Public Comment
LA River Metals TMDL
Deadline: 5/15/08 by 12 p.m.

COALITION FOR PRACTICAL REGULATION

CPR

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May 15, 2008

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Subject: Proposed Approval of Amendment to Establish a Total Maximum Daily Load for Metals in the Los Angeles River

I am writing on behalf of the Cities of Signal Hill and Downey and the Coalition for Practical Regulation, an *ad hoc* group of more than 40 cities in Los Angeles County that have come together to address water quality issues. We thank the State Water Resources Control Board ("State Board") for the opportunity to provide these comments regarding the proposed approval by the State Board of a Basin Plan Amendment to establish a Total Maximum Daily Load for Metal in the Los Angeles River ("Metals TMDL"). A number of the cities in CPR are responsible jurisdictions under the Metals TMDL.

Our comments focus on the alternatives analysis required under the California Environmental Quality Act ("CEQA") as well as on the amendment by the California Regional Water Quality Board for the Los Angeles Region ("Regional Board") of the Metals TMDL to accelerate compliance dates. Unfortunately, that acceleration of compliance dates may make it impossible for important special studies, studies called for in the TMDL, to be completed prior to the reconsideration of the TMDL by the Regional Board. This is crucial because, as the State Board found when it approved the original version of the Metals TMDL in 2005 (the "2005 TMDL"), much of the deposit of metals in the Los Angeles River watershed is the result of atmospheric deposition of metals, something that is beyond the control of the responsible jurisdictions.

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Overview

In July 2007, the Los Angeles County Superior Court remanded the Metals TMDL back to the Regional Water Board with the requirement that the Regional Water Board "consider alternatives to the project." This remand came as the result of a lawsuit that, among other things, challenged the failure of the Water Boards in adopting the TMDL to comply with the requirements of CEQA, which requires lead agencies to describe "a range of reasonable alternatives to the proposed project . . . that could feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." 14 Cal. Code Reg. § 15126.6. *See also* Pub. Res. Code § 21080.5 and 23 Cal. Code Reg. § 3777.

In response to the Court's order, the Regional Water Board prepared an "Addendum to CEQA Documentation -- Alternatives Analysis" (June 22, 2007, later revised August 23, 2007). However, this Addendum failed to adequately address reasonable TMDL alternatives that could be successfully utilized to achieve the goal of the Metals TMDL project, targeted water quality improvements. The Regional Board's Addendum only included alternatives cited in trial briefs filed by the petitioners in the lawsuit. It ignored the Court's ruling that the Water Boards have the burden of formulating alternatives.

Specifically, CPR submits that the Water Boards should have considered additional feasible alternatives, including a Modified Interim Compliance Date Alternative, an Atmospheric Deposition Alternative, an Expanded Source Analysis/Linkage Analysis Alternative with a modified implementation schedule, an Increased Focus on Industrial Stormwater Discharges and Other Sources of Metals Alternative, a Water Quality Attainment Strategy Alternative (WQAS) similar to the *SFRWQCB Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Urban Creeks* approved by the San Francisco Regional Water Board, and other potential project alternatives cited in the Burhenn & Gest LLP comment letter of May 15, 2008, which is being submitted separately and is hereby incorporated herein. Each of these alternatives is discussed in more detail below.

Additionally, when the Addendum was revised on August 23, 2007, it failed to discuss the reasonable and feasible alternatives contained in an August 6, 2007 comment letter from Burhenn & Gest LLP filed on behalf of several Metals TMDL responsible jurisdictions. That comment letter suggested three additional alternatives: a TMDL that would extend compliance dates to allow for the special studies, a TMDL addressing atmospheric deposition, and a TMDL that included an increased focus on industrial stormwater discharges and other sources of metal. In addition, that comment letter noted that there were other alternatives that would both result in less significant environmental impacts and achieve project goals. CPR submits that the alternatives suggested in the Burhenn & Gest comment letter and/or development of the Atmospheric Deposition Alternative, Expanded Source Analysis/Linkage Analysis Alternative, and Water Quality Attainment Strategy Alternative (WQAS) described below would satisfy both CEQA requirements and the Court's order.

Atmospheric Deposition Alternative

The Regional Water Board's June 2, 2005 Staff Report and other material in the record for the 2005 TMDL contained extensive information about the relationship between atmospheric deposition and annual loadings of metals to the Los Angeles River. Regional Water Board staff, in producing the Addendum, therefore should have considered an Atmospheric Deposition Alternative that would assign a load allocation to atmospheric deposition of metals. There is precedent for such an alternative, e.g., Mercury TMDLs in Georgia and Louisiana, which assigned load allocations of 99% and 99.5% respectively to atmospheric deposition of mercury in order to use Clean Air Act authorities to control mercury at the source. Copies of these TMDLs were submitted to Regional Water Board staff in 2004 and are included as Attachments A and B to this letter.

In addition, when the 2005 TMDL was up for adoption, the Southern California Coastal Water Research Project (SCCWRP) and UCLA conducted joint studies on the effects of indirect dry weather atmospheric deposition on the Los Angeles River Watershed. One of these SCCWRP/UCLA joint studies states:

"In semi-arid regions such as Southern California, pollutants may build-up on impervious surfaces during the extended dry season, and subsequently wash-off into nearby water-bodies once the wet season begins. Atmospheric deposition may be especially important as a source of pollutants to stormwater in these regions because significant quantities of trace metals and other pollutants are emitted into the atmosphere daily (SCAQMD, 2003), and the ultimate fate of the trace metals in particular is unknown."

The study goes on to conclude:

"This research demonstrates: (1) atmospheric deposition potentially accounted for 57-100% of the trace metal loads in annual stormwater discharges in this highly impervious catchment; and (2) dry deposition appears to be the dominant mechanism for transfer of atmospheric pollutants to surfaces in semi-arid Los Angeles. Because atmospheric deposition is potentially a large fraction of runoff load, further research into the processes of resuspension and sequestration of deposited materials, and washoff in stormwater runoff is warranted." (*Contribution of trace metals from atmospheric deposition to stormwater runoff in a small impervious urban catchment,* Sabin et al., 2005)

The 2005 TMDL Staff Report cited a 2004 joint SCCWRP/UCLA study entitled "Dry Atmospheric Deposition of Trace Metals in the Los Angeles Coastal Region," which estimated that dry weather indirect deposition could be several thousand kilograms per year, and that estimates of copper, lead, and zinc deposited on the land were several times greater than the estimated loads of these metals in the river from non-atmospheric sources. The study estimated the dry weather indirect deposition of copper to be 16,000 kg/year, lead to be 12,000 kg/year, and zinc to be 80,000 kg/year.

Adoption of the 2005 TMDL brought the severity of the problem into even clearer focus. The Regional Water Board did not include a load allocation for indirect deposition, despite the overwhelming evidence that such deposition plays a significant role in water quality in urban watersheds. Instead, the loadings of metals associated with indirect atmospheric deposition were accounted for in the estimates of stormwater loadings. Since atmospheric deposition was not addressed adequately in the 2005 TMDL, 40 cities, Caltrans and the County of Los Angeles are now directly responsible for the particulate matter that falls on them from the atmosphere, despite the fact that they do not have any regulatory authority over that deposition.

There are Clean Air Act provisions that can be used to address atmospheric deposition. The secondary (welfare-based) particulate matter component of the National Ambient Air Quality Standards appears to be the appropriate vehicle for controlling atmospheric pollutants that cause impairments to water quality, since water is one of the defined welfare benefits. Section 108(a) of the Clean Air Act (42 U.S.C. § 7408) directs the U.S. EPA Administrator to identify certain pollutants which "may be anticipated to endanger public health and welfare." Welfare effects as defined in Section 302(h) of the Clean Air Act (42 U.S.C. § 7602(h)) include, but are not limited to, "effects on soils, **water**, crops, vegetation, man-made materials, animals, wildlife, weather, visibility and climate, damage and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being." (Emphasis added)

The issue of atmospheric deposition was of great concern to State Board members when the 2005 TMDL was submitted for approval at the October 20, 2005 Board meeting. During that meeting, Board Member Secundy indicated, "What we want to do is be able to go after the root cause of the problem." (Transcript of October 20, 2005 State Board Hearing, p. 19) Board Member Katz noted that we were here because the Air Board had not done its job. As the result of these concerns, the findings adopted by the State Board included specific directions that there be consultation among the water boards, the California Air Resources Board ("CARB") and the responsible jurisdictions concerning atmospheric deposition and also that if the Regional Board would not reconsider the Metals TMDL, the State Board would do so on its own motion.

Subsequently, the State Board and CARB held an historic joint meeting in February 2006 to address the relationship between atmospheric deposition and water quality. In addition, Regional Board staff has held exploratory meetings with the South Coast Air Quality Management District.

Despite all of this available information, and the concerns expressed by State Board members regarding the problem of atmospheric deposition, the Regional Board adopted the Addendum without considering an Atmospheric Deposition Alternative. Neither the 2005 TMDL nor the 2007 TMDL contains a mechanism to address the primary source of metals in the Los Angeles River, atmospheric deposition. The Metals TMDL provides an opportunity for the State and Regional Water Boards to develop a TMDL that seriously addresses the sources of atmospheric pollutants that impair water quality. The State Board should remand the Metals TMDL to the Regional Board with direction to develop and consider an Atmospheric Deposition Alternative.

Expanded Source Control/Linkage Analysis Alternative

The Regional Water Board's 2005 TMDL Staff Report noted, "additional monitoring and special studies may be needed to evaluate the uncertainties and assumptions made in development of this

TMDL." The Staff Report went on to indicate that special studies may be warranted to evaluate the numeric targets in the TMDL and to better characterize the loadings from natural sources. Staff also suggested that studies should also be considered to evaluate the potential contribution of atmospheric deposition to metals loadings and sources of atmospheric deposition. In response, the Regional Board in the Basin Plan Amendment adopting the 2005 TMDL required the TMDL to be reopened after five years, in light of special studies, to "refine the estimate of loading capacity, waste load and/or load allocations, and other studies that may serve to optimize implementation efforts." June 2, 2005 Basin Plan Amendment, p. 17.

When the 2005 TMDL took effect in early 2006, there had not yet been a determination regarding which special studies should be pursued, what they would cost, how funding would be allocated, and whether or not there would be sufficient time to complete the studies by the deadline set in the TMDL. None of the local jurisdictions, including the City of Los Angeles and the County of Los Angeles, had sufficient staff to manage these complex studies. Nonetheless, certain of the responsible jurisdictions, led by the Cities of Downey and Signal Hill, began taking steps *before* the effective date of the TMDL to organize the jurisdictions and agencies to conduct special studies and to address the Coordinated Monitoring Program ("CMP") required under the TMDL. A more detailed account of the earliest efforts can be found in the comment letter of the City of Signal Hill, and associated exhibits, submitted to the Regional Board on August 6, 2007. Copies of the letter and exhibits have been submitted to the State Board under separate cover and are hereby incorporated into this letter.

To summarize for the State Board, during the first several months of 2006, briefings on the TMDL were held for city managers of the responsible jurisdictions and a working group of public works officers was formed to report on the need for special studies and, most importantly, a funding formula for those studies. After meetings in April and May 2006, the public works officers recommended three special studies, a specific funding formula, and an organizational structure for the monitoring and special studies. A voluntary Steering Committee was formed to prepare an issues memorandum and participation survey, the purpose of which were to educate City Council members and determine their willingness to support both the special studies and the CMP.

The Steering Committee has met ten times since October 2006 to review special studies issues. During that time, an issues memorandum and participation survey were prepared and released to the jurisdictions. Also, the three recommended special studies were condensed to two -- one to develop Site-Specific Objectives (SSOs) and one to estimate the atmospheric deposition of metals and assess the impacts of open areas. The Steering Committee also reviewed the CMP, which was prepared by a Technical Committee chaired by the County and City of Los Angeles.

Following hundreds of phone calls and emails, the Steering Committee determined that a broad majority of the jurisdictions supported funding the special studies. The Gateway Cities Council of Governments ("COG") agreed to act as a fiduciary agent for scientific oversight of the CMP and implementation of the special studies. On March 20, 2008, City Managers, County staff, Caltrans and Regional Board Executive Officer Tracy Egoscue met to review final work plans for the special studies and the CMP. The responsible jurisdictions were also asked to finalize a funding formula for these projects and ballots were distributed at the meeting. Of the 42 agencies, including 40 cities, all have supported funding for the CMP and, to date, 38 cities have decided to support the funding formula for the special studies. Those special studies are estimated to cost nearly $4 million. The agencies plan to be entering into agreements this summer to proceed with the special studies.

Meanwhile, the COG approved a Memorandum of Agreement ("MOA") for the funding of the CMP, and it is anticipated that the COG will be the fiduciary agent for the funding of implementation of the special studies. The Steering Committee is finalizing an MOA for funding of the special studies and will be submitting that to the COG Board for approval shortly.

Regional Water Board staff have been kept apprised of this effort throughout. However, they have not actively participated in this effort, which was accomplished exclusively by staff at the responsible jurisdictions.

These extensive coordinated efforts – starting with establishing an organizational structure involving over 40 agencies and jurisdictions – demonstrate the commitment by the responsible jurisdictions to move forward to develop and complete the special studies that will provide important additional information that will be valuable in refining numeric targets, analyzing sources, and improving the linkage analysis components of the TMDL. These studies will also be valuable for selection and implementation of appropriate best management practices (BMPs) for the watershed.

When the 2005 TMDL was adopted, both the Regional Board and the regulated community recognized that additional research was required into the impacts of metals on the beneficial uses of the river, and that that such research would refine the TMDL implementation effort. However, an alternative that would facilitate the completion of the research and incorporation of the results into the TMDL was not included in the Addendum. Such an alternative should have provided a modified schedule of interim compliance dates that would ensure that the research could be completed and reviewed by Regional Board staff prior to the scheduled TMDL reopener. For details of the suggested interim compliance date modifications that would be involved in such an alternative, please see the City of Signal Hill letter. It should be noted that the modification request would not change the final compliance date for the Metals TMDL, but would allow enough time for the special studies to be completed and reviewed by Regional Board staff *prior* to the reopener. The studies also would be available to the State Board, were this Board to review the TMDL on its own.

However, the Regional Board is proposing amendments to the Basin Plan that will complicate and further delay completion of the special studies. The Regional Board is proposing amendments to the Basin Plan that would incorporate a Policy for Developing Water Effects Ratios for Metals in the Inland Surface Waters of Los Angeles and Ventura Counties. This proposed policy would require three years of monitoring in Water Effects Ratio ("WER") studies. A CEQA scoping session was held on May 6, 2008. The responsible jurisdictions are now hesitant to proceed with the planned SSO study until the proposed WER policy has been adopted, because they are concerned that the current scope of work for the SSO study will not be consistent with the WER policy. Adoption of the WER policy will probably take at least three to six additional months. Given the delays resulting from adoption of the new policy, and the three years monitoring requirement, at least the first six years of the interim compliance schedule should be changed from the proposed specific dates to dates which represent anniversaries from the effective date of the TMDL, as set forth in Table 7-13.2 of the 2005 Basin Plan Amendment. The specific schedule changes that should be made include:

- The deadline for Submission of Special Studies should be four years after the effective date of the TMDL;
- The deadline for Reopening the TMDL should be five years after the effective date of the TMDL;
- The deadline for Submission of Implementation Plans should be 54 months after the effective date of the TMDL; and
- The deadline for Submission of First Jurisdictional Group Compliance Demonstration should be six years after the effective date of the TMDL.

CPR therefore requests that the State Board either remand the Proposed TMDL to the Regional Board for consideration of the Expanded Source Control/Linkage Analysis Alternative or, alternatively, that the State Board direct the Regional Board to modify the TMDL compliance dates in accordance with the above request, in order to complete the special studies that would assist with determining numeric targets, analyzing sources, and improving the linkage analysis components of the TMDL, thus optimizing implementation efforts, an expressed goal of the Regional Board in adopting the Basin Plan Amendment for the Metals TMDL.

Water Quality Attainment Strategy Alternative

A third Alternative that should be included in the alternatives analysis is a Water Quality Attainment Strategy ("WQAS") Alternative similar to the *SFRWQCB Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Urban Creeks* approved by the San Francisco Regional Water Board.
This strategy, which was incorporated as a Basin Plan Amendment in 2005 (prior to the preparation of the Addendum), addresses true source control and helps ensure compliance with water quality objectives. During the April 15, 2008 State Board hearing on the Los Angeles River Trash TMDL, at least one Board member expressed interest in the application of Water Quality Attainment Strategy.

The *SFRWQCB Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Urban Creeks* was developed by the San Francisco Regional Water Board and adopted as "a Basin Plan Amendment…to establish a water quality attainment strategy that addresses pesticide-related toxicity in Bay Area urban creeks." The Project Description section of the WQAS and TMDL states: "The Water Board must develop a TMDL to address the urban creeks designated as impaired pursuant to Clean Water Act § 303(d)(1), and the water quality attainment strategy set forth in the proposed Basin Plan Amendment meets this requirement." (*Diazinon and Pesticide-Related Toxicity in Urban Creeks Water Quality Attainment Strategy and TMDL Proposed Basin Plan Amendment Staff Report,* California Regional Water Quality Control Board San Francisco Bay Region. November 9, 2005. P. 40).

The strategy adopted by the San Francisco Regional Board was a combined WQAS and TMDL. Use of a similar approach would facilitate the use of regulatory authorities by a range of agencies to address water quality impairments through true source control. In San Francisco, the cornerstone of the WQAS is pollution prevention. The strategy includes a program of immediate actions to control discharges, and a program of monitoring to determine progress toward meeting targets and effectiveness of earlier actions. Its strategic goals focus on proactive regulation, education and outreach, and research and monitoring. It calls for involvement of all entities responsible for discharges and emphasizes better coordination with agencies. Its implementation component was designed to utilize adaptive management to respond to new information as it becomes available. Implementation measures will be tracked regularly and the Regional Board will review the strategy approximately every five years.

If the ultimate goal of a TMDL is for water to meet applicable water quality objectives, all reasonable means of achieving that goal must be considered. Using the San Francisco Bay WQAS as a model for a WQAS for Metals in the Los Angeles River would foster greater cooperation and coordination between regulators and the regulated community to address water quality impairments. As noted above, 42 jurisdictions and agencies are already organizing to fund and implement a CMP and two special studies with an estimated cost of $4 million.
The WQAS model is a feasible TMDL alternative meriting serious consideration by the Water Boards.

CPR requests that the State Board remand the proposed TMDL with instructions that Regional Board staff consider such a WQAS alternative.

Conclusion

The State Board should not approve the Metals TMDL as approved by the Regional Board. Instead, CPR requests that the Board remand the TMDL to the Regional Board with directions to include additional alternatives in the Alternatives Analysis Addendum to CEQA Documentation. These alternatives should include a Modified Interim Compliance Date Alternative, an Atmospheric Deposition Alternative, an Expanded Source Analysis/Linkage Analysis Alternative with a modified implementation schedule, an Increased Focus on Industrial Stormwater Discharges and Other Sources of Metals Alternative, a Water Quality Attainment Strategy Alternative (WQAS) similar to the *SFRWQCB Water Quality Attainment Strategy and TMDL for Diazinon and Pesticide-Related Toxicity in Urban Creeks* approved by the San Francisco Regional Water Board, and other potential project alternatives cited in the Burhenn & Gest LLP letter of May 14, 2008. Moreover, CPR believes that the WQAS Alternative should be selected as the Preferred Alternative, and the TMDL be readopted by the Regional Board to be a combined WQAS and TMDL.

Alternatively, the State Board could remand the proposed TMDL to the Regional Board with instructions to adopt a TMDL that incorporates changed interim compliance dates that would provide sufficient time for completion of the special studies, so that the Regional Board and, potentially, the State Board can benefit from the results of these studies prior to the time that the TMDL is reopened. As noted above, at least the first six years of the compliance schedule should be changed to specify compliance dates that reflect anniversaries of the effective date of the TMDL, as set forth in listed in Table 7-13.2 of the 2005 TMDL. This modification will enable the TMDL to meet the intent of the Regional Board, that there be sufficient time for the completion of the special studies prior to the reopener of the TMDL, to allow for a more optimal implementation of the TMDL.

Moreover, CPR strongly recommends that the State Board seize the opportunity presented by this TMDL to pursue the use of the authorities given to the Air Boards by the Clean Air Act to control at the source atmospheric pollutants that are causing water quality impairments in California.

Thank you again for the opportunity to provide these comments.

Sincerely,

Larry Forester, Council Member
City of Signal Hill

MERCURY TMDLS FOR LITTLE RIVER AND CATAHOULA LAKE WATERSHED

SUBSEGMENTS 081601, 081602, 081603, and 081605

TMDL REPORT

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 6, DALLAS, TX
and the
Office of Environmental Assessment
Louisiana Department of Environmental Quality

Prepared by:

PARSONS

February 2003

MERCURY TMDLS FOR LITTLE RIVER AND CATAHOULA LAKE WATERSHED

SUBSEGMENTS 081601, 081602, 081603, and 081605

TMDL REPORT

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 6, DALLAS, TX

and the

Louisiana Department of Environmental Quality
Office of Environmental Assessment

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FEBRUARY 2003

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act (CWA) requires states to identify water bodies that are not meeting state water quality standards and to develop total maximum daily pollutant loads for those water bodies. A total maximum daily load (TMDL) is the amount of pollutant a water body can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the water body.

To meet this requirement of the CWA, the Louisiana Department of Environmental Quality (LDEQ) has scheduled completion of TMDLs in the Ouachita River Basin, in northeast Louisiana for 2002 and is relying on the EPA Region 6 to assist in the completion of some of these TMDLs. Little River from Bear Creek to Catahoula Lake (Subsegment 081602), located in the Ouachita River Basin, was placed on the list of impaired waters established as part of the 2002 Consent Decree and later modified LDEQ 1999 303(d) List due to elevated mercury concentrations in fish tissue. Subsequently, a fish consumption advisory for the Little River from Highway 500 near Georgetown to Catahoula Lake (58.25 miles), Catahoula Lake (18,797 acres), and the 11-mile reach of Little River (French Fork) from the lake to the dam near Archie was jointly issued by the Louisiana Department of Health and Hospitals (LDHH), the Louisiana Department of Environmental Quality (LDEQ), and the Louisiana Department of Wildlife & Fisheries (LDWF) on November 20, 2000. The study area includes subsegments 081601, 081602, 081603, 081605, 081606, 081607, 081608, 081609, 0816010, and 0816011. Potential mercury sources to the Little River from the upstream, contributing watersheds (Dugdemona River and Castor Creek) were evaluated due to the persistent nature of mercury in the environment; however, there are no current fish consumption advisories for these watersheds. Since atmospheric deposition is a known source of mercury, in addition to the study area, this TMDL report assesses potential mercury contributions from an airshed that extends a distance of 100 kilometers out from the Little River/Catahoula watershed.

While there have been no known violations of the numeric ambient water quality criterion for mercury, Little River, Catahoula Lake, and French Fork Little River do not meet the narrative water quality standard for toxic substances due to the fish advisory. The LDEQ narrative water quality standard for toxic substances states:

> "No substance shall be present in the waters of the state or the sediments underlying said waters in quantities that alone or in combination will be toxic to human, plant, or animal life or significantly increase health risks due to exposure to the substances or consumption of contaminated fish or other aquatic life."

The endpoint selected for these TMDLs is the methylmercury edible fish tissue concentration of 0.5 mg/kg, which is the basis of the fish consumption advisory. The benefits of using a fish tissue criterion include: (1) it accounts for spatial and temporal complexities that occur in aquatic systems; (2) it accounts for bioaccumulation and biomagnification in the aquatic food web; and (3) it is more closely tied to the goal of protecting public health from consumption of edible fish. An endpoint of 0.5 mg/kg methylmercury in fish tissue has been used previously in an approved mercury TMDL for another portion of the Ouachita River Basin in Louisiana (USEPA, 2002). As a numeric translator for this narrative standard, an endpoint of 0.5 mg/kg methylmercury in edible fish tissue has been selected as the target for these TMDLs.

All available fish tissue data, sediment and water data, air release and deposition data within the watershed and the airshed, point source discharge data, and geologic data were evaluated. Potential mercury sources to the Little River from the contributing watersheds and atmospheric components were calculated based on an annual mass balance approach. EPA's BASINS Version 3 was used to simulate watershed mercury loading to the Little River, Catahoula Lake, and their tributaries. Wet deposition rates were derived from the National Atmospheric Deposition Program Mercury Deposition Network data available for four Louisiana monitoring sites. Available data indicates that there are no natural sources of mercury in the geology throughout the watershed.

The calculated allowable load of mercury for the Little River/Catahoula Lake watershed is 111.38 lbs/yr. Because this assessment estimates 99.5 percent of the current mercury loadings to the Little River/Catahoula Lake watershed are from atmospheric deposition, 99.5 percent or 110.62 lbs/yr is assigned to the load allocation. The estimated current mercury load to the watershed is 164.76 lbs/yr. Therefore, this mercury load must be reduced by 53.38 lbs/yr (or 32.43 percent) to an allowable loading of 111.38 lbs/year. Since point sources are a relatively small portion of the total mercury load to the system, no reductions in point sources loads are required in this TMDL. The calculated load of 0.76 lbs/yr is established as the TMDL waste load allocation. Demonstrations that these assumed waste loads are met will provide reasonable assurances that the TMDL is achievable. Since conservative assumptions were used in the development of the TMDL calculations, the margin of safety (MOS) is implicit. The following table summarizes the TMDL calculations.

Table ES-1
Results

TMDL Calculations	
Current Estimated Loading	164.76 lbs/yr.
Waste Load Allocation	0.76 lbs/yr.
Load Allocation	110.62 lbs/yr.
Margin of Safety	0
TMDL	111.38 lbs/yr.

The TMDL authorizes re-allocation of the individual WLAs among point sources and indeed assumes that this will occur, but only to the extent that the sum of re-allocated loads remain at or below the sum of the original individual WLAs (sometimes described here as the cumulative WLA).

Since most of the current mercury loadings to the Little River/Catahoula Lake watershed are estimated to be from atmospheric deposition, significant reductions in atmospheric deposition within the airshed will be necessary to achieve the applicable endpoint of 0.5 mg/kg in fish tissue. Ongoing and future reductions in mercury emissions using a multimedia approach provide reasonable assurance that water quality standards will be attained. EPA and LDEQ have and will continue to take key steps nationally and regionally toward reducing mercury emissions and environmental and human health risks associated with mercury exposure. A combination of multiple state and federal programs will provide reasonable assurances that nonpoint sources of mercury can be reduced to levels necessary to meet the endpoint. The combined affect of these programs should translate to 50 percent reduction in annual emissions in Louisiana, which is greater than the 32 percent reduction required by these TMDLs.

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
AMSA	Association of Metropolitan Sewerage Agencies
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BAT	Best available technology
cfs	Cubic feet per second
CWA	Clean Water Act
DO	Dissolved oxygen
DOC	Dissolved organic carbon
EPCRA	Emergency Planning and Community Right-to-Know Act
FDA	Food and Drug Administration
FWQC	Federal Water Quality Coalition
GAP	Gap analysis program
GIS	Geographic information system
GP	General permit
Hg	Mercury
HgS	Cinnabar
HWC	Hazardous waste combustors
km	Kilometer
LA	Load allocation
LAC	Louisiana Administrative Code
LAG	Beginning of LPDES general permit numbering system
LAR	Beginning of LPDES multi-sector general permit numbering system for storm water discharges associated with industrial/construction activities
lbs/yr	Pounds per year
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDWF	Louisiana Department of Fish and Wildlife
LPDES	Louisiana Pollutant Discharge Elimination System
MDN	Mercury Deposition Network
mg/kg	Milligram per kilogram
mg/L	Milligrams per liter
MOS	Margin of safety
MWC	Municipal waste combustors

MWI	Municipal waste incinerators
mya	Million years ago
NADP	National Atmospheric Deposition Program
ng/L	Nanograms per liter
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWR	National Wildlife Refuge
ONRW	Outstanding natural resource water
PBT	Persistent, bioaccumulataive, and toxic
PCS	USEPA Permit Compliance System
PLOAD	Pollutant load
ppm	Parts per million
QA/QC	Quality assurance/quality control
SIC	Standard industrial classification
TCEQ	Texas Commission on Environmental Quality
TEDI	Toxics emissions data inventory
TMDL	Total maximum daily load
tpy	Tons per year
TRI	Toxic release inventory
TSS	Total suspended solids
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
WLA	Wasteload allocation
WQS	Water quality standards
WWTP	Wastewater treatment plant

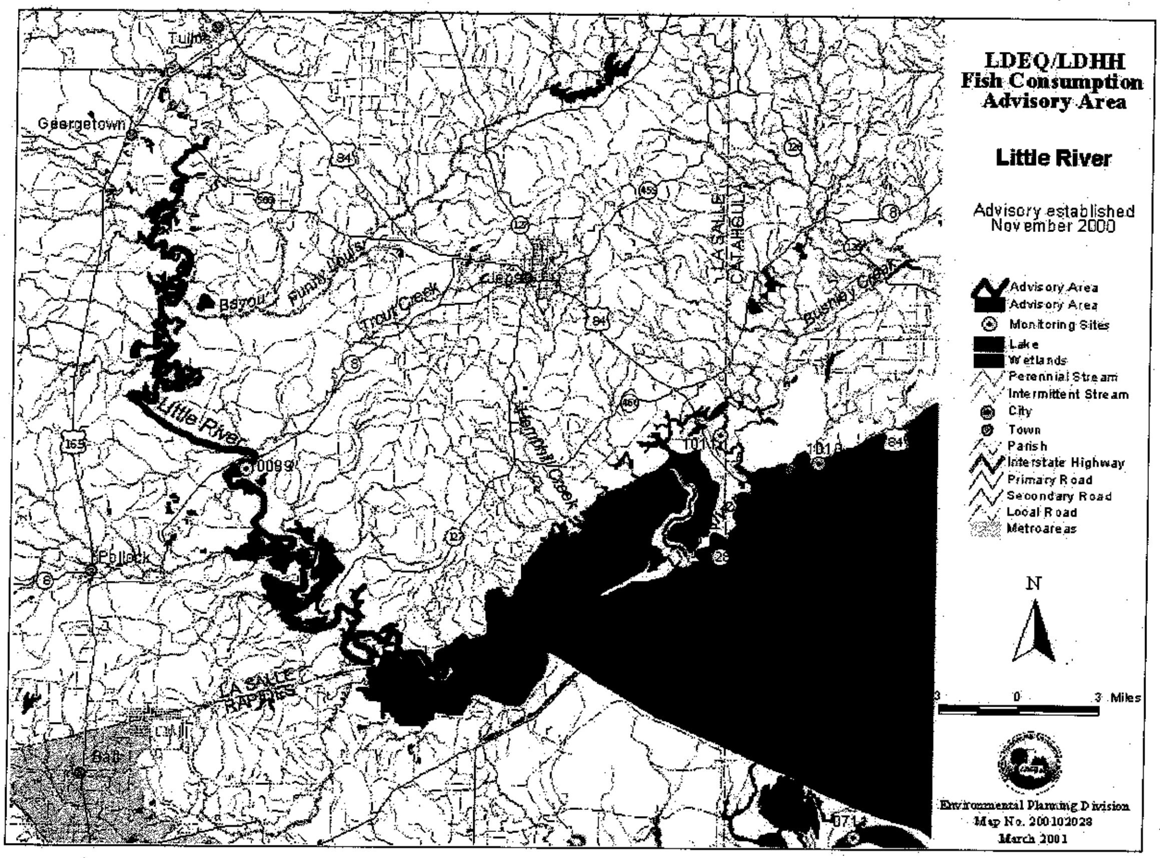
SECTION 1 INTRODUCTION

This report documents the data and assessment utilized to establish total maximum daily loads (TMDLs) for mercury for three waterbodies in Louisiana in accordance with the requirements of §303 of the Clean Water Act, Water Quality Planning and Management Regulations (40 CFR Part 130), and U.S. Environmental Protection Agency (USEPA) guidance. The purpose of a TMDL is to determine the pollutant loading a waterbody can assimilate without exceeding the water quality standard for that pollutant. The TMDL also establishes the pollutant load allocation necessary to meet the water quality standard established for a waterbody based on the relationship between pollutant sources and in-stream water quality conditions. The TMDL consists of a wasteload allocation (WLA), a load allocation (LA), and a margin of safety (MOS). The WLA is the fraction of the total pollutant load apportioned to point sources. The LA is the fraction of the total pollutant load apportioned to nonpoint sources. The MOS is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

A fish consumption advisory for the Little River, including Catahoula Lake, was jointly issued by the Louisiana Department of Health and Hospitals (LDHH), the Louisiana Department of Environmental Quality (LDEQ), and the Louisiana Department of Wildlife & Fisheries (LDWF) on November 20, 2000. LDEQ's Mercury Monitoring Program revealed elevated mercury levels in fish at monitoring sites 0089 and 1010. Figure 1.1 shows these monitoring sites along with the fish consumption advisory area. As illustrated, the advisory includes the 58.25-mile segment of Little River from Highway 500 near Georgetown to Catahoula Lake (subsegments 081601, 081602), all of Catahoula Lake (subsegment 081603), and the 11-mile stretch of French Fork Little River from Catahoula Lake to the weir near Archie (subsegment 081605). To adequately address mercury sources contributing to the fish consumption advisory, this TMDL report also evaluates subsegments that are hydrologically connected to the Little River and Catahoula Lake. For the purposes of this TMDL report the Little River/Catahoula Lake watershed includes the following subsegments:

- 081601 – Little River, confluence of Castor Creek and Dugdemona River to Junction with Bear Creek
- 081602 – Little River, from Bear Creek to Catahoula Lake
- 081603 – Catahoula Lake
- 081605 – Little River, from Catahoula Lake to dam at Archie
- 081606 – Fish Creek, headwaters to Little River
- 081607 – Trout Creek, headwaters to Little River
- 081608 – Big Creek, headwaters to Little River
- 081609 – Hemphill Creek, headwaters to Catahoula Lake, including Hair Creek
- 081610 – Old River, Catahoula Lake to Little River
- 081611 – Bayou Funny Louis, headwaters to Little River

Figure 1.1 Fish Consumption Advisory Area



http://www.deq.state.la.us/surveillance/mercury/2000report/intro.htm

The USEPA recognizes that Dugdemona River (subsegment 0814) and Castor Creek (subsegment 0815), watersheds to the north of Little River, are considered tributaries of Little River (subsegments 081601, 081602). For the purposes of this TMDL report, however, Dugdemona River (subsegment 0814) and Castor Creek (subsegment 0815) are described as the contributing watershed (see Figure 2.2). It is important to note that there is no fish consumption advisory for these subsegments and that they were included in this assessment only to account for other potential mercury sources that may influence water quality in the Little River/Catahoula Lake watershed (See Section 5 for more detail). Water quality and fish data for subsegments 0814 and 0815 did not support including them on LDEQ's 303(d) list.

SECTION 2
STUDY AREA DESCRIPTION

These TMDLs for mercury have been developed to address the areas specified in the fish consumption advisory and as defined in the LDEQ 303(d) List. To adequately address mercury sources contributing to the fish consumption advisory, this TMDL report asses subsegments that are hydrologically connected to the Little River and Catahoula Lake (see Figure 2.1). The affected parishes include Grant, Rapides, La Salle, Catahoula, and Winn. Since atmospheric deposition is a known source of mercury, this TMDL report also assesses potential mercury contributions from an airshed that extends a distance of 100 kilometers out from the Little River/Catahoula watershed (see Figure 2.2).

2.1 OUACHITA RIVER BASIN

The headwaters of the Ouachita River are found in the Ouachita Mountains in west central Arkansas near the Oklahoma border. The Ouachita River flows south through northeastern Louisiana and joins the Tensas River to form the Black River, which empties into the Red River. The Ouachita River Basin (Basin 8) covers over 10,000 square miles of drainage area. Most of the basin consists of rich, alluvial plains cultivated in cotton and soybeans. The northwest corner of the basin is a commercially harvested pine forest (LDEQ 1996). The Little River/Catahoula Lake watershed is contained within the Ouachita River Basin.

2.2 LITTLE RIVER/CATAHOULA LAKE WATERSHED

Little River is formed by the confluence of the Dugdemona River and Castor Creek near the northeastern corner of Grant Parish, Louisiana. The Little River meanders to the south and east, forming the boundary between Grant and La Salle Parishes, before emptying into Catahoula Lake. Catahoula Lake is largely contained within La Salle Parish, although a small section of the lake extends westward into Rapides Parish. The French Fork Little River flows from the northeast portion of the lake and lies almost entirely within the Catahoula National Wildlife Refuge (NWR) and the Saline Wildlife Management Area. This reach of Little River seldom flows since flow is restricted to control the water level of Catahoula Lake for the purpose of waterfowl management. It only flows when the control structure at the Catahoula Lake Diversion Canal is opened to drain Catahoula Lake or when the Black River is flooding. When the lake is draining, water flows from French Fork Little River to Catahoula Lake. In addition, during flood conditions on the Black River, when the Black River backs up into Catahoula Lake, water flows from French Fork Little River over the dam at Archie (LDEQ 2000a).

