State of Mississippi
Water Quality Assessment
2004 Section 305(b) Report

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Mississippi Department of
Environmental Quality

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ABSTRACT

Section 305(b) of the Federal Clean Water Act (CWA) requires each state to describe the quality of its water resources, both surface water and ground water, in a report for the United States Environmental Protection Agency (EPA), Congress, and the public on a biennial basis. The Mississippi Department of Environmental Quality (MDEQ), as the lead agency for environmental protection in Mississippi, is the state agency responsible for generating this report. The purpose of Mississippi's 2004 Water Quality Assessment §305(b) Report is to comprehensively describe for EPA, Congress, and the public the status of the quality of the state's waters. This 2004 §305(b) report fulfills all reporting requirements under §305(b) of the CWA. Along with the water quality assessment information, the report also describes the state's assessment methodology and gives the causes and sources of pollution for those waters identified as impaired. Additionally, Mississippi's water quality monitoring program is described in this report. To fulfill the ground water portion of §305(b) reporting requirements, MDEQ is submitting a separate report assessing the status of ground waters in Mississippi.

Table of Contents

Table of Tables

Table of Figures

PART I

INTRODUCTION

Introduction

Background and Purpose

According to the Federal Clean Water Act (CWA), § 305(b) requires each state to describe the quality of their water resources, both surface water and ground water, in a report for the United States Environmental Protection Agency (EPA), Congress, and the public on a biennial basis. The Mississippi Department of Environmental Quality (MDEQ), as the lead agency for environmental protection in Mississippi, is the state agency responsible for generating this report. For more information on the agency's mission, organizational structure, programs, and contacts, visit MDEQ's web site at www.deq.state.ms.us.

Historically, §305(b) reporting has involved comprehensive statewide assessments every two years (on even years) since 1972 when the CWA was passed. Beginning in 2000, MDEQ began performing §305(b) assessments annually, reporting on the status of individual river basins in accordance with the rotating basin cycle of MDEQ's newly-adopted Basin Management Approach. In this type of water management approach, phased water quality management activities are rotated among five hydrologic groupings of river basins in the state. This basin-wide approach allows the state to focus its resources in smaller geographical areas/basins in a given year in order to provide a more thorough characterization for that area. Water quality assessment and reporting annually in compliance with basin rotation cycles is a procedure strongly endorsed by EPA. MDEQ adopted this annual reporting option for the §305(b) assessment in 2000 and has conducted basin assessments since that time.

Within this annual basin reporting format, however, states must still complete a comprehensive statewide assessment report every five years. In addition, since ground water aquifers do not adhere to the same boundaries as drainage basins, assessments for ground water do not fall easily into the rotating basin approach to water quality management and assessment. As such, §305(b) ground water assessments are updated every five years. Thus, with Mississippi's most recent statewide report being the *Mississippi 1998 Water Quality Assessment §305(b) Report*, this 2004 report is designed to be comprehensive in nature based upon the most current updated information applicable for statewide assessment of Mississippi's surface and ground waters. To fulfill ground water reporting requirements according §305(b) of the CWA, MDEQ is submitting a separate report entitled: *State of Mississippi Ground Water Quality Assessment* (MDEQ 2004).

For §305(b) assessment, surface water quality data and other environmental information collected on the state's streams, rivers, lakes, estuaries, and coastal waters are compiled, summarized, and analyzed. In addition, ground water data and information are also assessed for the aquifers in the state. Monitoring data are routinely collected by MDEQ statewide through several different monitoring activities. These activities include an Ambient Fixed Station Monitoring Network, Basin Monitoring Networks, Agricultural Chemical Ground Water Monitoring Network, intensive surveys and other special water quality studies. Data are used for many varied purposes, and are collectively analyzed and considered for assessment as part of the §305(b) water quality assessment process. In order to provide a thorough assessment, data are also solicited from and provided by other agencies, institutions, and private entities that conduct monitoring activities in the state.

The purpose of Mississippi's 2004 Water Quality Assessment §305(b) Report is therefore to comprehensively describe for EPA, Congress, and the public the status of the quality of the state's waters. Along with the water quality assessment information, the report also describes the state's assessment methodology and gives the causes and sources of pollution for those waters identified as impaired. Additionally, Mississippi's water quality monitoring program is outlined in this report.

This 2004 §305(b) report is a comprehensive statewide report of surface water quality representing a five-year data reporting window of 1999–2003. Different from the individual basin §305(b) assessments of 2000–2003, this report presents a compilation and summary of data collected statewide. Only data collected within the reporting window are used for assessment. In general, since 2002, more rigorous data quality and quantity requirements have been employed by MDEQ to ensure only scientifically-defensible data are used in the §305(b) assessment process. The use of more rigorous data quantity and quality requirements has resulted in a reduction in the amount of data available for use in §305(b) assessment but confidence, reliability, and accuracy in the assessment decisions and corresponding §303(d) listing decisions for impaired waters is greatly enhanced.

For the §305(b) report, all data and information are considered for assessment but only water quality data that meet data quantity and quality requirements according to the state's Consolidated §305(b) Assessment and §303(d) Listing Methodology (CALM) are assessed. Assessment involves analysis of monitoring data and information to determine if a water body meets its designated use or uses. Water bodies are assigned one of more designated use(s) as outlined in Mississippi's water quality standards document. These designated uses are: aquatic life support, water contact recreation, fish/shellfish consumption, and/or drinking water supply. Waters assessed as not attaining their use(s) in the §305(b) assessment process become candidates for listing on Mississippi's §303(d) list.

