in excess of 1.6 nanograms/liter through the mercury characterization effort in 4 above;

9. Review the mercury minimization plans and determine the plan's acceptability as identified in 5 above;

10. Assure that mercury minimization plans are implemented as expeditiously as practicable;

11. As appropriate, take the lead on revising or establishing new individual wasteload allocations (within the cumulative wasteload allocation of 0.06 kg/year assigned in this TMDL); and to allow movement within the cumulative WLA of 0.06 without having to reopen the TMDL, e.g., if Option B isn't working or if one of the 13 needs to get an individual WLA.

12. Adopt numeric water quality criteria for mercury for protection of public health in accordance with 40 C.F.R. §131.11(b).

11. Implementation

EPA recognizes that a TMDL improves water quality when there is a plan for implementing the TMDL. However, CWA section 303(d) does not establish any new implementation authorities beyond those that exist elsewhere in State, local, Tribal or Federal law. Thus, the wasteload allocations within TMDLs are implemented through enforceable water quality-based effluent limitations in NPDES permits authorized under section 402 of the CWA. Load allocations within TMDLs are implemented through a wide variety of State, local, Tribal and Federal nonpoint source programs (which may be regulatory, non-regulatory, or incentive-based, depending on the program), as well as voluntary action by committed citizens. See New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs), dated August 8, 1997.

EPA believes it is useful during TMDL development, if time is available, to gather information that would facilitate TMDL implementation. For example, the TMDL may identify management strategies that categories of sources can employ to obtain necessary load reductions. EPA believes, however, that TMDL implementation – and implementation

planning – is the responsibility of the State of Georgia, through its administration of the National Pollutant Discharge Elimination System (NPDES) point source permit program and through its administration of any regulatory or non-regulatory nonpoint source control programs.

A consent decree in the case of Sierra Club v. EPA, 1:94-cv-2501-MHS (N.D. Ga.), requires EPA to develop TMDLs for all waterbodies on the State of Georgia's current 303(d) list that are not developed by the State that year, according to a schedule contained in the decree. That is, EPA and the State work cooperatively to develop all TMDLs for a given set of river basins each year, with all river basins in the State covered over a 5-year period. On July 24, 2001, the U.S. District Court entered an order finding that the decree also requires EPA to develop TMDL implementation plans. EPA disagrees with the court's conclusion that implementation plans are required by the decree and has appealed the July 24, 2001, order.

In the absence of that order, EPA would not propose an implementation plan for this TMDL. The Agency is moving forward, however, to comply with the obligations contained in the order. EPA has coordinated with the Georgia Environmental Protection Division (EPD) to prepare an initial implementation plan for this TMDL and has also entered into a Memorandum of Understanding (MOU) with EPD, which sets out a schedule for EPD to develop more comprehensive implementation plans after this TMDL is established. The initial plan provides for an implementation demonstration project to address one of the major sources of pollution identified in this TMDL while State and/or local agencies work with local stakeholders to develop a revised implementation plan.

EPA understands, pursuant to the July 24, 2001, order, that it continues to have responsibilities for implementation planning if for any reason EPA cannot complete an implementation plan for this TMDL as set out in the MOU. If the July 24, 2001, order is vacated, EPA would expect to support efforts by the State of Georgia to develop an implementation plan for this TMDL. EPA recognizes that approximately 99% of the mercury load into this watershed is from air deposition. EPD activities to implement this TMDL, in addition to activities related to future air source reductions, will focus primarily on outreach and education regarding how households and other sources of mercury to POTWs can minimize the introduction of mercury to their wastewater.

12. References

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13. Appendix A. Analysis of Atmospheric Deposition of Mercury