Average annual precipitation in the study area, recorded at the nearest Louisiana climatic station in Alexandria-Estler, is 59.32 inches based on a 30-year period of record (1961-1990) (Louisiana State University 2000). The average annual rainfall amounts throughout the study

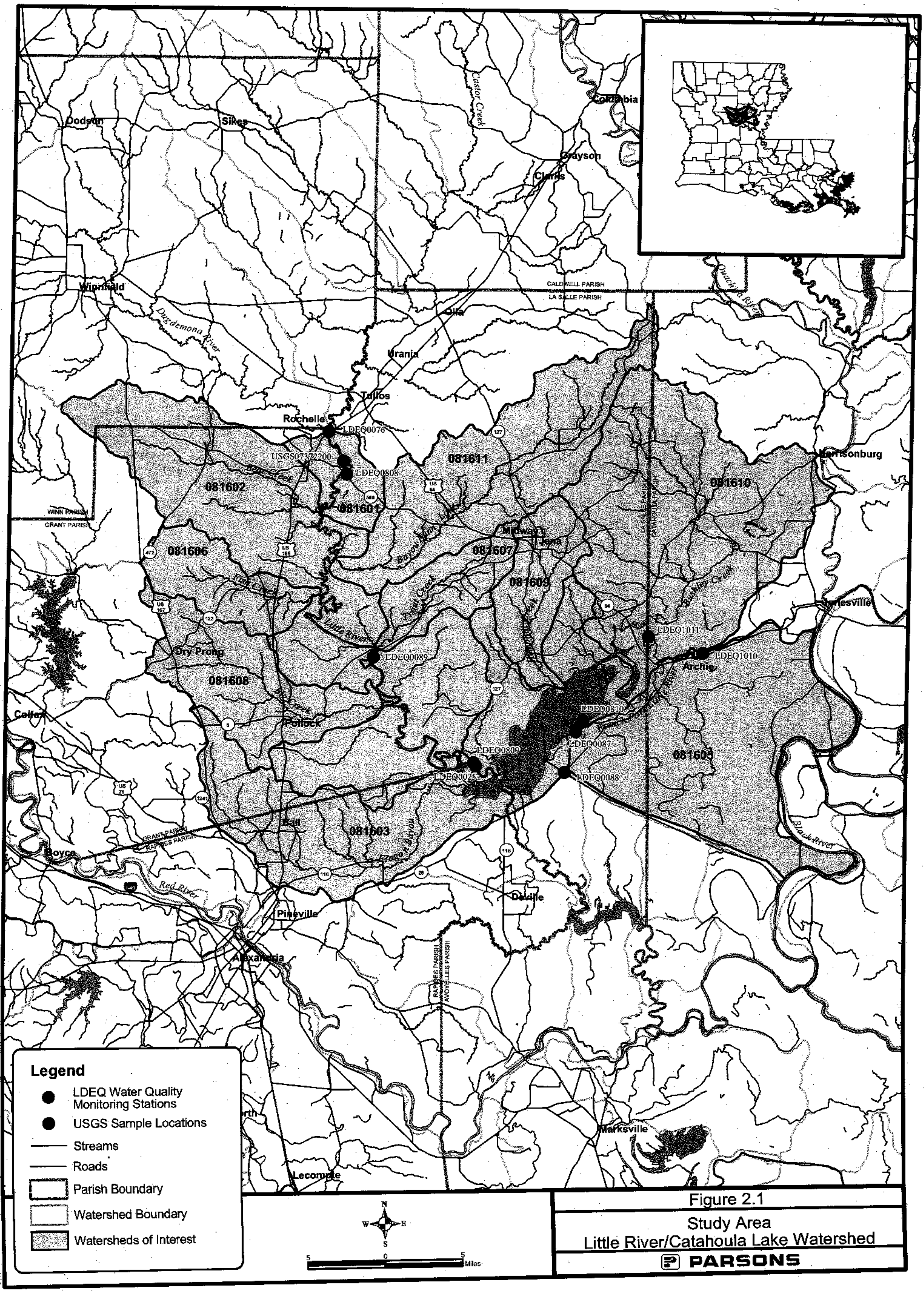


Figure 2.1

Study Area
Little River/Catahoula Lake Watershed

PARSONS

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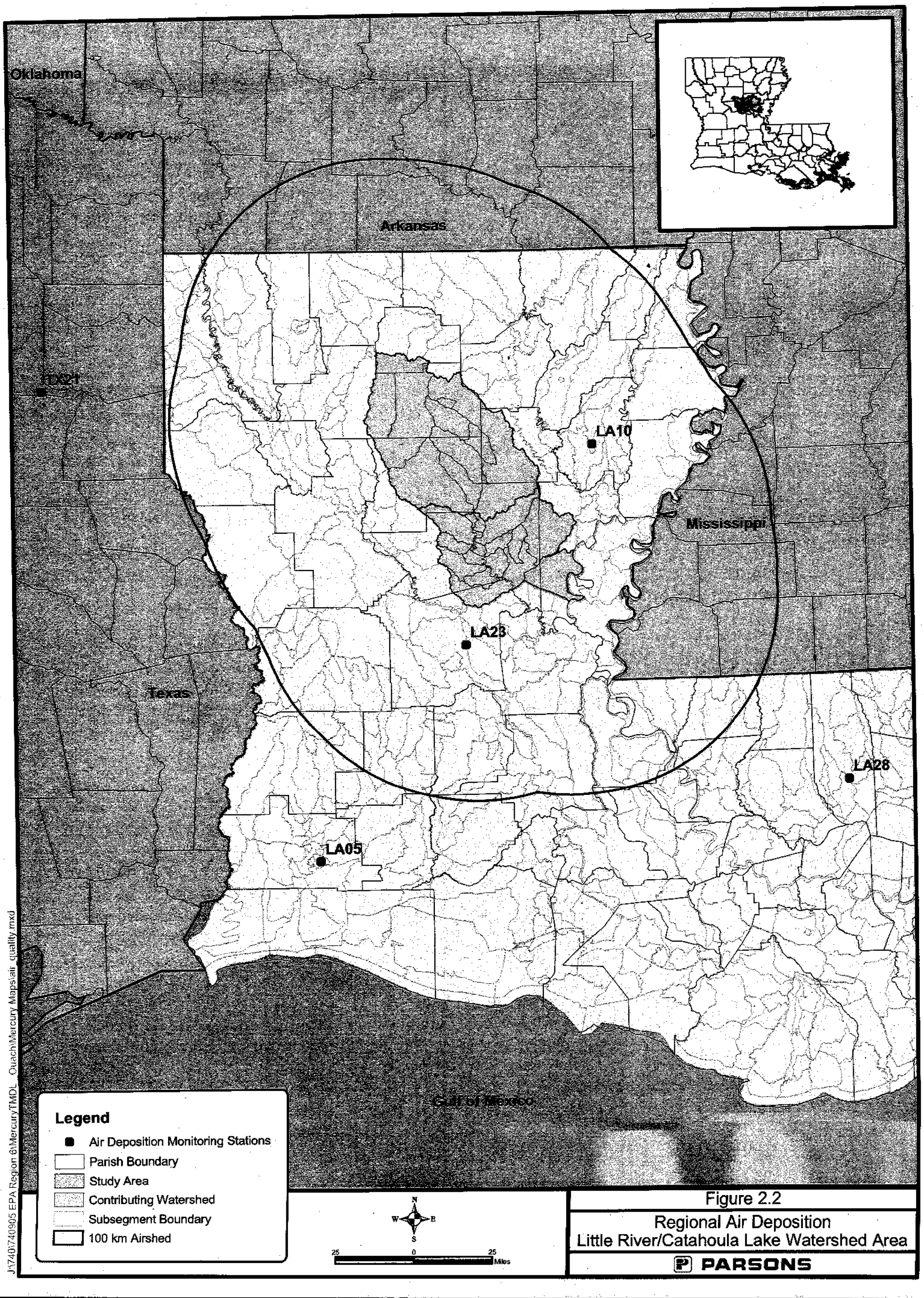

Figure 2.2
Regional Air Deposition
Little River/Catahoula Lake Watershed Area

area are shown in Figure 2.3. The annual average stream flow for Little River, as determined from U.S. Geological Survey (USGS) gauging station 07372200 near Rochelle, Louisiana (period of record from 1958-1991), is 2,286 cubic feet per second (cfs). The location of this gauge station is shown in Figure 2.1.

2.3 PHYSIOGRAPHY AND SOILS

The study area lies between, and is affected by, the valleys and flood plains of the Mississippi River and Red River. In this area there are three major physiographic divisions – alluvial valleys created from stream floodplains; "piney" hills of the Flatwoods area; and a small, topographically intermediate division of upland terraces found along stream valleys (Lytle and Sturgis 1962; Fisk 1938). Under current Natural Resources Conservation Service (NRCS) classifications, within and around the study area, these divisions can further be defined as soils of the Ouachita River Valley, Red River Valley, Southern Mississippi Valley, and Western Terraces and Uplands (NRCS 1998). Figure 2.4 depicts the NRCS soil types.

The soils found upland and outside of the Little River stream valley are those of the Western Pleistocene and Tertiary floodplains, terraces and uplands. These were previously identified as part of the Coastal Plain area (Lytle and Sturgis 1962). The soils are nearly level to gently sloping, comprised of grayish brown sandy loams at the surface, and underlain by sand clay loam subsoils. Typically the soils contain little organic matter and nutrients.

Within the Western Pleistocene and Tertiary divisions, soils near the headwaters of Little River were previously described as part of the general Flatwoods soil area. The materials are nearly level, poorly drained soils comprised of sands, clays, and silts derived from Pleistocene-age rocks (Lytle and Sturgis 1962). The soil is somewhat acidic and low in organics and nutrients. Because of the presence of siltpans, claypans, and high water levels, drainage is considered poor. Major uses are pine forest and some grazing.

Along the lower Little River and the western area of Catahoula Lake, the soils are within the Western Pleistocene floodplains and terraces (Recent Alluvium association). These soil types transition to Southern Mississippi Valley Alluvium to the north, east and south shores of Catahoula Lake as well as northeast along the French Fork of the Little River downstream to the Ouachita River. They are typically described as recent sediment deposits along streams and rivers. Their features include nearly level to gently sloping ridges (levees) along channels, backslopes, and basins/swamps. Soils of the Southern Mississippi Valley Alluvium within the Catahoula Lake area can be mixed older sediments from the Ouachita, Red River, and Mississippi floodplains. The soils vary from medium acidic, sandy loams along the natural levees, to acid or silty clays of the backslopes. As with other soils of the overall area, these soils tend to have low to medium acidity and low organics and nutrients (Lytle and Sturgis 1962). The extent of the soils are limited north and west by higher lands of the Mississippi valley escarpment trending northeast along and north of the lake, and southerly below the southeastern lakeshore (Fisk 1938).

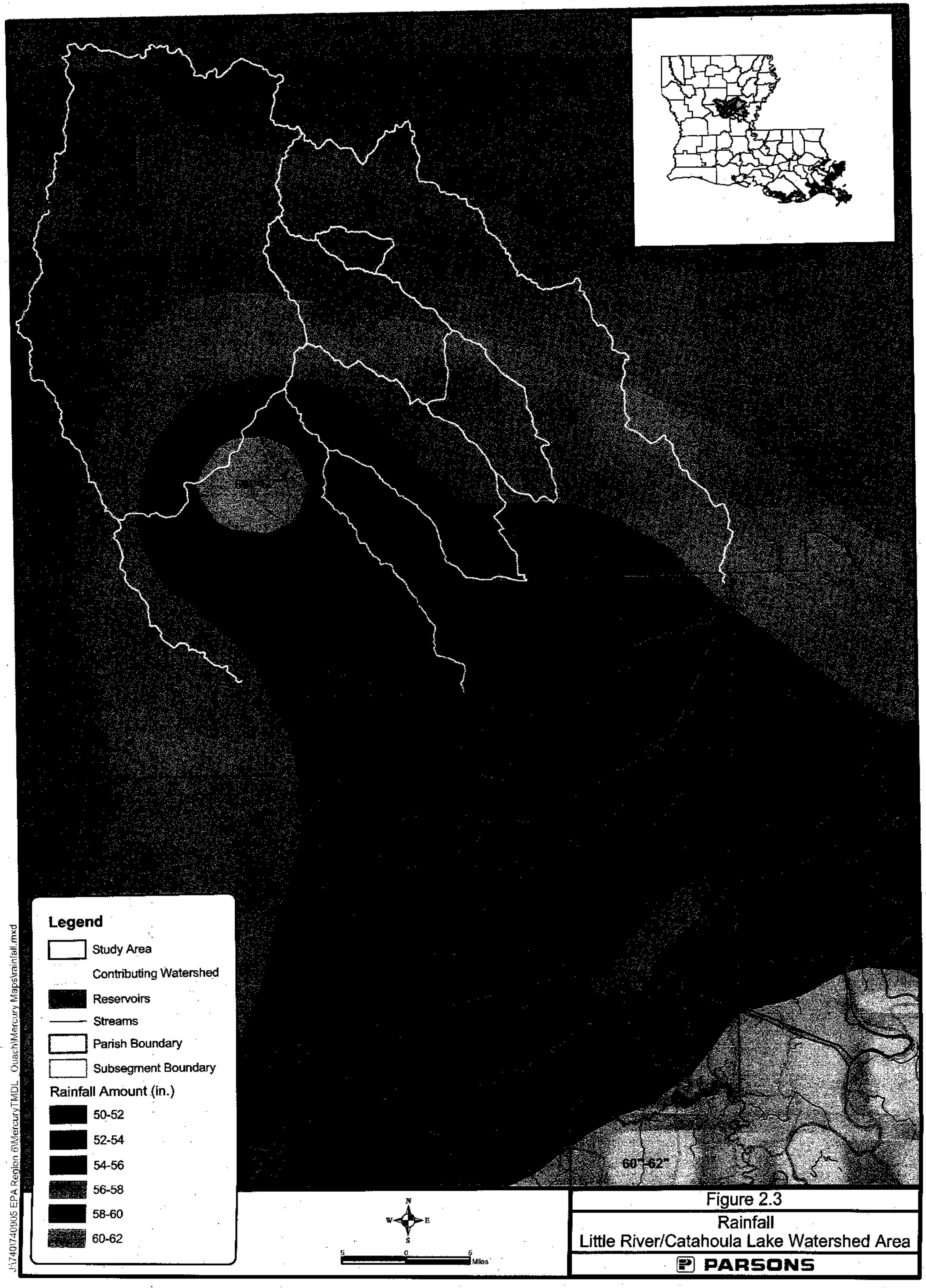

Figure 2.3
Rainfall
Little River/Catahoula Lake Watershed Area

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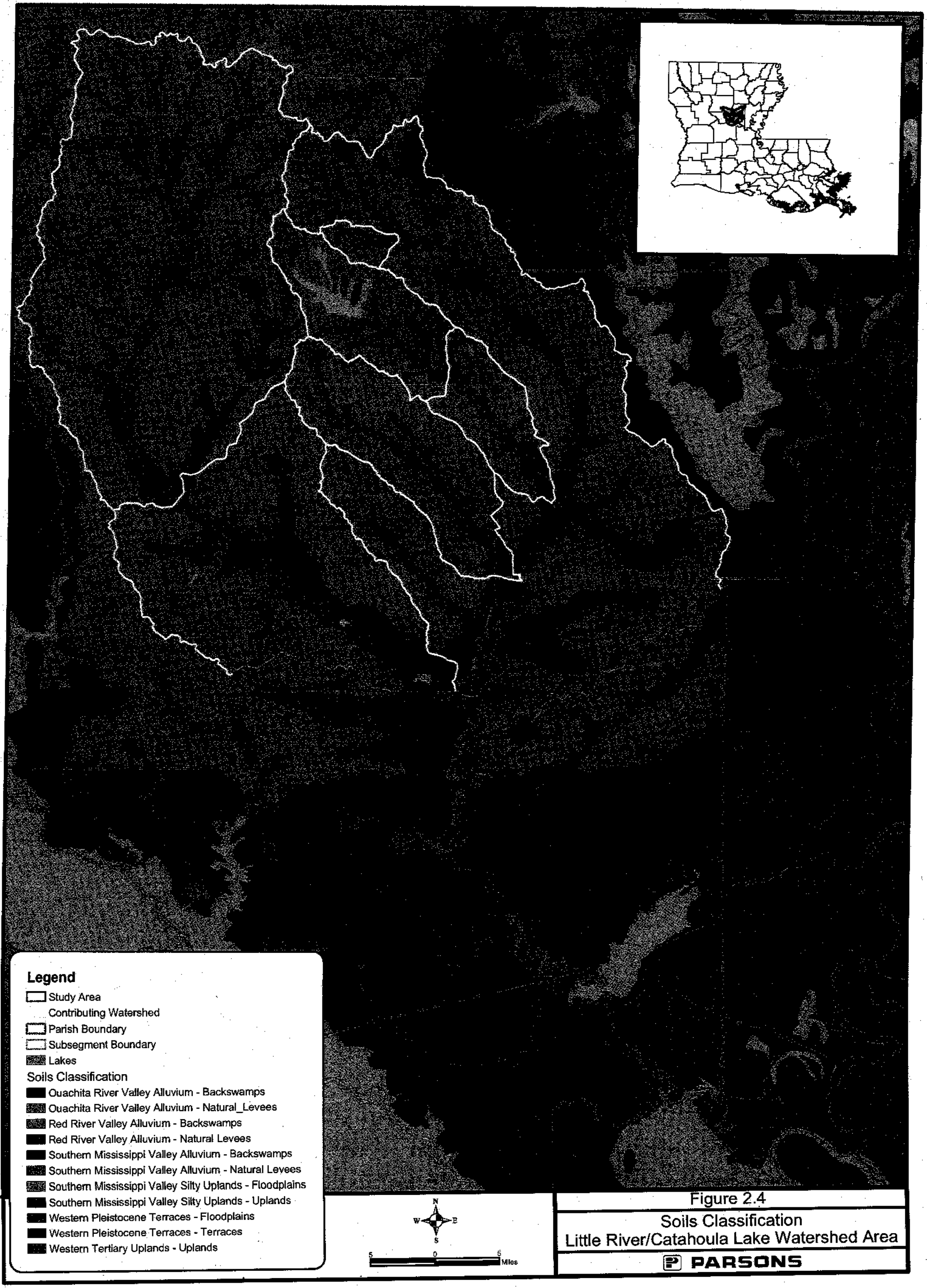

Figure 2.4
Soils Classification
Little River/Catahoula Lake Watershed Area

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2.4 GEOLOGY

Near surface rock strata of the study area have been estimated to be of Eocene to Holocene (54 to 38 million years ago-(mya)), or recent (from 11,000 years ago to present day) age, and reflect the depositional cycles of flooding and retreating of rivers in the region. In general, rocks closest to water bodies are the youngest, consisting of Quaternary alluvial valley deposits. Strata of the upland terraces within the study area are older and vary from sandstones to lignitic or fossiliferous clays. The following descriptions are summarized from the 1984 geologic map (Louisiana Geologic Survey 1984) with additional information from the publication on geology of Grant and La Salle Parishes (Fisk 1938).

Holocene-age alluvium is observed adjacent to Little River and its tributaries above Catahoula Lake, as well as most of the lake boundaries. The strata are described as gray to brownish gray clays and silty clays. The alluvium includes all the valley deposits with the exception of natural levees along the major river bodies. The latter is found along the lower reaches of Little River's French Fork that flows from Catahoula Lake northeasterly towards the Ouachita River. South of Catahoula Lake are Pleistocene-age braided stream terraces of tan and brown fine to coarse sand. These are considered glacial outwash of the ancestral Arkansas River, and are intermittently cut by younger alluvial river deposits as found along the Saline and Muddy Bayous.

Higher in elevation but within the stream valleys are Pleistocene-age Prairie Terraces. These deposits are light gray to light brown clays, sandy clays, silts, sands, and some gravels. These deposits are typical of stream valleys throughout the study area as well as southward to the Red River floodplain. Also found are occasional deposits of Intermediate and High Terraces that contain similar materials but are more dissected and topographically higher than Prairie Terraces. The three terrace types are separated by erosional unconformities.

Associated with a band of High Terrace deposits across central Louisiana trending east-northeast are Oligocene and Eocene strata, typically dated with fossils found in key strata. The Oligocene-age Catahoula Formation deposits are gray to white sandstones, quartz sand, volcanic ash, and brown sandy clays, with occasional petrified wood. Occurrences of the Catahoula are found along Fish Creek and a small tributary of Little River north of Fish Creek, as well as east of Little River along Bayou Funny Louis. Higher in elevation in the same east-northeast trending band are found rocks of the Oligocene Vicksburg Group (undifferentiated), described as lignitic clays with thin interbeds of lignite or micaceous sands, calcareous shale, some petrified wood, and local bluish fossiliferous clays.

Eocene-age rocks of the Jackson Group (undifferentiated) and older Cockfield Formation, separated by unconformities, are located along higher elevations away from the upper reaches of Little River and its tributaries. The Jackson Group includes lignitic clays with interbeds of limonitic sands, with calcareous and fossiliferous beds near the base of the group. Cockfield Formation deposits are brown lignitic clays, silts, and sands, with sideritic glauconite that can weather to ironstone in the lower part of the formation.

2.5 LAND USE

The study area covers approximately 853,585 acres of east central Louisiana. The land cover for each subsegment is shown in Table 2.1. These land use figures were derived from the USEPA BASINS Version 3 data sets which rely on USGS land use/land cover data. The aggregate land use in acres for the Little River/Catahoula Lake watershed is shown in Table 2.2. The study area is dominated by forest (60.06 percent) and agricultural land (20.10 percent). The Dugdemona River and Castor Creek watersheds consist of another 1,379,881 acres that are included in this assessment for the purposes of quantifying pollutant source loads from the contributing watershed north of the study area (see Section 5 and Appendix D). Figure 2.5 provides a map derived from USEPA BASINS Version 3 data sets that depict the different land use/land cover categories of the study area and the contributing watershed. Although there are a number of towns in the study area, most of them have populations less than 10,000 people. Urbanized or developed land uses comprise less than 2.5 percent of the study area, with residential and commercial land uses concentrated in the Catahoula Lake subsegment. Catahoula National Wildlife Refuge and Salina Wildlife Management Area border the northeast shoreline of Catahoula Lake.

Table 2.1 Land Use Summary for Each Subsegment (Acres)

Land Use	81601	81602	81603	81605	81606	81607	81608	81609	81610	81611
Agriculture	378	3,852	12,165	95,200	429	3,653	2,503	3,892	46,929	2,595
Forest Land	13,262	146,657	72,378	4,609	28,518	19,046	48,383	23,077	78,665	78,086
Orchards, Groves, Vineyards, Nurseries	0	0	174	0	0	93	2	0	0	0
Strip Mines, Quarries, and Gravel Pits	0	1,151	577	0	0	103	443	130	1,192	45
Transitional Areas	1,046	10,702	5,094	0	1,495	1,051	1,498	645	15,676	10,074
Urban or Built-Up Land	569	1,388	10,562	626	103	1,165	1,620	3,820	812	505
Water	69	546	18,044	1,971	0	0	37	0	1,587	0
Wetlands	2,928	18,371	20,663	19,951	473	257	1,348	230	8,693	1,779
Total Acres	18,252	182,667	139,657	122,357	31,018	25,368	55,834	31,794	153,554	93,084

Table 2.2 Aggregate Land Use Summary for Little River/Catahoula Lake Watershed

Land Use	Total Acres	Percent Total
Agriculture	171,596	20.10
Forest Land	512,681	60.06
Orchards, Groves, Vineyards, Nurseries	269	0.03
Strip Mines, Quarries, and Gravel Pits	3,641	0.43
Transitional Areas	47,281	5.54
Urban or Built-Up Land	21,170	2.48
Water	22,254	2.61
Wetlands	74,693	8.75
Total Acres	853,585	100.00

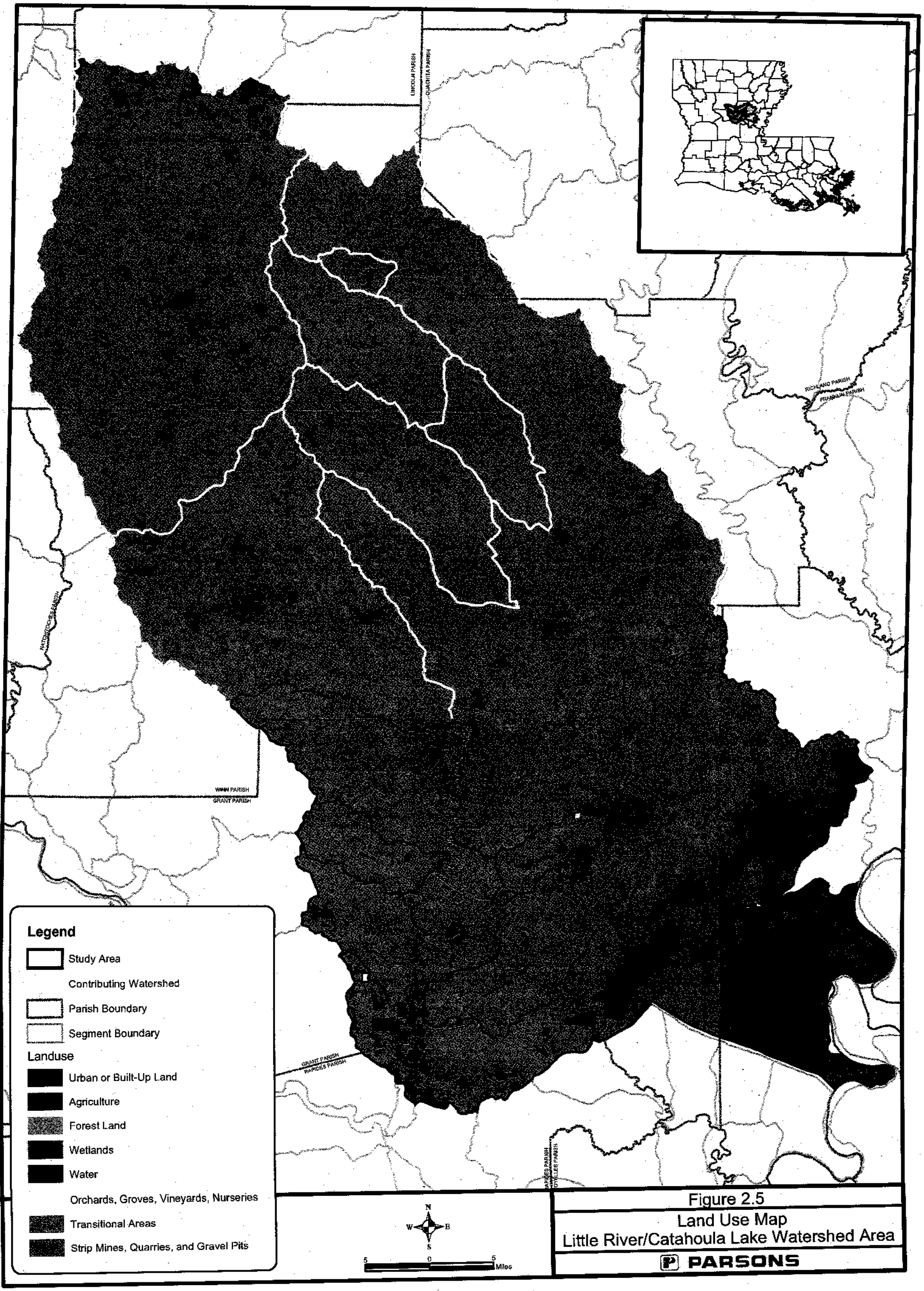


Figure 2.5
Land Use Map
Little River/Catahoula Lake Watershed Area

SECTION 3
PROBLEM DEFINITION AND ENDPOINT IDENTIFICATION

3.1 PROBLEM DEFINITION

This TMDL report meets the provisions of the federal Clean Water Act (CWA) Section 303(d), which requires Louisiana Department of Environmental Quality (LDEQ) or the USEPA to develop a pollutant load allocation for each waterbody/pollutant combination identified on the list established as part of the 2002 Consent Decree (United States 2002). The list established in the Consent Decree and later modified (LDEQ 1999 303(d)) included mercury in fish tissue as a pollutant of concern in subsegment 081601, 081602, 081603, and 081605. The fish consumption advisory for the Little River from Highway 500 near Georgetown to Catahoula Lake (58.25 miles), Catahoula Lake (18,797 acres), and the 11-mile reach of Little River (French Fork) from the lake to the dam near Archie was jointly issued by the Louisiana Department of Health and Hospitals (LDHH), the LDEQ, and the Louisiana Department of Wildlife & Fisheries (LDWF) on November 20, 2000. While there have been no known violations of the numeric ambient water quality criterion for mercury, Little River, Catahoula Lake, and French Fork Little River do not meet the narrative water quality standard for toxic substances because of the fish consumption advisory.

The LDEQ narrative water quality standard for toxic substances states:

> *"No substance shall be present in the waters of the state or the sediments underlying said waters in quantities that alone or in combination will be toxic to human, plant, or animal life or significantly increase health risks due to exposure to the substances or consumption of contaminated fish or other aquatic life."*

The LDEQ and LDHH coordinate the assessment of health risks for the consumption of fish and jointly issue advisories if warranted. The LDWF and Louisiana Department of Agriculture and Forestry can also participate in the health risk assessment. When the average mercury concentration exceeds 0.5 parts per million (ppm) in fish or shellfish, a fish consumption advisory may be issued. Fish sampling conducted in October 1996, at monitoring site 0089 (Little River, upstream of Catahoula Lake, southwest of Jena), showed elevated mercury levels in fish tissue. Additional fish sampling at site 0089 was conducted in May 2000, with an overall average mercury concentration of 0.867 ppm (see Table 4.2). Fish sampling in June 2000 at monitoring site 1010 (Little River, downstream of Catahoula Lake, near Jonesville) also revealed elevated mercury levels, with an average mercury concentration of 0.512 ppm (see Table 4.2). Therefore, a precautionary fish consumption advisory for the area was issued by the LDEQ, LDHH, and LDWF for the Little River/Catahoula Lake watershed. The fish consumption advisory is provided in Appendix A. Based on this fish tissue data, the Little River/Catahoula Lake watershed exceeds LDEQ's narrative water quality criterion for toxic pollutants. This TMDL report has been developed to address the elevated levels of mercury in fish tissue for the LDEQ subsegments identified in the consumption advisory area.

3.2 LDEQ SURFACE WATER QUALITY STANDARDS

Water quality standards (WQS) for the State of Louisiana have been promulgated in the Louisiana Administrative Code (LAC), Title 33, Part IX (LDEQ 2002). The designated uses for the subsegments within the Little River/Catahoula Lake watershed are shown in Table 3.1. Designated uses for these subsegments include primary contact recreation, secondary contact recreation, and propagation of fish and wildlife. In addition to these designations, subsegments 081601, 081602, 081606, 081607, and 081608 are also recognized as outstanding natural resource waters (ONRW), which receive higher levels of protection under State water quality standards. ONRWs include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by LDEQ as waters of ecological significance. No activity that would degrade ONRWs would be allowed, even if the activity were economically or socially needed by the region.

Table 3.1 Designated Uses for Little River/Catahoula Lake Watershed

Subsegment	Subsegment Description	Designated Uses
081601	Little River, Confluence of Castor Creek and Dugdemona River to junction with Bear Creek	A, B, C, G
081602	Little River, from Bear Creek to Catahoula Lake	A, B, C, G
081603	Catahoula Lake	A, B, C
081605	Little River from Catahoula Lake to dam at Archie	A, B, C
081606	Fish Creek headwaters to Little River (Scenic)	A, B, C, G
081607	Trout Creek headwaters to Little River (Scenic)	A, B, C, G
081608	Big Creek headwaters to Little River (Scenic)	A, B, C, D, G
081609	Hemphill Creek headwaters to Catahoula Lake	A, B, C
081610	Old River Catahoula Lake to Little River	A, B, C
081611	Bayou Funny Louis headwaters to Little River	A, B, C

A - Primary Contact Recreation; B - Secondary Contact Recreation; C – Propagation of Fish and Wildlife; D – Drinking Water Supply; G – Outstanding Natural Resource Waters

The applicable freshwater acute and chronic criteria for dissolved mercury are 2.04 micrograms per liter (μg/L) and 0.012 μg/L, respectively. Furthermore, if the 4-day average concentration for dissolved mercury exceeds the chronic criteria of 0.012 μg/L more than once in a 3-year period, the edible portion of aquatic species of concern must be analyzed to determine whether the concentration of methylmercury exceeds the Food and Drug Administration (FDA) action level of 1.0 mg/kg. LDEQ must notify USEPA if the action level is exceeded and take appropriate action such as issuance of a fish consumption advisory (LAC 33:IX.1113.C.6). In order for the waterbodies in the fish consumption advisory area to meet the designated use designed to protect human health, the narrative criteria for toxic substances must be met.

3.3 ENDPOINT IDENTIFICATION

40 CFR§130.7(c)(1) states that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standard." In certain circumstances, such as with fish consumption advisories, it is possible that numeric water quality criteria can be met, and the designated use still not be met. Since the primary objective of a TMDL is to restore and maintain the designated uses of impaired waterbodies, an endpoint or target must be established to determine if this goal has been attained. In the case of these TMDLs for mercury, restoring and maintaining the "fishable" use and protection of human health represent the water quality goals to be achieved by implementing the pollutant load allocations defined in this report.

An endpoint for mercury can be established as a water numeric criterion, a sediment concentration, or a fish tissue value. There are no documented exceedances of the dissolved mercury water quality criteria in the fish consumption advisory area, yet fish tissue concentrations are elevated. This phenomenon is described in more detail in Section 5. Thus, a dissolved mercury numeric water quality criterion would not provide an adequate endpoint for these TMDLs. In addition, sediment concentration data in the fish consumption advisory area are limited and correlations with fish tissue concentrations cannot be developed. Thus, sediment concentration is not a good endpoint for these TMDLs.

When the edible fish tissue methylmercury concentration exceeds 1.0 mg/kg, LDEQ and LDHH will recommend a limited consumption advisory for certain fish species and/or no consumption advisory for other fish species for pregnant or breast feeding women and children under the age of 7, and limited consumption for the general population. In addition, the LDEQ and LDHH will consider issuing a limited consumption advisory for pregnant or breast feeding women and children under the age of 7 when the edible fish tissue methylmercury concentration exceeds 0.5 mg/kg.

Since the LDEQ WQSs do not include a numeric water quality criterion for mercury explicitly calculated to protect human health, it is necessary to use the narrative criterion for toxic substances provided above on page 3-1 as the basis for setting the water quality target for these TMDLs. The best endpoint for establishing a TMDL is the methylmercury fish tissue concentration of 0.5 mg/kg, which is the basis of the fish consumption advisory. The benefits of using a fish tissue criterion include: (1) it accounts for spatial and temporal complexities that occur in aquatic systems; (2) it accounts for bioaccumulation and biomagnification in the aquatic food chain; and (3) it is more directly tied to the goal of protecting public health from consumption of edible fish. An endpoint of 0.5 mg/kg methylmercury in fish tissue has been used previously in an approved mercury TMDL for another portion of the Ouachita River Basin in Louisiana (USEPA 2002). As a numeric translator for this narrative standard, an endpoint of 0.5 mg/kg methylmercury in fish tissue has been selected as the target for these TMDLs.

While the USEPA has published a new human health criterion for methylmercury in fish tissue of 0.3 mg/kg (USEPA 2001), it is not used as an endpoint for these TMDLs since it has not been adopted in the LDEQ WQSs. LDEQ should review the basis of this criterion, including risk management assumptions for fish consumption rates, reference dose, and body weight, and evaluate the appropriateness of revising the existing methylmercury criterion during the next triennial revision of the state water quality standards.

SECTION 4
DATA ASSESSMENT

Data relevant to the study area for this assessment were obtained from a variety of sources, including but not limited to LDEQ, USEPA, Texas Commission on Environmental Quality (TCEQ), LDHH, NRCS, FDA, USGS, and the National Atmospheric Deposition Program (NADP). This section summarizes available data for mercury concentrations in ambient water, sediment, fish tissue, and the atmosphere.

4.1 AMBIENT WATER DATA

As part of the statewide ambient water quality network, mercury concentrations are monitored throughout Louisiana, including 14 monitoring sites within the Little River/Catahoula Lake watershed. These routine monitoring data are available at http://www.deq.state.la.us/surveillance/wqdata/wqdata.aspx. However, since ultra-clean sampling procedures were not followed by this monitoring program, the mercury data available from the LDEQ ambient water quality network are not considered in this TMDL study.

The LDEQ has sampled mercury in ambient water using clean techniques. Table 4.1 shows the dissolved mercury concentrations at site 0089, located in Little River southwest of Jena. These limited data, compared to the Louisiana freshwater chronic criterion for dissolved mercury, which is 12 ng/L, indicate that WQSs for dissolved mercury in ambient water are being met.

Table 4.1 Dissolved Mercury in Ambient Water at Site 0089

Date Collected	Hg (ng/L)
10/4/2000	0.72
11/14/2000	1.22
1/10/2001	10.80
2/13/2001	8.50
3/21/2001	10.60

(Source: LDEQ, Environmental Planning Division)

4.2 FISH TISSUE DATA

To assess the extent of mercury contamination in Louisiana, an extensive state-wide mercury study was started in 1994. Sampling mercury in fish tissue has been an integral part of this study. As of October 2002, fish were collected and sampled at a total of 428 sites. Complete results from the fish sampling are available online at http://www.deq.state.la.us/surveillance/mercury/mercraw.htm. Fish were collected using an electroshocking rig, nets, hook and line, or traps as described in LDEQ's *Quality Control Manual For Biosurveys and Fish Community Assessments* (LDEQ 1991). Target species included largemouth bass, channel catfish, blue catfish, crappie (*Pomoxis annularis* and *P. nigromaculatus*), and bowfin (*Amia calva*). If these target species were not found, other appropriate species such as freshwater drum (*Aplodinotus grunniens*), garfish (*Lepisosteus sp.*), striped bass (*Morone saxatilis*), white bass (*M. chrysops*) and buffalo (*Ictiobus sp.*) were collected. Composite fish samples consisted of skinless fillets from three to ten individuals of the same species and size class to make a total sample weight of at least 250 grams. Larger fish were analyzed individually.

There are four sample sites located in the Little River/Catahoula Lake watershed. Table 4.2 is a summary of the average mercury concentrations found in each species sampled at these sites from 1996 through 2001. A complete listing of the sampling results is included in Appendix B. These data show that the average fish tissue concentrations of mercury exceed the endpoint of 0.5 mg/kg at all four sites.

Table 4.2 Average Mercury in Fish Tissue (mg/kg Wet Weight)

Site	Site Description	Fish Species	Average Concentration (ppm)	Overall Average Concentration (ppm)
0089	Little River southwest of Jena, LA Subsegment 081602	Black Crappie	0.359	0.867
		Bluegill Sunfish	0.077	
		Bowfin	1.731	
		Channel Catfish	0.289	
		Largemouth Bass	1.336	
		Smallmouth Buffalo	0.516	
		White Crappie	0.576	
0810	Catahoula Lake east of Big Point Subsegment 081603	Blue Catfish	0.454	0.669
		Channel Catfish	0.270	
		Freshwater Drum	0.664	
		Largemouth Bass	0.742	
		White Bass	1.470	
		White Crappie	0.338	
1010	Little River near Jonesville, LA Subsegment 081605	Blue Catfish	0.385	0.512
		Flathead Catfish	0.718	
		Freshwater Drum	0.774	
		Largemouth Bass	0.601	
		Smallmouth Buffalo	0.296	
		White Bass	0.617	
		White Crappie	0.266	
1011	Old River northwest of Archie, LA Subsegment 081610	Flathead Catfish	1.071	0.911
		Freshwater Drum	1.072	
		Largemouth Buffalo	1.105	
		White Crappie	0.451	

4.3 SEDIMENT DATA

Table 4.3 includes all the mercury sediment data available from LDEQ for the subsegments within the fish consumption advisory area. The average of this sediment data is 0.06 mg/kg which corresponds to about a 30th percentile of all sediment data for the state. That is, 70 percent of the sediment values statewide were greater than 0.06 mg/kg. This information may be considered as baseline data for comparison to mercury sediment concentrations measured in the future.

Table 4.3 Mercury in Sediments

Site	Description	Subsegment	Sample Date	Total Mercury (mg/kg)
1001	Bushley Bayou South southwest of Harrisonburg, LA	081610	2/29/2000	0.038
			10/10/2000	0.012
1011	Old River northwest of Archie, LA	081610	5/30/2000	0.06
0810	Catahoula Lake east of Big Point, LA	081603	5/17/2001	0.079
0089	Little River southwest of Jena, LA	081602	10/8/1996	0.153
			5/16/2000	0.024

4.4 ATMOSPHERIC DEPOSITION DATA

There are four ambient air monitoring stations in Louisiana that are part of the National Atmospheric Deposition Program (NADP) Mercury Deposition Network (MDN). The locations of the stations are depicted in Figure 2.2. Weekly results of mercury concentrations in air and mercury wet deposition are available for each station. Weekly data are available at http://nadpdata/sws.uiuc.edu.

Table 4.4 is a summary of the average annual mercury concentrations in precipitation for each station, and Figure 4.1 shows the average annual concentration for each station.

Table 4.4 Average Mercury Concentrations (ng/L)

Year	NADP Monitoring Station			
	LA05	LA10	LA23	LA28
1998	10.133	8.264	---	10.070
1999	16.644	15.503	---	17.863
2000	19.320	15.706	---	15.805
2001	11.411	21.351	10.456	12.370

Source: http://nadp.sws.uiuc.edu

Figure 4.1 Average Mercury Concentration

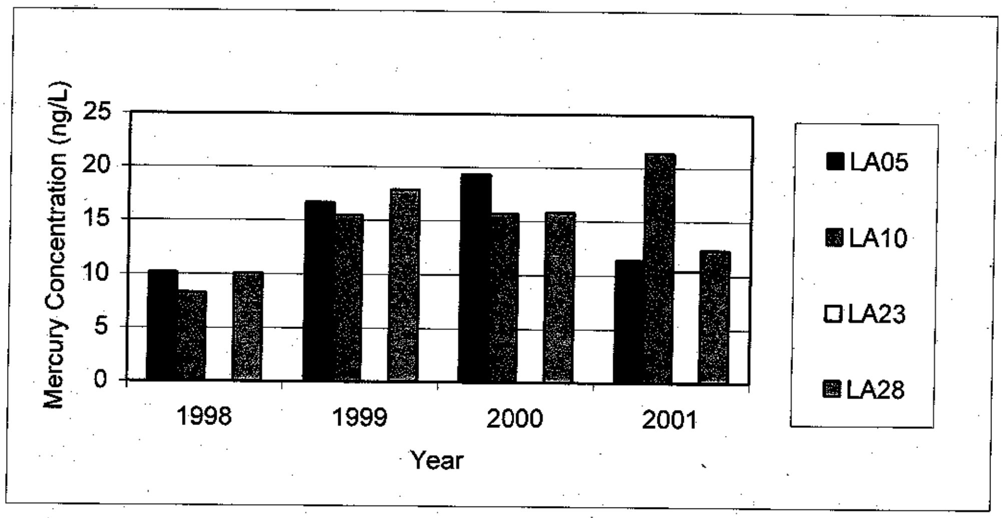


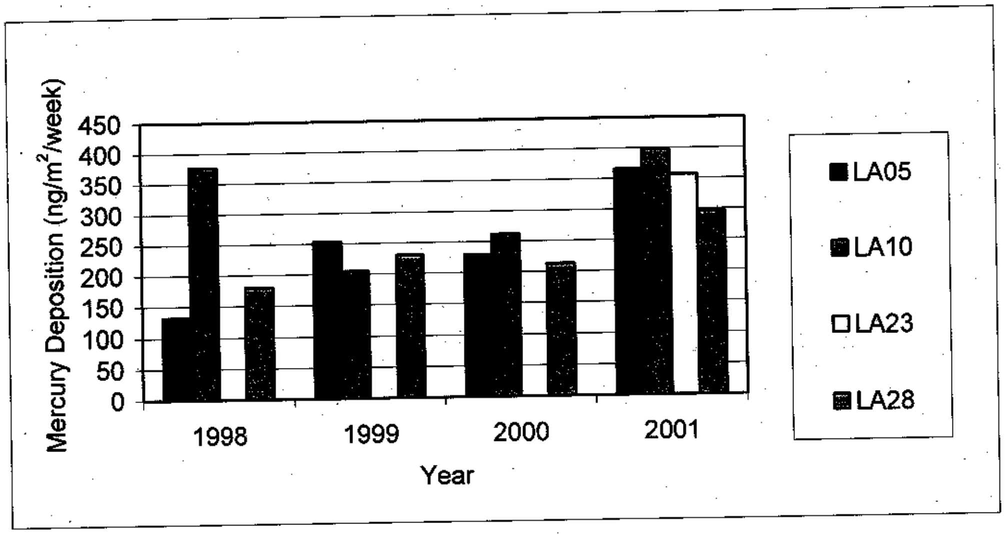
Table 4.5 is a summary of the average mercury wet deposition for each station by year, and Figure 4.2 shows the average wet deposition for each station graphically.