Mississippi's Surface Waters

Mississippi lies predominantly within the East Gulf Coastal Plain physiographic region except for a small part of northeastern Mississippi which is part of the Interior Low Plateaus Province. The state is characterized with low to moderate topographic elevations, and slopes generally from the north southward to the Gulf of Mexico. The climate of the state is humid and subtropical with climatic variations influenced by the large land mass to the north and the Gulf to the south. Mean annual precipitation ranges from 50 inches in the north to 65 inches near the coast. Most rainfall occurs in the spring for the majority of the state; but on the coast, July, August and September often have more rainfall. Fall is the driest season statewide with streams and rivers generally reaching their lowest stage for the year during October. Temperatures in the state vary with latitude and in the winter average from 31^{o}F in the north to 43^{o}F on the coast. Summer temperatures throughout Mississippi average 90^{o}F with frequent excursions above 100^{o}F especially in the south.

Mississippi has a population in excess of 2,844,000 (2000 Census) and covers a surface area of 47,689 square miles. The state is divided into ten major stream basins with a total length of

streams in excess of 86,000 miles. Of these miles, 37% are perennial characterized by flowing water throughout the year. Intermittent streams which flow during rainy seasons but are dry during summer months represent 63% of Mississippi's total stream mileage. There are over 2,400 miles of man-made ditches and canals in the state. The Mississippi River (approximately 400 miles) and the Pearl River (approximately 80 miles) form Mississippi's border with Arkansas and Louisiana on the west side of the state. The state is covered with hundreds of publicly owned lakes, reservoirs and ponds covering a combined area of approximately 246,000 acres. According to landuse information, wetlands cover an estimated 2,728,000 acres with tidal marsh comprising approximately 53,000 acres. The southern edge of Mississippi's contiguous land mass borders the Mississippi Sound with the coastline along the Mississippi Sound totaling approximately 86 miles. The total area of estuarine waters is approximately 758 square miles. This area includes the St. Louis Bay, Back Bay of Biloxi, Pascagoula Bay, Mississippi Sound, and the portion of the Gulf of Mexico that extends three miles south of the Barrier Islands. A tabular summary of the information given above can be found in Table 1.

Table 1: Mississippi Atlas

State Population	2,844,658
State surface area (square miles)	47,689
Number of river basins	10
Total number of river and stream miles*	86,500
- Number of perennial river miles (subset)*	31,738
- Number of intermittent stream miles (subset)*	54,762
- Number of ditch and canal miles	2,418
Number of lakes/reservoirs/ponds (.>25 acres)	1,450
Acres of lakes/reservoirs/ponds (>25 acres)	246,651
Square miles of estuaries/harbors/bays	758
Number of coastal miles	86
Acres of freshwater wetlands	2,728,072
Acres of tidal wetlands	52,875

*From EPA NHD estimates

All waters of the state are classified for uses consistent with the goals of the Clean Water Act. Waters are classified according to one or more of the following classifications: Public Water Supply; Shellfish Harvesting; Recreation; Fish and Wildlife; and Ephemeral Stream. These classifications are explained fully in the State's water quality standards (WQS), *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2003) available on MDEQ's web site. A summary of classified uses of State waters is found in Table 2.

Table 2: Total Sizes of Waters According to Use Classification

Classified Use	**Total Size According to Classification**			
	Rivers (miles)	Lakes (acres)	Estuaries (sq. miles)	Coastal Shoreline (miles)
Fish & Wildlife[a]	85,311	117,696		
Public Water Supply[ab]	33	13,219		
Recreation[b]	1,043	93,159	720	74
P. Water Supply & Rec.[ab]		22,577		
Shellfish Harvesting[bc]			38	8
Recreation/Shellfish[b]				4
Ephemeral	113			
Total:	86,500	246,651	758	86

[a]Also suitable for Secondary Contact Recreation
[b]Also suitable for Fish and Wildlife
[c]Also suitable for Recreation

PART II

SURFACE WATER ASSESSMENT METHODOLOGY AND STATEWIDE ASSESSMENT SUMMARY

Assessment Methodology

Introduction

Surface water quality assessments are technical reviews of physical, chemical, bacteriological, biological, and/or toxicological monitoring data as well as other information to determine the quality of surface water resources. A primary goal of surface water quality assessments, as required by §305(b) of the Clean Water Act (CWA), is to determine if the state's surface waters are meeting the fishable and swimmable goals of the CWA. A secondary goal of the §305(b) assessment process is to provide the necessary information on water body impairment for use in the development of the state's CWA § 303(d) list.

Surface water quality assessments are general characterizations of water body health and involve comparing data to the state's Water Quality Standards (WQS). Mississippi's WQS specify the appropriate levels for which various water quality parameters or indicators support a water body's designated use(s). Each use assessed for a water body is determined to be either "Attaining" or "Not Attaining" in accordance with the applicable water quality standards and EPA guidelines for assessments pursuant to §305(b). A water body's use is said to be impaired when, based on current and reliable site-specific data of sufficient quantity, quality, and frequency of collection, it is not attaining its designated use(s). Where data and information of appropriate quality and quantity indicate non-attainment of a designated use or uses for an assessed water body, the water body will be placed on the *Mississippi 2004 Section 303(d) List of Impaired Water Bodies* (MDEQ 2004) and be subject to further monitoring and/or Total Maximum Daily Load development. Assessments are necessary to answer basic questions like:

> *Does the water body support a healthy and diverse aquatic life for fish and other aquatic organisms?*
> *Is a water body safe for swimming?*
> *Are fish caught in this water body safe to eat?*

To achieve the goals of the CWA, it is necessary to have requirements and guidelines for how water quality data are collected, analyzed, and assessed. A consistent and scientifically-defensible assessment methodology provides the mechanism to enable and support sound decision-making. The U.S. Environmental Protection Agency (EPA) has developed, with state and public input, a national guidance document for the §305(b) assessment and §303(d) listing process. CALM, finalized by EPA in 2002, provides a framework for states to document and report how they collect and use water quality data and information for their §305(b) reporting and §303(d) listing process. EPA recommended the use of the CALM guidance for the 2004 assessment but also allowed states flexibility and the option of using previous §305(b) guidance for water quality assessment purposes. For the Mississippi 2004 assessment, MDEQ has developed a document entitled *MISSISSIPPI CALM (Consolidated Assessment and Listing*

Methodology) 2004 Assessment and Listing Cycle (MDEQ 2004) which can be found in its entirety in Appendix A. The purpose of this document is to specify MDEQ's data requirements and assessment guidelines for the 2004 §305(b) assessment and §303(d) listing cycle. Mississippi's CALM document primarily reflects EPA CALM recommendations but also retains some elements of the 1997 §305(b) guidance.

Water Quality Standards

Surface waters in Mississippi are used for a number of purposes. Waters are used for drinking and food processing, shellfishing, recreation, fishing, and aquatic life support. Water bodies are classified and assigned various use classifications by MDEQ in the state's Water Quality Standards based on the use of the water body identified by the public and other entities. The use classifications and associated EPA designated uses for water quality assessment purposes recognized by the State of Mississippi are as follows:

Use Classification	**EPA Associated Designated Use**
Public Water Supply	Drinking Water Supply
Recreation	Contact Recreation
Fish and Wildlife	Aquatic Life Use, Fish Consumption
Shellfish Harvesting	Shellfish Consumption

Most of Mississippi's waters are classified as Fish and Wildlife. For each of the use classifications listed above, there are various water quality criteria or standards that apply to those water body uses. These criteria are used in the assessment process. A water body (part or all of a stream, river, lake, estuary or coastline) should support one or more of these uses. A complete description of Mississippi's water body use classifications and water quality standards can be found in the state's WQS.

Mississippi 2004 §305(b) Assessment Methodology

Water quality data and information can take many different forms, from routine fixed network monitoring and intensive surveys with extensive water chemistry, biology, and physical data sampling to simple observations. For §305(b) Water Quality Assessment Reports, MDEQ assesses the state's streams, rivers, lakes, and estuaries by considering all existing and readily available information. This process is not limited to data collected only by MDEQ. MDEQ solicits available water quality data and information from various state, federal, public, and private sources. Data solicitation is facilitated through Mississippi's Basin Management Approach. The public may also submit water quality data for consideration at any time. This broad spectrum of available data is considered when making water quality assessments.

Data Representativeness

Previous EPA §305(b) guidance, *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Supplement* (EPA 1997), promoted the use of two types of assessments: "evaluated" and "monitored". MDEQ has historically used evaluated and monitored assessments to make broader water quality statements to compensate for historically limited monitoring coverage. A water body assessed using evaluated data is defined as one for which the use support decision is based on information other than site-specific monitoring data. Such information includes land use surveys, incidents of pollution spills/fish kills, point source discharge data, and monitoring data greater than 5 years old. These data generally have a greater degree of uncertainty in characterizing in-stream water quality condition than assessments based upon site-specific in-stream monitoring data. Prior to 2002, this evaluated information was used in the assessment process as specified by EPA §305(b) guidance. Recognizing the varying uncertainty of data and information potentially used by states in the assessment process, §305(b) guidance recommended assigning a rating for the level of information, or data confidence, used in the assessment. MDEQ reported these evaluated waters in the state's 1996, 1998, and 2000 §305(b) reports as having a low confidence rating due to the lack of substantiated information supporting these assessments. However, according to the EPA Region IV mandates, any water quality impairments identified in §305(b), low confidence or not, are still subject to §303(d) listing. As a result, Mississippi has a very large §303(d) list. The state has and still is committing monitoring resources, at the expense of other statewide water quality monitoring needs, to address the many evaluated waters for which no impairment may actually exist.

Data previously used for evaluated assessments will still be considered and used as screening information in the §305(b)/§303(d) assessment and listing process. However, for 2004, as in 2002, MDEQ will only use this information for a non-attainment assessment decision when those data and information demonstrate compelling evidence of degradation of the overall condition of a water body, as described in Mississippi's CALM document, and data quality documentation is available. If there is no documented data quality information or data do not meet data quality objectives, the water body is placed on a targeted monitoring list to confirm the actual water quality condition. MDEQ will use site-specific monitoring data of sufficient quality and quantity for making final water quality §305(b) assessments and §303(d) listing decisions.

Section 305(b) water quality assessments are based on one or more different types of monitoring data that have been grouped together by water body and then analyzed collectively in order to determine the water quality status or condition of the water body. Monitoring data used for §305(b) assessments primarily consist of one or more of the following data types: physical/chemical, biological, habitat, bacteriological, and/or toxicological. Current site-specific ambient monitoring data are believed to most accurately portray water quality conditions. A water body is considered monitored if sufficient (both in quantity and quality) physical, chemical, biological, bacteriological, and/or fish tissue data were collected on the water body at any time within the data

window established for the §305(b) reporting period. Data used in §305(b) assessments are considered representative if the data are collected within the most recent five years prior to the assessment. For the 2004 §305(b) report, this data window is from 1999-2003.