Table 4.5 Average Mercury Deposition ($ng/m^2/week$)

Year	NADP Monitoring Station			
	LA05	LA10	LA23	LA28
1998	132.445	376.908	---	180.831
1999	253.376	204.935	---	230.565
2000	229.552	261.488	---	213.212
2001	365.695	396.902	356.440	296.138

Source: http://nadp.sws.uiuc.edu/nadpdata/mdnreport98.asp

Figure 4.2 Average Mercury Deposition



These state-specific atmospheric mercury data are used to predict mercury loads in the study area and contributing watershed as discussed in Section 5.5. While mercury concentration and deposition data are fairly consistent throughout the state, there are some differences between stations. As a result, data have been weighted by the distance of each station from the center point of the watershed for purposes of calculating mercury watershed loading. Thus, mercury data from the stations located closest to the watershed are weighted more heavily.

Releases of toxic substances, including mercury, must be reported annually to the USEPA as part of the Toxic Release Inventory (TRI) program required by Title III of the Emergency Planning and Community Right to Know Act (EPCRA). Facilities must report releases to the air, water, and land annually. Releases of air toxins, including mercury, must be reported annually to LDEQ as part of the Toxics Emission Data Inventory (TEDI) as required by LDEQ regulations. The TEDI includes more facilities since all major sources are required to report emissions, not just facilities covered by Standard Industrial Classification (SIC) codes 20 –39 as required under the TRI program. There are differences in the emissions reported under TRI and TEDI since the reporting thresholds are not the same. Table 4.6 includes mercury air emissions data by SIC code for Louisiana. Statewide 2000 TRI and 2001 TEDI data show air emissions of 1,418 pounds per year (lbs/yr) and 1,554 lbs/yr, respectively. A summary of the mercury air emissions in Louisiana, as reported in TEDI, is provided in Appendix C.1 and Appendix C.2.

Table 4.6 Louisiana Air Emissions Data

SIC	Industry Type	2000 TRI (lbs/yr)	2001 TEDI (lbs/yr)
24	Lumber/Wood	NR	3
26	Paper	91	270
28	Chemicals	1306	1259
29	Petroleum Refining	11	22
32	Stone/Clay/Glass/Concrete	10	NR
Total		1418	1554

NR = None Reported

SECTION 5
IDENTIFICATION OF POLLUTANT SOURCES

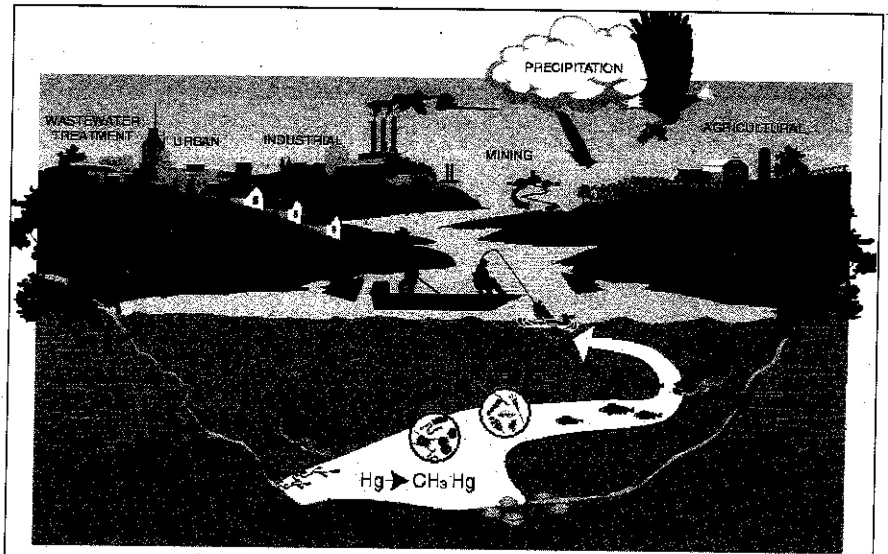
5.1 MERCURY CYCLE

Mercury is a highly volatile element emitted and cycled in the environment through naturally-occurring and anthropogenic processes. Although there are many potential sources, the greatest anthropogenic source of mercury in water appears to be emissions from coal fired electric plants. Natural sources of mercury contamination include volcanic activity. Mercury released into the air can travel long distances and then be deposited into streams and lakes through atmospheric deposition (fall-out), making it nearly impossible to pinpoint sources of contamination. Mercury is also released into water and air by some industrial processes, waste incineration, and improper disposal of mercury-containing products (http://www.deq.state.la.us/surveillance/mercury/mercury_faqs.htm).

Figure 5.1 illustrates the transformation and movement of mercury in atmospheric, soil and aqueous systems. Mercury exists in the environment in different forms: Hg(0) (elemental), Hg(II) (inorganic), and CH_3Hg (organic). In the atmosphere, mercury exists almost entirely in the relatively insoluble gaseous Hg(0) state which can be transported over long distances from the source. Elemental Hg(0) can be converted in the atmosphere to the more soluble inorganic form that can be readily deposited to land or water. Wet and dry deposition is the mechanism by which mercury emitted into the atmosphere is transported to land and surface water. In surface waters, methylation of mercury can occur where inorganic Hg (II) binds to sediment or suspended solids and is transformed into methylmercury. Methylmercury is mercury that has been converted by bacteria or other processes into an organic (containing carbon) compound, CH_3Hg. Methylmercury is the only form of mercury that can be readily bioaccumulated by fish, humans, and other organisms; therefore, essentially all mercury found in fish is methylmercury.

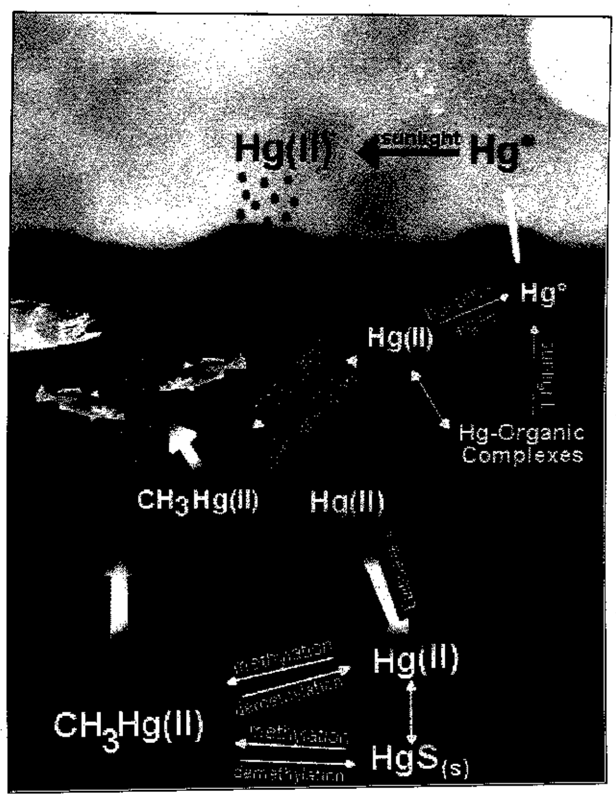
This mobilization of mercury through aquatic systems is shown in Figure 5.2. For humans and wildlife, the mercury exposure pathway of particular concern is consumption of fish tissue with elevated levels of methylmercury.

Figure 5.1 The Mercury Cycle



(Illustration by Connie J. Dean, U.S. Geological Survey)

Figure 5.2 Pathways for Mercury Through the Aquatic Ecosystem



http://loer.tamug.tamu.edu/Research/Mercury/mercury.htm

5.2 METHYLMERCURY FORMATION

Studies have shown that local geochemical differences in water bodies can affect methylation rates and ultimately mercury bioaccumulation in fish. Several factors that influence methylation include low pH, high dissolved organic carbon (DOC) and low dissolved oxygen (DO). Physical and chemical characteristics of the watershed, such as soil type and erosion, and fluctuating water levels can also affect the amount of mercury transported from soils to water bodies (USEPA 1997).

Low pH has been shown to correlate with increased methylmercury. Piscivorous fish in waters with low pH (≤6.7) often contain mercury concentrations in fish muscle in the range of 0.5-2.0 ppm (USEPA 1995). This correlation is evident in lakes far from anthropogenic sources of mercury in which mercury in the fish is likely derived from the atmosphere. In such remote lakes, the greater accumulation of methylmercury in fish in low pH waters has been attributed in part to greater in-lake microbial production of methylmercury. In 1997, fish from 13 water bodies located in East Texas were collected to determine the relationships between mercury concentrations in fish and physicochemical variables in water and sediment. The results of the East Texas study found that a pH less than 5.7 in water alone accounted for 51 percent of the variation in expected mercury concentrations in largemouth bass (TNRCC 2000). Several monitoring stations within the Little River/Catahoula Lake watershed have a pH less than 6.7, making these waterbodies vulnerable to methylation of mercury.

In 1991, the Wisconsin Department of Natural Resources began the Wisconsin Background Trace Metals Study, during which strict adherence to the trace metal clean techniques were followed. Results of the study show that partitioning and speciation of mercury in Wisconsin rivers is strongly influenced by land use and land cover characteristics of the watershed. Highest total mercury and methylmercury yields were observed from sites that passed through wetlands (USEPA 1995). It is believed that mercury is complexed and transported in the dissolved phase with DOC. High levels of DOC in both surface waters and pore waters is a characteristic of wetlands. Wetlands are a significant component of land uses in the Little River/Catahoula Lake watershed. As shown in Table 2.2, wetlands comprise approximately 9 percent of the total watershed. As can be seen from Figures 1.1 and 2.5, wetlands are situated along Little River for the majority of its length from Highway 500 to Catahoula Lake. The Catahoula National Wildlife Refuge (NWR) borders the northeast shoreline of Catahoula Lake and is recognized as a Wetland of International Importance.

Low DO and fluctuating water levels have been found to influence production of methylmercury (TNRCC 2000). As described in Section 2, subsegment 081605, the reach of Little River from Catahoula Lake to the dam Archie, lies almost entirely within the Catahoula NWR and the Saline Wildlife Management Area. Vegetation consists primarily of lowland hardwood forest subject to annual flooding from Catahoula Lake. Flow in this reach of Little River is restricted for the purpose of waterfowl management at Catahoula Lake. Generally, the lake is drained in the summer to encourage production of moist soil vegetation valuable to waterfowl. During the fall, the water level is raised in the lake to enhance commercial fishing resources, and is maintained for migratory waterfowl. This fluctuation in water levels may be encouraging the methylation of mercury, which has been shown to be accelerated in newly formed reservoirs due to sudden inundation of organic matter and exposure of soils containing mercury (TNRCC 2000). It is thought that the fluctuation of water levels allows mobilization of inorganic mercury, resulting in increased microbial methylation by sulfate reducing bacteria.

The purpose of this TMDL is to establish the acceptable loading of mercury from all sources so that mercury levels in fish tissue will decline and compliance with the narrative water quality standard will be achieved. This TMDL report identifies point source discharges to the watershed, and focuses on nonpoint sources from anthropogenic air emissions. While there are approximately 6,000 oil and gas wells scattered throughout the Little River/Catahoula Lake watershed, operations from these facilities should not contribute mercury to the watershed since there are no known sources of naturally occurring mercury based on the geology of the study area.

5.3 POINT SOURCES

Information on National Pollutant Discharge Elimination System (NPDES) permitted dischargers was obtained from the USEPA Permits Compliance System (PCS) and LDEQ records. In addition to identifying point source dischargers in subsegments 081601, 081602, 081603, 081605, 081606, 081607, 081608, 081609, 081610, and 081611 which are shown as the Watersheds of Interest on Figure 2.1, point source dischargers located in the Contributing Watershed delineated on Figure 2.2 were also considered. This was done to account for possible point source loadings from other watersheds hydrologically connected to Little River. From this investigation, there were 73 relevant facilities with individual permits that discharge to waterbodies hydrologically linked to Little River and Catahoula Lake (See Appendix C-3). It was determined that dischargers from general permits designated as GP, LAG, and LAR do not have reasonable potential to contain mercury, and therefore, are not included in the list. Only two facilities have mercury limitations in its permits. They are the Town of Jena/LaSalle wastewater treatment plant (Permit No. LA0033260) and Candence Environmental Energy (Permit No. LA0101559). The mercury load for Cadence Environmental Energy was not calculated since the permit authorizes only intermittent stormwater discharges. The calculated mercury loading to the watershed from these two facilities summarized in Table 5.1 is 0.18 pounds per year.

Table 5.1 NPDES Facilities with Mercury Limitations

NPDES No.	Facility Name	Hg Limit	Hg Load
LA0033260	Town of Jena/LaSalle	0.00048 lbs/day	0.18 lbs/yr
LA0101559	Cadence Environmental Energy	10 µg/L	NC

NC = Not Calculated

Studies on municipal wastewater treatment plants (WWTPs) indicate that trace levels of mercury can be present in discharges from these facilities. Municipal wastewater treatment facilities were assumed to discharge some mercury because mercury at low levels has been measured in WWTPs in Arkansas and other U.S. regions. The Arkansas Department of Environmental Quality conducted a monitoring study of five WWTPs in Arkansas using clean sampling procedures and ultra-trace level analyses, and found an average concentration of about 15.0 ng/L in municipal discharges (USEPA 2002). An Association of Metropolitan Sewerage Agencies (AMSA) study of 24 facilities in 6 states showed a range of average effluent concentrations of 3.1 ng/L to 9 ng/L with maximum effluent concentrations ranging from 5 to 29 ng/L (AMSA, 2002 Mercury Source Control and Pollution Prevention Program Evaluation-Final Report.)

Point source discharges of bioaccumulative chemicals like mercury may have particular local significance, apart from their contribution to the cumulative load. Point source discharges by their nature may create "hot spots" where observed elevated concentrations have potential impact on aquatic life, wildlife, and human health. Consequently, comparing contributions from the air and water sources may conceal the real impact of mercury from point source discharges. In many cases elevated receiving water concentrations may be dictated solely by the mercury concentration in the effluent as opposed to the mercury delivered from air deposition. This is supported by field data and will generally be true when comparing the near-field effects of effluent discharges relative to air sources.

Because effluent sampling for mercury in the past has been conducted without the benefit of newer clean techniques little is known about the potential to discharge mercury for the majority of dischargers in this watershed. It is possible that some dischargers may have mercury in their effluent at levels greater than 12 ng/l. Based on this information, USEPA believes that it is appropriate to assume that discharges from the municipal WWTPs (SIC 4952) in this watershed contain mercury levels equal to 12 ng/L. Based on this assumption, the estimated mercury loads from these facilities were calculated based on their permitted design flow. It should be noted that a flow of 10,000 gallons per day was assumed to estimate the mercury loading from municipal WWTPs where no permitted flow information was available. In addition, mercury loads from other facilities (not SIC 4952) were not calculated since there was no information on which to base an estimate. The total estimated mercury loading from existing point source dischargers is 0.76 lbs/yr as summarized in Appendix C-3. An important element of this TMDL report is that dischargers within the watershed will need to evaluate their potential to discharge mercury in order to demonstrate that a facility is discharging at levels consistent with the assumptions of this TMDL, i.e., at or below 12 ng/l.

5.4 NONPOINT SOURCES

5.4.1 Background Sources

Based on review of the geologic and soils studies available for the area, there are no known naturally occurring areas of mercury to which those concentrations found in local media can be attributed. As evidenced by the discussion of geology and soils (Section 2.2 and 2.3), no background mercury has been documented in the near-surface rock strata nor in soil associations of the area. The sediment deposits are consistent with floodplain and terrace deposits.

The nearest documented source of naturally occurring mercury is the cinnabar (HgS) "district" of southern Arkansas. The district is restricted to the southern portion of the

Ouachita Mountains (Scott and McKimmey 1997; Armstrong *et al.* 1995; Stone *et al.* 1995; Branner 1932).

The downstream extent of naturally occurring mercury into the water bodies of Louisiana has not been documented. For the Little River and Catahoula Lake watershed, a possible connection with the naturally occurring mercury found in Arkansas soils and waters is through the Ouachita River. As floodwaters deposited mixed alluvium around the French Fork of Little River, around the northeastern and western shores of Catahoula Lake, and upstream of Little River (Lytle and Sturgis 1962) since Recent times (roughly 11,000 years ago to present day), it is possible but not documented that these sediments could have contained mercury from the upstream Ouachita River waters and sediments. An extensive sampling and analysis program would be necessary to prove or disprove the presence of naturally occurring mercury, particularly considering the distance of several hundred miles along the bends of the Ouachita River upstream to the cinnabar district in Arkansas. Furthermore, the presence of mercury along the upstream reaches of Little River and its tributaries would not be explained by background mercury within Ouachita sediments and waters, as the latter's influence is only found around the lake and lower reach of Little River, and is limited by the Mississippi Valley escarpment (see the soils discussion in Section 2.3). Therefore, it is concluded that the presence of mercury as a background presence in the upper reaches of the Little River is unlikely, and that other nonpoint sources should be considered.

5.4.2 Air Sources

The following excerpt from the LDEQ Mercury 2000 Report, provides a helpful synopsis of the many and varied sources of mercury in Louisiana and the nation (Summary of Issues Related to Mercury Contamination of Fish, LDEQ, March 2000, http://www.deq.state.la.us/surveillance/mercury/mercsumm.htm).

"Ambient concentrations of mercury throughout the United States have increased significantly since the beginning of the industrial revolution. As a result of the proliferation of mercury in the environment, many of the fish people consume, including ocean caught species such as tuna, swordfish and shark purchased at local stores, are contaminated with low levels of mercury. Much of this is due to the fact that mercury is present in coal used at electrical power plants and is used in many products such as thermometers, fluorescent and mercury vapor lights, and electrical switches which may eventually be incinerated or placed in landfills. Mercury in these materials is released to the atmosphere as a gas by coal burning, trash incineration or direct volatilization. In a process similar to acid rain, the mercury is later deposited on the earth's surface through atmospheric deposition.

"Other sources of mercury emissions to the atmosphere include chloralkali plants, which use mercury cathodes to generate chlorine and alkali from brine using electricity, hazardous waste incinerators, and pulp and paper mills.

"Paper mills, waste incinerators, and chloralkali plants that are major sources under LDEQ's Air Toxics rule are required to report mercury emissions under the TEDI. Because of the nature of atmospheric mercury, the concentrations of mercury in Louisiana surface waters cannot be directly traced to air emissions from facilities located within Louisiana. Twenty-six facilities are currently included in LDEQ's TEDI. Electrical power plants are currently exempt from LDEQ's Air Toxics rule but not other air quality regulations, and are not required to report mercury or any other emissions as part of the TEDI."

Since mercury air emissions can be transported over long distances, these emissions are generally broken down into local, national, and global emissions. Local air emissions for these TMDLs are defined as the airshed within 100 kilometer (km) of the watershed as shown in Figure 2.2. While this encompasses parishes outside the fish consumption advisory area, only those areas that contribute flow to the study area are used to estimate watershed mercury loading from atmospheric deposition as described in Section 5.5.

The EPA BASINS model, Version 3, was used to estimate mercury loading to the watershed from both rainfall runoff and soil erosion. Actual mercury concentration and wet deposition data from the MDN were used in the model. Table 5.2 shows that the total estimated mercury loading from air sources to the watershed from both wet and dry deposition is 164 lbs/yr as discussed in Section 5.5. Therefore, nonpoint source pollutants from aerial deposition represents over 99 percent of the total loading to the watershed.

Table 5.2 Estimated Mercury Loading from Air Sources

Source	(kg/yr)	(lbs/yr)
Soil Erosion Load	10.78	24
Runoff Load	63.82	140
Total	74.60	164

5.5 WATERSHED MERCURY LOADING

While various analyses for watershed mercury loadings are possible at various complexity levels, the limited amount of data available for the Little River/Catahoula Lake watershed precluded the use of detailed dynamic modeling. As an alternative method, the mercury contributions to the Little River from the study area and contributing watershed and atmospheric components were calculated based on an annual mass balance approach. Watershed-scale loading of mercury to the Little River was simulated using the tools available in BASINS, Version 3 (USEPA 2001a).

The main component of the BASINS system utilized was the PLOAD model. PLOAD is a simplified, geographic information system (GIS)-based model intended to calculate pollutant loads for watersheds. PLOAD estimates nonpoint source loads on an annual average basis using either the export coefficient or USEPA's Simple Method approach.

The PLOAD model was employed to provide estimates of both the average annual runoff and eroded sediment total suspended solids (TSS) loads from each of the 17 subsegments that were considered. The hydrologic and TSS loading coefficients required by the model were developed from values available in the literature. The PLOAD model varies the loading coefficients by land use provided with GIS coverage. Figure 5.3 illustrates the land use characteristics for the 17 subsegments in the analysis. Appendix D-1 presents results of the PLOAD modeling for the Little River/Catahoula Lake watershed for both annual average runoff volumes and annual average TSS loads. Appendix D-5 includes the PLOAD Event Mean Concentration and Appendix D-6 includes the PLOAD Percent Impervious Cover used in the model.

The predominant source for mercury in the Little River watershed is atmospheric deposition. The wet deposition rates for each of the 17 subsegments were derived from the NADP MDN data available for the four Louisiana stations. Average annual wet deposition rates and rainfall mercury concentrations were calculated from these four stations as distance weighted averages. Appendix D-2 illustrates the derivation of both the weighted average mercury wet deposition rates and the weighted average rainfall mercury concentrations. The weighted averages were calculated based upon the inverse square of the distance from the individual NADP/MDN station to the centroid of the airshed.

To calculate the mercury load transported in the runoff from the Little River/Catahoula Lake watershed, the assumption was made that the runoff contains the same mercury concentration as the originating rainfall. The results calculated with this conservative assumption are shown in Appendix D-3. The estimated mercury load to the watershed from rainfall runoff is 63.82 kg/yr or 140 lbs/yr.

There are no measurements of soil mercury concentrations within the Little River watersheds or surrounding watersheds. There were a number of measurements of soil mercury concentrations taken at a variety of locations in the Savannah River, Georgia watershed where the average mercury wet deposition rate is 12.22 ng/m^2/year. Assuming that these soils are in equilibrium with the annual average wet deposition rate and that the resulting soil mercury concentrations are linearly proportional to the loading rate, the average Savannah River soil mercury concentration for the annual average mercury wet deposition rates calculated for each of the 17 subsegments were adjusted to yield the predicted soil mercury concentrations shown in Appendix D-4. Assuming that the sediment loads from Appendix D-1 have the same mercury concentration as the respective subsegment from which they originated, the calculated mercury loads from soil erosion for each subsegment are shown in Appendix D-4. The estimated mercury load to the watershed from soil erosion is 10.78 kg/yr or 24 lbs/yr.

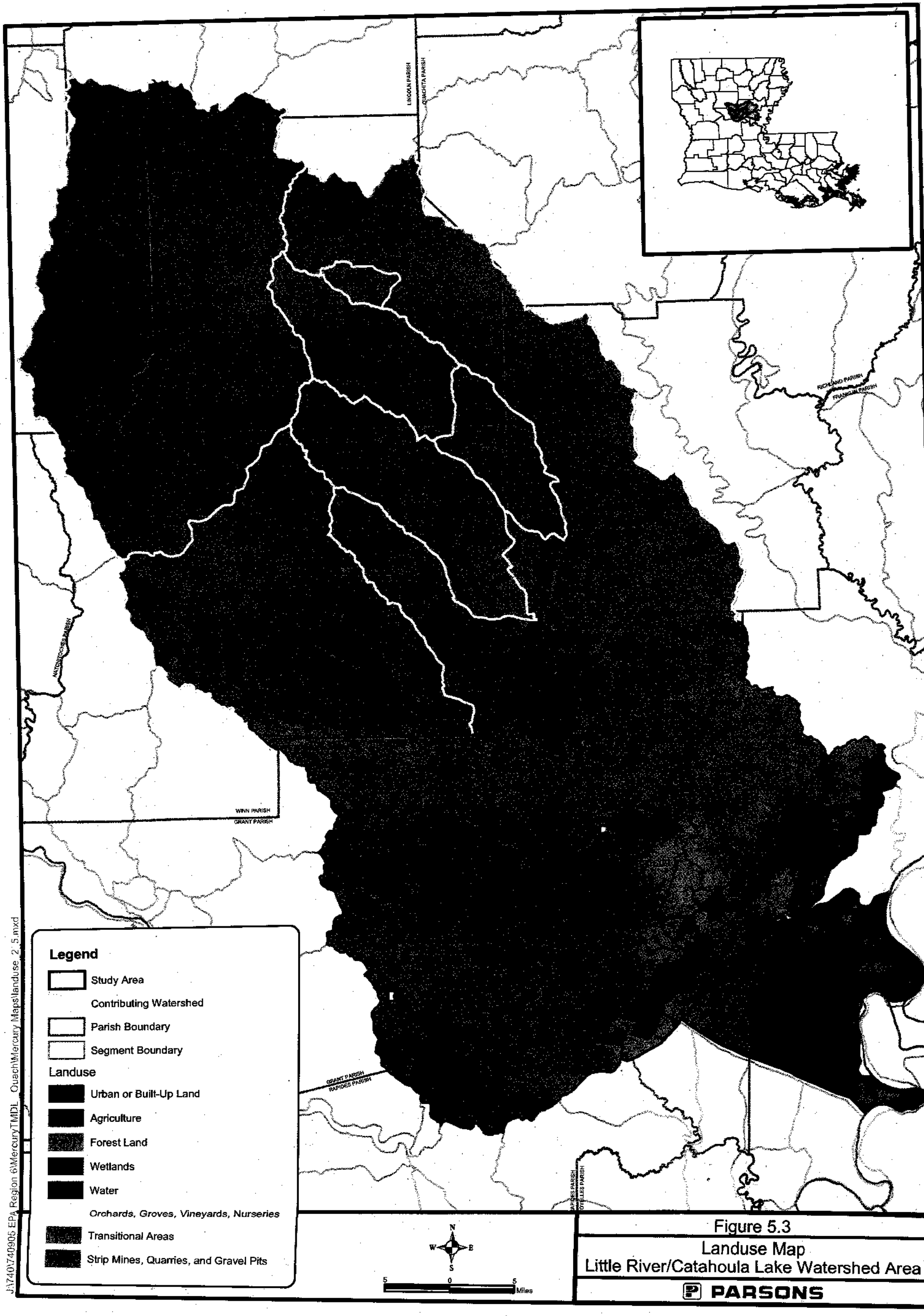


Figure 5.3
Landuse Map
Little River/Catahoula Lake Watershed Area

SECTION 6
TMDL CALCULATIONS

6.1 CURRENT LOAD EVALUATION

The current mercury load to the Little River/Catahoula Lake watershed is determined based on input from point sources and from both natural and air nonpoint sources. The estimated mercury load to the watershed from point sources is 0.76 lbs/yr as discussed in Section 5.3 and summarized in Appendix C-3, and 164 lbs/yr from air nonpoint sources as summarized in Table 5.2. USEPA concluded that there is no natural mercury load to the watershed based on the geology of the area. Table 6.1 summarizes the estimated current mercury loads.

Table 6.1 Summary of Estimated Current Mercury Loading

Source	Mercury Load (lbs/yr)	Percent of Load
Point Sources	0.76	0.5 %
Nonpoint Air Sources	164	99.5%
Total	164.76	100%

Estimated mercury loads from rainfall runoff and soil erosion are the major contributors to the total mercury load to the watershed. The fate and transport of mercury from water and sediments to fish tissue is complex and is influenced by local geochemical conditions. Fate and transport modeling of mercury once it is in the waterbody was not attempted since there is not enough site-specific data to calibrate and verify a model. Rather, USEPA assumed that 100 percent of the mercury load to the waterbody was available for uptake, bioaccumulation, and biomagnification by fish.

USEPA selected the average concentration of mercury in fish tissue for all species to best represent the concentration throughout the entire Little River/Catahoula Lake watershed. This average concentration for mercury in fish tissue, taken from Table 4.2, for all species at the four monitoring stations is 0.74 mg/kg as shown by Table 6.2.

Table 6.2 Mercury in Fish Tissue (mg/kg)

Site	Description	Average
0089	Little River Southwest of Jena	0.867
0810	Catahoula Lake East of Big Point	0.669
1010	Little River near Jonesville	0.512
1011	Old River Northwest of Archie	0.911
Watershed Average		0.740

The mercury concentration in fish tissue must be reduced by 32.4 percent to achieve the safe tissue concentration of 0.5 mg/kg. Therefore, the mercury load to the watershed must also be reduced by 32.4 percent or 53.38 lbs/yr. Calculations are shown below.

Percent Reduction = [(0.74 mg/kg - 0.50 mg/kg) / (0.74 mg/kg)] X 100 = 32.43%

Pollutant Load Reduction = (164.76 lbs/yr) X (32.4 % / 100) = 53.38 lbs/yr

6.2 TMDL DETERMINATION

The following equation was used to define the allowable loading of mercury, or the TMDL, to meet the endpoint.

TMDL = Current Estimated Pollutant Loading –Pollutant Load Reduction Necessary

TMDL = 164.76 lbs/yr – 53.38 lbs/yr = 111.38 lbs/yr

Table 6.1 shows that 99.5 percent of the mercury load to the watershed is from non-point air emission sources. Because point sources are a relatively small portion of the total mercury load to the system, no reductions in point sources loads are required in this TMDL. The calculated load of 0.76 lbs/yr is established as the TMDL waste load allocation. Demonstrations that these assumed waste loads are met will provide reasonable assurances that the TMDL is achievable.

6.3 MARGIN OF SAFETY

The CWA requires that TMDLs take into consideration a margin of safety (MOS). USEPA and LDEQ guidance allows for the use of implicit or explicit expressions of the MOS or both (Waldon 2000). When conservative assumptions are used in development of the TMDL, or conservative factors are used in the calculations, the MOS is implicit. When a percentage of the load is factored into the TMDL calculation as a MOS, the MOS is explicit. The following conservative assumptions were made providing an implicit MOS, as an explicit MOS was not considered appropriate.

- The estimated mercury concentration in runoff is equivalent to the concentration of mercury in the originating rainfall, which assumes no loss of mercury from adsorption or any other mechanism during overland flow.
- Calculations for mercury concentrations associated with TSS loading from soil erosion to the water column assume no loss of mercury from any mechanism during transport.
- Mercury loading to the watershed was considered 100 percent available for uptake, bioaccumulation, and biomagnification by fish.
- The permitted design flow of point source dischargers was used to calculate mercury loadings from WWTPs, rather than actual average flow rates, which are

typically much lower. This maximizes the predicted impact of discharges, and provides an allocation that is more protective.

6.4 TOTAL MAXIMUM DAILY LOAD

The estimated current mercury load to the Little River/Catahoula Lake watershed is 164.76 lbs/yr. This mercury load must be reduced by 53.38 lbs/yr to an allowable loading of 111.38 lbs/year. For this TMDL, the load is allocated between point and non-point sources as shown by Table 6.3. USEPA did not consider seasonal variability since the mercury deposition network (MDN) data did not show seasonal trends and because bioaccumulation in fish occurs over several years.

Table 6.3 TMDL Summary (lbs/yr)

TMDL Calculations	
Current Estimated Loading	164.76
Waste Load Allocation	0.76
Load Allocation	110.62
Margin of Safety	0
TMDL	111.38

The TMDL authorizes re-allocation of the individual WLAs among point sources and indeed assumes that this will occur, but only to the extent that the sum of re-allocated loads remain at or below the sum of the original individual WLAs (sometimes described here as the cumulative WLA). USEPA established this TMDL under the assumption that most wastewater facilities are discharging at or below 12 ng/l. The percent reductions and relative loading levels are predicated on this assumption. If a discharger desires a mercury allocation that accommodates mercury loadings above 12 ng/l, the TMDL explicitly assumes that the permitting authority can revise the individual WLA accordingly, but only if the sum of all individual WLAs does not exceed the cumulative WLA

SECTION 7
ONGOING AND FUTURE POLLUTANT LOADING REDUCTIONS

USEPA estimates that approximately 99.5 percent of the current mercury loadings to the Little River/Catahoula Lake watershed are from atmospheric deposition. As defined in Section 6.4 of this report, the total allowable load of 111.38 lbs/yr will necessitate a 32.43 percent reduction in mercury loading to achieve the applicable endpoint of 0.5 mg/kg in fish tissue. Consequently, significant reductions in atmospheric deposition within the airshed will be necessary. Ongoing and future reductions in mercury emissions using a multimedia approach provide reasonable assurance that WQSs will be attained. USEPA and LDEQ have taken key steps nationally and regionally toward reducing mercury emissions and environmental and human health risks associated with mercury exposure.

7.1 AIR AND WASTE

Based on the December 1997 Mercury Study Report to Congress (USEPA 1997), USEPA estimates that 60 percent of the total mercury deposited in the U.S. water bodies and contaminating fish comes from domestic anthropogenic air emission sources.

The largest emitter of mercury to the atmosphere is coal-fired electric power plants. In December 2000, USEPA announced its intent to regulate mercury air emissions from power plants. The agency will propose regulations by 2003 and issue final rules by 2004. In February 2002, President Bush announced the Clear Skies Initiative, a program that will dramatically reduce and cap emissions of nitrogen oxides, sulfur dioxide, and mercury. The initiative is projected to result in substantial emission reductions from power generators by 2020. In Louisiana, mercury emissions are expected to be reduced by 20 percent relative to 2000 emissions (http://www.epa.gov/clearskies/pdfs/LA-summary-9-16.PDF).

Under the Clean Air Act, the USEPA has issued stringent regulations for significant emitters of mercury which, once implemented, is expected to reduce nationwide emissions from anthropogenic sources by about 50 percent from 1990 levels. These actions include:

- Municipal Waste Combustors (MWC): In 1995, USEPA issued emission limits for MWCs based on maximum achievable control technology. The implementation date for new and existing MWCs was December 2000. Overall mercury emissions from MWCs were estimated to be 54 tons per year (tpy) in 1990 and are expected to reduce mercury emissions from these types of facilities by at least 90 percent.
- Medical Waste Incinerators (MWI): In August 1997, USEPA issued emission limits for MWIs. The implementation date for new and existing MWIs was September 2002. Overall mercury emissions from MWIs were estimated to be 50 tpy in 1990, were reduced to 16 tpy (primarily as a result of state regulations), and are estimated to be reduced by an additional 94 percent or more.
- Hazardous Waste Combustors (HWC): In 1999, USEPA issued emission standards for HWCs, including cement kilns and light weight aggregate kilns that

burn hazardous waste. Overall mercury emissions from HWCs were estimated to be 2.5 percent of the total national mercury emissions in 1990. This regulation has not been implemented pending final resolution of a lawsuit. Once fully implemented, mercury emissions from HWCs are expected to be reduced by at least 50 percent.

A combination of multiple state and federal programs will provide reasonable assurances that nonpoint sources of mercury can be reduced to levels necessary to meet the endpoint. The combined affect of these programs should translate to 50 percent reduction in annual emissions in Louisiana, which is greater than the 32 percent reduction required by these TMDLs.

7.2 MUNICIPAL AND INDUSTRIAL DISCHARGERS

USEPA assigned a gross waste load allocation of 0.76 lbs/year for all point source dischargers in the study area and contributing watershed. This assumes that all dischargers meet the mercury target concentration of 0.012 µg/L. This load is 0.5 percent of the TMDL load calculated in this TMDL Report. USEPA recognizes that this is a relatively small share of the allowable total mercury load to the watershed. However, USEPA also acknowledges that mercury is a highly persistent bioaccumlative pollutant that can contribute to mercury bioaccumulation. Regulations at 40 CFR Part 122.44(d)(1) require permitting authorities to determine "whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criterion within a state [or tribal] water quality standard," and to develop water quality-based NPDES permits accordingly. Although no specific reductions are required of point source discharges in this TMDL, these factors suggest that additional efforts by LDEQ and USEPA are necessary to demonstrate that discharges are meeting the assumed concentration of 0.012 µg/L.

USEPA will work with LDEQ to establish mechanisms for demonstration that these loads are being met. Mechanisms that could be used to demonstrate compliance may include a certification process demonstrating that there are no known or suspected operations that could reasonably be expected of discharging mercury. Effluent sampling may be necessary for dischargers that cannot meet the certification requirement. Sampling requirements, if applicable, should include sampling and analyses using clean methods. USEPA Method 1631 is now available which has a detection limit of 0.0002 µg/L or 0.2 ng/L. Mercury monitoring to meet the requirements of this TMDL should follow procedures as outlined in USEPA Method 1631. With these additional data, USEPA and LDEQ could consider the possibility of revising the TMDL at some point in the future if warranted.

If a facility is found to discharge mercury at levels above 12 ng/L, a mercury minimization plan is an example of a reasonable action to be taken. USEPA expects that the State of Louisiana, as the duly authorized permitting authority, will determine any additional necessary elements of a mercury characterization/minimization plan, considering the size and nature of the affected facility. LDEQ should address the need for additional permit requirements on a case-by-case basis. Through these actions, over the long-term, it can be demonstrated that waste load allocations are being met.

As presented, the Little River TMDL predicts compliance with water quality standards after full implementation of MACT controls on a nationwide basis. The TMDL estimates a needed reduction of approximately 33% with MACT controls resulting in a 50% reduction as a National average. Mercury minimization plans and/or numeric limits for point sources are still needed for two reasons. First, the assumed MACT reductions are a National average and do not adequately characterize the reductions that may or may not take place in and around the watershed. This leads to uncertainty about whether or not the needed reduction will actually be attained and if future assimilative capacity will exist. Second, the MACT reductions provide an indicator of overall reduction to the watershed and do not account for possible localized effects of effluent containing mercury. Local characteristics such as water velocity, bed substrate, oxygen content and microbial community structure all contribute to methylation potential. Since these characteristics have not been defined for each of the dischargers in the area, there exists the potential that effluent containing mercury may cause localized exceedences of the criteria and therefore, minimization plans and/or numeric limits are necessary in order to assure that the discharge does not cause and/or contribute to an exceedance of the applicable water quality standard. In conclusion, due to uncertainty in the TMDL analysis, mercury minimization plans and/or numeric limits are necessary to assure compliance with the water quality standards.

7.3 POLLUTION PREVENTION

Source reduction, through product substitution and innovation, is the key element to pollution prevention. The U.S. industrial demand for mercury dropped 75 percent from 1988 to 1997 (http://www.epa.gov/mercury). Reductions in mercury use are driven by voluntary efforts and by increasingly strict federal and state regulations, such as increasing regulation of mercury in products or outright bans on the use of mercury in products for which alternatives are available. For example, in 1996, USEPA eliminated the use of mercury in most batteries under the Mercury Containing and Rechargeable Battery Management Act. Other voluntary measures such as the commitment by the American Hospital Association to reduce the use of mercury-containing products will continue to decrease the amount of mercury available in the waste stream. Next to source reduction, recycling is fundamental to mercury pollution prevention. When mercury must be used and recycling is not a possibility, proper disposal is critical in reducing the potential of atmospheric dispersion.

7.4 LDEQ STATEWIDE MERCURY MONITORING PROGRAM

Over the past 4 years LDEQ has worked to expand its statewide mercury monitoring program. The primary objective of this program is to determine statewide mercury contamination levels of fish commonly eaten in Louisiana, as well as mercury concentrations in sediments, water, and epiphytic plant material, and mercury loadings from aerial deposition.

Fish tissue information provides input for analyses of risks to human health due to consumption of mercury-contaminated fish. This will allow LDHH and LDEQ to address public concerns regarding the safety of fish consumption from many water bodies. Epiphytic plant material is used to help further define the significance of atmospheric sources of mercury. Results of the epiphytic plant material analyses, together with fish tissue, water and sediment concentration information, will continue to help address questions regarding sources of mercury. Additional local and statewide remedial actions can be more effectively targeted to reduce mercury sources by combining data generated from this and previous projects and the knowledge of LDEQ field personnel. This project will also provide baseline data that can be used for ongoing trend analysis.

LDEQ's sampling site selection continues to evolve and is based on several needs. New sites are sampled in order to expand the extent of water bodies tested. Recently, sites have been selected in basin subsegments in which no previous sampling has occurred. In the next few years, all promulgated water bodies are expected to be sampled for mercury contamination. Water bodies currently under an advisory for mercury are resampled annually. Finally, some water bodies are resampled if LDHH determines additional samples are needed in order to make a decision regarding the need for fish consumption advisories.

Beginning in October 1998, LDEQ implemented an air monitoring program designed to assess the geographical extent and quantity of atmospheric mercury deposition. Air monitors were set up at the Southeastern University Campus in Hammond, Louisiana, McNeese State University in Lake Charles, Louisiana, and at the Louisiana State University sweet potato farm in Chase, Louisiana (See Figure 2.2). Samples are tested for wet deposition of total mercury during rainfall events. If possible, samples are collected weekly. LDEQ's air monitoring sites are part of the National Atmospheric Deposition Program (NADP) and the MDN.

As of December 2000, weekly data from October 1998 through June 2000 were available. The data show mercury levels are being detected regularly in rainwater. The data are analyzed by the NADP staff, and any future reports concerning the deposition data will be published by the NADP. Any interested party may access the data at the following website: http://nadp.sws.uiuc.edu/mdn.

LDEQ adheres to well-defined sampling procedures and a quality assurance project plan when collecting mercury data. These procedures are outlined in the Mercury Monitoring Report Program (LDEQ 2000) located at http://www.deq.state.la.us/surveillance /mercury/2000report/program.htm and in the *Quality Assurance Project Plan Surface Water Monitoring and Analysis* that was followed throughout this monitoring program (LDEQ 1991b). USEPA will work with LDEQ to modify future state sampling and analysis methods to utilize clean methods that ensure appropriate detection limits for metals. This program is an important tool for LDEQ in evaluating the progress of the mercury reductions that are prescribed by these TMDLs. LDEQ's targeted data collection efforts in subsegments with fish consumption advisories will provide the data necessary to ultimately remove the fish consumption advisory or revise the TMDL at some point in the future, if warranted.

SECTION 8
PUBLIC PARTICIPATION

When USEPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires USEPA to publish a public notice and seek comments concerning the TMDL. USEPA prepared this TMDL pursuant to the consent decree, Sierra Club, *et al.* v. Clifford *et al.*, No. 96-0527, (E.D. La.) signed and entered April 1, 2002. Federal regulation requires that public notice be provided through the Federal Register and through newspapers in the local area. The Federal Register notice was issued on December 20, 2002 (Volume 67, Number 245, page 77994). This TMDL was also noticed in local newspapers. Comments and additional information were submitted during the 30-day public comment period and this TMDL has been revised accordingly. Comments and responses are found in Appendix E. USEPA will provide notice to LDEQ that this TMDL has been made final. USEPA will also request LDEQ to incorporate the TMDL into the state Water Quality Management Plan.

SECTION 9
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APPENDIX A
FISH CONSUMPTION ADVISORY

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GOVERNOR

David Hood
Secretary
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James H. Jenkins, Jr.
Secretary
Department of
Wildlife & Fisheries
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Baton Rouge, LA
70898-9000

The following fish consumption advisory was issued on 11/20/00 by the Department of Health & Hospitals, the Department of Environmental Quality, and the Department of Wildlife & Fisheries. For more information, please contact:

DHH	DEQ	DWF
Robert Starszak	Chris Roberie	Gary Tilyou
(504) 568-8537	(225) 765-0634	(225) 765-2343

FISH CONSUMPTION ADVISORY FOR THE LITTLE RIVER AT BODIE'S LANDING

Based on fish sampling of the Little River at Bodie's Landing in Grant and La Salle parishes, unacceptable levels of mercury have been detected in largemouth bass, white crappie, freshwater drum, flathead catfish, and bowfin. The advisory includes Little River from Highway 500 near Georgetown to the weir near Archie, including Catahoula Lake . Therefore, the Louisiana Department of Health & Hospitals, Department of Environmental Quality, and Department of Wildlife & Fisheries advise that the following precautions be taken when eating fish taken from the Little River at Bodie's Landing.

- **Pregnant women, breast-feeding women, women planning to be pregnant, and children less than seven years of age should NOT consume largemouth bass, freshwater drum, flathead catfish, or bowfin from the advisory area and should consume no more than TWO MEALS PER MONTH of white crappie (a meal is considered to be half a pound of fish for adults and children). There are no limits on other species.**

- **Non-pregnant women, women not planning to become pregnant, men, and children seven years of age and older should consume no more than TWO MEALS PER MONTH of largemouth bass, freshwater drum, flathead catfish, and bowfin combined from the advisory area. There are no limits on other species.**

Mercury is an element that occurs naturally in the environment. It is released into the environment through natural processes and human activities. Consequently, there are small amounts of mercury in lakes, rivers, and oceans. Nearly all fish contain trace amounts of mercury. They absorb mercury from the water and sediment as they feed on aquatic organisms. Larger predator fish contain more mercury than smaller fish. Therefore, in general, it is recommended that smaller fish be consumed instead of larger ones.

People are exposed throughout their lives to low levels of mercury. One way they can be exposed to mercury is from eating contaminated fish. Health effects from harmful levels of mercury can include nervous system and kidney damage. Developing fetuses are more sensitive to the toxic effects of mercury, especially in the first trimester. In addition to developing fetuses, infants and children are more sensitive to the effects of mercury; therefore, consumption advisories are issued at lower fish tissue concentration levels for these groups.

This advisory is issued as a precaution. Further sampling will be carried out by the Louisiana Department of Environmental Quality to determine the need for modifications to this advisory. If you have consumed largemouth bass, bowfin, flathead catfish, freshwater drum, and/or white crappie from these waters, it is not likely that there is an immediate need to be concerned about the effects of mercury. However, you should consult your personal doctor if you are concerned.

Jimmy Guidry, M.D.
State Health Officer and Medical Director
Department of Health & Hospitals

Madeline McAndrew
Assistant Secretary, Office of Public Health
Department of Health & Hospitals

David Hood
Secretary
Department of Health & Hospitals

J. Dale Givens
Secretary
Department of Environmental Quality

James H. Jenkins, Jr.
Secretary
Department of Wildlife & Fisheries

APPENDIX B
FISH TISSUE DATA

Table B.1 Mercury Concentrations (Wet Weight) in Fish Tissue from Fish Sampled at Site 0089

Date	Species	Weight (g)	Length (cm)	Number	Value (ppm)
10/08/96	LARGEMOUTH BASS	548.10	33.80	6	.752
10/08/96	LARGEMOUTH BASS	1162.40	43.70	2	.742
10/08/96	LARGEMOUTH BASS	1715.20	49.00	2	1.402
10/08/96	LARGEMOUTH BASS	2664.90	56.70	1	2.438
10/08/96	BOWFIN	2792.50	66.80	2	1.731
10/08/96	BLACK CRAPPIE	205.50	23.90	4	.458
10/08/96	BLACK CRAPPIE	345.90	27.20	5	.143
10/08/96	BLACK CRAPPIE	496.10	31.90	2	.227
10/08/96	BLUEGILL SUNFISH	113.40	18.10	7	.077
10/08/96	CHANNEL CATFISH	524.50	40.60	2	.289
05/16/00	LARGEMOUTH BASS	418.20	30.90	8	.786
05/16/00	LARGEMOUTH BASS	602.40	35.50	4	1.317
05/16/00	LARGEMOUTH BASS	1011.20	40.80	3	1.473
05/16/00	LARGEMOUTH BASS	1219.10	44.70	2	1.781
05/16/00	WHITE CRAPPIE	164.40	23.20	5	.246
05/16/00	WHITE CRAPPIE	255.20	26.00	2	.345
05/16/00	WHITE CRAPPIE	652.10	34.40	1	1.136
05/16/00	BLACK CRAPPIE	340.20	27.50	4	.609
05/16/00	SMALLMOUTH BUFFALO	1908.90	46.40	3	.516

Table B.2 Mercury Concentrations (Wet Weight) in Fish Tissue from Fish Sampled at Site 1010

Date	Species	Weight (g)	Length (cm)	Number	Value (ppm)
06/01/00	LARGEMOUTH BASS	453.60	31.70	3	.337
06/01/00	LARGEMOUTH BASS	581.20	34.70	4	.378
06/01/00	LARGEMOUTH BASS	1275.80	43.50	1	.739
06/01/00	LARGEMOUTH BASS	1956.20	49.90	1	1.177
06/01/00	WHITE BASS	444.20	33.00	3	.457
06/01/00	WHITE BASS	637.90	37.30	2	.776
06/01/00	WHITE CRAPPIE	222.10	25.40	6	.210
06/01/00	WHITE CRAPPIE	326.00	27.50	2	.218
06/01/00	WHITE CRAPPIE	482.00	31.30	4	.368
06/01/00	FRESHWATER DRUM	517.40	34.30	4	.588
06/01/00	FRESHWATER DRUM	708.80	37.80	1	1.007
06/01/00	FRESHWATER DRUM	1800.20	49.50	2	.813
06/01/00	BLUE CATFISH	552.80	38.20	2	.264
06/01/00	BLUE CATFISH	963.90	45.80	2	.384

Date	Species	Weight (g)	Length (cm)	Number	Value (ppm)
06/01/00	BLUE CATFISH	2735.80	63.90	2	.788
06/01/00	FLATHEAD CATFISH	2721.00	62.00	1	.718
09/19/01	BLUE CATFISH	666.20	42.70	2	.283
09/19/01	BLUE CATFISH	1143.50	49.60	3	.281
09/19/01	BLUE CATFISH	1701.00	56.60	2	.307
09/19/01	FRESHWATER DRUM	269.30	28.90	4	.314
09/19/01	FRESHWATER DRUM	916.70	41.60	3	.901
09/19/01	FRESHWATER DRUM	1162.40	45.80	2	1.023
09/19/01	LARGEMOUTH BASS	436.60	30.60	5	.380
09/19/01	LARGEMOUTH BASS	585.90	34.00	3	.609
09/19/01	LARGEMOUTH BASS	793.80	37.40	4	.552
09/19/01	LARGEMOUTH BASS	1162.40	43.00	1	.634
09/19/01	SMALLMOUTH BUFFALO	2239.70	49.60	3	.296
09/19/01	WHITE CRAPPIE	239.00	26.20	7	.210
09/19/01	WHITE CRAPPIE	306.20	27.30	5	.294
09/19/01	WHITE CRAPPIE	406.40	30.40	3	.141
09/19/01	WHITE CRAPPIE	496.10	32.90	4	.424

Table B.3 Mercury Concentrations (Wet Weight) in Fish Tissue from Fish Sampled at Site 0810

Date	Species	Weight (g)	Length (cm)	Number	Value (ppm)
05/17/01	BLUE CATFISH	652.10	41.60	4	.528
05/17/01	BLUE CATFISH	935.60	46.80	2	.379
05/17/01	CHANNEL CATFISH	652.10	38.90	2	.270
05/17/01	FRESHWATER DRUM	283.50	28.40	2	.324
05/17/01	FRESHWATER DRUM	822.20	38.60	1	1.003
05/17/01	LARGEMOUTH BASS	436.60	30.50	5	.552
05/17/01	LARGEMOUTH BASS	496.10	33.30	2	.417
05/17/01	LARGEMOUTH BASS	808.00	38.10	2	.471
05/17/01	LARGEMOUTH BASS	1219.10	42.10	1	.909
05/17/01	LARGEMOUTH BASS	1559.30	46.50	1	1.362
05/17/01	WHITE BASS	793.80	39.50	2	1.470
05/17/01	WHITE CRAPPIE	326.00	27.30	2	.338

Table B.4 Mercury Concentrations (Wet Weight) in Fish Tissue from Fish Sampled at Site 1011

Date	Species	Weight (g)	Length (cm)	Number	Value (ppm)
05/30/00	FLATHEAD CATFISH	3118.50	64.30	1	.713
05/30/00	FLATHEAD CATFISH	14770.40	99.50	1	1.428
05/30/00	FRESHWATER DRUM	623.70	36.20	3	.899
05/30/00	FRESHWATER DRUM	793.80	39.30	2	1.343
05/30/00	FRESHWATER DRUM	1134.00	43.40	2	.975
05/30/00	LARGEMOUTH BUFFALO	680.40	35.30	3	.787
05/30/00	LARGEMOUTH BUFFALO	1431.70	44.50	2	1.111
05/30/00	LARGEMOUTH BUFFALO	1743.50	49.00	2	1.418
05/30/00	WHITE CRAPPIE	238.10	25.40	5	.344
05/30/00	WHITE CRAPPIE	364.50	29.00	7	.529
05/30/00	WHITE CRAPPIE	453.60	30.60	5	.479

APPENDIX C
LOUISIANA AIR EMISSIONS AND LIST OF NPDES DISCHARGERS

Table C.1 TEDI Mercury Emissions within Project Airshed[1] (lbs/yr)

BOISE CASCADE-OAKDALE PLYWOOD	Allen								910	3	3	3
BOISE CASCADE - SOUTHERN OPS	Beauregard		4	3	61	56	55	48	111	60	1	1
WESTVACO	Beauregard			2	2	2	2	2	1			
PPG INDUSTRIES, INC.											6	6
REYNOLD METALS LC CARBON											1	1
INTERNATIONAL PAPER-MANSFIELD	De Soto		75	66	67	218	260	240	240	40	36	47
GEORGIA PACIFIC CORPORATION	E Baton Rouge		83	81	143	73	69	73	70	2	2	21
CABOT CORPORATION											5	5
RHODIA, INC.	E Baton Rouge									0		
ROLLINS ENVIRON. SERVICES, INC	E Baton Rouge	1	2	2	9	9						
SAFETY-KLEEN	E Baton Rouge								0	0		
GEORGIA GULF CORPORATION											7	1
SYNGENTA CROP PROTECTION												4
DOW U.S.A., PLAQUEMINE SITE	Iberville	44	127		588	227	16			1		
NOVARTIS CROP PROTECTION INC.	Iberville								3	15	6	
STONE CONTAINER CORPORATION	Jackson		49	49	48	48	12	18	18	0		
LA-PACIFIC CORP., URANIA CMPLX	La Salle	2	2	2	2	2				3		
INTERNATIONAL PAPER	Morehouse		83	66	66	99	92	91	87	87	16	14
WILLAMETTE IND., INC. RED RIVER	Natchitoches			21	20	15	15	16	16	16	17	1
RIVERWOOD INTERNATIONAL PLNT31	Ouachita		53	54	56	16	14	14	14	20	4164	18
INTERNATIONAL PAPER-PINEVILLE	Rapides		45	46	47	2	95	60	57	60	56	71
MOTIVA-NORCO, ENTERPRISES												12
SHELL OIL-NORCO-EAST SITE											13	14
MOTIVA ENTERPRISES, LLC												9
CROWN PAPER COMPANY	West Feliciana					29		20	20	29	3	1
JAMES RIVER CORP.	West Feliciana		14	27	27							
Yearly Totals		47	537	419	1,136	796	630	582	1,547	333	4,336	229

1 See Figure 2.2 for delineation of project airshed.
2 Companies without a location (parish) were assumed to be within the project airshed to make a more conservative estimate of air deposition sources.
Source: http://www.deq.state.la.us/surveillance/mercury/2000report/intro.htm

Table C.2 TEDI Mercury Emissions Outside Project Airshed (lbs/yr)

RUBICON INC	Ascension	15	13	13	13	14	25	23	30	33	32	12
CONDEA VISTA-CHEMICAL COMPLEX	Calcasieu							20				
LYONDELL CHEMICAL, LK. CHARLES	Calcasieu									0		
PPG INDUSTRIES, INC.	Calcasieu	1,210	1,208	1,238	1,282	1,287	1,281	1,228	1,220	1,222	1218	1216
SUNLAND FABRICATORS/WALKER	Livingston								67			
UNION CARBIDE	St Charles	1				3	3	4	3	1	1	1
MARINE SHALE PROCESSORS. INC.	St Mary	30	25	22								
GAYLORD CONTAINER CORPORATION	Washington		91	80	87	83	85	90	89	88	91	96
Yearly Totals		1,256	1,337	1,353	1,382	1,387	1,394	1,365	1,409	1,344	1,342	1,325

Source: http://www.deq.state.la.us/surveillance/mercury/2000report/intro.htm

Appendix C-3
NPDES Discharge Permits

NPDES	Company/Facility Name	Basin Segment	Parish	SIC	Facility Type	Receiving Waters	Permitted Flow (MGD)	Estimated Annual Load (lbs/yr)
[illegible]								
LA0101559	CADENCE ENVIRONMENTAL ENERGY INC./ PINEVILLE DISTN CENTER	081603	Rapides	4953	HAZARDOUS WASTE-DERIVED FUEL	DITCH-BAYOU FLAGON-CATAHOULA LAKE	NA	0.0000
LA0068012	LASALLE PH SANITARY LANDFILL	0816	LaSalle	4953	MUNICIPAL SANITARY LANDFILL	LITTLE CHICKASAW CREEK	NA	0.0000
LA0043958	VILLAGE OFHARRISONBURG WWTP	081610	Catahoula	4952	POTW	STOKES CREEK-BAYOU BRUSHLEY	0.010	0.0004
LA0033260*	TOWN OFJENA/LASALLE WWTP	081609	LaSalle	4952	MUNICIPAL STP**	WEST PRONG CREEK-HEMPHILL CREEK	0.560	0.1800
LA0052591	TOWN OF POLLOCK WWTP	081608	Grant	4952	MUNICIPAL STP	BIG CREEK	0.010	0.0004
LA0064963	VILLAGE OF DRY PRONG WWTP	081608	Grant	4952	STP	BIG CREEK-LITTLE RIVER	0.050	0.0018
LA0098558***	TOWN OF POLLOCK / AIRPORT STP	081603	Grant	4952	WWTP	BACON BRANCH OF FLAGON BAYOU	0.290	0.0106
LA0048992	VILLAGE OF GEORGETOWN	081601	Grant	4952	STP	MAXIE CREEK TO LITTLE RIVER	0.100	0.0037
LA0033278	JENA/LASALLE WIRE & CABLE CO. / BELDEN CO., #2 FACILITY	0816	LaSalle	4952	STP		0.010	0.0004
LA0079545	TOWN OF BALL WWTP	0816	Rapides	4952	WWTP	FLAGON BAYOU	0.010	0.0004
LA0039098	RAPIDES PAR SEW DIST #2/ PINEBROOK ESTATES SUBD		Rapides	4952	RESIDENTIAL STP	KITCHEN CREEK	0.126	0.0046
LA0049760	STATE OF LA MILITARY DEPT / PINECREST STATE SCH CAMP BEAUREGARD	0816	Rapides	4952	SCHOOL STP	FLAGON BAYOU-CATAHOULA LAKE	1.325	0.0484
LA0032379	TOWN OF OLLA	0815	LaSalle	4952	WWTP	BEAR CREEK	0.160	0.0058
LA0040991	TOWN OF URANIA	0815	LaSalle	4952	WWTP	CHICKASAW CREEK-CASTOR CREEK	0.280	0.0102
LA0049905	TOWN OF CHATHAM	0815	Jackson	4952	WWTP	UNAMED DITCH-EDWARDS CREEK	0.080	0.0029
LA0060712	COLUMBIA HEIGHTS SD#1	0815	Caldwell	4952	WWTP	HURRICANE CREEK/BLACK BAYOU	0.235	0.0086
LA0082210	VILLAGE OF CLARKS	0815	Caldwell	4952	WWTP	HURRICANE CREEK B. CASTOR	0.147	0.0054
LA0108359	PLACID PPLN CO LLC / NEBO & LARTO MIX STORAGE	081603	LaSalle	4612	PETRO STORAGE & TRANSFER	DEVILS C-CATAHOULA L-LITTLE R-RED R	NA	0.0000
LA0007790	BELDEN CORP./DIV. OF COOPER IND. / LASALLE PLT.	0816	LaSalle	3357	WIRE & CABLE MANUFACTURE	HEMPHILL CREEK	NA	0.0000
LA0047546	FARMLAND INDUSTRIES INC / POLLOCK NITROGEN PLANT	081602	Grant	2873	ANHYDROUS AMMONIA/NITROGEN	LITTLE RIVER - CATAHOULA LAKE	NA	0.0000
LA0007501*	DYNEA-WINNFIELD PLANT	0815	Winn	2869		SEG 081402_OUACHITA RIVER BASIN	0.080	0.0029
LA0002780	POWER SILICATES INC	081603	Rapides	2819	GLASS MFG-SODIUM SILICATE	FLAGON BAYOU	NA	0.0000
LA0081574	HUNT PLYWOOD CO INC / POLLOCK PLYWOOD MILL	081602	Grant	2436	SOFTWOOD PLYWOOD	DITCHES-MILL CREEK	0.004	0.0001
[illegible]								
LA0052761	McClendon, Glen Trucking Co	081401	Lincoln	7542	Carwashes		NA	0.0000
LA0104043	Winnfield Compaction Station	081402	Winn	4953	POTW	Creosote Branch	NA	0.0000
LA0038539	City of Jonesboro	081401	Jackson	4952	Sanitary Wastewater, East Oxidation Pond	E. Garrett Creek-Little Dugdemona River	0.300	0.0110
LA0038547	City of Jonesboro	081401	Jackson	4952	Sanitary Wastewater, North Oxidation Pond	Garrett Creek-Dugdemona River	0.200	0.0073
LA0046477	City of Jonesboro	081401	Jackson	4952	Sanitary Wastewater, South Oxidation Pond	Ditch-Garrett Creek-Little Dugdemona River	0.500	0.0183
LA0039756	Village of East Hodge	081401	Jackson	4952	Sanitary Wastewater	Little Dugdemona-Dugdemona River	0.060	0.0022
LA0039829	Village of North Hodge	081401	Jackson	4952	Sanitary Wastewater	Ditch-Dugdemona River	0.062	0.0023
LA0065102	Village of Simsboro	081401	Lincoln	4952	Sanitary wastewater	Madden Creek-Dugdemona River	0.158	0.0058
LA00388228	Town of Grambling	081401	Lincoln	4952	Sanitary wastewater	Redwine Creek-Dugdemona River	1.500	0.0548
LA0032042	Ruston Development Center	081401	Lincoln	4952	Sanitary wastewater	Spring Creek-Madden Creek-Dugdemona	0.025	0.0009
LA0036331	City of Ruston, South Side Plant	081401	Lincoln	4952	Sanitary wastewater	Future Site - Unknown	0.010	0.0004
LA0054704	Grambling State University (Closed)	081401	Lincoln	4952	Sanitary wastewater	River	0.010	0.0004
LA0033201	Village of Hodge (South Forth St.)	0814	Jackson	4952	Sanitary wastewater		0.010	0.0004
LA0043915*	City of Winnfield	081402	Winn	4941	Water Supply	Creosote Branch	1.430	0.0522
LA0103012	Dependable Tank Lines	081402	Winn	4213	Trucking Co - Truck Wash	Dugdemona River	NA	0.0000
LA0108189	GE Rail Car Repair Service	081401	Jackson	4011	Railcar repair service	Little Dugdemona River	NA	0.0000
LA0046281	Pabco Inc. (formerly Calsilite Group)	081401	Lincoln	3299	mfg	Madden Creek	0.002	0.0001
LA0105481	LA Industries, a Division of TXI, Plant #12	081401	Jackson	3273	ready mix concrete	Little Dugdemona Creek	NA	0.0000
LA0007650	Ball-Foster Glass Container Co	081401	Lincoln	3221	container mfg	Madden Creek-Mill Creek	0.0241	0.0009
LA0007501*	Neste Resins Corp	081402	Winn	2821	Synthec Resin	Brushy Creek	NA	0.0000
LA0007684*	Smurfit-Stone Hodge Mill/Plant	081401	Jackson	2621	Paper Mill	Dugdemona River	8.500	0.3105

Appendix C-3
NPDES Discharge Permits

NPDES	Company/Facility Name	Basin Segment	Parish	SIC	Facility Type	Receiving Waters	Permitted Flow (MGD)	Estimated Annual Load (lbs/yr)
LA0097721	Willamette Industries, Arcadia Oriented Strand Beam Plant	081401	Lincoln	2493	Sanitary wastewater, stormwater	Unnamed tributary-Dugdemona River	0.0018	0.0001
LA0106259	Willamette Industries, Simsboro Laminated Beam	081401	Lincoln	2493	Sanitary wastewater, stormwater	Madden Creek	0.0015	0.0001
LA0007803	Willamette Industries, Surepine Div.	081401	Lincoln	2493	Sanitary wastewater, particleboard mfg		NA	0.0000
LA0101940	Mid-State Wood Preservers	081401	Lincoln	2491	treating	Dugdemona River	0.0008	0.0000
LA0076953	Willamette Industries, Dodson Sawmill/Plywood Plant	081401	Winn	2432	& sawmill	Antwine Creek-Big Creek-Dugdemona River	0.0025	0.0001
LA0102016	Barnes Hardwood Inc.	081401	Lincoln	2421	Lumber Mill	Unnamed Streams-Madden Creek	NA	0.0000
LA0007498	Plum Creek Manufacturing	081402	Winn	2411	Saw Mill	Black Bayou	NA	0.0000
LA0105104	Tony James Logging	081402	Winn	2411	Logging Equipment/Repair	Brushy Creek-Dugdemona River	NA	0.0000
LA0103080	James Drilling	081402	Winn	1389	Oilfield Service	Dugdemona River	NA	0.0000
LA0007757	Jonesboro Generating Plant	081401	Jackson		Stormwater, power plant	Little Dugdemona River	NA	0.0000
LA0055832	Winnfield Limestone Quarry	0814	Winn		Limestone Quarry		NA	0.0000
[illegible]								
LA0107531	D&M Unlimited LLC	0815	Caldwell	7542		Black Bayou	NA	0.0000
LA0032379	Town of Olla	0815	La Salle	4952	WWTP, Oxidation lagoon	Bear Branch-Chickasaw Creek	0.048	0.0017
LA0040991	Town of Urania	0815	La Salle	4952	WWTP	Chickasaw Creek	0.028	0.0010
LA0049905	Town of Chatham	0815	Jackson	4952	WWTP	Unnamed ditch-Edwards Creek	0.010	0.0004
LA0060712	Columbia Heights Sewer District	0815	Caldwell	4952	WWTP	Hurricane Creek-Black Bayou	0.025	0.0009
LA0082210	Village of Clarks	0815	Caldwell	4952	WWTP	Hurricane Creek-B. Castor	0.010	0.0004
LA0097110	Koch Transportation-Olla Compression Station	0815	La Salle	4922	NG Compression Station	Ditch-Chickasaw Creek	NA	0.0000
LA0103012	Dependable Tank Lines	0815	Winn	4213		Dugdemona River	NA	0.0000
LA0108189	General Electric Rail Car Repair Service	0815	Jackson	4011		Little Dugdemona River	NA	0.0000
LA0105481	LA Industries, a Division of TXI, Plant #12	0815	Jackson	3273		Little Dugdemona Creek	NA	0.0000
LA0064424	Cavenham Forest Industries	0815	La Salle	2491	Wood Preserving	Mill Branch-Castor Creek	NA	0.0000
LA0007668	Louisiana Pacific	81501	La Salle	2436	Soft wood, veneer & plywood	Unnamed Creek-Chicasaw Creek	0.040	0.0015
LA0098884	Hunt Plywood	0815	La Salle	2421		Unnamed creek-Chickasaw Creek	0.001	0.0000
LA0098884	Hunt Forest Prod Inc.	081501	La Salle	2421	Hardwood Sawmill	Unnamed Tributary-Chickasaw Creek	NA	0.0000
LA0007498	Plum Creek Manufacturing	0815	La Salle	2411		Black Bayou	0.040	0.0015
LA0065200	International Paper Co/INTL Paper Standard Woodyard	0815	La Salle	2411		Chickasaw Creek	NA	0.0000
LA0105104	Tony James Logging	0815	Winn	2411		Brushy Creek - Dugdemona River	NA	0.0000
LA0103080	James Drilling	0815	Winn	1381		Ditch - Dugdemona River	NA	0.0000
							TOTAL	0.7614

* Major Facility Estimated Load (lbs/yr) = Flow (MGD) X Concentration (mg/L) X Conversion Factors
** From Table 5.1 ***LA0098558 Load = 0.29 X 12.0/10^6 X 8.34 X 365 = 0.0106 lbs/yr
NA - Not Available

APPENDIX D
SUPPORTING DATA FOR ESTIMATING WATERSHED MERCURY LOADING

Appendix D-1
PLOAD Results
for Flow and TSS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
081401	Dugdemona River - Headwaters to Big Creek	Ouachita	85,863,861.84	437,001	813.73	25,661,894,884.70	196.48
081402	Dugdemona River - From Big Creek to Little River	Ouachita	12,052,729.37	243,163	558.09	17,599,849,446.55	49.57
081501	Castor Creek - Headwaters to Little River	Ouachita	1,754,519.32	468,241	920.78	29,037,786,983.93	3.75
081502	Chatham Lake	Ouachita	7,462,610.39	9,749	18.50	583,539,901.66	765.47
081503	Beaucoup Creek - Headwaters to Castor Creek	Ouachita	17,486,347.79	45,874	84.96	2,679,362,961.57	381.18
081504	Flat Creek - Headwaters to Castor Creek	Ouachita	49,381,235.92	103,049	197.57	6,230,708,134.40	479.20
081505	Caney Lake	Ouachita	77,841,197.23	72,804	133.41	4,207,105,308.60	1,069.19
081601	Little River - Confluence of Castor Creek and Dugdemona	Ouachita	18,679,002.33	18,252	45.17	1,424,548,226.61	1,023.42
081602	Little River - From Bear Creek to Catahoula Lake (Scenic)	Ouachita	37,946,448.78	182,667	417.32	13,160,586,795.46	207.74
081603	Catahoula Lake	Ouachita	34,622,088.34	139,657	421.57	13,294,639,026.87	247.91
081605	Little River - From Catahoula Lake to dam at Archie	Ouachita	3,442,118.10	122,357	272.33	8,588,137,147.65	28.13
081606	Fish Creek - Headwaters to Little River (Scenic)	Ouachita	6,237,295.01	31,018	60.82	1,917,935,482.56	201.08
081607	Trout Creek - Headwaters to Little River (Scenic)	Ouachita	5,194,944.08	25,368	49.58	1,563,546,382.16	204.78
081608	Big Creek - Headwaters to Little River (Scenic)	Ouachita	5,590,024.39	55,834	110.26	3,477,238,245.13	100.12
081609	Hemphill Creek - Headwaters to Catahoula Lake (includes	Ouachita	29,530,286.15	31,794	61.18	1,929,503,400.31	928.80
081610	Old River - Catahoula Lake to Little River	Ouachita	10,188,561.91	153,554	329.48	10,390,381,278.09	66.35
081611	Bayou Funny Louis - Headwaters to Little River	Ouachita	36,066,012.26	93,084	191.77	6,047,535,571.02	387.46
		TOTALS	**353,475,421.39**	**2,233,466**		**147,794,299,177.27**	

Appendix D-2

Weighted Average Hg Deposition Calculations from NADP/MDM Stations

Subsegment Number	Subsegment Description	Centroid X-coordinate	Y-coordinate	Weighted Average Wet Deposition (ug/m2/yr)	Weighted Average Rainfall Concentration (ng/l)
081401	Dugdemona River - Headwaters to Big Creek	2,811,541.37	3,829,610.72	41.55	15.28
081402	Dugdemona River - From Big Creek to Little River	2,836,105.79	3,806,999.12	41.75	15.40
081501	Castor Creek - Headwaters to Little River	2,863,958.97	3,829,610.25	41.85	16.24
081502	Chatham Lake	2,836,286.20	3,852,015.14	41.66	15.75
081503	Beaucoup Creek - Headwaters to Castor Creek	2,859,525.62	3,833,660.81	41.83	16.17
081504	Flat Creek - Headwaters to Castor Creek	2,849,242.71	3,826,139.71	41.79	15.93
081505	Caney Lake	2,839,112.83	3,843,272.38	41.71	15.80
081601	Little River - Confluence of Castor Creek and Dugdemona	2,866,635.32	3,791,297.74	41.94	15.42
081602	Little River - From Bear Creek to Catahoula Lake (Scenic)	2,865,572.19	3,777,943.95	42.06	14.73
081603	Catahoula Lake	2,883,430.82	3,761,782.33	42.57	13.48
081605	Little River - From Catahoula Lake to dam at Archie	2,915,012.94	3,772,321.34	42.53	13.67
081606	Fish Creek - Headwaters to Little River (Scenic)	2,856,381.96	3,776,793.38	42.00	14.65
081607	Trout Creek - Headwaters to Little River (Scenic)	2,881,062.38	3,782,329.12	42.08	15.01
081608	Big Creek - Headwaters to Little River (Scenic)	2,861,893.99	3,766,653.06	42.17	14.12
081609	Hemphill Creek - Headwaters to Catahoula Lake (includes	2,890,829.28	3,784,776.96	42.08	15.13
081610	Old River - Catahoula Lake to Little River	2,904,720.38	3,795,267.10	41.97	15.66
081611	Bayou Funny Louis - Headwaters to Little River	2,883,010.19	3,796,601.61	41.93	15.84

NADP/MDM Station	Station Location	X-coordinate	Y-coordinate	[illegible]	Concentration (ng/l)
LA05	Lake Charles	2,848,457.93	3,574,218.81	36.21	15.03
LA10	Chase	2,893,665.09	3,828,497.23	41.89	16.57
LA23	Alexandria	2,921,819.64	3,713,025.66	44.44	10.62
LA28	Hammond	3,121,718.72	3,763,288.33	33.26	14.61

Appendix D-3
Loading Calculations
from Runoff

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
081401	Dugdemona River - Headwaters to Big Creek	Ouachita	437,001	25,661,894,884.70	15.28	11.11
081402	Dugdemona River - From Big Creek to Little River	Ouachita	243,163	17,599,849,446.55	15.40	7.67
081501	Castor Creek - Headwaters to Little River	Ouachita	468,241	29,037,786,983.93	16.24	13.36
081502	Chatham Lake	Ouachita	9,749	583,539,901.66	15.75	0.26
081503	Beaucoup Creek - Headwaters to Castor Creek	Ouachita	45,874	2,679,362,961.57	16.17	1.23
081504	Flat Creek - Headwaters to Castor Creek	Ouachita	103,049	6,230,708,134.40	15.93	2.81
081505	Caney Lake	Ouachita	72,804	4,207,105,308.60	15.80	1.88
081601	Little River - Confluence of Castor Creek and Dugdemona	Ouachita	18,252	1,424,548,226.61	15.42	0.62
081602	Little River - From Bear Creek to Catahoula Lake (Scenic)	Ouachita	182,667	13,160,586,795.46	14.73	5.49
081603	Catahoula Lake	Ouachita	139,657	13,294,639,026.87	13.48	5.07
081605	Little River - From Catahoula Lake to dam at Archie	Ouachita	122,357	8,588,137,147.65	13.67	3.32
081606	Fish Creek - Headwaters to Little River (Scenic)	Ouachita	31,018	1,917,935,482.56	14.65	0.80
081607	Trout Creek - Headwaters to Little River (Scenic)	Ouachita	25,368	1,563,546,382.16	15.01	0.66
081608	Big Creek - Headwaters to Little River (Scenic)	Ouachita	55,834	3,477,238,245.13	14.12	1.39
081609	Hemphill Creek - Headwaters to Catahoula Lake (includes	Ouachita	31,794	1,929,503,400.31	15.13	0.83
081610	Old River - Catahoula Lake to Little River	Ouachita	153,554	10,390,381,278.09	15.66	4.61
081611	Bayou Funny Louis - Headwaters to Little River	Ouachita	93,084	6,047,535,571.02	15.84	2.71
		TOTALS	**2,233,466**	**147,794,299,177.27**		**63.82**

Appendix D-4

Loading Calculations from Soil Erosion

Subsegment	Description	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
081401	Dugdemona River - From Big Creek to Little River	Ouachita	437,001	41.55	15.17	64.68	1,454.27	0.64	
081402	Dugdemona River - From Big Creek to Little River	Ouachita	243,163	41.75	15.24	64.99	110.46	0.03	
081501	Castor Creek - Headwaters to Little River	Ouachita	468,241	41.85	15.27	65.14	110.71	0.05	
081502	Chatham Lake	Ouachita	9,749	41.66	15.21	64.85	22,517.76	0.22	
081503	Beaucoup Creek - Headwaters to Castor Creek	Ouachita	45,874	41.83	15.27	65.11	11,257.05	0.52	
081504	Flat Creek - Headwaters to Castor Creek	Ouachita	103,049	41.79	15.25	65.06	14,141.21	1.46	
081505	Caney Lake	Ouachita	72,804	41.71	15.22	64.92	31,485.36	2.29	
081601	Little River - Confluence of Castor Creek and Dugdemona	Ouachita	18,252	41.94	15.31	65.28	30,304.80	0.55	
081602	Little River - From Bear Creek to Catahoula Lake (Scenic)	Ouachita	182,667	42.06	15.35	65.47	6,169.11	1.13	
081603	Catahoula Lake	Ouachita	139,657	42.57	15.54	66.26	7,451.19	1.04	
081605	Little River - From Catahoula Lake to dam at Archie	Ouachita	122,357	42.53	15.52	66.20	844.75	0.10	
081606	Fish Creek - Headwaters to Little River (Scenic)	Ouachita	31,018	42.00	15.33	65.39	5,963.77	0.18	
081607	Trout Creek - Headwaters to Little River (Scenic)	Ouachita	25,368	42.08	15.36	65.50	6,084.54	0.15	
081608	Big Creek - Headwaters to Little River (Scenic)	Ouachita	55,834	42.17	15.39	65.65	2,981.39	0.17	
081609	Hemphill Creek - Headwaters to Catahoula Lake (includes	Ouachita	31,794	42.08	15.36	65.50	27,595.02	0.88	
081610	Old River - Catahoula Lake to Little River	Ouachita	153,554	41.97	15.32	65.33	1,966.12	0.30	
081611	Bayou Funny Louis - Headwaters to Little River	Ouachita	93,084	41.93	15.30	65.27	11,471.52	1.07	
		TOTALS	**2,233,466**					**10.78**	

Appendix D-5

PLOAD Event Mean Concentration (EMC) by Land Use Category

11	RESIDENTIAL	41
12	COMMERCIAL AND SERVICES	55.5
13	INDUSTRIAL	60.5
14	TRANS, COMM, UTIL	73.5
15	INDUST & COMMERC CMPLXS	57
16	MXD URBAN OR BUILT-UP	26
17	OTHER URBAN OR BUILT-UP	26
21	CROPLAND AND PASTURE	107
22	ORCH,GROV,VNYRD,NURS,ORN	107
23	CONFINED FEEDING OPS	132
24	OTHER AGRICULTURAL LAND	132
32	SHRUB & BRUSH RANGELAND	1
41	DECIDUOUS FOREST LAND	45
42	EVERGREEN FOREST LAND	45
43	MIXED FOREST LAND	45
51	STREAMS AND CANALS	26
52	LAKES	19
53	RESERVOIRS	19
61	FORESTED WETLAND	19
62	NONFORESTED WETLAND	19
73		70
74	BARE EXPOSED ROCK	70
75	STRIP MINES	70
76	TRANSITIONAL AREAS	70

Appendix D-6

PLOAD Percent Impervious Cover by Land Use Category

11	RESIDENTIAL	25
12	COMMERCIAL AND SERVICES	85
13	INDUSTRIAL	70
14	TRANS, COMM, UTIL	65
15	INDUST & COMMERC CMPLXS	75
16	MXD URBAN OR BUILT-UP	60
17	OTHER URBAN OR BUILT-UP	75
21	CROPLAND AND PASTURE	20
22	ORCH,GROV,VNYRD,NURS,ORN	20
23	CONFINED FEEDING OPS	25
24	OTHER AGRICULTURAL LAND	20
32	SHRUB & BRUSH RANGELAND	20
41	DECIDUOUS FOREST LAND	25
42	EVERGREEN FOREST LAND	25
43	MIXED FOREST LAND	25
51	STREAMS AND CANALS	100
52	LAKES	100
53	RESERVOIRS	100
61	FORESTED WETLAND	80
62	NONFORESTED WETLAND	85
73		100
74	BARE EXPOSED ROCK	100
75	STRIP MINES	50
76	TRANSITIONAL AREAS	50

APPENDIX E
RESPONSE TO PUBLIC COMMENTS

Appendix E
USEPA Response to Comments
Louisiana Department of Environmental Quality (LDEQ) Comments dated January 21, 2003

LDEQ comment #1

It is inappropriate to assume that dischargers discharge a pollutant when it has not been included in their permit. USEPA knows that when effluent limits are determined for each facility, they are based on a number of factors, including the type of facility, types of waste-streams and effluent data submitted during the application process.

USEPA Response: Wasteload allocations have been a required element of TMDLs since 1985 (See 40 C.F.R. § 130.2(i)). USEPA regulations since 1989 have made it clear that water quality-based effluent limitations must be consistent with the assumptions of any available wasteload allocation prepared pursuant to USEPA's TMDL regulations. See 40 C.F.R. §122.44(d)(1)(vii)(B); 54 Fed. Reg. 23868- 23879 (June 2, 1989). In addition, the 1987 amendments to the Clean Water Act acknowledge the relationship between TMDLs, wasteload allocations and the ensuing effluent limitations. See CWA section 303(d)(4).