Physical and chemical data include such parameters as pH, temperature, dissolved oxygen, nutrients, suspended solids, turbidity, specific conductance, and certain water column toxicants. Chemical monitoring data are compared to applicable water quality numeric criteria as found in MDEQ's most current version of the WQS document. This allows MDEQ to determine which pollutant specific numeric criteria are violated. The specific water quality criteria used for various parameters can be found in Mississippi's WQS. These criteria are used for aquatic life, recreation, shellfish consumption, and drinking water use assessment.

Biological data include the community structure of aquatic insects and other benthic macroinvertebrates, fish, or algae as well as the condition of biological habitat in the water body. The biota of a water body reflect the physical, chemical, and biological integrity of the system and are considered to be direct indicators of Aquatic Life Use Support (ALUS). For Mississippi §305(b) assessments, benthic macroinvertebrate community data are the biological indicator primarily used to determine ALUS. Biological data collected as part of a MDEQ statewide biological monitoring project to develop a Mississippi Index of Biological Integrity known as M-BISQ (Mississippi Benthic Index of Stream Quality) have been the primary source of data for ALUS assessments in Mississippi waters, due to rigorous project data quality objectives and a robust data set. For a description of the M-BISQ project, see Part IV, Intensive Surveys and Special Project Monitoring.

Bacteriological data include water column surveys for fecal coliform bacteria or other bacteriological indicators. These data are used to assess the recreation use for waters to protect the public in swimming and other water related activities. For the 2004 §305(b) assessment, the only data meeting Mississippi CALM requirements were from MDEQ project sampling to address statewide §303(d) listed waters with pathogens indicated as the cause of impairment. A description of this project can be found in Part IV, Intensive Surveys and Special Project Monitoring. Fecal coliform data are also used indirectly for assessment of the Shellfish Consumption use. Shellfish Consumption use assessment is accomplished through the review of the current shellfish harvesting classification of Mississippi coastal waters established by the National Shellfish Sanitation Program (NSSP) in Mississippi. The NSSP is administered by the Mississippi Department of Marine Resources (MDMR), and classifies coastal waters in Mississippi as either approved, conditionally approved, restricted or prohibited based on results of fecal coliform monitoring conducted by MDMR.

Fish tissue data include the analyses of fish flesh for the presence of toxic organic chemicals and metals. For this report, the Fish Consumption Use is assessed only for non-attainment based on whether MDEQ and the Mississippi Department of Health have issued a Fish Tissue Advisory for a water body in the state. If an advisory for restricted

or no consumption is in place and is supported by water body-specific fish tissue monitoring, the water body is assessed as not attaining this use. Due to the lack of extensive fish tissue data statewide that are analyzed for a complete suite of parameters, water bodies could not be comprehensively assessed.

The length of record of the data, the type of data and the frequency of data collection are considered when making use support determinations. According to the Mississippi CALM, at least 20 data points over a two-year period for conventional parameters and 10 data points within three years for metals are required for assessment. For bacteria data, a minimum of five fecal coliform samples collected over a 30-day period in each season (contact and non-contact) over two years are necessary for bacteriological assessment.

In general, data utilized in §305(b) assessments are collected, analyzed, and interpreted in a manner consistent with state and EPA guidelines.

Data Quality

The ability to make meaningful and scientifically defensible statements about the overall status of a water body depends directly on the vigor and quality under which the data are collected, analyzed, and reported. Data generated by MDEQ, other agencies, and individuals should be of the quality and quantity necessary to make credible and realistic assessment decisions on the condition of the state's waters. Whenever possible, data need to be of the highest quality and developed using sampling and analytical protocols and standard operating procedures recognized by state and EPA quality assurance (QA) program plans. Data will not be assessed from data-reporting entities that do not provide data quality information or documented SOPs or procedures, if requested by MDEQ.

Water Body Use Support Determination

Beginning in 2002, in accordance with recommendations from EPA's new Consolidated §305(b) Assessment and §303(d) Listing guidance document, *Consolidated Assessment and Listing Methodology, Toward a Compendium of Best Practices* (EPA 2002), MDEQ began using more rigorous data sufficiency requirements for the §305(b) assessment process. The use of more stringent data quality and quantity requirements to identify assessable data has resulted in the reduction of the amount of data available for assessment decisions but allowed for more accurate assessments than previous §305(b) reports. Although all data are considered for assessment, once a data set is reviewed, all data and information collection activities may not meet the rigorous quality, quantity, and sampling frequency requirements given in Mississippi's CALM. However, these data and information collection activities still serve a useful purpose and MDEQ will not disregard these data in the §305(b) assessment process. Data and information that do not meet the requirements stated in the CALM methodology will be used for a listing decision when those data demonstrate compelling evidence of the condition of a water body (i.e., catastrophic or obvious environmental or public health impacts). In addition,

these data and information may be used to target additional monitoring in other MDEQ programs (e.g., permitting, nonpoint source, complaint response and resolution, etc.).

Use support decisions are made based on a cumulative evaluation of all the monitoring data coupled with any other existing and readily available information for an individual water body. A detailed description of the assessment methodology used by MDEQ for the 2004 §305(b) Assessment and §303(d) Listing process is provided in Appendix A. The Mississippi CALM, describes the minimum data quantity and quality needed to meet data sufficiency requirements for assessment. Decision-making criteria for attainment and non-attainment of each designated use are also presented in this document. These guidelines apply, as appropriate, to rivers, streams, lakes, estuaries, and coastal waters.

Within the WQ assessment process, a certain degree of uncertainty is inherent for any assessment decision made. The correctness of data analysis is directly dependent on study design, data quantity, data quality, and the accuracy and rigor of the methods used in collection, laboratory analysis, and the assessment methodology process itself. All data used to make formal assessments of the quality of the state's waters, regardless of its source, will be evaluated in keeping with the requirements and guidelines contained in Mississippi's CALM document.

Assessment Database (ADB)

All information collected during the assessment process is placed in Mississippi's version of EPA's Assessment Database (ADB) which has been customized to facilitate Mississippi's assessment and reporting needs. The ADB is EPA's replacement of the Waterbody System (WBS) and is useful for maintaining the quality and consistency of water body assessments. Information placed in ADB for each water body includes location and description, assessment types, assessment category (1-5 according to EPA's Integrated Listing protocol), use support determinations, causes of impairment, and sources of impairment. The ADB allows for the linking of impairment causes and sources with different uses for the same water body and is used to generate the various required summary tables for each water body type. These tables include: Summary of Water Body Categories, Individual Use Support Summaries, and Summaries of Impairment Causes and Sources. Electronic ADB files for the §305(b) assessment are submitted to EPA for compilation with data from the other states.

All water bodies cataloged in the ADB are also geo-referenced using the Reach Indexing Tool (RIT) provided by EPA. Using the RIT, in conjunction with the National Hydrograph Dataset (NHD) coverage, all water body assessments are assigned a unique identifier or reporting unit (RU). MDEQ assigns reporting unit Id's according to where the water body is located within an 11-digit watershed. The 11-digit watershed is referred to as the assessment unit (AU). It is the combination of the assessment unit and reporting unit that is cataloged in the ADB to store and track assessment information. All geo-referenced information is provided to EPA electronically.

Statewide Assessment Summary

Designated Use Support-Rivers and Streams

For the 2004 §305(b) Water Quality Assessment Report, the Mississippi Department of Environmental Quality (MDEQ) assessed approximately 24% (7,692 miles) of Mississippi's total 31,738 miles of perennial streams and rivers for one or more uses. The status of water quality on the remaining 76% (24,046 miles) of the state's perennial rivers and streams is unknown. All assessments were made using monitoring data collected on the major tributary within an 11-digit watershed.

The low percentage of assessed waters relative to the total stream and river mileage (only 9% when the total 86,500 miles of perennial and intermittent rivers and streams are considered) in the state is not an indication of MDEQ's lack of monitoring efforts. In fact, for this reporting period, MDEQ monitored the mainstem tributary for 94% of the state's 482 11-digit watersheds. These monitoring efforts entailed data collected at more than 790 sites in the state (Figure 1). MDEQ also monitored an additional 140 sites on selected large rivers, lakes, and estuaries as part of its Ambient Fixed Station Monitoring Network. Unfortunately, the mathematical calculation of miles monitored/assessed is surprisingly low when compared to the total miles of water resources in the state. The resulting assessed mileage is not a fair depiction of the enormous effort and resources expended by MDEQ to monitor the state's surface water resources. It is more a factor of the amount of water resources in the state and limitations recommended by EPA §305(b) guidance on assigning assessed mileage to a monitoring station. As Mississippi's situation attests, it is not practical for a state to monitor all waters for a comprehensive assessment when the state has 86,500 miles of streams and rivers. MDEQ recognizes the need for a combination of monitoring and assessment approaches to address this situation in future assessments. One such tool is probability-based monitoring surveys that are a more cost-effective and efficient way to produce a statistical estimate, of known confidence, describing the condition of a resource based on a random sampling design. Recommended by EPA for §305(b) assessments, a state can assess 100% of its waters utilizing a probabilistic approach. MDEQ is currently using this methodology as part of the EPA National Coastal Assessment Program and is interested in expanding the probabilistic approach to the state's freshwater resources.