In this TMDL, wasteload allocations have been established that allow dischargers to discharge at loads equivalent to a concentration at or below 12 ng/L. This value was chosen because it is the driver for several permits already in effect in the watershed and because our calculations show that there is sufficient loading capacity in the TMDL to allow for this load. These WLAs are a basic principle of the process used to establish the TMDL. USEPA believes it is reasonable to assume that permitted point sources discharge mercury, even in very small quantities. While it is true that a number of NPDES-permitted sources have not reported mercury in their effluent in past permit applications, USEPA believes this is because the analytical methods in use at the time were not sensitive enough to detect the mercury's presence at these lower concentrations.

Now, however, data gathered with clean sampling procedures show that mercury is present in most wastewater. Moreover, the potential for municipal wastewater treatment facilities to discharge mercury at levels greater than the 12 ng/l target has been demonstrated in POTWs in Arkansas and other US regions. The Arkansas Department of Environmental Quality (ADEQ) conducted a monitoring study of five POTWs in Arkansas using clean sampling procedures and ultra-trace level analyses and found an average concentration of about 15 ng/L in municipal discharges (Alan Price, ADEQ, personal communication 2001). An Association of Metropolitan Sewerage Agencies (AMSA) study of 24 facilities in 6 states showed a range of average effluent concentrations of 3.1 ng/L to 9 ng/L with maximum effluent concentrations ranging from 5 to 29 ng/L (Mercury Source Control and Pollution Prevention Program Evaluation-Final Report, AMSA, 2002). Facilities that discharge to the impaired segment are given a cumulative wasteload allocation. If sufficient data is presented to the State permitting authority, individual waste load allocations may be adjusted to allow sharing of the TMDL wasteload allocation as long as the sum of these wasteload allocations does not exceed that specified in the TMDL and localized water quality limitations are not violated.

LDEQ comment #2

The Permit Division feels it is highly inappropriate to assign any allocations or monitoring requirements to point sources in view of their miniscule contribution to the impairment. This TMDL documents that the dischargers in the watershed contribute less than 1% to the total mercury load in Little River. There are no point source wastewater dischargers that have any potential to cause or contribute to this mercury impairment which is admittedly atmospheric in deposition, thus none should be required to monitor for mercury unless they are already doing so in a valid LPDES permit. Further, to require a source reduction program in the event any discharger "got a mercury hit" in an analysis is a costly, useless exercise. These resources of time and money are desperately needed by small municipalities to maintain and upgrade their systems, both collection and treatment.

USEPA Response: While USEPA acknowledges that the estimated loads from point sources are low, USEPA disagrees with the presumption that there are no point source dischargers that have any potential to cause or contribute to this impairment. Little is known about the potential to discharge mercury for the majority of dischargers in this watershed because effluent sampling for mercury in the past was conducted without the benefit of newer clean techniques. As referenced in previous comments, there is some reason to believe that some dischargers may have mercury in their effluent at levels greater than 12 ng/l, which is the individual WLA for each point source discharger. This TMDL does not call for monitoring beyond what may already be authorized under permit regulations. Rather, a facility is expected only to evaluate its potential to discharge mercury in order to demonstrate that it is discharging at levels consistent with the assumptions of this TMDL, i.e., at or below its 12 ng/l WLA. If a facility can demonstrate by sampling that its effluent is at or below the 12 ng/l WLA or through certification or other mechanism, then no reductions are contemplated by the TMDL. Moreover, LDEQ as the permitting authority has the discretion of defining other steps in the permitting plan process that would decrease the burden on small facilities if they can devise steps to show they are not a potential source of mercury.

USEPA agrees that the point sources are a small component of the overall mercury loading into the waters affected by today's TMDLs. USEPA does not agree, however, that point sources should not be responsible for any of the load reductions necessary for the waters to attain standards. The reductions contemplated by the cumulative wasteload allocation reflect the fact that mercury is a bioaccumulative, persistent pollutant that has been linked to serious health effects. EPA remains concerned about children potentially exposed to mercury in the womb. In a recent publication, "America's Children and the Environment: Measures of Contaminants, Body Burdens and Illnesses" (EPA, 2003) conclude that about 8 percent of women of childbearing age in the United States have concentrations of mercury in their body at levels of potential concern. For these TMDLs, USEPA believes as a matter of policy that point sources that can reduce their mercury discharges in a cost-effective way should do so. The mere fact that air sources are currently the dominant cause of impairment does not excuse point sources from implementing feasible pollution prevention measures to reduce their contribution of mercury, however small, to the environment. Indeed, sources that implement pollutant minimization (PMPs) plans frequently remove from the environment considerably more of the pollutant than can be accomplished through treatment. This is because less of the pollutant is generated in the first place; except when the pollutant can be completely destroyed (e.g., by changing its molecular structure), treatment solutions usually result in simply transferring the pollutant from one medium to another (e.g., from water to the air or land).

USEPA also notes that point source discharges of bioaccumulative chemicals like mercury may have particular local significance, apart from their contribution to the cumulative load. Point source discharges by their nature may create "hot spots" where observed elevated concentrations have potential impact on aquatic life, wildlife, and human health. Consequently, comparing contributions from the air and water sources conceals the real impact of mercury from point source discharges. EPA believes that in many cases elevated receiving water concentrations may be dictated solely by the mercury concentration in the effluent as opposed to the mercury delivered from air deposition. This is supported by field data in other locations and will generally be true when comparing the near-field effects of effluent discharges relative to air sources. Empirical data supports USEPA's research into air deposition of mercury and fish tissue modeling that showed that controls on point sources could factor site-specifically into reducing fish tissue levels of mercury. In short, USEPA believes it is reasonable to expect NPDES permittees to implement feasible and achievable measures to reduce the amount of mercury they discharge into the environment.

USEPA does not believe that these TMDLs place massive cost burdens on NPDES point sources. Point sources represent less than 1% of the load allocations necessary for the waterbodies to attain standards. USEPA anticipates that when reduction efforts are necessary, the point sources will be able to achieve their individual WLAs or, at a minimum, the cumulative WLA for all point sources, through implementation of feasible and achievable mercury minimization measures, identified by the point sources themselves. In addition to reducing direct discharges of mercury to the waters affected by these TMDLs, mercury minimization also can have the additional benefit of significantly reducing the creation of methylmercury and the transfer of mercury to wastewater treatment sludge.

USEPA recognizes that it is possible that reductions in mercury emissions from air sources may, by themselves, eventually result in the attainment of water quality standards for the affected waters. However, while USEPA projects significant reductions from current or proposed MACT regulations, for a number of TMDLs USEPA cannot be certain at this time that all reductions needed to meet the TMDL's load allocations will be achieved. One way that USEPA is accounting for these uncertainties is by assigning cumulative wasteload allocations that assume that mercury dischargers will either maintain their effluent at or below applicable wasteload allocations for mercury or will implement feasible minimization measures (i.e., do the best they can to reduce their loadings of mercury to the affected water). USEPA is also accounting for these uncertainties through its margin of safety. In addition, these measures can conceivably yield reductions beyond those actually contemplated in the cumulative WLAs, thus providing a margin of safety to offset equivalent reductions that ultimately may not be achieved from the air sources.

Under USEPA's regulations, NPDES permits must include conditions as necessary to achieve applicable water quality standards. See 40 C.F.R. § 122.44(d)(1). In order to decide whether such limitations or conditions are necessary, the permitting authority must determine whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream exceedance of the applicable water quality standard. See 40 C.F.R. § 122.44(d)(1)(i). USEPA believes that NPDES discharges of mercury to these waterbodies do have the reasonable potential to cause or contribute to an exceedance of water quality standards. However, if they are regulated at levels that are consistent with the assumptions of the wasteload allocations in these TMDLs, they will not cause or contribute to the exceedance of water quality standards. Therefore, more stringent limitations than those derived from the wasteload allocations should not be necessary to achieve water quality standards.

As presented, the Little River TMDL predicts assimilative capacity after full implementation of MACT controls on a nationwide basis. The TMDL estimates a needed reduction of approximately 33% with MACT controls resulting in a 50% reduction as a National average. If that prediction were accurate for the Little River (such that there would be considerably more reductions achieved than actually needed), there perhaps would be a basis for allowing all point sources to remain at existing effluent quality. However, EPA does not have certainty that "more than enough" reductions will be achieved through MACT controls. The assumed MACT reductions are a National average and may not adequately characterize the reductions that may or may not take place in and around the Little River watershed. This leads to uncertainty about whether or not more than the needed reduction will actually be attained and if sufficient assimilative capacity will be created to all point sources to remain at existing effluent quality. Also contributing to this uncertainty is that fact that the MACT reductions provide an indicator of overall reduction to the watershed and do not account for possible localized effects of effluent containing mercury. Local characteristics such as water velocity, bed substrate, oxygen content and microbial community structure all contribute to methylation potential. Since these characteristics have not been defined for each of the dischargers in the area, there exists the potential that effluent containing mercury may cause localized exceedences of the criteria and therefore, PMPs and/or numeric limits are necessary in order to assure that the discharge does not cause and/or contribute to an exceedance of the applicable water quality standard. In conclusion, due to uncertainty in the TMDL analysis, PMPs and/or numeric limits are necessary to meet the assumptions of the

TMDL and assure compliance with the water quality standards." The concentration-based water quality criterion for mercury explicitly takes into account bioconcentration of grams of mercury in fish tissue, thus reflecting both concentration and mass concerns. While it is possible that individual dischargers implementing mercury minimization measures might exceed the WLA of 12 ng/l on a case-by-case basis, the extra discharges are already reflected in the cumulative wasteload allocations of these TMDLs, which also reflect the numerous other NPDES dischargers that appear to be maintaining mercury discharges below 12 ng/l. This means that the total point source loading, in the aggregate, would be at or below the cumulative WLA.

LDEQ comment #3

It was assumed that a linear relationship exists between the mercury load to the subsegment and the fish tissue mercury concentrations. The relationship between mercury load to a waterbody and the accumulation of mercury in the fish tissue is not thoroughly understood. A TMDL based on this relationship is disputable.

USEPA Response: USEPA concurs with LDEQ that the relationship between mercury loading to a watershed and the accumulation of mercury in fish tissue is complex and highly variable and is influenced by a number of natural processes. This representation of mercury fate establishes a spatially varying relationship between point and atmospheric loadings, total mercury in soil, total mercury in water and sediment, methyl mercury in water and sediment, and mercury in fish tissue. This analysis assumes that reductions in loadings will lead to proportional mercury loading reductions in all media over time. While this seems to be relatively simple it does represent our current knowledge of mercury cycling in the environment.

Studies done around the nation indicate methylation uptake rates of available mercury can vary widely with some studies confirming a linear relationship between loading and bioaccumulation in fish tissue. Recent modeling results from pilot studies in the Everglades (EPA, 2003b) support that for the Everglades there is a linear relationship between mercury deposition and levels of mercury in fish. This relationship of fish mercury levels and deposition is almost 1:1. While it is not appropriate to transfer these results directly to other sites, it does provide support that this assumption is realistic and has been substantiated in at least one other location. USEPA has made commitments to improve the predictability of the models for mercury cycling in wetlands and tributary systems. A comprehensive data collection effort throughout the Little River/Catahoula Lake watershed as well as within appropriate reference watersheds involving water, sediment, and fish sampling in tandem would be necessary to demonstrate more specific methylation rates. However, without additional watershed specific data to demonstrate a substantial decrease in the bioavailability of mercury in water or sediment, USEPA has selected a conservative approach to calculate the estimated loading and necessary TMDL. The conservative assumption that 100% of the mercury loading is bioavailable is an implicit component of the margin of safety, which is a required element of a TMDL.

This analysis assumes that reductions in loadings will lead to proportional mercury loading reductions in all media over time. While the spatial representations and time trends predicted by the model are uncertain, the expected reduction of mercury concentrations in soil, water, sediment, and fish due to reduced loadings is sound. It should be obvious that present concentrations in fish have resulted from loadings averaged over an appropriate time (as affected by transport, transformation, and bioaccumulation processes). Further, if all loadings could be completely eliminated, the mercury concentrations in all media and fish would eventually equilibrate to very low levels, below concentrations of concern relative to human health. We assume that methylation/demethylation rates and food web structure will be unaffected by future mercury load reductions. Therefore, predicted mercury concentrations in all media at a location (given sufficient time to re-equilibrate) will be related to load reductions in a roughly linear manner. This approach used the best technology we have available for developing a TMDL for mercury.

Federal Water Quality Coalition (FWQC) Comments dated January 21, 2003

I. USE OF FISH ADVISORIES AND NARRATIVE STANDARDS

FWQC comment #1

USEPA used a methylmercury fish tissue concentration of 0.5 mg/kg as the endpoint for the TMDL, which is stated to be the State's interpretation of its narrative standard. This number is also the basis for the fish consumption advisory issued by the State. Whether this is considered to be an interpretation of the State's narrative standard, or use of a fish consumption advisory, or both, we are concerned that it is an inappropriate method for calculating a TMDL endpoint, for several reasons. As for fish advisories, these notices are a very imperfect tool for judging whether water quality is truly impaired. They are generally issued by state health departments, without any process for public input, and often without any formal criteria for data quantity, quality or validity. In many cases, the advisory is issued only for informational purposes, to trigger further investigation, or is issued on a cautionary basis, when fish tissue levels of a substance do not yet pose a significant risk but are worth some attention. To utilize the advisory level as a "narrative interpretation" does not make it any more valid as a legal matter. The fish tissue concentration has not been formally adopted into the water quality standards through Louisiana's rulemaking process. Use of this criterion, without formal rulemaking, is legally invalid, because the criterion has not been subjected to public notice and participation that occurs during the rulemaking process.

By using the fish tissue criterion to declare the Little River impaired, USEPA is essentially replacing the state's water quality standard for mercury. Section 303(c) of the Clean Water Act (the "Act") provides a procedure for USEPA to properly revise standards in accordance with the procedures set forth in the Act. When the state's water quality standards were promulgated, USEPA had the opportunity to specify any changes necessary to comply with the Act. Indeed, USEPA retains the ability to revise the standards at any time, if necessary to comply with the Act:

(4) The Administrator shall promptly prepare and publish proposed regulations setting forth a revised or new water quality standard for the navigable waters involved—

(A) if a revised or new water quality standard is submitted by such State under paragraph (3) of this subsection for such waters is determined by the Administrator not to be consistent with the applicable requirements of this chapter,.or

(B) in any case where the Administrator determines that a revised or new standard is necessary to meet the requirements of this chapter.

The Administrator shall promulgate any revised or new standard under this paragraph not later than ninety days after he publishes such proposed standards, unless prior to such promulgation, such State has adopted a revised or new water quality standard which the Administrator determines to be in accordance with this chapter.

CWA § 303(c)(4), 33 U.S.C. § 1313(c)(4). If USEPA truly believes that Louisiana's numeric water quality standards are insufficient to meet the requirements of the Act, USEPA can avail itself of this procedure to properly promulgate the necessary standards, rather than circumventing Louisiana's approved water quality standards for mercury.

USEPA Response: USEPA disagrees that its water quality target for this TMDL suffers from legal deficiencies. Louisiana has not adopted a numeric value for protection of human health. They have however, adopted a narrative water quality criterion to protect human health. See Section LAC 33:IX.1113.B.5. This narrative water quality criterion provides: "No substances shall be present in waters of the state or the sediments underlying said waters in quantities that alone or in combination will be toxic to human plant, or animal life or significantly increase health risks due to exposure to the substances or consumption of contaminated fish or aquatic life."

The State of Louisiana, in part, protects from violations of this narrative criterion by issuing fish consumption advisories according to state developed and approved methodologies. The Louisiana Department of Health and Hospitals (LDHH) and LDEQ coordinate in the assessment of data for health risks and jointly issue advisories if warranted. The Louisiana Department of Wildlife and Fisheries and the Louisiana Department of Agriculture and Forestry are also apprised of the situation and allowed to comment. LDHH and LDEQ use a limited meals approach in establishing health advisories. The two lead agencies will consider issuing a health advisory limiting fish consumption for pregnant or breast feeding women and children under seven for locations and species where the average concentration of mercury exceeds 0.5 parts per million (ppm) in fish and shellfish. At average concentrations exceeding 1.0 ppm, the agencies will recommend limited meals or no consumption for pregnant or breast feeding women and children under seven and limited consumption for the general population. In addition, LDHH considers other types of information when making advisory decisions. These considerations include, but are not limited to, information on sensitive subpopulations and local fish consumption practices that can affect exposure, the number of samples within a species, and the size and number of fish collected (LDEQ website http://www.deq.state.la.us/surveillance/mercury/2000report/intro.htm) USEPA believes that it was appropriate and consistent with the State's narrative water quality standards to establish the fish tissue target for this TMDL at the same 0.5 ppm tissue concentration used by the state to issue first stage fish advisories. According to State procedures if average fish tissue levels are reduced below this level no fish consumption advisories are warranted and USEPA would interpret this to mean that the narrative WQS for fish consumption are being supported.

USEPA has determined that fish tissues in the Little River contain levels of mercury from municipal, industrial and other (i.e., air) sources at levels that are harmful to humans who consume fish from the River. Therefore, USEPA has concluded that the Little River exceeds Louisiana's narrative water quality criterion for toxic pollutants. In view of that conclusion, USEPA has the authority to establish a TMDL to address that impairment. Congress did not limit the term "applicable waterquality standards" in CWA section 303(d)(1)(C) to standards based upon numeric criteria, and USEPA's 1985 regulations at 40 C.F.R. § 130.7(b)(3) define "applicable water quality standards" to refer to "those water quality standards established under section 303 of the Act, including . . . narrative criteria. "See also 40 C.F.R. § 130.7(c)(1) ("TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS"). Indeed, the use of narrative water quality criteria has been explicitly recognized by the courts when applying "applicable standards" in the TMDL context, see Dioxin/Organochlorine Center v. Clarke, 57 F.3d 1517, 1521 & n.6, 1524 (9th Cir. 1995), as well as in the NPDES permitting context, See, e.g., American Paper Institute v. USEPA, 996 F.2d 346 (D.C. Cir. 1993). Therefore, USEPA is authorized to apply Louisiana's narrative water quality criterion for toxic pollutants in establishing these TMDLs.

The commenter asserts that USEPA's interpretation of Louisiana's narrative water quality criteria in effect usurps the primary responsibility accorded to the states to develop water quality standards. They maintain that USEPA's interpretation is tantamount to a revision of the state's adopted and approved numeric water quality criterion for mercury, and that this de facto revision is unlawful because USEPA failed to follow the procedures established in Clean Water Act section 303(c) for adoption of federal water quality standards. The commenter concluded that the ensuing water quality target (and the TMDL) is invalid. USEPA disagrees with these comments. First, contrary to the commenter's assertions, USEPA is not developing a federal water quality standard to supersede Louisiana's standard, but rather is interpreting a water quality standard that has been duly adopted by the State and certified by the Attorney General. The state's direction that "No substances shall be present in waters of the state... that alone or in combination... significantly increase health risks due to exposure to the substances or consumption of contaminated fish or aquatic life" signifies the state's clear intent that this criterion be interpreted as necessary in order to be applied in the State's water quality based approach to pollution control (e.g., through the NPDES permitting process, the TMDL program or other applicable state programs). It means that a permit writer or TMDL-developing authority applying the narrative criterion needs to interpret the narrative criterion and thus calculate the amount of a toxic pollutant that may be introduced to the water without producing a toxic effect in humans. That calculated amount thus becomes the target for the permit limit (or in the case of a TMDL, the target for the loading capacity) in fulfillment of the explicit intention of the narrative criterion: to avert toxic effects to humans. Thus, far from usurping the state's responsibility, USEPA's act of interpreting the narrative criterion gives significance to the state's own regulatory structure.

The fact that Louisiana has also adopted a numeric water quality criterion of 12 ng/l for the protection of aquatic life is irrelevant. The Little River is listed as not meeting uses designed to protect human health. Therefore, USEPA properly chose to apply Louisiana's narrative water quality criterion for the protection of human health from the effects of toxics under these facts. USEPA reasonably decided it would not be appropriate to ignore the narrative criteria applicable to human health merely because a less protective numeric criterion for aquatic life exists. The narrative and numeric criteria for mercury are complementary; in the absence of a numeric water quality criterion explicitly calculated to protect human health, it is appropriate to use the narrative criterion when human health is at issue. Again, based on information specific to this waterbody USEPA has determined that sufficient loading capacity exists such that if point sources maintain a concentration of mercury equivalent to the state adopted criterion to protect for aquatic life the human health loading targets for the waterbody will be met.

USEPA further notes that the federal water quality standards regulations at 40 C.F.R. Part 131 requires adoption of water quality criteria that protect designated uses. Such criteria must be based on sound scientific rationale, must contain sufficient parameters to protect the designated use, and may be expressed in either narrative or numeric form. In adopting water quality criteria, States, Territories and authorized Tribes are expected to establish numerical values based on 304(a) criteria, 304(a) criteria modified to reflect site specific conditions, or other scientifically defensible methods, or establish narrative criteria where numerical criteria cannot be determined, or to supplement narrative criteria. See 40 C.F.R. § 131.11. Narrative criteria are descriptions of the conditions of the waterbody necessary to attain and maintain its designated use, while numeric criteria are values expressed as levels, concentrations, toxicity units or other measures that quantitatively define the permissible level of protection. To adequately protect designated uses, USEPA believes water quality standards should include both narrative and numeric water quality criteria. In certain circumstances it is possible that numeric water quality criteria can be met and the designated uses still not be achieved. For example, factors such as food web structure, the concentration of dissolved organic carbon in the ambient water, and accumulations in the sediment may affect uptake of mercury into fish flesh on a site-specific basis. In these circumstances, USEPA recommends States and authorized Tribes translate the applicable narrative criteria on a site-specific basis, or if necessary adopt site-specific numeric criteria, to protect designated uses. However, ultimately, the TMDLs should be established to implement the applicable designated uses and criteria.

Second, as noted above, USEPA's act of interpreting the State's narrative criterion ensures the level of protection established by the State for the Little River through the adoption of the designated use of fishing will be achieved. Accordingly, this is not a situation where USEPA has - or should have - determined that Louisiana's current water quality standards are inconsistent with the Clean Water Act. To the contrary USEPA has already determined that the Louisiana standards met the requirements of the CWA and the implementing federal regulations when approving the narrative criterion providing "No substances shall be present... in quantities that alone or in combination will... significantly increase health risks due to exposure to the substances or consumption of contaminated fish or aquatic life." By using site-specific information, USEPA is interpreting Louisiana's duly adopted narrative criterion in a way that ensures that the designated uses are protected as required by the Clean Water Act. The commenters imply that this situation is similar to one where a state had adopted and USEPA had approved a numeric water quality criterion for the protection of human health that new science and/or data now shows to be unprotective. That is not the case. Rather, USEPA is appropriately turning to the narrative criteria to account for the unique site-specific conditions of the Little River as they affect the methylation and uptake of mercury into the food chain, and ultimately affect human health. Thus, in this case, and based upon site specific data, USEPA properly decided to interpret and apply the narrative criterion.

Third, USEPA's act of interpreting Louisiana's narrative criterion does not abridge public participation or otherwise deviate from the procedures associated with the adoption of water quality standards. As noted above, USEPA is interpreting a criterion that was duly adopted by the state pursuant to section 303(c), which requires public participation. Thus, USEPA is not establishing a federal water quality standard without regard for the requirements of the CWA or the APA; rather, it is interpreting the existing Louisiana standard in order to establish a water quality target for the TMDL. Thus, the public participation requirements and rule making procedures of section 303(c) do not apply. Moreover, USEPA has explicitly sought (and received) public comments regarding its interpretation of the narrative criterion, consistent with 40 C.F.R. §130.7(c)(1)(ii), thereby allowing scientific and policy issues to be aired. During the public comment period on this TMDL, affected dischargers, the general public, state agencies, and other interested parties could and did submit information and comments that they believe should be considered in establishing the water quality target. USEPA has provided a written response to those comments on page 8 of Appendix E. Moreover, the appropriateness of the water quality target based on USEPA's interpretation is subject to judicial review. USEPA notes that the CWA and the implementing water quality standards at 40 CFR 131 do not require that States, Territories and authorized Tribes adopt translator procedures for their narrative criteria. Where adopted into water quality standards, they are subject to USEPA review and approval. When these procedures are not adopted into water quality standards but established as guidance, USEPA considers in reviewing and taking action to determine whether the underlying narrative criteria meet the requirements of the CWA and the implementing federal regulations. Such procedures must, in the final analysis, be scientifically defensible and protect the designated use. Some States, Territories and authorized Tribes adopt into their water quality standards translator procedures by which to derive a quantified numeric interpretation of the narrative criterion. However, others do not, or may choose to establish such procedures as guidance for interpreting the applicable narrative criteria site-specifically. The choice of whether and how to establish translation procedures is left to the prerogative of the State, Territory or authorized Tribe. USEPA acknowledges that such a choice must be implemented consistent with State's governing administrative laws and procedures.

USEPA also recognizes that narrative water quality criteria are not expressed as numbers and thus are not directly amenable to TMDL calculations. However, as expressed in USEPA guidance, a State, Territory, authorized Tribe, or USEPA can quantify narrative criteria for use on regulatory actions. USEPA has also used such an approach in promulgating water quality standards for States, Territories and authorized Tribes. See 40 C.F.R. Part 132, Appendix F, Procedure 3 (referring to "values," which are that rule's equivalent to quantifications of narrative criteria); 60 Fed. Reg. 15366 (March 23, 1995) (Great Lakes Water Quality Initiative); 57 Fed. Reg. 60848 (November 19, 1991) (National Toxics Rule); see also Technical Support Document for Water Quality-based Toxics Control, USEPA/505/2-90/001 (March 1991); Guidance for Water-Quality-based Decisions: The TMDL Process," USEPA 440-4-91-001 (1991).

Fourth, USEPA disagrees with comments asserting that USEPA's interpretation is procedurally flawed because USEPA did not promulgate a mechanism by which to "translate" Louisiana's narrative water quality criterion. USEPA agrees with the commenter that, had Louisiana chosen to establish a specific translator mechanism for its narrative criteria (e.g., in order to bind permit writers or TMDL authorities when interpreting a narrative or to meet the requirements of CWA section 303(c)(2)(B)), it would have needed to do so as part of its water quality standards adoption process. See Water Quality Standards Handbook: Second Edition (1994), at 3-16, 3-22. However, Louisiana has not adopted such a mechanism. Therefore, it was appropriate for USEPA to interpret Louisiana's narrative water quality criterion in the context of this TMDL. Under these circumstances, it would be inappropriate and intrusive for USEPA to promulgate a regulation of general applicability that establishes a translator mechanism for Louisiana's narrative water quality criterion.

Finally USEPA notes that calculating a water quality target based on a state's narrative criterion is analogous to the act of deriving water quality-based permit limits from such criteria. USEPA has promulgated and successfully defended a regulation that describes three different approaches that permitting authorities can employ to interpret a state's narrative water quality criterion. See 40 CFR § 122.44(d)(1)(vi); see also American Paper Institute vs. EPA, 996 F.2d 346 (D.C. Cir. 1996) (upholding regulation as consistent with the purposes of the Clean Water Act). Two approaches are relevant here. One way is using the water quality criterion recommendations published by USEPA under CWA section 304(a). See 40 CFR § 122.44(d)(1)(vi)(B). A second way is to calculate a numeric criterion that the permitting authority demonstrates will attain and maintain applicable narrative water quality criteria and fully protect the designated use. See CFR § 122.44(d)(1)(vi)(A). Under this approach, the permitting authority may use a proposed state numeric criterion or an explicit policy or regulation interpreting its narrative water quality criterion supplemented with other relevant information, including predicted local human consumption of aquatic foods, the state's determination of an appropriate risk level, and other site-specific scientific data that may not be included in USEPA's criteria documents. See id; see also 54 Fed Reg. 23,868- 23876 (June 2, 1989. Under this approach, the authority interpreting the state narrative is authorized to employ any information that it believes will produce a limitation that will attain and maintain the water quality criteria and fully protect the designated uses. USEPA has employed the second approach in interpreting Louisiana's narrative water quality criterion, albeit for a slightly different, although related, purpose. Because the wasteload allocations in today's TMDL ultimately will become the basis for NPDES permit limits for certain dischargers, see 40 CFR § 122.44(d)(1)(vii)(B), it is reasonable for USEPA to apply the principles of the permitting regulation in the course of developing the TMDL.

II. REQUIREMENTS FOR POINT SOURCES

FWQC comment #2

In the TMDL, USEPA estimates that 99.5% of the mercury loadings are contributed by air sources. Based on the fish tissue concentrations over the entire watershed and the calculated TMDL endpoint target, USEPA believes that a reduction of 32.43% is needed in fish tissue levels. USEPA estimates that federal and state programs will result in a 50% reduction in air emissions, which the Agency believes is more than sufficient to bring the water to attainment of standards. Therefore, no loading reductions from current levels are needed from point sources. We agree with the Agency that this is the correct result.

Although specific reductions from point sources are not required, the Draft TMDL does state that additional efforts by LDEQ and USEPA may be required to demonstrate that point source discharges are meeting the State water quality standard of 12 ng/l. As for mechanisms that may be used to make that demonstration, the Draft TMDL identifies certification for minor facilities that they do not use mercury, and effluent sampling using Method 1631 for major facilities and for minor facilities that cannot certify. If a facility is found to discharge above the water quality standard, USEPA states that DEQ could require the discharger to implement a mercury minimization plan. We understand the Agency's interest in ensuring that the point sources, which it has determined to be minor contributors, do not increase their discharges to a point where they are no longer minor. However, we do have some concerns and questions about the suggested measures in the Draft TMDL.

USEPA Response: USEPA established this TMDL under the assumption that most wastewater facilities are discharging at or below 12 ng/l. The percent reductions and relative loading levels are predicated on this assumption. As discussed in USEPA's Response to LDEQ Comment #1, this WLA was selected because a number of permits already had water quality-based effluent limitations based on this value (when it was thought that protecting aquatic life would be sufficient to protect human health) and, consequently, control strategies had already started to be developed and implemented. Moreover, there is a reasonable likelihood that controls on air sources of mercury will result in achievement of the load allocation in this TMDL, with the result that there is sufficient loading capacity available to accommodate loads associated with the cumulative 12 ng/l WLA.

As the commenter correctly states, the TMDL contemplates the use of Method 1631 for any analyses conducted to demonstrate compliance with the wasteload allocations in this watershed. This method will allow appropriate detection levels of mercury in water that will allow facilities to establish that they are complaint with the loadings established in the TMDL. Use of other NPDES methods for the analysis of mercury do not allow sufficient sensitivity to demonstrate compliance with the TMDL load allocations.

FWQC comment #3

As to the possible certification requirement for minor facilities that do not use mercury, we support having this option available, so facilities whose discharges would clearly not pose significant mercury concerns are not forced into extensive monitoring regimens in order to show that they do not pose concerns. However, we do not understand why this certification option should be limited to "minor" facilities. A major discharger that does not use mercury is no more likely to pose mercury concerns than a minor discharger that does not use mercury. Also, it is not clear from the Draft TMDL what would be needed in a certification. For example, there are many facilities, including those of Coalition members that may have mercury on-site, in switches or other equipment (that are not likely to lead to presence of mercury in wastewater), but which have made (and continue to make) substantial efforts to reduce the use and presence of mercury at their sites. If these sources are allowed to submit certifications relating to these voluntary mercury reduction programs, it would provide the agency with a basis for concluding that mercury discharges from these facilities will not increase, which addresses the agency's concern as to these minor sources, while also encouraging and rewarding voluntary mercury reduction efforts.

USEPA Response: The WLAs in this TMDL assume that each facility will discharge at or below 12 ng/l. If discharges exceed that concentration, then reductions in mercury loadings may be necessary in order to ensure that the cumulative WLA is not exceeded in the waterbody as a whole or in localized areas. The TMDL identifies a certification as one mechanism that a facility could employ to demonstrate to the permitting authority that mercury in its effluent is at or below 12 ng/l. Language in the TMDL has been modified such that this option is not restricted to minor facilities.

The TMDL leaves to the discretion of the permitting authority the decision how to establish effluent limitations based on the TMDL. EPA expects that that decision would be made by the permitting authority on a case-by-case basis, reflecting the facts as they exist at the time the permit is issued. EPA believes it is important, however, that the TMDL identify mercury minimization plans as one possible basis for an effluent limitation not only because such plans have shown to be effective, but also because EPA wanted to assure the State that a limitation based on mercury minimization would be consistent with the assumptions of the TMDL, if the State chose to base effluent limitations on results of minimization and if they were justified by the facts on a case-by-case basis. Major POTWs and industrial facilities, are required to conduct sampling as par of their permit application process so while a certification mechanism is available to them it will not override their requirements for sampling during permit application. In accordance with 122.21(j)(4)(iv), all POTWS with a design flow rate equal to or greater than one million gallons per day, with an approved pretreatment program, or as required by the Director, shall analyze for the pollutants listed in Appendix J, Table 2 (priority pollutants). Facilities less than one mgd are not required to analyze for these pollutants during the application process.

In accordance with 122.21(g)(7), applicants with processes in one or more primary industry categories must report quantitative data for the applicant's industrial category found in table I of Appendix D, and toxic metals (including total mercury), cyanide, and total phenols found in table III of appendix D. Therefore, based on the application requirements, all industries must monitor once during the life of the permit. (See also 40 CFR 122.44(d)(1)(i)). Therefore, EPA does not believe that they will need to make a separate certification, although nothing in the TMDL prevents this. To the extent that these facilities can show that they have no potential to discharge mercury above 12 ng/l, no further action is contemplated by the TMDL.

FWQC comment #4

As for the possible requirement for minimization plans, we believe that development and implementation of minimization plans should not be mandated as a permit condition for point sources. As an initial matter, we question whether the state has the legal authority to impose such permit conditions. NPDES permitting authority is limited to requiring reductions at the point of discharges rather than in-plant locations. While this requirement may be similar to the Great Lakes Initiative rule for Pollutant Minimization Programs (PMPs), the authority for that requirement is limited to the Great Lakes Basin. Moreover, in the case challenging the GLI rule (AISI v. USEPA, 115 F.3d 979 (D.C. Cir. 1997)), the U.S. Court of Appeals for the D.C. Circuit ruled that USEPA does not have the authority to require reductions at in-plant sources of pollutants, but can only set limits that are to be achieved by the source at the point of eventual discharge to waters of the U.S. Likewise, it is questionable whether a state could have this authority as a state's authority is delegated to it by USEPA. USEPA cannot delegate authority it does not have. Furthermore, any requirement that the source achieve reductions, such as those required by minimization plans, when the TMDL itself will include loading reductions from other sources that will, by themselves, result in attainment of standards, is simply inconsistent with the basic notion of a TMDL. Those reductions are not needed to achieve the TMDL's goal, and therefore have no legal basis within the TMDL process.

USEPA Response: The commenter raises two issues here. First, the commenter asserts that USEPA (and therefore the states) lacks the legal authority to require point sources to implement mercury minimization plans in NPDES permits. Second, the commenter asserts that point sources should not be expected to reduce their discharges of mercury because controls on air sources will be more than sufficient to result in attainment of water quality standards. A response to the first issue is provided below. For a response to the second issue, please see the USEPA response to LDEQ Comment #2 on page 2 of Appendix E.

The commenter characterizes the TMDL as "mandat[ing]" NPDES permit writers to impose, as permit conditions, a requirement that sources develop and implement mercury minimization plans. This statement mischaracterizes the TMDL. The TMDL establishes wasteload allocations for point sources, as it is required to do under USEPA's regulations. The TMDL does not (nor, as a non-regulatory instrument, could it) require the use of mercury minimization plans in NPDES permits. Rather, the TMDL simply identifies mercury minimization plans as a potentially reasonable mechanism that the permit writer could consider when it calculates limitations that are "consistent" with the individual wasteload allocations of 12 ng/l. See 40 C.F.R. § 122.44(d)(1)(vii)(B). The TMDL leaves to the discretion of the permitting authority the decision how to establish effluent limitations based on the TMDL. USEPA expects that that decision would be made on a case-by-case basis, reflecting the facts as they exist at the time the permit is issued. USEPA believes it is important, however, that the TMDL identify mercury minimization plans as one possible basis for an effluent limitation not only because such plans have shown to be effective, but also because USEPA wanted to assure the State that a limitation based on mercury minimization would be consistent with the assumptions of the TMDL, if the State chose to base effluent limitations on results of minimization and if they were justified by the facts on a case-by-case basis.

The commenter asserts that mercury minimization is a form of in-plant water quality-based effluent limitation and therefore is unlawful, citing a decision by the U.S. Court of Appeals for the D.C. Circuit in American Iron & Steel Institute, et al. v. USEPA (AISI), 115 F.3d 979 (D.C. Cir. 1997). USEPA disagrees that mercury minimization is an in-plant effluent limitation. The TMDL does not contemplate the establishment or enforcement of water quality-based effluent limitations within the facility. Rather, mercury minimization is a tool that USEPA expects dischargers would use to reduce their mercury loadings at the point of discharge to the Little River. As such, it would be the basis for an adjustment to the individual WLA of 12 ng/l that otherwise applies to each mercury discharger. In other words, if a discharger desires a mercury allocation that accommodates mercury loadings above 12 ng/l, the TMDL explicitly assumes that the permit writer can revise the individual WLA accordingly, but only if the sum of all individual WLAs does not exceed the cumulative WLA and if the revised WLA reflects the actual or predicted effects of a facility-designed mercury minimization program. The TMDL assumes that the adjusted WLA will reflect mercury minimization (rather than simply existing effluent quality levels above 12 ng/l) for two reasons. First, as noted elsewhere, mercury bioaccumulates; therefore, there is the potential that mercury introduced to the environment (rather than withheld from the environment by pollution prevention) can lead to environmental harm.

Second, the cumulative WLA is based on the assumption that all discharges will be at or below 12 ng/l or, for those that exceed that level, that there will be sufficient remaining load within the cumulative WLA to accommodate mercury loadings as reduced through mercury minimization. The analysis supporting this TMDL does not support the notion that all point sources of mercury can discharge at existing effluent quality and still, in sum, achieve the cumulative WLA. If a commenter objects to a permit authority considering mercury minimization as the basis for an adjusted WLA, then it is free to request a water quality-based effluent limitation based on the original individual WLA of 12 ng/l.

While it is possible that an adjusted WLA could give rise to a numeric end-of-pipe water quality-based effluent limitation, it is also possible that a permitting authority may determine that it is infeasible to calculate a numeric effluent limitation based on the effects of mercury minimization. In this case, USEPA's regulations at 40 C.F.R. § 122.44(k)(3) authorize the imposition of non-numeric effluent limitations in the form of best management practices, in this case mercury minimization measures.[1] The CWA defines "effluent limitation" broadly, and USEPA's regulations reflect this as well. Each provides that an effluent limitation is "any restriction" imposed by the permitting authority on quantities, discharge rates and concentrations of a pollutant discharged into a water of the United States. CWA § 502(11) (emphasis supplied); 40 C.F.R. § 122.2 (emphasis supplied). Neither definition requires an effluent limitation to be expressed as a numeric limit. The D.C. Circuit observed, "Section 502(11) defines 'effluent limitation' as 'any restriction' on the amounts of pollutants, not just a numerical restriction." NRDC v. USEPA, 673 F.2d 400, 403 (D.C. Cir.) (emphasis in original), cert. denied sub nom. Chemical Mfrs. Ass'n v. USEPA, 459 U.S. 879 (1982). Thus, the definition of "effluent limitation" contemplates a range of restrictions that may be used as appropriate.

In this TMDL, the narrative version of the WLA could be expressed essentially as follows: the quantity of mercury loadings that would be present in each point source's effluent after the point source quantifies the mercury in its effluent and implements measures, if appropriate, to minimize the identified loadings. Under the narrative WLA, the permitting authority could establish NDPES permit limitations (in the form of narrative requirements) and conditions that could require the discharger, for example, to develop and implement mercury minimization measures.

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[1] While these WLAs are not, in themselves, enforceable water quality-based effluent limitations, USEPA believes that an analogy to such limits for this purpose is appropriate because of their close relationship. See 40 C.F.R. § 122.44(d)(1)(vii)(B) (requiring the permitting authority to ensure that water quality-based effluent limitations in NPDES permits are consistent with the assumptions and requirements of WLAs established in a TMDL).