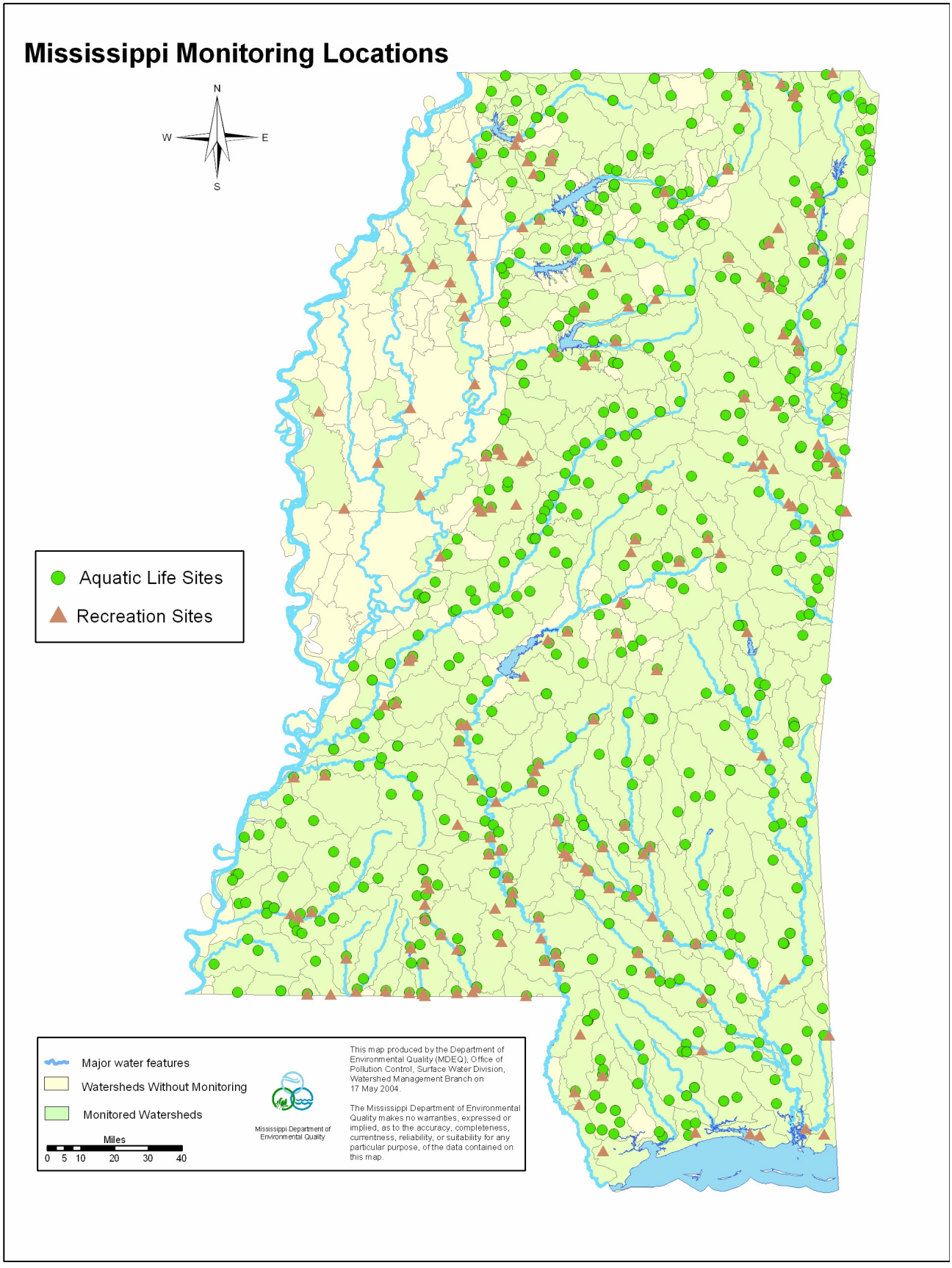


Figure 1: Monitoring Locations in Mississippi

A summary of use support for the state's assessed rivers and streams is found in Table 3 and Figure 2. For water bodies with multiple assessed uses, the EPA Assessment Database (ADB) summary under represents the actual amount of attaining mileage assessed. For water bodies with multiple uses assessed, the ADB automatically assigns the water body mileages according to the Integrated Reporting category system. This categorization system assigns a water body to only one of five categories:

Category 1: Attaining all uses
Category 2: Attaining some uses but insufficient information for assessment of other uses
Category 3: Insufficient information to assess any use
Category 4: Not attaining a use but a TMDL is not necessary
Category 5: Not attaining a use and a TMDL is needed

EPA defines a Category 1 water as having sufficient data to prove there is no impairment for any potential designated use of that water body. Due to EPA requirements for Category 1 that all uses are assessed, Mississippi currently has no water bodies assigned to Category 1. If a water body is attaining one use but is not attaining another use, it is assigned to one of the not attaining categories (Category 4 or 5). Therefore, the amounts of waters attaining a designated use are under represented in the following table.

Of Mississippi's assessed stream and river miles, approximately 9% are in category 2 for attaining some uses but unknown for remaining water body uses, and 2% are in category 4 as not attaining one or more designated uses but a TMDL is not necessary. Waters in category 5 as not attaining and needing a TMDL make up 13% of the assessed water bodies. The status of the remaining 76% of water bodies in Mississippi is unknown and these waters are reflected in category 3. Of the 4,066 miles of waters in category 5, 77% (3,119 miles) are assessed as being biologically impaired. Stressor Identification studies will be conducted to determine the actual cause and source of the impairment for these waters. Water bodies in category 5 can be found listed by river basin in Section A (Water Bodies with Monitoring Data) of the 2004 §303(d) list. Maps of all use support assessments and monitoring locations where data were collected for this assessment are provided by basin in an addendum to this report.

Table 3: Summary of Use Support Assessments for Rivers and Streams

Degree of Use Support	Total Size in Miles
Category 1: Attaining All Uses	
Category 2: Attaining Some Uses but Unknown for Other Uses	2,951
Category 3: Unknown/Insufficient Data for Assessment	**78,808**
Intermittent Miles	54,762
Perennial Miles	24,046
Category 4: Not Attaining – No TMDL Needed	**675**
A. TMDL Completed	655
B. Impairment Caused by Pollution	0
C. Expected to Attain Use before Next Assessment	20
Category 5: Not Attaining – TMDL Needed	**4,066**
A. Pollutant Identified	947
B. Biological Impairment- Cause Unknown	3,119
Total Miles	**86,500**

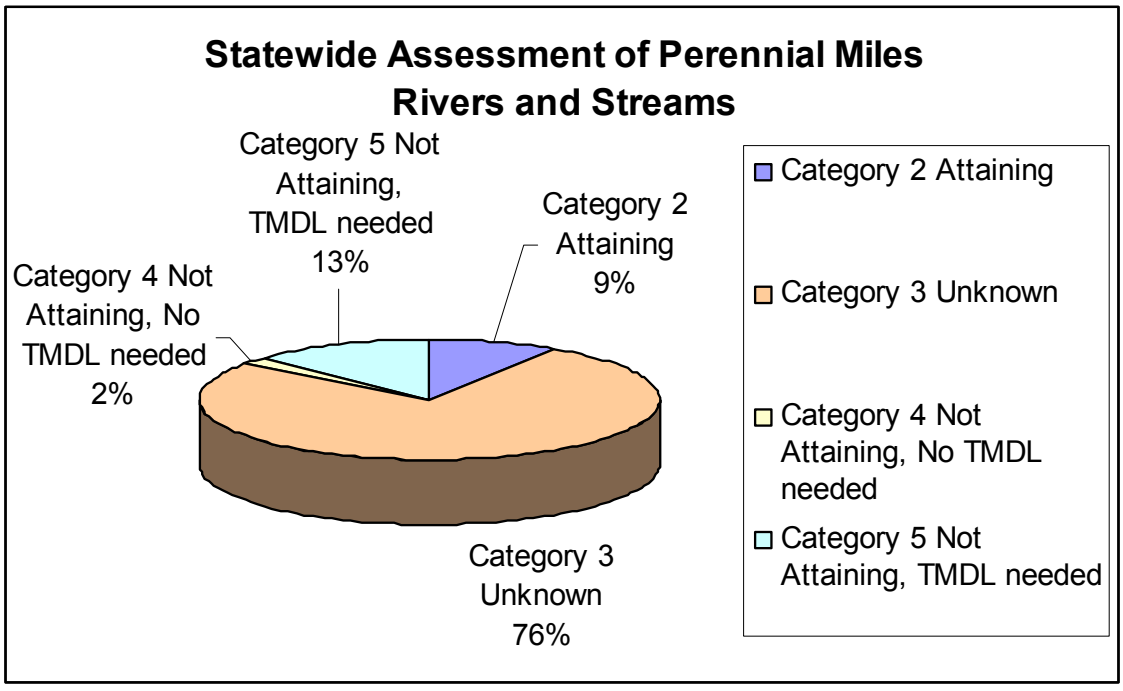


Figure 2: Statewide Assessment of Perennial Miles-Rivers and Streams

Causes and Sources of Impairment of Designated Uses- Rivers and Streams

Causes and sources of impairment were assigned for streams and rivers having one or more uses impaired. Total assessed sizes of streams and rivers affected by various cause categories are given in Table 4 and depicted in Figure 3. For the majority of miles of assessed water bodies not meeting their designated uses, impairment is caused by unknown pollutants or other factors contributing to biological impairment. In these latter cases, actual monitoring has detected biological impairment but the exact pollutant cause is undetermined. Pathogens were indicated as the cause of impairment in 22% of the non-attaining water bodies. To a lesser extent, impacts statewide are also attributed to mercury, organic enrichment/low dissolved oxygen, salinity/TDS/chlorides, PCB's and pesticides. All of the stream miles determined to be impaired by mercury and PCB's are the result of fish consumption advisories. For the biologically impaired waters, the next step in the water quality management process will be to conduct stressor identification analyses to identify the stressor(s) causing the impairment. Once the stressor(s) are identified, the Total Maximum Daily Load (TMDL) process, where applicable, can proceed. For stressors identified that are attributed to pollution where TMDLs cannot be generated, other water quality management actions will be determined through the Basin Management Approach.

Total sizes of rivers and streams affected by various source categories are given in Table 5 and shown in Figure 4. The majority of impairment was identified as biological and the sources of the impairment are yet to be determined. As a result, unknown sources contribute pollutants to the majority of river miles assessed as not attaining one or more uses. To a lesser extent, pollutants are contributed by contaminated sediments, unspecified nonpoint source activities (i.e. urban, agricultural, silvicultural, and/or industrial runoff), and other smaller sources. As stated above, Stressor Identification Analyses will be conducted for biologically impaired waters to identify sources of pollution contributing to impairment.

Table 4: Summary of Impairment Causes for Rivers and Streams

Cause Categories	Total Size Miles
DDT/Toxaphene	283
Mercury	291
Organic Enrichment/Low DO*	51
Other (Bio Impairment)**	3,613
Pathogens	1,200
PCB's*	14
Salinity/TDS/Chlorides*	5
Total***	5,457

* Grouped into Miscellaneous Causes category in figure.
**Definitive cause identification is not possible at the time of assessment. Category used to relate to waters where biological indicators (macroinvertebrates) were used and impairment was indicated but further investigation needed to quantify pollutant.
***Total exceeds number of actual impaired miles due to presence of multiple impairment cause(s) per assessed water body