If a permit writer were to impose a non-numeric water quality-based effluent limitation in the form of a mercury minimization requirement, it could find authority in 40 C.F.R. § 122.4(k)(3). This is not a situation, as was the case in AISI, supra, where the regulation at issue appeared to require achievement of a numeric water quality-based effluent limitation prior to end-of-pipe treatment. Rather, in this possible situation, there would be no numeric water quality-based effluent limitation because presumably it would be infeasible to calculate one. The non-numeric effluent limitation would function as the restriction on mercury loadings necessary to ensure that the mercury ultimately discharged by the facility, at the end of the pipe, would be at levels consistent with the WLA for that discharge. USEPA disagrees with the commenter that the CWA can be read to prohibit a restriction on effluent unless that restriction can be expressed in numeric terms.

FWQC comment #5

In voicing these concerns, we want to emphasize that we are not saying that point sources, in situations such as those presented by the Draft TMDL, will choose to do nothing. That is far from the case. Many point sources of mercury, including Coalition members, are already taking significant steps, on a voluntary basis, to reduce mercury levels in their discharges. Some municipalities, for example, have been promoting management practices to be followed by dentists and similar sources of mercury inputs to their sewage treatment systems. In many cases, these efforts are being undertaken in active cooperation with the relevant State and local agencies, taking into account relative source contributions, feasibility of reductions, and other relevant factors. Also, there are many watersheds where the point sources are already contributing their fair share, or more, toward funding efforts to evaluate and solve water quality problems. Those efforts will continue to take place, and they should be encouraged. But we do not think that they should be mandated. We would like to work with USEPA to seek out ways to promote these efforts without imposing them as permit requirements.

If USEPA, despite the concerns raised above, insists on providing that minimization plans can be included as requirements in NPDES permits, we believe that several important modifications need to be made in those permit conditions. Dischargers should have control over the development and implementation of their site-specific minimization plans. Basically, the dischargers should identify the sources, assess the possible reduction measures, and report periodically to the State on their progress. It would be extremely burdensome for States to have to approve or disapprove these site-specific plans. State approval/disapproval of every discharger's plan would add unnecessary time to the process, delay implementation of the plans, and place States in a position of second-guessing the discharger on process-related technical judgments. Therefore, States should not approve or disapprove the steps or plans. In addition, States should not impose enforceable limits or implementation requirements based on the plans in NPDES permits.

USEPA Response: The TMDL simply identifies mercury minimization plans as a potentially reasonable mechanism that the permit writer could consider when it calculates limitations that are "consistent" with the individual wasteload allocations of 12 ng/l. See 40 C.F.R. § 122.44(d)(1)(vii)(B). The TMDL leaves to the discretion of the permitting authority the decision of how to establish effluent limitations based on the TMDL, whether they be numeric limits or PMPs EPA believes that the TMDL is not the appropriate mechanism to establish specific requirements of minimization or certification plans. EPA expects that that decision would be made on a case-by-case basis, reflecting the facts as they exist at the time the permit is issued. EPA believes it is important, however, that the TMDL identify mercury minimization plans as one possible basis for an effluent limitation not only because such plans have shown to be effective, but also because EPA wanted to assure the State that a limitation based on mercury minimization would be consistent with the assumptions of the TMDL, if the State chose to base effluent limitations on results of minimization and if they were justified by the facts on a case-by-case basis.

III. OTHER SCIENTIFIC ISSUES

FWQC comment #6

We commend USEPA for recognizing the conservative nature of the assumptions used in developing the Draft TMDL, and deciding as a result not to use an explicit margin of safety in the Draft TMDL. However, there are several assumptions made in the Draft TMDL that we are concerned about, including the following: (1) assuming that 100% of the mercury loadings is available for uptake, bioaccumulation and biomagnification; (2) assuming a linear relationship between mercury loadings and methylmercury levels in fish; and (3) assuming that the soil geology precludes any release of mercury from soils. We are not aware of the technical basis for these assumptions, and the final TMDL should provide an explanation of any basis that exists, particularly since other USEPA and Federal agency documents contradict these assumptions.

USEPA Response: Regarding concerns #1 and #2 in the above paragraph, please refer to USEPA's response to LDEQ's Comment #3 on page 5 of Appendix E. Regarding concern #3 above, USEPA contends that existing soils maps and geologic surveys of the area are valid sources of data to rely on when developing TMDLs. Extensive soils sampling throughout the watershed and contributing watersheds are not considered necessary to determine more exactly if and where sources of mercury may emanate from surface geology.

FWQC Comment #7

Further, USEPA should address several other scientific concerns. First, USEPA needs to consider the effect that damming of the watershed has on the conversion of mercury to methylmercury.

USEPA Response: In Section 5.2, USEPA recognizes that seasonal fluctuations of water levels in Catahoula Lake, which are the result of management operations, may have an effect on methylation rates. For a variety of reasons as outlined in Section 5.2, it is plausible that lowering the Lake level may actually increase the potential for methylation of mercury. However, significant additional site-specific data would be needed to determine specifically if or how the lowering of the Lake level may affect methylation rates of mercury or to determine that 100% of mercury loadings is not bioavailable over time. Given the physical characteristics (shallow and eutrophic) of Catahoula Lake and the significant acreage of wetlands surrounding the eastern portion of the Lake, research indicates that these characteristics promote methylation of mercury. Therefore, USEPA believes that it is an appropriate and valid approach to use a conservative assumption that 100% of mercury loadings are bioavailable. Should the state consider evaluating and/or modifying Lake level management practices the results may have more of a direct bearing on implementation of the TMDL. However, if the study results show a significant difference in methylation rates, the state could consider revising the TMDL at a later date.

FWQC comment #8

Second, rather than calculating fish tissue levels by averaging all of the data from all of the species at each sampling location, USEPA should consider actual consumption rates and trophic levels of the various species tested.

USEPA Response: In calculating fish tissue levels using available, recent fish tissue data USEPA relied on the standard practice of LDHH and LDEQ to use average fish tissue concentrations when comparing data to the State's narrative criteria to the 0.5 ppm tissue concentration used by the state to issue first stage fish advisories [cite document in support of this statement]. While site-specific creel census data would be helpful for understanding the actual human health risk present to the local populations, this type of data would be more applicable for use by human health risk professionals when issuing advisories than for establishing TMDLs. Data on actual consumption rates by species within this watershed were not available to USEPA. However, it is a valid assumption that higher concentrations of mercury will typically occur in the higher trophic level species which are more frequently consumed and in larger quantities. Where even average tissue concentrations are elevated enough to cause a human health concern to the population in general (assuming a consumption rate of 30 grams), it is readily apparent that the narrative water quality criterion to protect human health is not being met. Therefore USEPA used an average concentration of mercury in fish tissue for all species (as opposed to the maximum concentration for any one species) as a reasonable estimate of the overall edible fish tissue concentrations throughout the watershed to determine the percent reduction of mercury required.

FWQC comment #9

Also, USEPA appears to improperly assume an average condition in using Mercury Deposition Network data in determining wet and dry deposition.

USEPA Response: USEPA did not simply average mercury deposition data from the MDN. Instead, USEPA used a distance-weighted average for estimating the mercury deposition in the watersheds using actual MDN data. That is average annual wet deposition rates and rainfall mercury concentrations were calculated from four

Louisiana monitoring stations as distance weighted averages. The weighted averages were calculated based upon the inverse square of the distance from the NADP/MDN station to the center of the airshed. This method for estimating mercury deposition is a conservative approach and USEPA considers this appropriate as another aspect of the implicit margin of safety.

FWQC comment #10

Finally, on page 5-6, in borrowing from a Louisiana document for a synopsis of the nonpoint sources of mercury, USEPA goes beyond a summary of the sources and includes an inaccurate statement: that "power plants generally do not have any type of pollution abatement systems for mercury." Therefore, we recommend that USEPA delete this paragraph.

USEPA Response: USEPA acknowledges this comment and has removed portions of the paragraph noted on page 5-6.

TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Total Mercury in Fish Tissue Residue

In the

Middle & Lower Savannah River Watershed

For Segments

Clarks Hill Lake Dam to Stevens Creek Dam

Stevens Creek Dam to US Highway 78/278

US Highway 78/278 to Johnsons Landing

Johnsons Landing to Brier Creek

Brier Creek to the Tide Gate

EPA United States Environmental Protection Agency

Region 4 serving the southeast

TOTAL MAXIMUM DAILY LOAD (TMDL)

Total Mercury in Fish Tissue Residue

In the

Middle & Lower Savannah 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 Savannah River in Georgia:

Clarks Hill Lake Dam to Stevens Creek Dam

Stevens Creek Dam to US Highway 78/278

US Highway 78/278 to Johnsons Landing

Johnsons Landing to Brier Creek

Brier Creek to the Tide Gate

The calculated allowable load of mercury that may come into the identified segments of the Savannah River without exceeding the applicable water quality standard of 2.8 nanograms per liter is 32.8 kilograms per year. EPA interpreted the State of Georgia's narrative water quality standard for toxic substances for the protection of public health to determine the applicable water quality standard. Based on a current estimated loading of 58.8 kilograms per year, an estimated 44% reduction in mercury loading is needed for the identified sections of the Savannah River to meet the applicable water quality standard of 2.8 nanograms per liter. It is estimated that reductions in air deposition of mercury will result in a 38% to 48% reduction in mercury loading to the Savannah River. Twenty-nine (29) facilities permitted by the State of Georgia under the National Pollutant Discharge Elimination System Program are provided wasteload allocations in this TMDL.

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__________, 2001.

Beverly H. Banister, Director
Water Management Division

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1. Executive Summary

The U.S. Environmental Protection Agency (EPA) Region 4 is establishing this Total Maximum Daily Load (TMDL) for total mercury in the middle/lower Savannah River Basin for the 5 contiguous segments of the Savannah River from the Clarks Hill Lake Dam to the Tide Gate. The segments are as follows:

- Clarks Hill Lake Dam to Stevens Creek Dam
- Stevens Creek Dam to US Highway 78/278
- US Highway 78/278 to Johnsons Landing
- Johnsons Landing to Brier Creek
- Brier Creek to the Tide Gate

Four of these segments are listed on the State of Georgia's 2000 Section 303(d) list of impaired waters because mercury in certain species of fish tissue exceeds the the Georgia Department of Natural Resources (GDNR) Fish Consumption Guidelines State's guidelines. The fifth segment, Johnsons Landing to Brier Creek, was inadvertently omitted from the State of Georgia's 2000 Section 303(d) list. This segment is impaired based on GDNR Fish Consumption Guidelines, and the Georgia Environmental Protection Division intends to include this segment on the State's 2002 Section 303(d) List (personal communication, Mork Winn, February 27, 2001). Therefore, this TMDL identifies the allowable annual load of total mercury for the middle/lower Savannah River from Clarks Hill Dam to the Tide Gate that will result in attainment of the applicable water quality standard, and the unrestricted use of these segments for fish consumption.

This TMDL satisfies a consent decree obligation established in Sierra Club, et. al. v. EPA Civil Action, 1: 94-CV-2501-MHS. The State of Georgia requested EPA to develop this TMDL for the impaired segments of the Savannah River, and as such, EPA is establishing this TMDL for Georgia for the 5 segments of the Savannah River. Although the mid-line of the Savannah River serves as the east-west boundary between the states of Georgia and South Carolina, the TMDL does not provide wasteload allocations to South Carolina NPDES facilities. This TMDL reflects assumptions that concentrations of mercury in the South Carolina portion of the Savannah River will meet the applicable Georgia water quality standards at the South Carolina-Georgia border.

EPA originally proposed this TMDL for total mercury for the middle and lower Savannah River between Clarks Hill Dam and the Tide Gate on February 8, 2000. In response to significant comments received during the public comment period, the TMDL was revised and re-proposed on December 8, 2000. This public comment period closed on January 22, 2001. By establishing this TMDL at this time, EPA is satisfying a court-order to finalize this TMDL by February 28, 2001. This TMDL is being established in phases with this TMDL document representing the first phase of the process. EPA expects to develop a revised TMDL for mercury for the middle/lower Savannah River in 2004. EPA believes that a phased approach is appropriate for this TMDL because information on the actual contributions of mercury to the Savannah River from both point and nonpoint sources will be much better characterized in the future.

In order for this TMDL to be developed, the applicable water quality standard must be determined. The State of Georgia does not have a numeric water quality standard for the protection of public health from total mercury. EPA determined that Georgia's numeric water quality standard for protection of aquatic life, 12 nanograms per liter (ng/l), is not protective of human health. Based on site-specific field data from the middle/lower Savannah River, ambient concentrations of total mercury in the water column are well below 12 ng/l yet concentrations of mercury in fish tissue exceed levels protective of public health. Therefore, EPA does not regard the State's aquatic life criterion as the applicable water quality standard for this TMDL. Instead, EPA has derived a numeric interpretation of the State of Georgia's narrative water quality standard for toxic substances (Chapter 391-3-6-.03 Section (5)(e)) using EPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (EPA 2000). Using recommended national values, and site-specific data collected in the middle/lower Savannah River Basin, EPA interpreted Georgia's water quality standard and has determined that the applicable water quality standard for total mercury in the ambient water of the Savannah River Basin is 2.8 ng/l (parts per trillion). At this concentration, or below, fish tissue residue concentrations of mercury will not exceed 0.4 mg/kg, which is protective of the general population from the consumption of freshwater fish. This interpretation of Georgia's water quality standard was based on site-specific data gathered for the Savannah River in 2000 specifically for the purpose of this TMDL. It does not apply to any other water in the State of Georgia. In addition, in any future TMDLs for Savannah River, it is possible that EPA may revise this interpretation based on new site-specific data collected at that time.

During the time that this TMDL was proposed and was in public review between December 8, 2000, and January 22, 2001, EPA issued federal criterion recommendations for methylmercury on December 30, 2000. (See Water Quality Criteria for Protection of Human Health: Methylmercury, EPA-823-F-01-001.) This document recommends 0.3 mg/kg as a fish tissue residue concentration for protection of human health. Since EPA was under court order to finalize this TMDL by February 28, 2001, EPA had insufficient time to consider the new federal criterion recommendations in the establishment of this TMDL. Therefore, EPA may reconsider this TMDL at some future date (prior to 2004) in order to consider the new federal criterion guidance in the context of this waterbody. It should be noted, however, that today's TMDL protects the designated uses and achieves the applicable water quality standard as interpreted by EPA. In order to assure protection, EPA made conservative assumptions in this TMDL in the derivation of the applicable water quality standard, particularly relating to the bioaccumulation factor (BAF). EPA assumed that all 17.5 grams per day of fish consumed are of largemouth bass, which as a trophic level 4 fish, bioaccumulates mercury at comparatively high rates. (This means that consumers of these fish will be exposed to more mercury than would be the case if they consumed lower trophic level fish species.) The resulting water quality standard as interpreted by EPA appears to be as protective as the numeric value EPA would have derived using the recommended assumptions in the Human Health Methodology (a "weighted" BAF rather than a trophic level 4 BAF; a general population consumption rate of 17.5 grams per day; a methylmercury reference dose of 0.0001 mg/k/day; and a relative source contribution dose of 0.00027 mg/kg/day). This conclusion depends on the appropriate "weighted BAF" value, which will be considered in any future revision of this TMDL.

Computerized modeling techniques have been employed in the development of this TMDL. The loading of mercury from the watershed into the Savannah River was simulated using a Watershed Characterization System (WCS) model developed by EPA Region 4 (USEPA, Region 4, 2001). The WCS provides a simplified simulation of precipitation-driven runoff and sediment delivery. Solids load from runoff is used to estimate pollutant delivery to the River from the watershed. The water quality model known as WASP5 (Ambrose, et al., 1993) is used to simulate mercury fate and transport in the Savannah River. WASP5 is a general dynamic mass balance framework for modeling contaminant fate and transport in surface waters.

EPA evaluated the current loading conditions and calculated the water column concentration using the modeling approach described in this document. **The calculated allowable load of mercury that can come into the Savannah River without exceeding the applicable water quality standard as interpreted by EPA of 2.8 ng/l is 32.8 kilograms/year.** Because this assessment indicates that 99% of the loading of mercury is from atmospheric sources, 99% of the allowable load will be assigned to the load allocation, and 1% of the available load will be assigned to the wasteload allocation. Therefore, the Load Allocation and Wasteload Allocation for the middle/lower Savannah River are:

Load Allocation (atmospheric sources) = 0.99 (32.8) = 32.5 kilograms/year

Wasteload Allocation (NPDES sources) = 0.01 (32.8) = 0.3 kilograms/year

The estimated current loading of mercury to the Savannah River from the surrounding watershed is 58.8 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 (58.8 kg/year) and the calculated allowable load (32.8 kg/year) is 26 kilograms/year. Since 32.8 kg/year is 56% of the estimated current loading of mercury, it is estimated that a 44% reduction in total mercury loading is needed for the middle/lower Savannah River to achieve a water column concentration of 2.8 ng/l.

An analysis conducted by the EPA Region 4 Air Program concludes that an estimated 38% to 48% reduction in mercury deposition to the Savannah Watershed can be achieved by 2010. EPA expects these reductions to be achieved through full implementation of the current Clean Air Act (CAA) Section 112 Maximum Achievable Control Technology (MACT) requirements, Section 111 New Stationary Source Standards, and Section 129 Solid Waste Combustion requirements at sources within the local airshed. (USEPA, 2000)

This TMDL assigns a cumulative wasteload allocation (WLA) to all NPDES point sources of 0.3 kilograms per year. This TMDL assumes that this cumulative WLA will be accomplished through the imposition of numeric water quality-based permit limits or through the implementation of mercury minimization plans at appropriate NPDES facilities. The wasteload allocation options for NPDES permitted facilities are described in Section 10.

2. Introduction

The U.S. Environmental Protection Agency (EPA) Region 4 is establishing this Total Maximum Daily Load (TMDL) for total mercury for the middle/lower Savannah River from the Clarks Hill Lake Dam to the Tide Gate. The segments are as follows:

- Clarks Hill Lake Dam to Stevens Creek Dam
- Stevens Creek Dam to US Highway 78/278
- US Highway 78/278 to Johnsons Landing

- Johnsons Landing to Brier Creek
- Brier Creek to the Tide Gate

Four of these segments are listed on the State of Georgia's 2000 Section 303(d) list of impaired waters because mercury in certain species of fish tissue exceeds the the Georgia Department of Natural Resources (GDNR) Fish Consumption Guidelines State's guidelines. The fifth segment, Johnsons Landing to Brier Creek, was inadvertently omitted from the State of Georgia's 2000 Section 303(d) list. This segment is impaired based on GDNR Fish Consumption Guidelines, and the Georgia Environmental Protection Division intends to include this segment on the State's 2002 Section 303(d) List (personal communication, Mork Winn, February 27, 2001).

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 as interpreted by EPA, 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 establishing this TMDL for Georgia for the 5 segments of the Savannah River. Although the mid-line of the

Savannah River serves as the east-west boundary between the states of Georgia and South Carolina, the TMDL does not provide wasteload allocations to South Carolina NPDES facilities. This TMDL reflects assumptions that concentrations of mercury in the South Carolina portion of the Savannah River will meet the applicable Georgia water quality standards as interpreted by EPA at the South Carolina-Georgia border.

On February 8, 2000, EPA originally proposed this TMDL for total mercury for the segments of the Savannah River listed on the State of Georgia's 1998 Section 303(d) List. During the public comment period on that proposed TMDL which closed April 10, 2000, EPA received extensive and significant comments on the TMDL. As a result, EPA obtained an extension of the schedule to finalize the TMDL from June 7, 2000 to February 28, 2001. This TMDL satisfies the court-ordered commitment.

3. Phased Approach to the TMDL

EPA recognizes that it may be appropriate to revise this TMDL based on information gathered and analyses performed after February 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 Savannah River, if necessary, in 2004. The phased approach is appropriate for this TMDL because information on the actual contributions of mercury to the Savannah River from both point and nonpoint sources will be much better characterized in the future.

3.1. Phased Approach to Atmospheric Sources

The impairment of the Savannah River by mercury is largely due to the deposition of mercury from the atmosphere. This TMDL estimates that approximately 99 percent of the pollutant loads to the River come from the atmosphere (Table 8). An analysis of atmospheric deposition to the Savannah River 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 Savannah River 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, approximately 1 percent, of the mercury loading into the Savannah River is due to discharges from water point sources (e.g., pipes) into the Savannah 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 Savannah 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 the Savannah River 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 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 and that the agency has reasonable assurance that needed air reductions will be achieved. Nonetheless, it is important to point out that, because of these uncertainties, the anticipated 38% to 48% reductions in atmospheric deposition reported in this TMDL are an estimate only.

EPA expects that emissions of mercury from air sources (and consequently deposition of mercury to the Savannah River) will continue to be reduced during the first phase of this TMDL through implementation of the CAA's MACT and Section 129 and Section 111 regulations. In addition, EPA expects reductions in the air emissions of mercury may be achieved through implementation of voluntary programs. At the same time, EPA is considering additional regulatory actions under the CAA that may result in further reductions of mercury emissions from air sources. EPA is also undertaking new computer modeling that will allow a better characterization of sources contributing to the deposition of mercury and, therefore, more certainty regarding the extent of mercury reductions that can be achieved in a watershed from air sources. By 2004, when EPA expects to revise the TMDL, this additional modeling information and estimates of additional future reductions will be available, allowing EPA to validate the assumptions and verify the anticipated reductions in loadings and revise the TMDL accordingly.

3.2. 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 Georgia in the Savannah River Basin 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 Savannah River. This will allow EPA, as appropriate, to refine wasteload allocations provided in the TMDL.

Other circumstances may also influence the wasteload allocations that are established in the second phase of this TMDL. As an example, EPA issued criterion guidance for methylmercury on December 30, 2000. (See Water Quality Criteria for Protection of Human Health: Methylmercury, EPA-823-F-01-001.) This new guidance was issued after this TMDL was proposed on December 8, 2000, and is not incorporated into the development of this TMDL. However, the Federal Register notice announcing the availability of the new methylmercury criterion guidance explains that EPA expects the states to use the federal criterion as guidance in updating their water quality standards. EPA expects states to adopt a new or revised water quality criterion for methylmercury at levels necessary to protect human health. The State of Georgia will be undertaking a review of their water quality standards within the next 3 years; therefore, EPA anticipates that by 2004 Georgia will have adopted a numeric human health criterion for methylmercury. The revised 2004 TMDL will be based on the State's numeric human health criterion for mercury, if such criterion exists, rather than on EPA's interpretation of the State's narrative water quality standard for toxic substances as was done in this Phase 1 TMDL (See Section 5).

Because the impairment of the Savannah River 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 Savannah 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:

- 29 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 15 municipal facilities, and 14 industrial facilities. (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 states will collect additional ambient data on mercury concentrations in water, sediment and fish.
- EPA expects Georgia to adopt a numeric water quality criterion for methylmercury for the protection of human health that is based on EPA's recent criteria guidance, either as published or as modified to reflect site-specific conditions, or that are based on other scientifically defensible methods. (See 40 C.F.R. 131.11(b))

EPA intends to use the data and information collected and developed during the next four years to revise the Phase 1 TMDL, as necessary, to assure that EPA's interpretation of the State's applicable water quality standard is appropriate, and 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 Savannah River Basin will be reissued in 2005. Therefore, EPA intends to revise the TMDL one year prior to reissuance of permits in the Savannah River Basin.

4. Problem Definition

The water segments in the Savannah River Basin for which this proposed TMDL is being established are listed on the State of Georgia's 2000 Section 303(d) list except Johnsons Landing to Brier Creek (Johnsons Creek to Brier Creek is impaired and will be listed on the State's 303(d) List, See Section 2). The waters were listed (and Johnsons Landing to Brier Creek will be listed) because mercury in the tissue of several species of fish exceeds 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 contamination with mercury.

Table 1 Georgia Department of Natural Resources Fish Consumption Guideline

Mercury Fish Tissue Threshold (mg/kg)	Frequency of Consumption
0.23	Once a Week

0.70	Once a Month
2.3	Do Not Eat

If fish tissue contains 0.23 mg/kg (parts per million) or more mercury, the State's FCG indicates that the fish should not be consumed more than once a week. If fish tissue contains 0.70 mg/kg (parts per million) or more mercury, the State's FCG indicates the fish should not be consumed more than once a month, and if the fish tissue contains 2.30 mg/kg (parts per million) or greater of mercury, the State issues a "Do Not Eat" guideline.

The following FCG are in place for the segments of the Savannah River covered by this TMDL: 1) Columbia County - 1 meal per week for largemouth bass and spotted sucker, 2) Richmond/Burke Counties - 1 meal per week for largemouth bass, 3) Screven County - 1 meal per week for largemouth bass, 4) Effingham County - 1 meal per month for largemouth bass, 5) Fort Howard - 1 meal per week for white catfish and 1 meal per month for largemouth bass and bowfin, 6) Chatham County - 1 meal per week for largemouth bass, and 7) Tidal Gate - 1 meal per week for white catfish.

4.1. Health Effects of Mercury

The State of Georgia's fish consumption guideline program is designed to protect consumers in Georgia from the health effects of mercury consumed through fish in the diet. Human exposure to inorganic mercury in large amounts can cause a variety of health effects. The two organ systems most likely affected by methylmercury are the central nervous system and the kidney. However, the most significant concerns regarding chronic exposure to low concentrations of methylmercury in fish are for neurological effects in the developing fetus and children.

EPA recently issued national advisory concerning risks to children and to pregnant or nursing women associated with mercury in freshwater fish caught by their friends and family. (See EPA Consumption Advisory: Advice for Women and Children on Non-commercial Fish Caught by Friends and Family, EPA-823-F-01-004, January 2001.) The groups most vulnerable to the effects of mercury pollution include:

women who are pregnant or may become pregnant, nursing mothers, and young children. To protect against the risks of mercury in fish caught in freshwaters, EPA is recommending that these groups limit fish consumption to one meal per week for adults (6 ounces of cooked fish, 8 ounces uncooked fish) and one meal per week for young children (2 ounces cooked fish or 3 ounces uncooked fish). The National Academy of Sciences confirms that methylmercury is a potent toxin and concludes that the babies of women who consume large amounts of fish when pregnant are at greater risk for changes in their nervous system that can affect their ability to learn. (NAS, Toxicological Effects of Methylmercury, July 2000) EPA is issuing this advice for women who are pregnant or may become pregnant, nursing mothers, and young children to raise awareness of the potential harm that high levels of methylmercury in fish can cause to a baby or child's developing brain and nervous system. This advice provides guidance on the amount of fish caught by friends and family that these groups can eat to keep methylmercury from reaching harmful levels.

The purpose of this TMDL is to establish the acceptable loading of mercury from all sources, such that mercury levels in the middle/lower Savannah River will not exceed the applicable water quality standard as interpreted by EPA for protection of public health. If concentrations in the River can be reduced to the applicable water quality standard as interpreted by EPA (expressed in terms of ambient water column concentrations), fish tissue levels of mercury will decrease over time. Eventually, fish tissue levels of mercury should become low enough that consumers may eat unlimited quantities of fish from the River without fear of health effects.

5. Applicable Water Quality Standard

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

EPA collected site-specific data on ambient mercury in the water column and fish tissue from the Savannah River which indicate the 12 ng/l aquatic life criterion is not protective of human health. In July 2000, EPA collected samples of ambient water at 10 locations in the mainstem and 6 locations in tributaries to the Savannah River from below Clarks Hill Dam to the Tide Gate. Total mercury concentrations in the water ranged from 0.27 ng/l to 9.50 ng/l. These concentrations of mercury are well below the State's 12 ng/l aquatic life criterion. However, the average fish tissue residue concentration from 13 of the 16 sampling locations exceeds 0.23 mg/kg. Thus, at water concentrations below 12 ng/l (significantly below in most instances), fish tissue is accumulating mercury at levels above the State's Fish Consumption Guidelines indicating that a water concentration of 12 ng/l is not protective of human health.

Since the State lacks a numeric water quality criterion for the protection of human health, EPA has interpreted the State's narrative water quality standard for toxic substances (Chapter 391-3-6-.03 Section (5)(e)) to identify a water concentration sufficient to protect the human health designated use. In order to use the best available, sound science in interpreting this narrative, EPA used the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (EPA 2000) to derive the applicable water quality standard for this TMDL. This standard as interpreted by EPA is the maximum concentration of mercury that can be present in the water column without causing a fish tissue residue concentration that poses adverse health effects.

Using EPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (referred to as EPA's Human Health Methodology), EPA determined that a 0.4 mg/kg fish tissue residue value will protect the general population from the adverse health effects of mercury due to the consumption of freshwater fish. To interpret Georgia's Water Quality Standards, EPA assumed that the general population consumes 17.5 grams per day of large mouth bass, a trophic level 4 fish. EPA is using 0.4 mg/kg in fish tissue as the appropriate "end point" upon which to base the interpretation of the applicable water quality standard.

To calculate the maximum water column concentration that will not allow mercury to bioaccumulate in fish tissue to above 0.4 mg/kg, the EPA Human Health Methodology is again applied. The methodology is expressed below:

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

where:

WQS = EPA's Interpretation of Georgia's Water Quality Standard
Reference Dose = 0.0001 mg/kg/day MeHg
Body Weight = 70 kg
Units Conversion = 1.0E6
Consumption Rate = 0.0175 kg/day Fish•
Bioaccumulation Factor = 4,000,000 as measured in the Savannah Watershed
Fraction of the Total Mercury as Methylmercury = 0.0353 as measured in the Savannah Watershed

In the calculation, the Region used the recommended national values for most of the factors in the Human Health Methodology, including the reference dose of 0.0001-mg/k/day methylmercury; a standard average

• The fish intake value of 17.5 g/day (general adult population) was taken from EPA's 2000 Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (65 FR 66444-66482 (11/3/200)).

adult body weight of 70 kg; and the consumption rate for the general population of 17.5 grams per day. (Note that a recent report by the National Academy of Sciences confirms that methylmercury is a potent toxin, and concludes that EPA's reference dose of 0.0001 mg/kg/day is appropriate (See NAS, Toxicological Effects of Methylmercury, July 2000)). For the other factors in the calculation, bioaccumulation and fraction methylmercury, EPA collected site-specific data from the Savannah River Basin in August and September of 2000. (The site-specific data is presented in Section 6.4.) From this site-specific data, EPA determined a representative BAF value to be 4,000,000 and a median measured percentage methylmercury of 3.53%. Using recommended national values, and factors calculated from site-specific data, EPA interpreted Georgia's water quality standard and has determined that the applicable water quality standard for total mercury in the ambient water of the middle and lower Savannah River Basin is 2.8 ng/l (parts per trillion). This water quality standard, when fully achieved, will prevent the unacceptable bioaccumulation of mercury in fish from all segments of the middle/lower Savannah River. This interpretation of Georgia's water quality standard was based on site-specific data gathered for the Savannah River in 2000 specifically for the purpose of this TMDL. It does not apply to any other water in the State of Georgia. In addition, in any future TMDLs for Savannah River, it is possible that EPA may revise this interpretation based on new site-specific data collected at that time.

In determining the applicable water quality standard as interpreted by EPA, it was necessary to determine a representative bioaccumulation factor (BAF) as discussed above. It is common to have a large range in BAFs calculated from field data collected within the same river system. Figure 1 illustrates the range of BAFs calculated for all the fish sampled by EPA in August and September of 2000. The BAFs range from less than 1 million to over 18 million. An appropriate BAF for interpreting Georgia's Water Quality Standards was selected from the central tendency of the measured data for a fish 315 millimeter (mm) in length. (See Figure 1) EPA is assuming a 305-315 mm fish is representative of the size and age of fish that is most likely to be consumed and also represents the minimum length requirement for the fisherman to keep. A representative BAF for a 315 mm fish in the Savannah River Basin is 4,000,000.

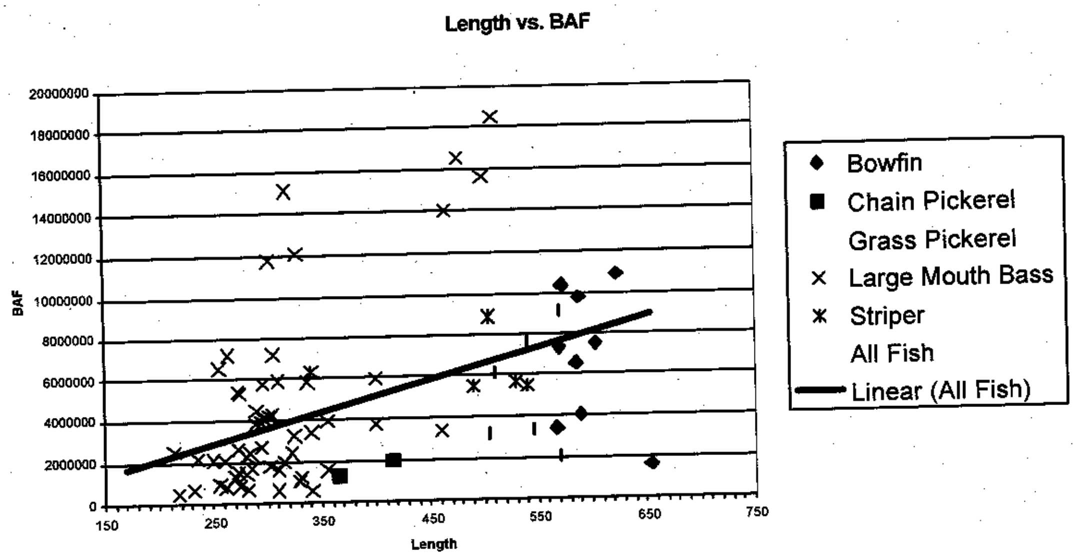

Figure 1 BAF vs. Length Fish Collection from Savannah Basin

Furthermore, to support the selection of the 4,000,000 BAF value, the individual fish for each segment/tributary were analyzed to determine a central tendency BAF that would be protective of the fish species and population that this TMDL is being developed to protect. Data collected for the sections of the river and tributaries were analyzed and compared statistically.

Table 2 provides the average BAFs determined for each tributary and segment of the Savannah River Basin for which data was collected. This analysis shows that an acceptable BAF would be between 3,255,807 and 4,604,485. Using this analysis and regression method shown in Figure 1, the selection of 4,000,000 provides a reasonable estimate of the BAF to be used in the Human Health Methodology calculation.

The site-specific data used to develop the applicable water quality standard was obtained during a one-time sampling event in the summer of 2000. EPA intends to revisit its interpretation of Georgia's water quality standard in Phase 2 when more data is available for total mercury in the water column over a longer time period and environmental conditions.

Table 2 Fish Tissue Analysis

River/Tributary Segment	Average Fish Tissue (ppm)	Water Column Total Hg (ng/L)	Water Column MeHg (ng/L)	Fraction MeHg	Average BAF
Savannah River-Below Clark's Hill Dam	0.251	0.27	0.02	0.078	11,710,280
Savannah River-Below Horse Creek	0.074	0.68	0.10	0.141	768,229
Savannah River-Below Butler Creek	0.316	1.19	0.16	0.131	2,026,871
Savannah River-Below Upper Three Run	0.181	3.27	0.07	0.020	2,744,723
Savannah River-Below Lower Three Run	0.180	9.50	0.06	0.006	3,142,770
Savannah River-Below Brier Creek	0.415	2.80	0.09	0.032	4,703,913
Savannah River-Clyo, USGS Gage	0.633	3.28	0.09	0.027	7,271,958
Savannah River-Below Ebenezer Creek	0.665	3.44	0.08	0.022	8,698,953
Savannah River-Tide Gate (Freshwater)	0.407	4.44	0.09	0.021	4,319,872
Savannah River-Tide Gate (Estuary)	0.389	4.09	0.06	0.015	6,321,951
Horse Creek	0.264	6.16	0.24	0.039	1,096,266
Butler Creek	0.305	2.14	0.39	0.182	780,769
Upper Three Runs Creek	0.783	5.82	0.16	0.027	4,896,829
Lower Three Runs Creek	1.085	2.43	0.13	0.051	8,676,761
Brier Creek	0.493	2.15	0.11	0.050	4,562,963
Ebenezer Creek	1.269	3.34	0.65	0.195	1,948,651
Average	0.482	3.44	0.15	0.065	4,604,485
Median	0.398	3.28	0.10	0.035	4,441,418
Average (Mean) River	0.351	3.30	0.08	0.049	5,170,952
Median River	0.352	3.28	0.08	0.024	4,511,893
Average (Mean) Tributary	0.700	3.67	0.28	0.091	3,660,373
Median Tributary	0.638	2.89	0.20	0.051	3,255,807

6. Background

The middle & lower Savannah River watershed is located in eastern Georgia. The entire drainage area of the Savannah watershed (USGS Hydrologic Unit Code (HUC) 3060106, 3060108, 3060109) is approximately 9318 square kilometers. The Savannah watershed is presented in Figure 2.

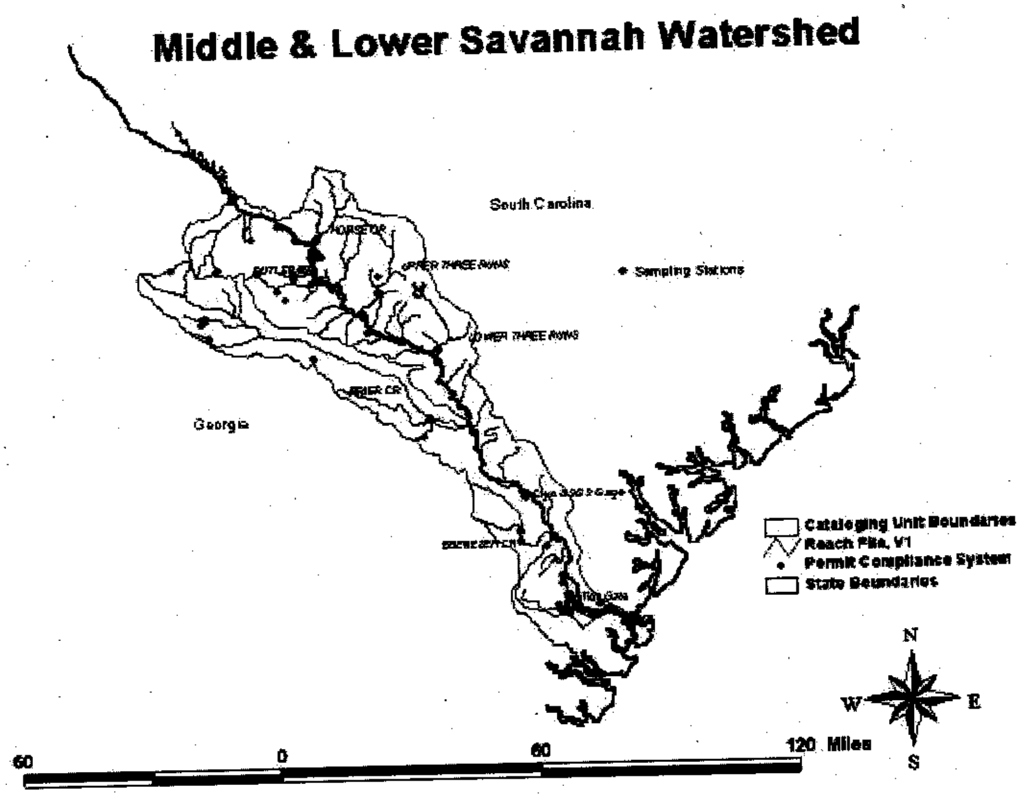

Figure 2 Savannah Watersheds

To develop the TMDL, EPA divided the Savannah watershed into 31 subwatersheds (Figure 3) that represent all of the major tributaries to the Savannah River. This TMDL presents a total mercury load for each of these subwatersheds in order to determine the impact of atmospheric deposition on the Savannah River.

Middle/Lower Savannah Sub Basin Delineation

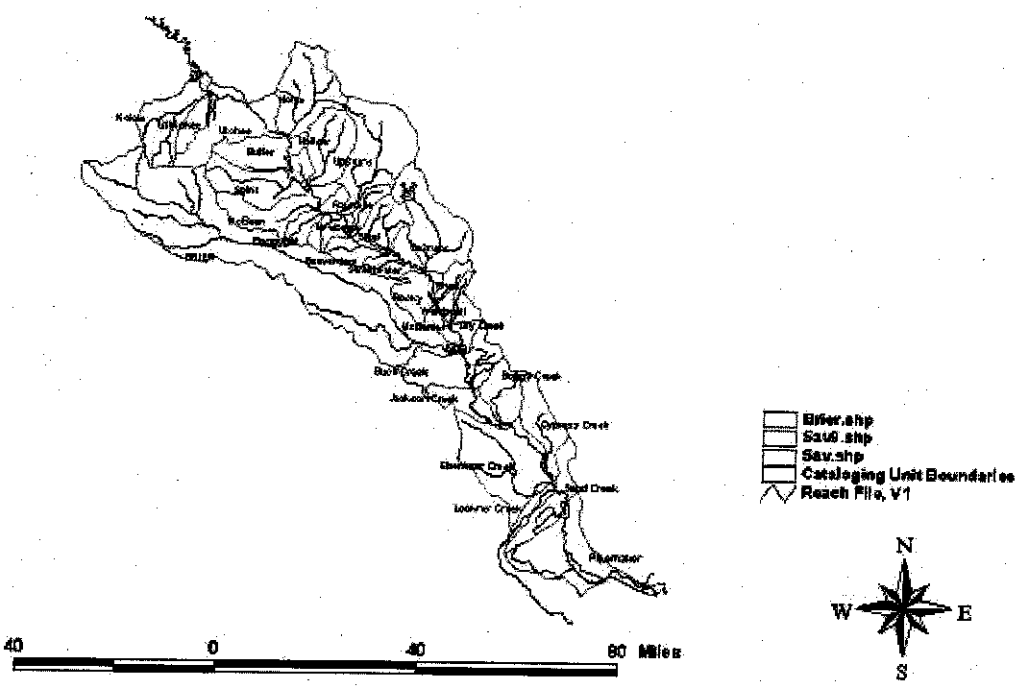

Figure 3 Savannah Watershed Delineation

The watershed contains several different types of land uses. The landuses for the Savannah River watershed are given in Figure 4. Different landuses collect and distribute mercury at different rates as a function of runoff and erosion.

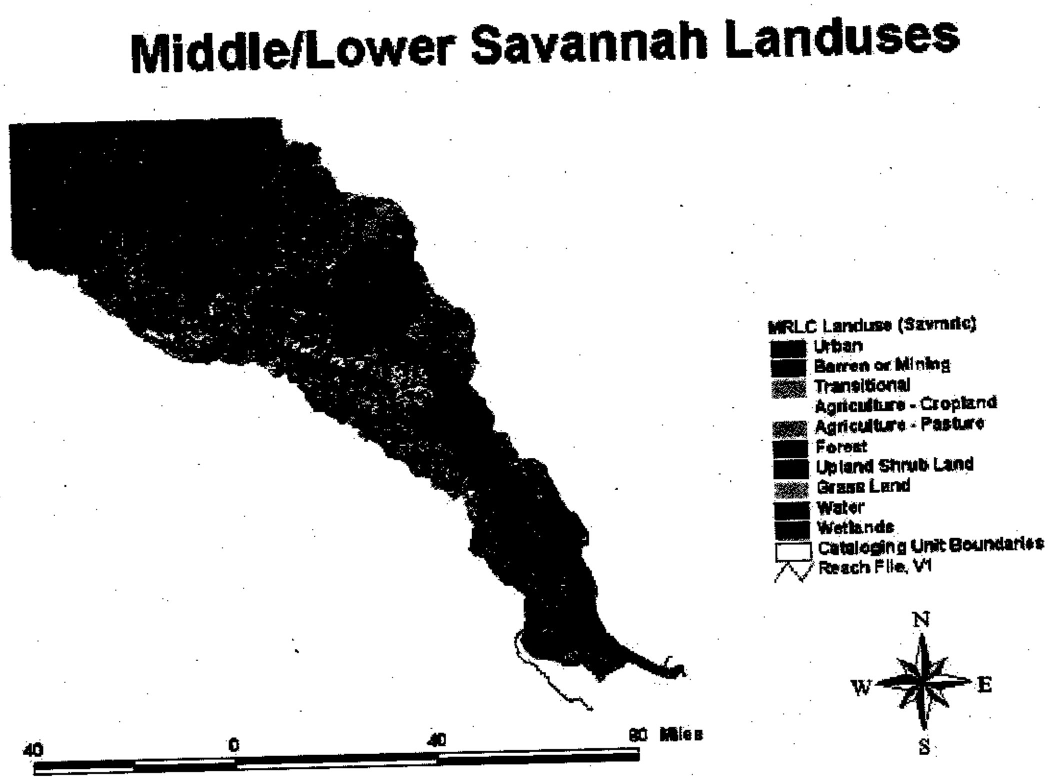

Figure 4 Savannah Watershed Landuses

6.1. Mercury Cycling

Mercury chemistry in the environment is quite complex and is not totally understood. Mercury has the properties of a metal (including persistence due to its inability to be broken down), but also has some properties of a hydrophobic organic chemical due to its ability to be methylated through a bacterial process. Methylmercury is easily taken up by organisms, and will bioaccumulate. It is effectively transferred through the food web, magnifying at each trophic level. This can result in high levels of mercury in organisms high on the food chain, despite nearly immeasurable quantities of mercury in the water column. In fish, mercury is not usually found in levels high enough to cause the fish to exhibit signs of toxicity, but the mercury in sport fish can present a potential health risk to humans.

Figure 5 provides a schematic of mercury cycling in the aquatic environment. The boxes represent stores of mercury, while the arrows illustrate the various fluxes that control mercury cycling in the environment. The top of the diagram summarizes the various forms of mercury that may be loaded into a waterbody. It is important to recognize that mercury exists in a variety of forms, including elemental mercury (Hg (0)), ionic mercury (Hg (I) & Hg (II)), and compounds in which mercury is joined to an organic molecule. In the schematic, Hg (I) is ignored, as Hg (II) generally predominates in aquatic systems. Mercuric sulfide (HgS or cinnabar) is a compound formed from Hg (II), but is shown separately, as it is the predominant natural ore. Organic forms of mercury include methylmercury (CH3Hg or "MeHg"), and also other organic forms, including natural forms such as dimethylmercury and man-made compounds such as organic mercury pesticides.

In the aquatic mercury cycle it is critical to consider the distribution of mercury load between the various forms. The major forms reaching the water from the watershed can have different behavior:

- Mercuric sulfide (HgS), can be washed into the water as a result of weathering of natural cinnabar outcroppings. HgS has low solubility under typical environmental conditions and would be expected to settle out to the bottom sediments. However, under aerobic conditions Hg (II) may be liberated by a bacteria-mediated oxidation of the sulfide ion. This Hg (II) would then be more bioavailable and would be available for methylation. Alternatively, under anaerobic conditions, HgS may be formed from Hg (II).

- Methylmercury (MeHg) is found in rainfall and may be found in small amounts in mine tailings or sediments. It is more soluble than HgS and has a strong affinity for lipids in biotic tissues.

- Elemental mercury (Hg (0)), may remain in mine tailings, as has been noted in tailings piles from recent gold mining in Brazil. Elemental mercury tends to volatilize into the atmosphere, though some can be oxidized to Hg (II).

- Other mercury compounds contain and may easily release ionic Hg (II). Such compounds are found in the fine residue left at abandoned mine sites where mercury was used to extract gold or silver from pulverized rock.

Dimethylmercury is ignored in the schematic because this species seems to occur in measurable quantities only in marine waters. Organic mercury pesticides also have been ignored in this TMDL study since such pesticides are not currently used in this country and past use is probably insignificant.

Mercury and methylmercury form strong complexes with organic substances (including humic acids) and strongly sorb onto soils and sediments. Once sorbed to organic matter, invertebrates can ingest mercury. Some of the sorbed mercury will settle to the bottom, and if buried deep enough, mercury in the bottom sediments will become unavailable to cycle. Burial in bottom sediments can be an important route of removal of mercury from the aquatic environment.

Methylation and demethylation play an important role in determing how mercury will accumulate through the food web. A biological process that appears to involve sulfate-reducing bacteria may result in methylated Hg (II). Rates of biological methylation of mercury can be affected by a number of factors. Methylation can occur in water, sediment and soil solution under anaerobic conditions and to a lesser extent under aerobic conditions. In water, methylation occurs mainly at the sediment-water interface and at the oxic-anoxic boundary within the water column. The rate of methylation is affected by the concentration of available Hg (II) (which can be affected by the concentration of certain ions and ligands), the microbial concentration, pH, temperature, redox potential, and the presence of other chemical processes. Methylation rates appear to increase at lower pH. Bacteria also cause demethylation of mercury.

Note in Figure 5 that both Hg (II) and methylmercury (MeHg) sorb to algae and detritus, but only the methylmercury is assumed to be passed up to the next trophic level. Invertebrates eat algae and detritus, thereby accumulating any MeHg that has sorbed to these constituents. Fish eating the invertebrates and either growing into larger fish (which have been shown to have higher body burdens of mercury) or eaten by larger fish will then bioaccumulate mercury. At each trophic level, a bioaccumulation factor must be assumed to represent the magnification of mercury that occurs as one moves up the food chain.

Typically, almost all of the mercury found in fish (greater than 95%) is in the methylmercury form. Studies have shown that fish body burdens of mercury increase with increasing size or age of the fish, with no signs of leveling off.

Although it is important to identify sources of mercury to the waterbody, there may be fluxes of mercury within the waterbody that would continue nearly unabated for some time even if all the sources in the watershed and waterbody were eliminated. In other words, compartments within the watershed and waterbody store significant amounts of mercury, and this mercury can continue to cycle through the system even without an ongoing source of mercury. The most important store of mercury is likely the river sediments and the surrounding swamps and marshes. The mercury in these pools may cause exposure to biota by being:

- Resuspended into the water column, where it is ingested or adsorbs to organisms that are later ingested.
- Methylated by bacteria. The methylmercury tends to attach to organic matter, which may be ingested by invertebrates and thereby introduced to the food web. It is methylmercury that poses the real threat to biota due to its strong tendency to accumulate in biota and magnify up the food chain.

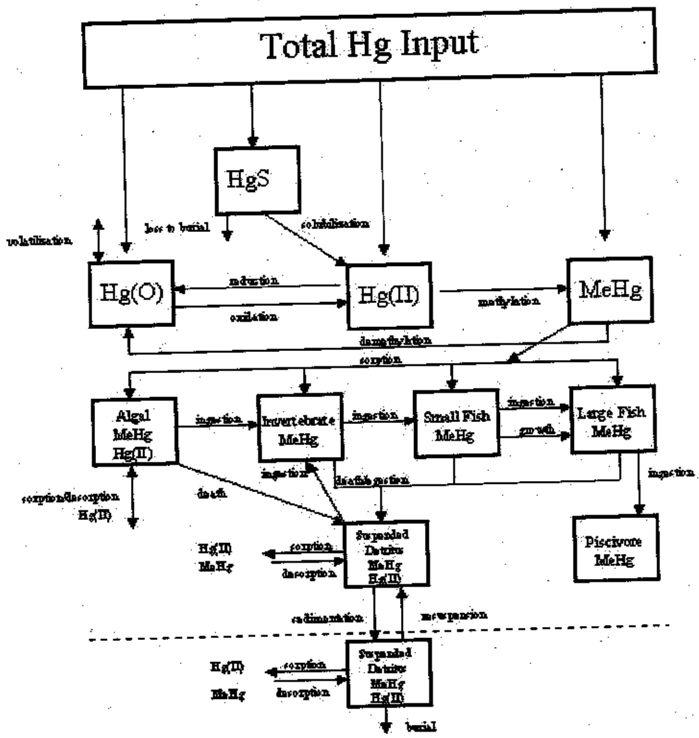

Figure 5 Mercury Cycling in the Aquatic Environment

6.2. *Source Assessment*

A TMDL evaluation examines the known potential sources of the pollutant in the watershed, including point sources, nonpoint sources, and background levels. For the purpose of this TMDL, facilities permitted under the National Pollutant Discharge Elimination System (NPDES) Program are considered point sources. Similarly, for the purpose of this TMDL air sources of mercury identified in the Mercury Report to Congress (EPA, 1997) which are located in the watershed and within a 100-kilometer boundary around the watershed, referred to as the local airshed are treated as nonpoint sources. All other air sources, outside the local airshed, are considered background sources of mercury. The source assessment serves as the basis for development of a model, and as the basis for the allocation of the total allowable load.

6.2.1. Sources of Mercury

It is estimated that approximately 99% of the mercury loading to the watershed is from atmospheric deposition (See Table 8 Annual Average Total Mercury Load). Mercury is deposited to the watershed as wet deposition (dissolved in rain) and as dry deposition of gaseous and particulate forms of mercury. For a more inclusive discussion of the air analysis performed as part of this TMDL, see Appendix A. Mercury deposited in the watershed comes from sources within the local airshed, from national sources located beyond the local airshed, and from international sources far away. Reactive gaseous mercury (RGM) is the dominant form of mercury in both rainfall and most dry deposition processes, and most of the RGM emitted from man made sources is deposited relatively quickly. Therefore, the analysis of air point sources focuses on sources located in the local airshed, and on their emissions of RGM to the air. For the purposes of this TMDL, the sources within the local airshed are treated as the nonpoint sources of mercury. Those sources outside the local airshed are considered to be part of the background load of mercury since identification of the distant sources that contribute mercury to the watershed was not accomplished for this Phase 1 TMDL.

The emissions inventory files prepared for the Mercury Report to Congress (EPA, 1997) identify stationary point sources of mercury in Georgia and South Carolina within the local airshed. Table 3 identifies these stationary sources of mercury deposition and their estimated contribution in 1995 of RGM, the form of mercury that is most likely to deposit within the local airshed, including the Savannah River watershed.

Table 3 Summaries of Mercury Emissions in the RGM Airshed during the Baseline Period (1994-1996)

Source Category	No. of Sources	Total Hg Emissions Baseline Period (kg/yr)	% of Total Hg	% of Total Hg that is RGM	Total RGM Emissions Baseline	% of Total RGM
MedWIs	36	963	25.65	73	703	39.93
Power Plants	17	866	23.08	30	260	14.76
Chlor-alkali	1	597	15.92	30	179	10.18
MuniWCs	3	589	15.69	60	353	20.08
Res/Ind Boilers	80	477	12.70	30	143	8.12
Pulp and Paper	12	121	3.23	30	36	2.06
Portland Cement	3	113	3.01	10	70	3.95
Sew Sludge Incin	6	26	0.69	60	16	0.88
HazWIs	2	1	0.03	8-95	<1	0.02
Total	160	3753	100.00		1760	100.00

6.2.2. Water Point Sources

Facilities covered by the National Pollutant Discharge Elimination System (NPDES) program are considered in this TMDL to be point sources of mercury within the Savannah watershed. There are approximately 80 NPDES facilities in Georgia discharging effluent to the Savannah River and its tributaries. (See Appendix B for a list of these facilities.) Because of the pervasive nature of mercury, and its presence in rainwater, it is assumed that all NPDES facilities discharge some mercury to the River. 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 priority pollutant monitoring. Therefore, most facilities do not have permit limits for mercury in their NPDES permits since they have not demonstrated "reasonable potential" for mercury in their effluent. This TMDL will address only those facilities that have the potential to discharge mercury above 2.8 ng/l (the applicable water quality standard as interpreted by EPA) and that may be adding mercury to their effluent above that in their present source water (See Section 10.2).

In 1999, EPA published a new analytical detection method for mercury that can reliably measure the chemical down to 0.5 ng/l (64 CFR 30417). Using this more sensitive analytical procedure and related field sampling protocols, EPA sampled a small cross section of the NPDES facilities in Georgia in the watershed (22 out of approximately 80 facilities). This limited sampling study confirmed EPA's suspicion that all NPDES facilities are discharging some concentration of mercury. Half of the facilities sampled (11 out of 22) are discharging mercury at a concentration below the water quality standard as interpreted by EPA of 2.8 ng/l, and the other half are discharging above this concentration. Based on the limited data from this one-time sampling event, EPA is estimating that NPDES point sources contribute approximately 1% of the current total load of mercury to the River.

6.3. 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 6 and Figure 7 illustrate the dry and wet deposition rates for the Savannah River watershed as derived by RELMAP. The RELMAP model was based upon the existing emissions inventory (1995 and 1996) and did not include some foreign airsheds (e.g., Mexico).

RELMAP Mercury Dry Deposition

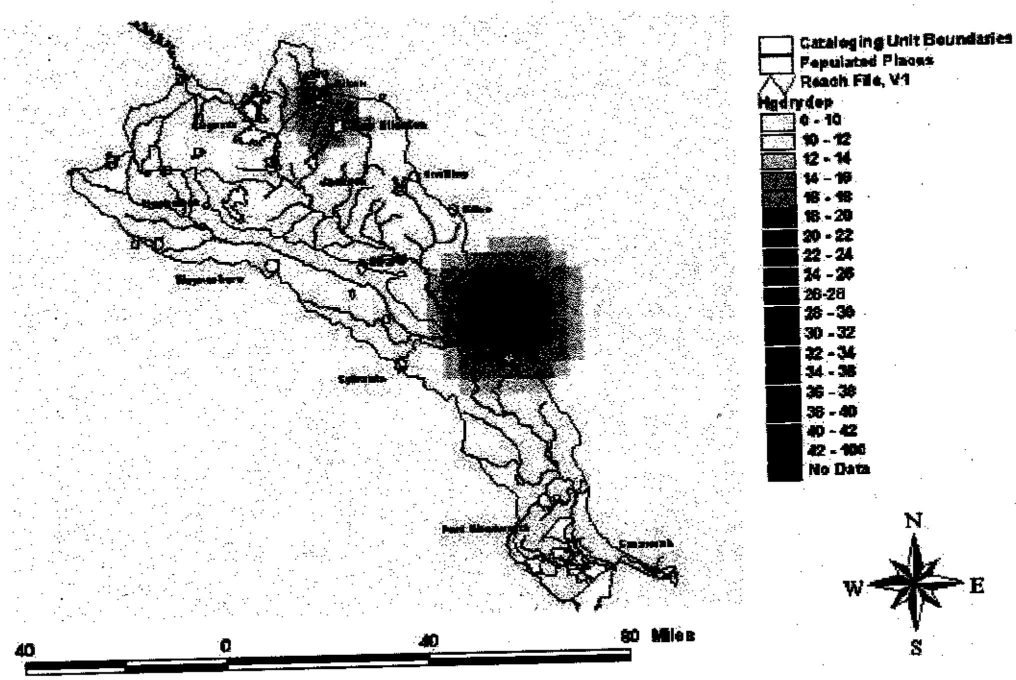

Figure 6 Mercury Dry Deposition Rates as Reported in the Mercury Report to Congress

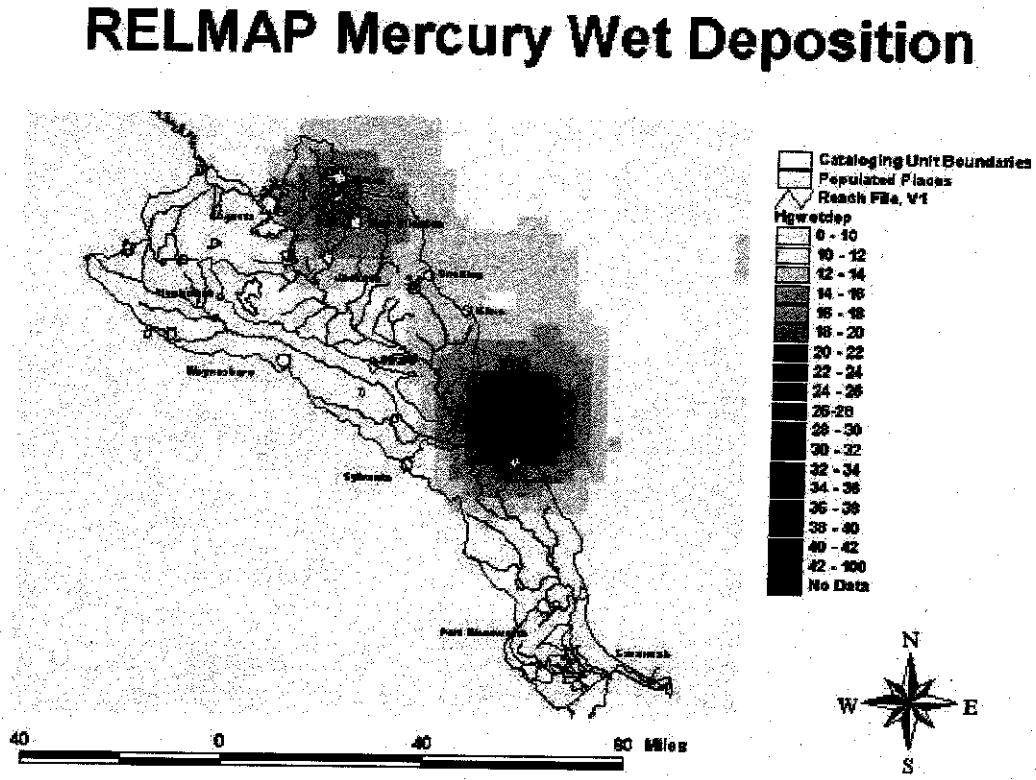

Figure 7 Mercury Wet Deposition Rates as Reported in the Mercury Report to Congress

6.4. Available Monitoring Data

The States of Georgia and South Carolina have routinely collected fish from the Savannah River for fish tissue analysis. Because mercury may bioaccumulate in fish tissue to mg/kg levels (parts per million), analytical procedures have been capable of detecting mercury at these levels. Therefore, data is available from the states for 1988 to 1998 on fish tissue from the Savannah River. These data indicate fish tissue, on average; exceed the State's Fish Consumption Guidelines in the water segments covered by this TMDL. In addition, EPA conducted a field sampling study in August and September of 2000 that included fish-tissue sampling and analysis. These data are available below in Section 6.4.4.

The states have also collected and analyzed ambient water concentration samples for total mercury. As explained above in Section 6.2.2, the analytical method for mercury used in the recent past has a detection limit of 200 ng/l, which is not sensitive enough to detect mercury at the low concentrations typically found in ambient surface water (rivers, creeks, and estuaries.) Therefore, laboratory results from samples of surface water collected by the states during their routine surface water monitoring programs typically have indicated a non-detect for mercury. Therefore, there is little ambient surface water mercury data available from the states. EPA's sampling study of the listed segments of the Savannah River in August and September of 2000 (EPA, November 2000) included water samples from 16 locations within the watershed. Samples were analyzed using EPA Method 1631, which has a detection limit of 0.5 ng/l. The results are presented below at Section 6.4.2.

6.4.1. EPA Region 4 Data

EPA Region 4 sampled the Savannah River watershed in August and September of 2000. Since even low concentrations of mercury in water can lead to significant accumulation of mercury in fish tissue, EPA sampled the Savannah 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 8. Water column, sediment and soil samples (taken adjacent to the water column samples outside the flood plain) were taken from 10 locations in the mainstem and 6 locations in tributaries throughout the middle and lower Savannah River watershed.

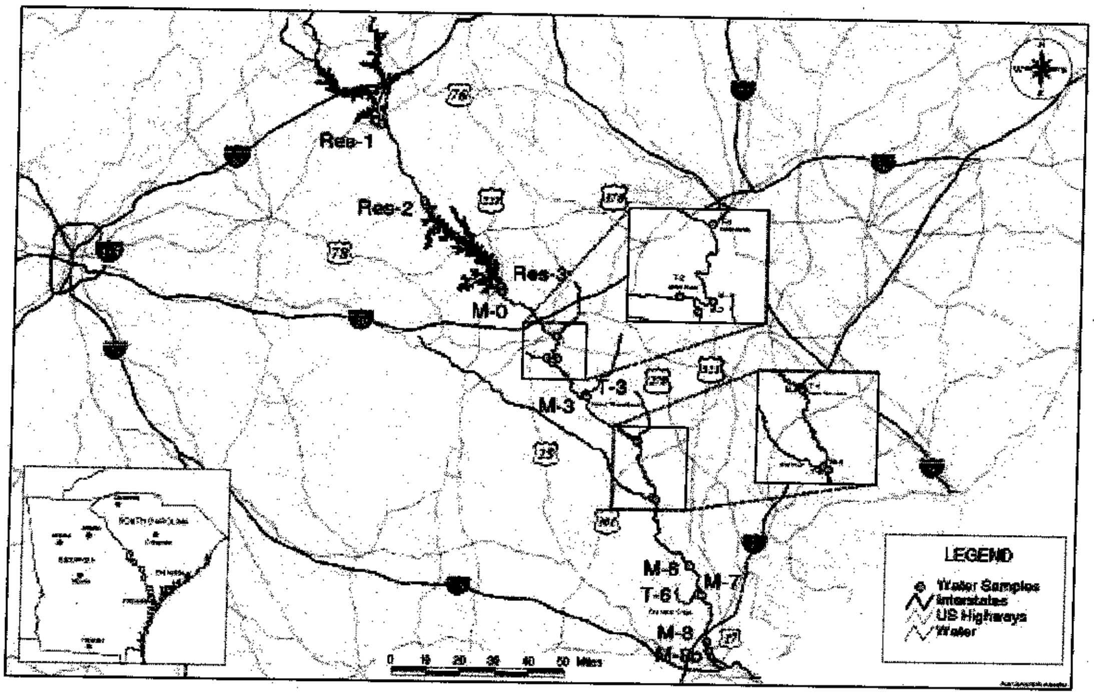

Figure 8 Savannah Watershed Water Column Sample Locations

Sample locations for the fish collection are illustrated in Figure 9. The 16 collection sites are located throughout the mainstem and tributaries in the middle and lower Savannah Basins. The fish collection consisted of 5 fish per sampling location, with the species of interest being largemouth bass. Largemouth bass were targeted because the State of Georgia's Fish Consumption Guideline is established to protect consumers from the consumption of largemouth bass. When 5 largemouth bass were not obtainable, other fish (Bowfin, Chain Pickerel, Grass Pickerel) were substituted.

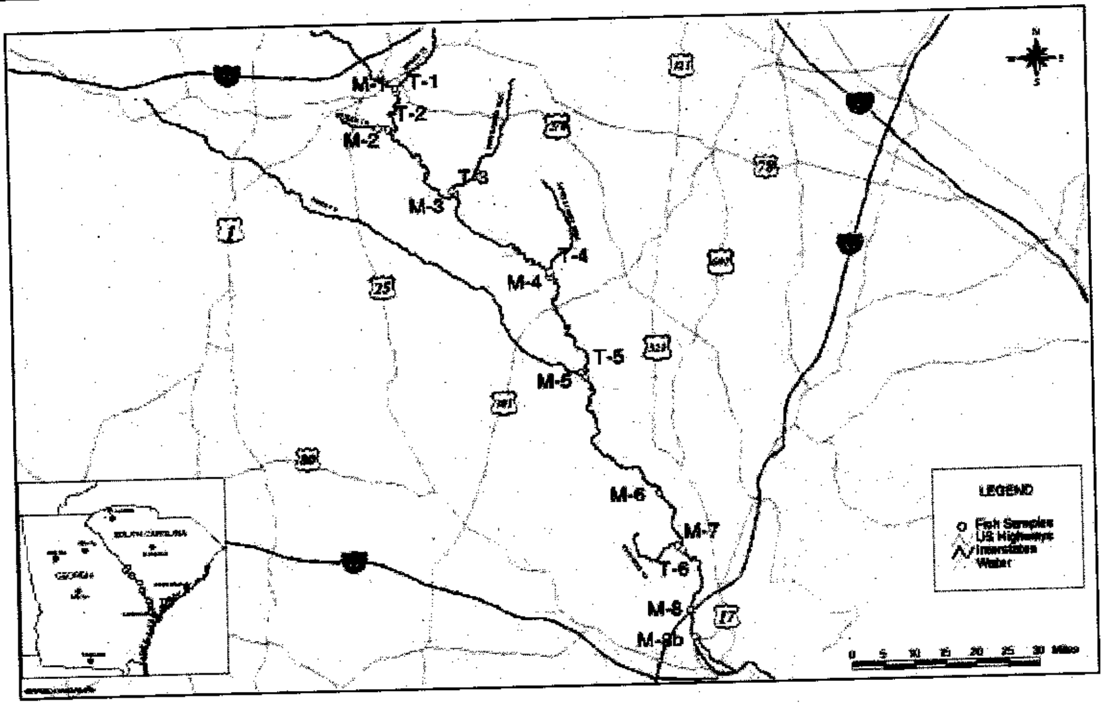

Figure 9 Savannah Watershed Fish Collection Locations

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

6.4.2. *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 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 4 provides the measured mercury concentrations in the water column in mainstem and tributaries in the Middle/Lower Savannah watershed.

Table 4 Water Column Mercury Concentrations

ID	Station	Total Hg (ng/l)	MeHg (ng/l)	Percent MeHg
M-0	Savannah River-Below Clark's Hill Dam	0.27	0.02	7.8
M-1	Savannah River-Below Horse Creek	0.68	0.10	14.1
M-2	Savannah River-Below Butler Creek	1.19	0.16	13.1
M-3	Savannah River-Below Upper Three Runs Creek	3.27	0.07	2.0
M-4	Savannah River-Below Lower Three Runs Creek	9.50	0.06	0.6
M-4	Savannah River-Below Lower Three Runs Creek(Filtered)	1.47	0.07	4.4
M-5	Savannah River-Below Brier Creek	2.80	0.09	3.2
M-6	Savannah River-Clyo, USGS Gage	3.28	0.09	2.7
M-7	Savannah River-Below Ebenezer Creek	3.44	0.08	2.2
M-8a	Savannah River-Tide Gate (Freshwater)	4.44	0.09	2.1
M-8a	Savannah River-Tide Gate (Freshwater) (Filtered)	1.00	0.03	3.2
M-8b	Savannah River-Tide Gate (Estuary)	4.09	0.06	1.5
T-1	Horse Creek	6.16	0.24	3.9
T-2	Butler Creek	2.14	0.39	18.2
T-3	Upper Three Runs Creek	5.82	0.16	2.7
T-4	Lower Three Runs Creek	2.43	0.13	5.1
T-5	Brier Creek	2.15	0.11	5.0
T-6	Ebenezer Creek	3.34	0.65	19.5

6.4.3. Sediment Data

Samples of river and tributary sediments were gathered at the same locations as the water samples to determine the amount of mercury associated with the sediments and porewater. This data provides important information that can be used to parameterize the water quality model by providing evidence of the effects of mercury in the sediments on the total mercury water column concentration.

Table 5 Sediment Mercury Concentrations

ID	Station	Total Hg (ng/g)	MeHg (ng/g)	Percent MeHg
M-0	Savannah River-Below Clark's Hill Dam	2.69	0.02	0.6
M-1	Savannah River-Below Horse Creek	10.16	0.00	0.0
M-2	Savannah River-Below Butler Creek	3.09	0.00	0.1
M-3	Savannah River-Below Upper Three Runs Creek	3.18	0.01	0.3
M-4	Savannah River-Below Lower Three Runs Creek	2.98	0.00	0.1
M-5	Savannah River-Below Brier Creek	10.08	0.01	0.1
M-6	Savannah River-Clyo, USGS Gage	2.53	0.12	4.7
M-7	Savannah River-Below Ebenezer Creek	83.36	0.56	0.7
T-1	Horse Creek	19.56	0.03	0.2
T-2	Butler Creek	14.02	0.02	0.1
T-3	Upper Three Runs Creek	3.08	0.00	0.1
T-4	Lower Three Runs Creek	3.13	0.00	0.1
T-5	Brier Creek	3.43	0.00	0.1
T-6	Ebenezer Creek	143.23	0.34	0.2

6.4.4. Watershed Soil Data

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 6 provides the mercury concentrations associated with soils collected during the summer of 2000.

Table 6 Mercury Concentrations in Soils from Surround Watershed

Station	Percent Dry Wt.	Total Hg (ng/g) Dry Weight	MeHg (ng/g) Dry Weight
Savannah River-Below Clark's Hill Dam	75.7	78.6	0.04
Savannah River-Below Butler Creek	79.1	33.1	0.03
Savannah River-Below Upper Three Runs Creek	82.5	22.7	0.05
Savannah River-Below Lower Three Runs Creek	82.9	56.8	0.00
Savannah River-Below Brier Creek	90.8	43.6	0.26
Savannah River-Clyo, USGS Gage	78.1	71.8	0.95
Savannah River-Below Ebenezer Creek	94.5	33.9	0.01
Butler Creek	97	43.8	0.06

Horse Creek	82.6	43.6	0.01
Upper Three Runs Creek	82.5	56.4	0.01
Lower Three Runs Creek	66.1	137.7	0.54
Brier Creek	84	26.3	0.32
Ebenezer Creek	91.7	28.1	0.11

6.4.5. Fish Tissue Data

Samples of fish were taken from the Savannah River and tributaries within the same area as the water column and sediment samples. Trophic level four fish (largemouth bass) were targeted in the collection because they represent a major portion of the fish size that is caught and kept by anglers and consumed as a source of food, and because Georgia's Fish Consumption Guideline is based on the protection of public health from the consumption of largemouth bass. Trophic level four fish also represent the upper end of the food chain where the biomagnification of mercury would be the highest. The fish fillets obtained during EPA's sampling effort were analyzed for total mercury. Table 7 provides the individual fish data. The fish tissue mercury concentration was used to determine the appropriate interpretation of Georgia's water quality standard for use in the TMDL.

Table 7 Fish Tissue Mercury Data

Location	Type	Total Length (mm)	Wt. lbs.	Total Hg (Wet Weight) (mg/kg)
Below Clark's Hill Dam	LMB	510	3.79	0.40
Below Clark's Hill Dam	LMB	337	1.13	0.12
Below Clark's Hill Dam	LMB	328	1.16	0.26
Below Clark's Hill Dam	LMB	305	0.77	0.15
Below Clark's Hill Dam	LMB	319	0.94	0.32
Horse Creek	LMB	340	1.22	0.12
Horse Creek	LMB	331	1.20	0.29
Horse Creek	LMB	310	0.86	0.14
Horse Creek	LMB	270	0.56	0.30
Horse Creek	LMB	316	0.94	0.48
Below Horse Creek	LMB	329	1.12	0.10
Below Horse Creek	LMB	261	0.57	0.07

Location	Type	Total Length (mm)	Wt. lbs.	Total Hg (Wet Weight) (mg/kg)
Below Horse Creek	LMB	255	0.47	0.08
Below Horse Creek	LMB	218	0.33	0.05
Butler Creek	GP	219	0.17	0.19
Butler Creek	GP	170	0.08	0.45
Butler Creek	GP	220	0.18	0.33
Butler Creek	LMB	232	0.38	0.25
Below Butler Creek	LMB	460	3.13	0.52
Below Butler Creek	LMB	310	0.87	0.24
Below Butler Creek	LMB	288	0.61	0.59
Below Butler Creek	LMB	282	0.79	0.10
Below Butler Creek	LMB	275	0.59	0.13
Upper Three Runs Creek	Bowfin	585	4.21	1.04
Upper Three Runs Creek	Bowfin	589	3.92	0.64
Upper Three Runs Creek	Bowfin	567	3.72	0.54
Upper Three Runs Creek	Bowfin	603	3.91	1.19
Upper Three Runs Creek	Bowfin	505	2.67	0.50
Below Upper Three Runs Creek	LMB	322	0.91	0.16
Below Upper Three Runs Creek	LMB	340	1.03	0.22
Below Upper Three Runs Creek	LMB	280	0.58	0.09
Below Upper Three Runs Creek	LMB	304	0.78	0.28
Below Upper Three Runs Creek	LMB	284	0.61	0.16
Lower Three Runs Creek	Bowfin	624	5.12	1.36
Lower Three Runs Creek	Bowfin	570	3.61	1.14
Lower Three Runs Creek	Bowfin	509	2.45	0.76
Lower Three Runs Creek	Bowfin	588	3.38	1.22
Lower Three Runs Creek	Bowfin	540	3.01	0.95
Below Lower Three Runs Creek	LMB	302	0.76	0.10
Below Lower Three Runs Creek	LMB	401	1.90	0.34
Below Lower Three Runs Creek	LMB	294	0.70	0.15
Below Lower Three Runs Creek	LMB	355	1.41	0.22
Below Lower Three Runs Creek	LMB	273	0.57	0.08
Brier Creek	LMB	290	0.59	0.48
Brier Creek	LMB	263	0.47	0.78

Location	Type	Total Length (mm)	Wt. lbs.	Total Hg (Wet Weight) (mg/kg)
Brier Creek	LMB	255	0.47	0.71
Brier Creek	LMB	235	0.37	0.23
Brier Creek	LMB	214	0.25	0.27
Below Brier Creek	LMB	302	0.76	1.04
Below Brier Creek	LMB	401	1.90	0.33
Below Brier Creek	LMB	294	0.70	0.34
Below Brier Creek	LMB	355	1.41	0.14
Below Brier Creek	LMB	273	0.57	0.23
Clyo, USGS Gage	LMB	477	3.98	1.44
Clyo, USGS Gage	LMB	301	0.83	0.36
Clyo, USGS Gage	LMB	310	0.71	0.51
Clyo, USGS Gage	LMB	295	0.65	0.50
Clyo, USGS Gage	LMB	295	0.69	0.36
Ebenezer Creek	Bowfin	654	2.32	1.02
Ebenezer Creek	Bowfin	545	2.30	2.17
Ebenezer Creek	Chain Pickerel	415	0.98	1.25
Ebenezer Creek	Chain Pickerel	365	0.59	0.82
Ebenezer Creek	LMB	285	0.64	1.08
Below Ebenezer Creek	LMB	325	0.91	0.25
Below Ebenezer Creek	LMB	272	0.56	0.41
Below Ebenezer Creek	LMB	275	0.51	0.40
Below Ebenezer Creek	LMB	465	3.00	1.07
Below Ebenezer Creek	LMB	500	3.94	1.19
Tide Gate (Freshwater)	Bowfin	570	3.96	0.19
Tide Gate (Freshwater)	Bowfin	570	3.94	0.68
Tide Gate (Freshwater)	Bowfin	572	3.94	0.97
Tide Gate (Freshwater)	LMB	260	0.45	0.19
Tide Gate (Freshwater)	LMB	280	0.61	0.21
Tide Gate (Freshwater)	LMB	250	0.42	0.20
Tide Gate (Estuary)	Striper	490	2.98	0.34
Tide Gate (Estuary)	Striper	530	3.71	0.35
Tide Gate (Estuary)	Striper	540	3.94	0.34
Tide Gate (Estuary)	Striper	340	3.29	0.39

Location	Type	Total Length (mm)	Wt. lbs.	Total Hg (Wet Weight) (mg/kg)
Tide Gate (Estuary)	Striper	505	3.10	0.54

7. Model Development

The link between the fish tissue residue concentration 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 residue concentration and identified sources. This provides the basis for estimating the total assimilative capacity of the river and any needed load reductions. In developing this TMDL, EPA combined models of watershed loading of mercury 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 residue concentration of mercury) and the mercury loads to the water. The loading capacity of the River for mercury is then determined by the linkage analysis as a mercury-loading rate that is consistent with meeting the end-point fish tissue residue 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. The limited amount of data available for the Savannah River watershed prevented EPA from using a detailed dynamic watershed runoff model, which needs a great deal of data for calibration. Instead, EPA determined the mercury contributions to the Savannah River from the surrounding watershed and atmospheric components based on an annual mass balance of mercury in water and sediment loading from the watershed.

Watershed-scale loading of mercury in water and sediment was simulated using the Watershed

Characterization System (WCS) (USEPA, 2001). 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 from runoff can then be used to estimate pollutant delivery to the receiving waterbody from the watershed. This estimate is based on mercury concentrations in wet and dry deposition, which is processed by soils in the watershed and ultimately delivered to the receiving waterbody by runoff, erosion and direct deposition (EPA, November 2000)

7.2. Water Quality Fate and Transport Model

Water Quality Analysis Simulation Program (WASP5) (Ambrose, et al., 1993) was chosen to simulate mercury fate in the Savannah 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 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 without exceeding the applicable water quality standard, in this case, a numeric interpretation of the State of Georgia's narrative water quality standard for toxic substances of 2.8 nanograms per liter (ng/l). This TMDL determines the maximum load of total mercury that can enter the Savannah River watershed within a year without exceeding 2.8-ng/l total mercury in the water column. (See Section 5 for a discussion of EPA's interpretation of Georgia's water quality standard for this TMDL.)

8.1. 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. In fact, the applicable water quality standard as interpreted by EPA in this TMDL is based upon a largemouth bass of 315 millimeters in length, which represents a 3 to 5 year old bass. Therefore, the annual average load is more appropriate than a daily load for representing the long-term processes of bioaccumulation in fish tissue that are associated with the potential for health effects. Second, 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.

8.2. 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, seasonal variations are not important in this TMDL, which is expressed as an average annual load.

Methylation of mercury is expected to be highest during the summer because high temperatures and static hydrologic conditions result in hypoxic and/or conditions that promote methylation, and since predator feeding activity is also high 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.

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.

- Calculating BAFs from only trophic level four fish. This approach conservatively assumes that the public consumes only largemouth bass. This may be an over-estimate of amount of mercury to which the public is exposed through fish consumption because the typical diet of fish from other trophic levels that do not bioaccumulate mercury to the same degree as trophic level four fish. However, this assumption contributes to the TMDL's margin of safety because it accounts for uncertainties associated with precise fish diet. It also protects members of the public that consume fish from different trophic levels, but at a rate higher than the 17.5 g/day fish consumption rate employed for this TMDL.

- Assigning a 1% 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 standard can be achieved solely by controlling air sources. By assigning a 1% 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, the 1% reduction helps 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 Savannah 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

In order to establish the maximum annual average load of mercury that be assimilated by the Savannah River and achieve the appropriate water quality standard, interpreted by EPA to be 2.8 ng/l, the watershed loadings of mercury to the River must be integrated with the fate and transport of mercury in the River. As discussed above (Section 8.1.), annual average loads and average annual flows are used as the basis for assessing the current loadings of mercury to the River and to assess the future load reductions of mercury needed to achieve the applicable water quality standard.

9.1. Model Results

Both the Watershed Characterization System (WCS) nonpoint source runoff model and the receiving waterbody model (WASP5) are used to determine the maximum load of mercury that can occur and not exceed the applicable water quality standard of 2.8 ng/l as interpreted by EPA. This section provides detailed information on how the models are applied, how the watershed and waterbody are broken down into segments (computational boxes) and how the mercury is 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 WCS model were derived from the RELMAP air deposition model results reported in the Mercury Report to Congress. The RELMAP predictions for both wet and dry deposition were converted to a GIS coverage (Figure 6 and Figure 7) to provide a spatially variable deposition rate for the watershed. The WCS model was used to calculate the total load of mercury entering the mainstem portion of the Savannah River from the sub basins delineated in Figure 3. The predicted annual loads are given in Table 8. 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. The watershed model was calibrated to match the soil concentrations that were measured in the field.

Table 8 Annual Average Total Mercury Load

Sub Watershed	Area (ha)	Total Load mg/yr	Load/ha	% Impr Soil	% Sediment	% Runoff	% Direct Dep	% NPDES
Kiokee	32836.2	1669435.968	17.84	11.77	65.95	13.57	8.71	0
Little Kiokee	10088.81	331540.4058	11.05	31.17	23.49	34.63	10.7	0
Horse	42746.97	5147562.706	41.76	48.53	7.95	35.83	7.68	0
Butler	25390.8	3334875.266	49.68	66.84	7.04	14.13	11.98	0.01
Hollow	29416.43	2526441.021	29.43	37.81	33.08	22.42	6.69	0
Upper Three Runs	56241.64	3329200.071	22.57	58.61	11.55	27.76	2.09	0
Fourmile	8710.13	3595104.186	14.92	60.68	1.25	32.14	5.93	0
Lower Three Runs	46814.15	363748.1273	19.34	34.16	23.6	34.85	19.89	0
Brier Creek, SC	6666.03	2997886.561	22.05	30.02	36.68	29.28	4.02	0
Watchcall	8565.4	440622.7377	19.56	22.18	38.29	34.33	5.19	0
Boggygut	12453.06	513979.5685	15	17.29	47.96	25.32	9.42	0
Newberry	10942.14	566475.2132	18.24	30.34	35.14	20.52	14	0
Steel	18310.91	793120.762	12.03	42.15	1.43	45.59	37.34	0
Beaverdam	12445.57	630715.4352	17.83	41.31	18.39	23.24	16.96	0.1
Sweetwater	15726.24	1025257.81	21.55	18.38	34.82	29.49	17.3	0
Rocky	17327.97	1190980.475	22.3	10.02	51.67	21.94	16.37	0
King	7684.87	483180.7	22.22	12.57	20.19	23.28	43.96	0
McDaniel	7389.59	369119.15	17.92	15.7	15.71	22.93	45.66	0
Dry	10533.89	835142.4918	25.97	19.63	40.85	30.46	9.06	0
Buck	24444.06	1448923.275	20.02	16.76	35.24	26.26	21.73	0
Utchee	42722.19	3836027.353	33.56	57.18	9.71	12.67	20.42	0.02
Spirit	36322.28	1933472.456	19.07	43.43	18.67	21.09	16.39	0.68
McBean	28999.99	2996561.842	15.72	24.1	38.67	25.45	11.78	0
Boggy	18934.66	993640.7169	17.21	21.83	30.71	40.29	7.17	0
Jackson	15552.96	945151.025	20.75	17.3	35.21	21.92	25.57	0
Cypress	23982.3	942136.3707	13.05	22.65	32.07	33.37	11.91	0
Ebenezer	60100.2	1995424.682	11	21.56	24.35	38.82	15.26	0.01
Pipemaker	52092.53	3482463.854	25.96	32.44	2.04	8.72	56.39	1
Lockner	7001.55	209844.6119	10.33	42.03	11.97	38.36	6.88	0.75
Sand	22305.24	618689.0742	9.54	33.85	17.55	34.7	13.9	1.53
Brier Creek, GA	219195.9	9230475.848	10.92	31.01	25.68	36.62	6.68	0

9.1.2. *Water Quality Model*

The WASP5 toxic chemical program TOXI5 was set up to simulate mercury in the mainstem of the Savannah River. The segments identified in Section 1 comprise the mainstem of the Savannah River for the purposes of this analysis. The mainstem of the river was divided into 31 reaches. Each reach was further divided into 2 vertical compartments representing surface water and surficial sediment. The 2 centimeters (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 classes of solids, sand and silt, were simulated. 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 monomethyl mercury, 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 $7.1 \bullet 10^{-3}$

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 9.

Table 9 Specified and Calculated Reaction Rates and Coefficients

Component	Reaction	Compartment	Coefficient Value
Hg0	Volatilization	Water	1.0 - 3.9 day^{-1} (calc)
	Oxidation	Water	0.0001 day^{-1}
Hg(II)	Reduction	Water	0.010 day^{-1} (surface) 0.074 - 0.090 (calc)
	Methylation	Water	0.0001 day^{-1}
	Methylation	Sediment	0.00002 day^{-1}
	Partitioning to silt	Water, Sediment	4×10^5 L/kg
	Partitioning to sand	Water, Sediment	1×10^4 L/kg
	Partitioning to DOC	Water, Sediment	2×10^4 L/kg
MeHg	Demethylation to Hg(II)	Water Sediment	0.0001 day^{-1} 0.00002 day^{-1}
	Demethylation to Hg0	Water (Photolysis)	0.1 day^{-1} (surface) 0.074 - 0.090 (calc)
	Partitioning to silt	Water, Sediment	4×10^5 L/kg
	Partitioning to sand	Water, Sediment	1×10^3 L/kg
	Partitioning to DOC	Water, Sediment	2×10^5 L/kg

Two separate simulations of mercury in the Savannah River were run representing average flow and drought flow conditions. The average flow simulation was run for 30 years, so that steady-state conditions are achieved in the water and surficial sediment. Drought flow conditions were run for 180 days using the average-flow concentrations as initial conditions. Volumes, depths, and velocities were obtained from the EPDRIV1 hydrodynamic model currently being applied to Savannah River in support of work being conducted by Georgia EPD.

The flows, depths, velocities, and volumes used for average and drought conditions are summarized in Table 10.

Table 10 Flows, Depths, Velocities and Volumes used in WASP Model

River Mile	Segment	Volume (m)	Depth (m)	Velocity (m/sec)	Tributary	Flow (cms)
213	1	2916469	2.33	0.43	Headwater	273.49
203	2	2427977.4	2.52	0.53		
197	3	3737187.3	3.50	0.68		
193	4	5808927.7	6.96	0.27		
190	5	6741527	7.53	0.28	Horse Creek	4.50
186	6	4740424.8	7.44	0.38		
182	7	3374938.1	7.20	0.37		
179	8	2684006.2	5.87	0.61	Butler Creek	0.85
175	9	4041461.1	6.20	0.69	Spirit Creek/Bear Island	2.15
169	10	3085140.2	5.74	0.75	Hollow Creek	2.41
164	11	3806153.5	6.98	0.65		0.00
159	12	3738075.5	5.84	0.65	McBean, Boggy Gut, Newberry	2.83
154	13	2841953.7	6.71	0.66	Upper Three Runs	3.77
150	14	5921744	5.79	0.66	Fourmile Creek	1.10
142	15	7914561.9	5.70	0.65	Beaverdam, Steel Creek	3.34
133	16	9761070	5.57	0.81	Sweetwater, Lower Three Runs	3.99
116	17	6340925.8	5.63	0.70	Brier Creek, SC	1.81
107	18	7804913.5	5.96	0.65	Savannah Watch Call	2.04
96	19	5184161.4	6.95	0.72	Brier Creek, GA	25.57
89	20	3849710.4	7.51	0.67		0.00
84	21	3905226.2	7.21	0.70	Savannah Dry Branch	4.90
79	22	3989054.6	7.20	0.67		0.00
74	23	4086191.3	7.03	0.66		0.00
69	24	3918680.3	7.15	0.73	Boggy Branch	4.39
64	25	4858331.9	7.56	0.61		0.00
59	26	4767405.5	7.70	0.61		0.00
54	27	5109182.5	7.85	0.56		0.00
49	28	4910985.4	7.94	0.55		0.00
44	29	3656800.3	7.84	0.76	Ebenzer, Lockners, Abercorn	12.46
39	30	8558710.5	6.36	0.94		0.00
29	31	10107590	5.73	1.45		0.00

The WCS model 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. Loadings for drought flow conditions include only dry deposition (11 ì g/m^2-yr) directly to water surfaces. These loadings to the tributary network are subject to reduction and volatilization losses in transport to the mainstem. Under drought flow conditions, these losses could be very significant due to the long travel times. Average reduction factors were calculated for each tributary inflow using a reduction rate constant of 0.1 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.

Figure 10 compares the model predictions versus what was measured in the field summer of 2000. Because of the severe drought condition in Georgia prior to and during the sample collection, the only loading source of mercury to the watershed was direct deposition on the water. This modeling exercise was done to aid in the parameterization and calibration of the water quality model.

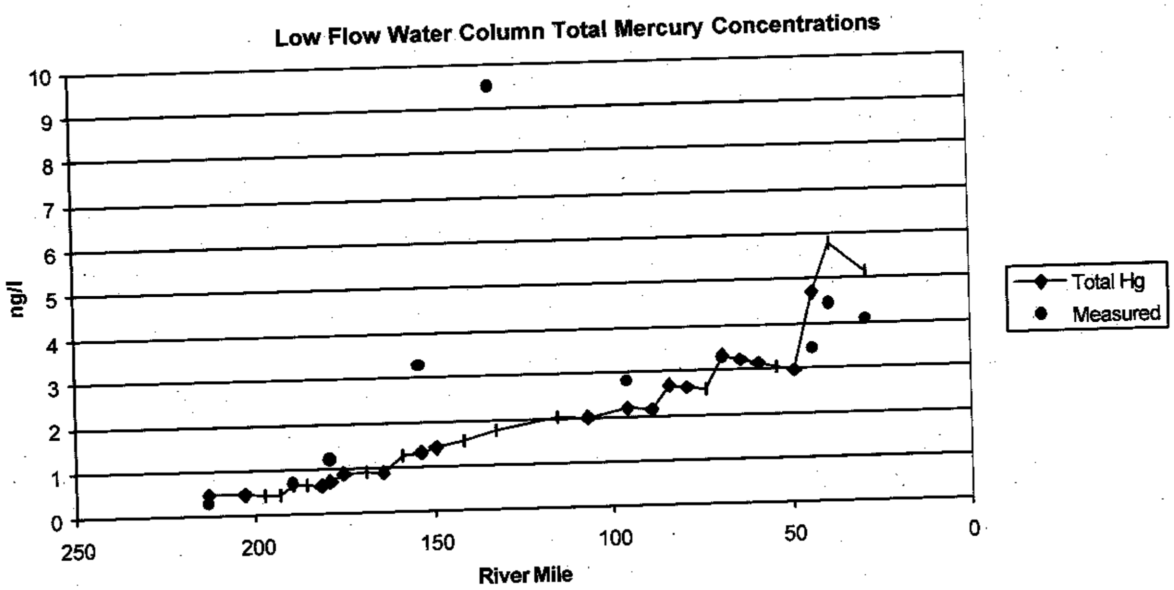

Figure 10 Model Predictions versus Observed Data for the Savannah River for Drought Conditions

Figure 11 provides a comparison of model predicted mercury sediment concentrations versus what was measured in the field.

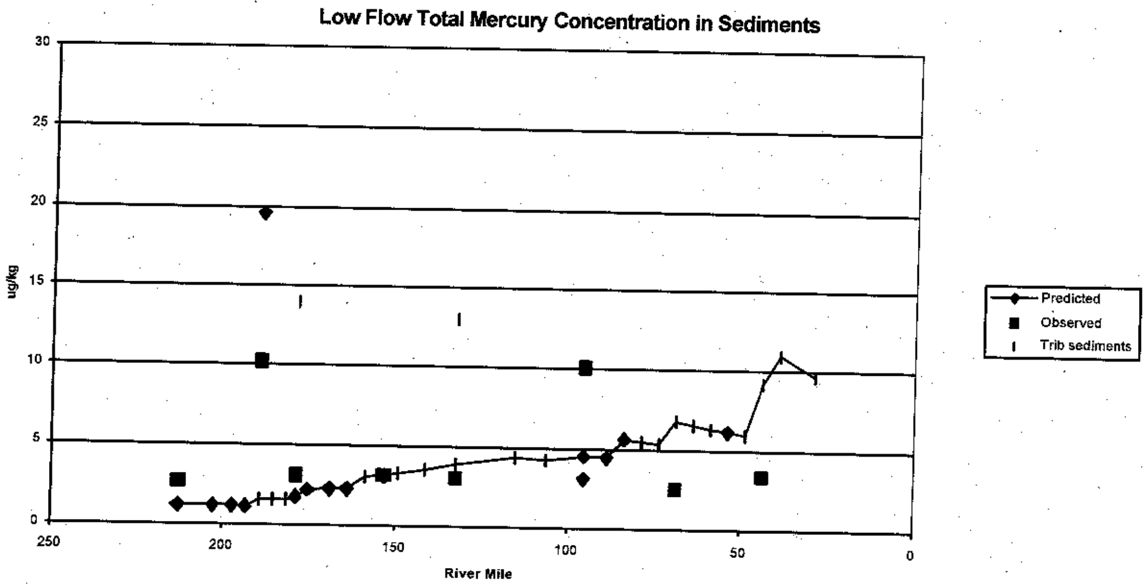

Figure 11 Model Predictions versus Observed Data for Total Mercury in the Sediments during Low Flow

Figure 12 provides the predicted water column concentrations under annual average load and flow for the Savannah 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 applicable water quality standard as interpreted by EPA.

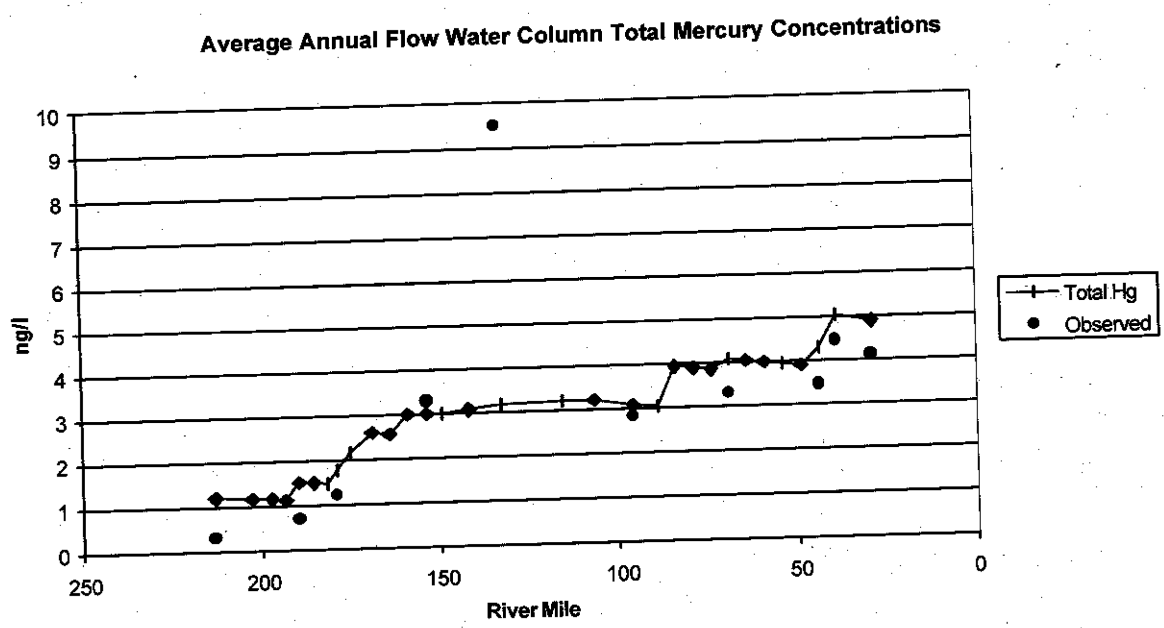

Figure 12 Model Predictions versus Observed Data for the Savannah River for Annual Average Flow

Figure 13 provides a comparison of model predicted mercury sediment concentrations versus what was measured in the field under annual average flow conditions.

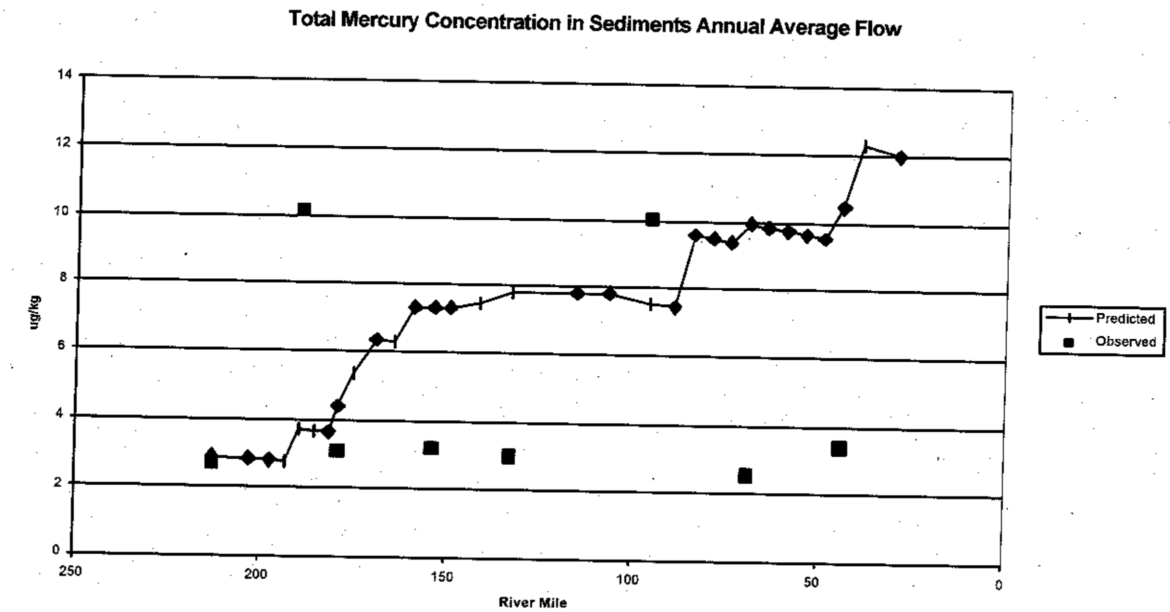

Figure 13 Model Predictions versus Observed Data for Total Mercury in the Sediments Annual Average Flow

9.2. *TMDL Determination*

To determine the total maximum load that can come into the Savannah River without exceeding the applicable water quality standard of 2.8 ng/l as interpreted by EPA, the current loading conditions are evaluated and the water column concentration in the River is determined using the modeling approach described above. This allows the development of a relationship between mercury loading and water column mercury concentrations in the River. 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 standard of 2.8 ng/l as interpreted by EPA. The TMDL is calculated as given below:

$$\frac{\textit{Highest Segment Concentration}}{\textit{Current Annual Average Load}} = \frac{\textit{WQS}}{\textit{TMDL Load}}$$

where:

Highest Segment Concentration = 5.0 ng/l
Current Annual Average Load to the Savannah River = 58.8 kilograms/year
Water Quality Standard = 2.8 ng/l as interpreted by EPA

The TMDL Load is calculated as 32.8 kilograms/year total mercury.

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 within the 100-kilometer boundary of the watershed, and as a Wasteload Allocation (WLA) to the point-source facilities in Georgia with a NPDES permit. 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 standard of 2.8 ng/l as interpreted by EPA.

The calculated allowable load of mercury that can come into the Savannah River without exceeding the applicable water quality standard of 2.8 ng/l as interpreted by EPA is 32.8 kilograms/year. Because this assessment indicates that 99% of the loading of mercury is from atmospheric sources, 99% of the allowable load will be assigned to the load allocation, and 1% of the available load will be assigned to the wasteload allocation. Therefore, the Load Allocation and Wasteload Allocation for the middle/lower Savannah River are:

Load Allocation (atmospheric sources) = 0.99 (32.8) = 32.5 kilograms/year

Wasteload Allocation (NPDES sources) = 0.01 (32.8) = 0.3 kilograms/year

The estimated current loading of mercury to the Savannah River from the surrounding watershed is 58.8 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 (58.8 kg/year) and the calculated allowable load (32.8 kg/year) is 26 kilograms/year. Since 32.8 kg/year is 56% of the estimated current loading of mercury, it is estimated that a 44% reduction in total mercury loading is needed for the middle/lower Savannah River to achieve a water column concentration of 2.8 ng/l.

10.1. Atmospheric Reductions

EPA estimates that approximately 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 as interpreted by EPA of 2.8 ng/l is to be attained. Based on the total allowable load of 32.8 kilograms per year, a 44% reduction of mercury loading is needed to achieve the applicable water quality standard as interpreted by EPA. An analysis conducted by the EPA Region 4 Air Program (Appendix A) concludes that an estimated 38% to 48% reduction in mercury deposition to the Savannah River watershed can be achieved by 2010. This conclusion was derived using the following methodology:

- The analysis used the results of national atmospheric mercury deposition modeling done for EPA's 1997 *Mercury Study Report to Congress* (referred to as *The Mercury Study*) to estimate the level of mercury deposited to the Savannah River watershed during the baseline period (1994-1996) from local sources (those in the watershed or within 100 km of the watershed), plus national and global sources. The analysis presumes that local sources primarily contribute to the loading by deposition of reactive gaseous mercury (RGM, divalent mercury gas), while national sources (i.e., at a distance >100 km) contribute particle bound mercury, and global sources contribute gaseous elemental mercury.

- The total RGM emitted from local sources was estimated for the baseline period from the emissions data files used to conduct *The Mercury Study* modeling. Local sources include categories such as hospital and medical waste incinerators, municipal waste incinerators, electric utility plants, a chlor-alkali chlorine production facility, and industrial and residential boilers.

- Future RGM emissions for 2010 from local sources were estimated using projected population growth as an indicator of growth in emissions over time, along with calculated reductions in mercury emissions due to MACT and Waste Combustion controls. Then an estimate of RGM deposition to the watershed was calculated for 2010 as proportional to local emissions.

- Combining the RGM value with an estimate of proportional national and global source contributions in 2010 developed the sum total deposition of mercury to the watershed in 2010. Comparison of the total value emitted in 1995/1996 with the total value calculated for emissions in 2010 indicates that a 38% to 48% reduction of mercury deposition is probable over the approximately 15 years from the baseline to 2010, based on currently promulgated standards in the Clean Air Act (MACT and Section 129.)

EPA expects these reductions to be achieved through full implementation of currently promulgated Clean Air Act (CAA) requirements under Section 112(d) Maximum Achievable Control Technology (MACT) and Section 129 Solid Waste Combustion, and Section 111 New Stationary Sources, at sources within the local airshed and nationally. The local airshed is defined in this TMDL to be the area within the watershed and a 100-kilometer boundary around the watershed. Additional reductions may be realized after further implementation of these requirements and other Clean Air Act sections.

The analysis conducted by the EPA Region 4 Air Program in Appendix A provides reasonable assurance that reductions needed in mercury loading can be achieved by reductions in mercury emissions from air sources within the local airshed and nationwide. There are, however, uncertainties in the air deposition analysis that should be recognized and are explained in Appendix A. 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 Section 129 or MACT regulations; 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, and that the Agency has reasonable assurance that needed air reductions will be achieved notwithstanding these uncertainties. It is anticipated, however, that additional data and information collected during implementation of this Phase 1 TMDL will allow a more certain analysis of attainable air reductions to be accomplished in the Phase 2 TMDL. EPA will determine at that time whether it is appropriate to revise the load allocation, or the wasteload allocation, to assure that the applicable water quality standard as interpreted by EPA will be achieved.

Future additional reductions in air deposition of mercury, beyond that presented in Appendix A, may occur through the implementation of voluntary programs as well as new CAA regulatory actions being considered by EPA. This TMDL does not currently depend on any additional future reductions beyond those identified in Appendix A. While it is not possible at this time to quantify these anticipated mercury reductions, an estimate of such quantification will be more likely during the Phase 2 TMDL. In December 2000, EPA announced that it intends to begin developing a regulation under CAA Section 112 to limit mercury emissions from coal-fired power plants. A proposal is expected in late 2003 and a final regulation at the end of 2004. As a group, these plants are the largest remaining source of mercury emissions in the United States. It is too early to estimate the reductions in mercury emissions that may result from regulation of electric utilities. In the meantime, we expect to see reduced emissions of mercury from this sector as a number of regulations are implemented to control SO_2 and NO_x, since some control technologies used to limit these pollutants collaterally reduce mercury emissions as well. A review of regulatory and related initiatives to reduce mercury emissions is provided in Appendix A. At this time, the overall, or relative percent, reduction in mercury emissions that may be realized in the future from the variety of activities underway or proposed is uncertain, and estimating such reductions is not appropriate for this TMDL. However, EPA is committed to continuing to track emissions of mercury and evaluate additional ways to reduce releases of mercury to the environment.

10.2. Allocation to NPDES Point Sources

This TMDL estimates that approximately 1% of the current loadings of mercury to the River are from NPDES point sources. For a discussion of EPA's basis for this estimate, see Section 8.2.2. At this time, one NPDES point source in Georgia has a permit to discharge mercury to the Savannah River. This facility is the Olin Corporation located in Augusta (NPDES Permit Number GA0003719). The TMDL also identifies 28 other NPDES point sources in Georgia for a wasteload allocation in this TMDL that Georgia and EPA believe have the potential to discharge significant amounts of mercury in their effluent. Twenty-four of these facilities have been identified because of their volume of flow (greater than 1 million gallons per day) or based on limited effluent data or the fact that they were rated as "major industrial" facilities by the State of Georgia. In making such "major industrial" facility determinations, Georgia takes into account factors such as toxic pollutant potential, public health impacts, and impacts on water quality. Another 4 facilities, considered to be "minor municipal" or "minor industrial" facilities, are also identified in the TMDL for a wasteload allocation. Data collected by EPA at these facilities in August 2000, indicate mercury concentrations in the facility's effluent above the applicable water quality standard as interpreted by EPA of 2.8 ng/l. EPA believes it is reasonable to assume that mercury is present in the discharge of these 29 NPDES permittees because of the persistent nature of mercury, and its pervasive presence in the environment, including rainwater. Table 11 (below) provides the list of NPDES facilities in Georgia that are provided a wasteload allocation in this TMDL.

There are approximately 50 other NPDES permitted facilities in Georgia located within the watershed. (See Appendix B for a list of all NPDES facilities in the watershed of the middle and lower Savannah River Basin provided to EPA by the Georgia Environmental Protection Division.) The TMDL does not provide a specific wasteload allocation to these facilities since they discharge less than 1 million gallons per day, or are considered "minor industrial" facilities. EPA assumes that these facilities are discharging mercury in concentrations below the 2.8-ng/l applicable water quality standard as interpreted by EPA, or are not adding concentrations of mercury above that in their source water. These facilities have a smaller flow rate (compared to the facilities identified above), and they are considered by the State of Georgia to be "minor municipal" or "minor industrial" facilities based on the factors set forth above (a "minor municipal" facility has flow less than 1 million gallons pre day). 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). EPA can consider this information in the revision of the TMDL in 2004, and will establish a wasteload allocation for any facilities for which data demonstrates mercury is present in their effluent at levels above the amount present in their source water.

In order to achieve the water quality standard as interpreted by EPA for mercury in the Savannah River, EPA has assigned to all NPDES point sources in the basin a cumulative wasteload allocation of 0.3 kg/year. For each of the 29 facilities identified as potential significant contributors of mercury, EPA is providing a specific 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 small share of the total mercury contributions to the Savannah River. However, EPA also recognizes that mercury is a highly dangerous 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 measure 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. For further discussion of the legal and policy rationale underlying these wasteload allocations, see the Response to Comments. 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 Georgia's water quality standard as interpreted by EPA to the discharger's effluent at the outfall point. For this TMDL, EPA has interpreted Georgia's water quality standard to be 2.8 ng/l. Therefore, under this option, the wasteload allocation for each NPDES point source identified in this TMDL would be the product of multiplying 2.8 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. The sum of these individual wasteload allocations is 0.001 kg/year, which is significantly less than the 0.3 kg/year cumulative wasteload allocation provided to all NPDES facilities. Under Option A, the individual wasteload allocations for each NPDES point source affected by this TMDL are provided in Table 11.

Table 11 NPDES Permitted Facilities and Assigned Wasteload Allocation at 2.8 ng/l

Major Municipal	NPDES ID	MGD	Kg/Yr
Augusta – Butler Creek	GA0037621	46.1	1.78E-04
Columbia County – Crawford Creek	GA0031984	1.5	5.81E-06
Columbia County – Reed Creek	GA0031992	4.6	1.78E-05

Columbia County – Little River	GA0047775	1.5	5.81E-06
Garden City WPCP	GA0031038	2	7.74E-06
Richmond County – Spirit Creek	GA0047147	2.24	8.67E-06
Savannah Crossroads (proposed facility)	GA0038326	1.2	4.64E-06
Savannah - President Street	GA0025348	27	1.04E-04
Savannah -Wilshire/Windsor	GA0020443	4.5	1.74E-05
Savannah Travis Field	GA0020427	1	3.87E-06
Sylvania WPCP	GA0021385	1	3.87E-06
Tybee Island	GA0020061	1	3.87E-06
Waynesboro	GA0020231	2	7.74E-06
Major Industrial/Federal			
DSM Chemicals Augusta Inc	GA0002160	3.765	1.46E-05
Fort James	GA0046973	18	6.97E-05
Georgia Power Vogtle	GA0026786	7.2	2.79E-05
International Paper Company	GA0002801	58.6	2.27E-04
Kemira	GA0003646	23	8.90E-05
PCS Nitrogen Fertilizer L.P.	GA0002071	1.152	4.46E-06
PCS Nitrogen Fertilizer LP	GA0002356	0.362	1.40E-06
Savannah Electric Effingham	GA0003883	108	4.18E-04
Stone Container	GA0002798	4.86	1.88E-05
Union Camp Corporation	GA0001988	28.09	1.09E-04
USA Fort Gordon	GA0003484	1.921	7.43E-06
USA Hunter AFB STP	GA0027588	0.544	2.11E-06
Significant Municipal Minors			
DHR Gracewood School Rec WPCP	GA0047279	0.5	1.94E-06
DHR Gracewood Hospital	GA0022161	0.003	1.16E-08
Significant Industrial Minors			
Olin Corporation Augusta	GA0003719	1.246	4.82E-06
Citgo Asphault	GA0004332	0.054	2.09E-07

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 29 facilities, result in a total loading of less than 0.3 kg/year. This assumption is based on information indicating wastewater treatment plants, which account for about 50% of 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 the cumulative effects of mercury minimization planning efforts are shown during the Phase 2 TMDL evaluation in 2004 not to be less than the cumulative 0.3 kg/yr wasteload allocation, EPA will provide a specific wasteload allocation to each facility to assure that the cumulative wasteload allocation will be attained.

Option B has a variety of different components that apply depending on whether the point source currently has a water quality-based effluent limitation for mercury in its NPDES permit. 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).

For the NPDES facility in Georgia with a current permit limit for mercury (Olin Corporation, NPDES Permit Number GA0003719), this TMDL assumes that the permit will include:

- a numeric water quality-based effluent limitation for mercury that is identical to its current water quality-based limit for mercury;
- a requirement to monitor for mercury using the version of EPA Method 1631 then in effect;
- a requirement to expeditiously develop a mercury minimization plan;
- a requirement to implement appropriate cost-effective mercury minimization measures identified through mercury minimization planning; and
- following completion of the mercury minimization plan, a numeric effluent limitation for mercury will be established in the permit that reflects the achievable level of mercury in the discharger's effluent upon implementation of appropriate, cost-effective minimization measures.

For NPDES facilities in Georgia identified in Table 11 (except for Olin Corporation, NPDES Permit Number GA0003719) this TMDL assumes that the permits will includes:

- 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, and the effluent concentration exceeds 2.8 ng/l).

- a requirement to implement appropriate cost-effective mercury minimization measures identified through mercury minimization planning if the monitoring data shows that an increased amount of mercury is present in the final effluent (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 point sources will not be authorized to discharge mercury above current effluent levels. Option B is predicated on the judgment that the 0.3 mg/year cumulative wasteload allocation will be achieved by applying waste minimization measures to current point source effluent conditions. 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) so that the cumulative wasteload allocation of 0.3 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 revise the TMDL 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).

<u>Other Assumptions Incorporated into this TMDL</u>.

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 Savannah 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).

This TMDL incorporates wasteload load allocations in the form of Option B only because each of the following factors is present:

- this TMDL addresses mercury, which EPA believes is best handled at these levels through waste minimization rather than through end-of-pipe treatment;
- the NPDES point sources, in the aggregate contribute only 1% of the total current mercury loadings to the Savannah River;
- EPA has reasonable assurance that implementation of pollution controls required under current law will result in reductions sufficient to achieve the load allocation of 32.5 kg/year assigned to air sources, thus authorizing a cumulative wasteload allocation of 0.3 kg/year.
- if the Savannah River were currently attaining water quality standards, mercury discharges from the identified NPDES point sources at levels equivalent to the cumulative wasteload allocation of 0.3 kg/year would not cause or contribute to an exceedance of applicable water quality standards for mercury as interpreted by EPA in the River; and
- 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 2.8 ng/l. Under these circumstances, waste characterization is a reasonable first step.

10.3. 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 Savannah River that are covered by this Phase 1 TMDL;
2. Take the lead on further characterization of air sources; and
3. Take the lead on revising the TMDL.

EPA expects Georgia to undertake the following responsibilities:

1. Identify the "major" NPDES facilities affected by this TMDL;
2. Identify other NPDES "minor" facilities affected by this TMDL which have the potential for a significant concentration of mercury in their effluent;
3. Modify the NPDES permits for the facilities identified in 1 and 2 above to reflect the conditions as identified in Section 10.2.;
4. Determine the frequency and duration of the mercury characterization to be undertaken by the facilities identified in 1 and 2 above;
5. 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 2.8 nanograms/liter through the mercury characterization effort in 4 above;

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

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

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

11. Assumptions with Respect to Loadings from South Carolina

This TMDL reflects EPA's assumption that concentrations of mercury in the South Carolina portion of the Savannah River will meet the applicable Georgia water quality standards at the South Carolina-Georgia border. The water quality standard that applies to this TMDL is Georgia's narrative water quality criterion for toxics, which provides that Georgia waters shall be free from toxic substances in amounts harmful to humans. EPA has interpreted that standard as 2.8 ng/l. As a technical matter, meeting Georgia's standard at the border is important because there is no hydrological difference between the South Carolina and Georgia portions of the Savannah River. Moreover, the fish travel freely across the border; they may be exposed to mercury in South Carolina, but be consumed by individuals in Georgia. Therefore, an important assumption of this TMDL is that concentrations of mercury at the Georgia/South Carolina border will not exceed 2.8 ng/l.

EPA believes that this assumption is reasonable because the TMDL already takes into account substantial reductions from South Carolina air sources located within the Savannah River watershed and within a 100 km radius of the watershed. The TMDL's gross load allocation to air sources also already accounts for emissions that EPA expects to remain from South Carolina air sources after application of air pollution controls. In addition, with respect to NPDES point sources in South Carolina, EPA believes that loadings from South Carolina can meet Georgia's water quality standard as interpreted by EPA for mercury at the border if South Carolina employs either of the two-wasteload allocation approaches discussed above for Georgia NPDES point sources. This TMDL expressly assumes that limitations on South Carolina point sources that reflect either approach will meet the requirements of 40 C.F.R. § 122.4(d), which states that South Carolina may not issue an NPDES permit unless it includes conditions that ensure compliance with Georgia's water quality standards. For a discussion of the bases for EPA's assumption, see the Response to Comments.

12. Appendix A

Appendix-A Savannah River Hg TMDL.PDF

Appendix B – List of NPDES Facilities in Middle/Lower Savannah Basin

Facility	NPDES Permit #	County
A&M Products Inc.	GA0036811	Jefferson
Air Liquid America	GA0046230	Chatham
Albion Kaolin Company	GA0002470	Richmond
Atlantic Wood Ind.	GA0047783	Chatham
Augusta Butler Creek	GA0037621	Richmond
Budget Inn Savannah	GA0034096	Chatham
Central of Georgia R/R	GA0002381	Chatham
Citgo Asphalt Refining Co.	GA0004332	Chatham
Coastal Water & Sewer Co.	GA02-234	Effingham
Columbia Co. Crawford	GA0031984	Columbia
Columbia Co. Detention Center	GA02-002	Columbia
Columbia Co. Health Dept.	GA0049735	Columbia
Columbia Co. Little River	GA0047775	Columbia
Columbia Co. Reed	GA0031992	Columbia
Crawford Eastside WPCP	GA0033693	Oglethorpe
CSR Aggregates Richmond	GA0037231	Richmond
Dearing LAS	GA02-007	McDuffie
DHR Gracewood Hospital	GA0022161	Richmond
DHR Gracewood Sch. WPCP	GA0047279	Columbia
DIT SRA#112/I-75 Visitor	GA0033278	Chatham
DIT Sylvania Welcome Stat	GA0030287	Screven
DOT Rest Areas #62 & #63	GA0047325	Columbia
DSM Chemicals Augusta, Inc.	GA0002160	Richmond
E.M. Industries Inc.	GA0034355	Chatham
ECC International Wrens	GA0048101	Jefferson
Effingham Elem School	GA0046990	Effingham
Engelhard Corp Chatham	GA0048330	Chatham
Fort James Company	GA0046973	Effingham
GAF Corporation Savannah Plant	GA0003841	Chatham
Garden City WPCP	GA0031038	Chatham
Georgia Pacific Corp.	GA0047007	Chatham
Georgia Pacific Gypsum	GA0001961	Chatham
Georgia Power Vogtle	GA0026786	Burke
Grovetown LAS	GA02-222	Columbia
Gulfstream Aerospace Corp	GA0003255	Chatham
Harlem WPCP	GA0020389	Columbia
Hephzibah WPCP	GA0049433	Richmond
Hercules	GA0026867	Chatham
Herty Foundation Savannah	GA0002402	Chatham
Hiltonia LAS	GA02-033	Screven
Intermarine USA	GA0003671	Chatham
International Paper Co.	GA0037711	Burke
International Paper Co.	GA0002801	Richmond
Kemira	GA0003646	Chatham
King Division of Spartan Mills	GA0004049	Richmond
Martin Marietta Aggr.	GA0002909	Richmond
Martin Marietta Matl Inc	GA0037346	Columbia

Olin Corporation Augusta	GA0003719	Richmond
PCS Nitrogen Fertilizer LP	GA0002071	Richmond
PCS Nitrogen Fertilizer LP	GA0002356	Chatham
Peridot Chemicals	GA0002925	Richmond
Pooler/Bloomingdale Req	GA0047066	Chatham
Richmond Co Spirit Cr.	GA0047147	Richmond
Rincon	GA0046442	Effingham
Sardis WPCP	GA0020893	Burke
Savannah Elec Effingham	GA0003883	Effingham
Savannah Elec Riverside	GA0003751	Chatham
Savannah Elec Wentworth	GA0003816	Chatham
Savannah Electric & Power Co	GA0047708	Chatham
Savannah President St	GA0025348	Chatham
Savannah Sugar Refinery	GA0003611	Chatham
Savannah Travis Field	GA0020427	Chatham
Savannah Wilshire/Windsor	GA0020443	Chatham
Savannah Yacht Club	GA0033189	Chatham
Solutia Inc	GA0002178	Richmond
South Carolina Electric	GA0003786	Richmon
Southern Aggregates Columbia	GA0036790	Columbia
Southern States Phosphorous & Fert	GA0002437	Chatham
Springfield	GA0020770	Effingham
Stone Container Corp	GA0002798	Chatham
Sylvania Yarns Systems Inc	WQ-IP-047	Screven
Thermal Ceramics Inc	GA0002488	Richmond
Thiel Kaolin Hobbs	GA0032981	Warrant
Tybee Island	GA0020061	Chatham
Union Camp Corporation	GA0001988	Chatham
USA Ft. Gordon	GA0003484	Richmond
USA Hunter AFB STP	GA0027588	Chatham
Waynesboro WPCP	GA0020231	Burke
Wrens WPCP	GA0021857	Jefferson

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