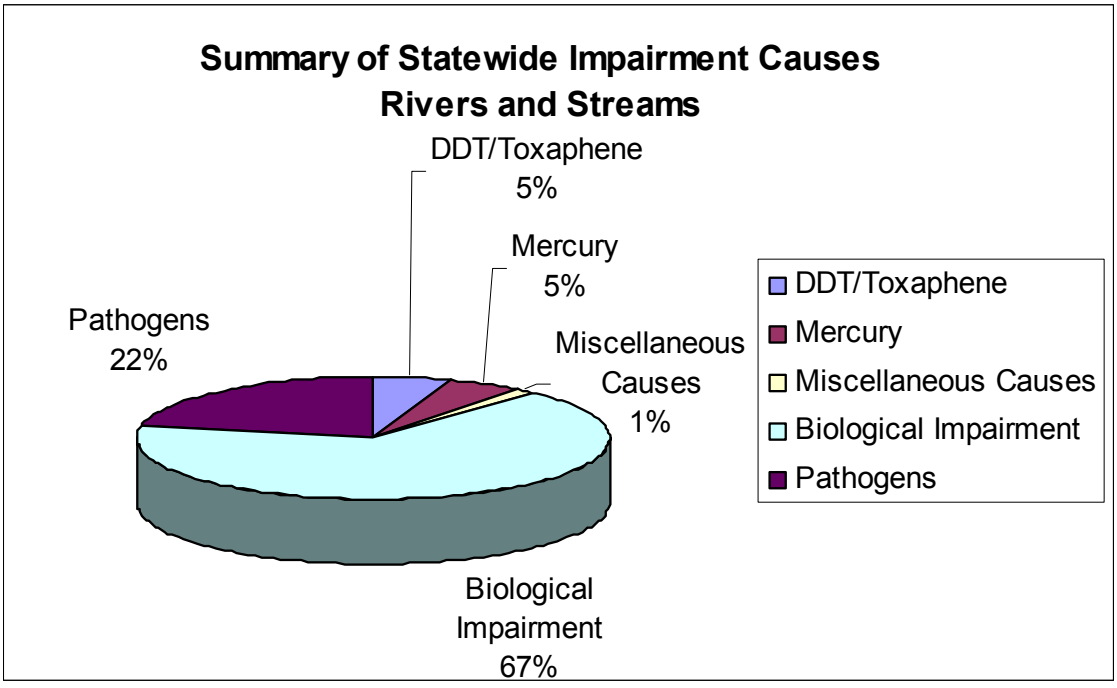


Figure 3: Summary of Causes Assessed-Rivers and Streams

Table 5: Summary of Impairment Sources for Rivers and Streams

Source Categories	Total Size Miles
Atmospheric Deposition	171
Channelization*	20
Contaminated Sediments	282
Erosion and Sedimentation*	6
Petroleum Activities*	5
Removal of Riparian Vegetation*	20
Source Unknown**	4,939
Unspecified Nonpoint Source*	14
Total***	5,457

*Grouped into Miscellaneous Sources category in figure.
**Definitive source identification is not possible at the time of assessment. Category used to relate to waters where biological indicators (macroinvertebrates) were used and impairment was indicated but further investigation needed to quantify source
*** Total exceeds number of actual impaired miles due to presence of multiple impairment source(s) per assessed water body

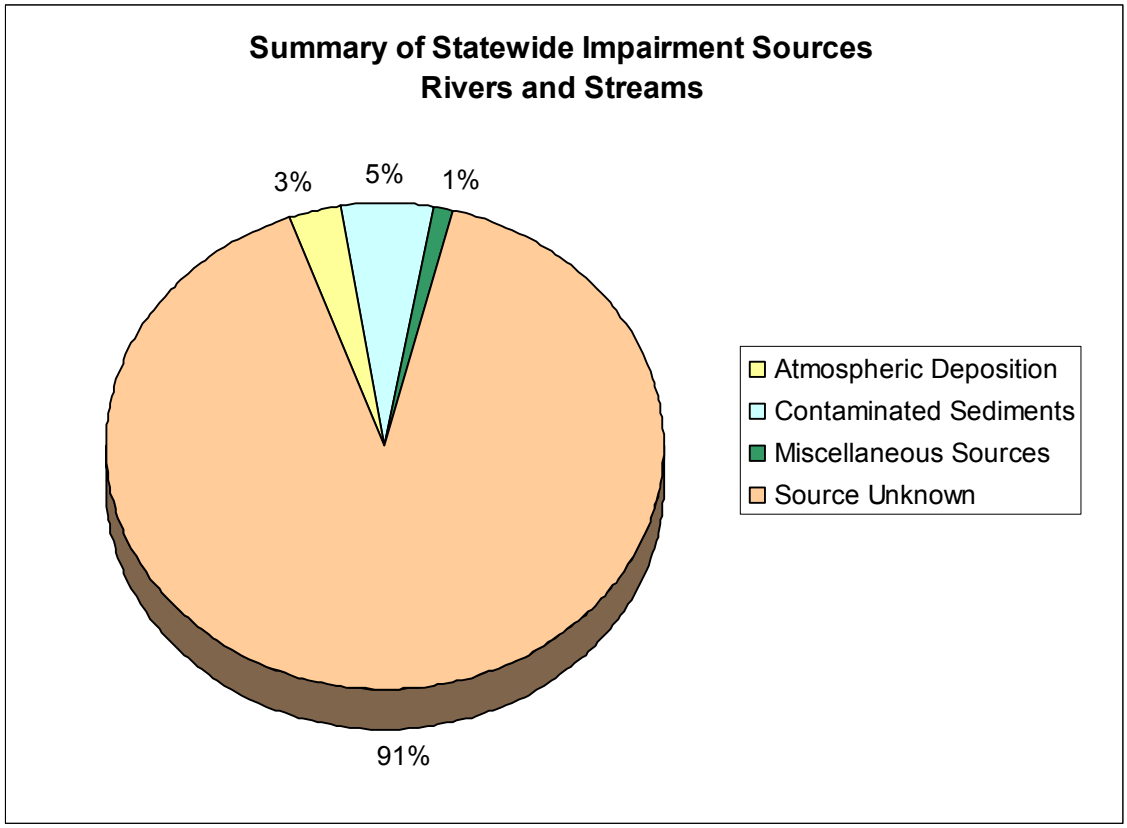


Figure 4: Summary of Sources Assessed-Rivers and Streams

Assessment Summary for ALUS and Recreation

Assessments for perennial miles of rivers and streams are cataloged by use. A water body may have several different uses assessed. The following tables and figures provide the assessment summaries for Aquatic Life Use Support and Recreation Use Support. The numbers represented in the tables below are different from the mileages presented earlier in this chapter. These mileages represent the assessment status assessed for a specific use. Figures 5 and 6 give a summary of use support according to the individual uses assessed.

Table 6: Individual Use Support Summary for Aquatic Life Use Support-Rivers and Streams

Status	Miles
Attaining	2,800
Unknown	25,295
Total Not Attaining	3,643
TMDL not needed	124
TMDL needed	3,519
Total Perennial Miles	**31,738**

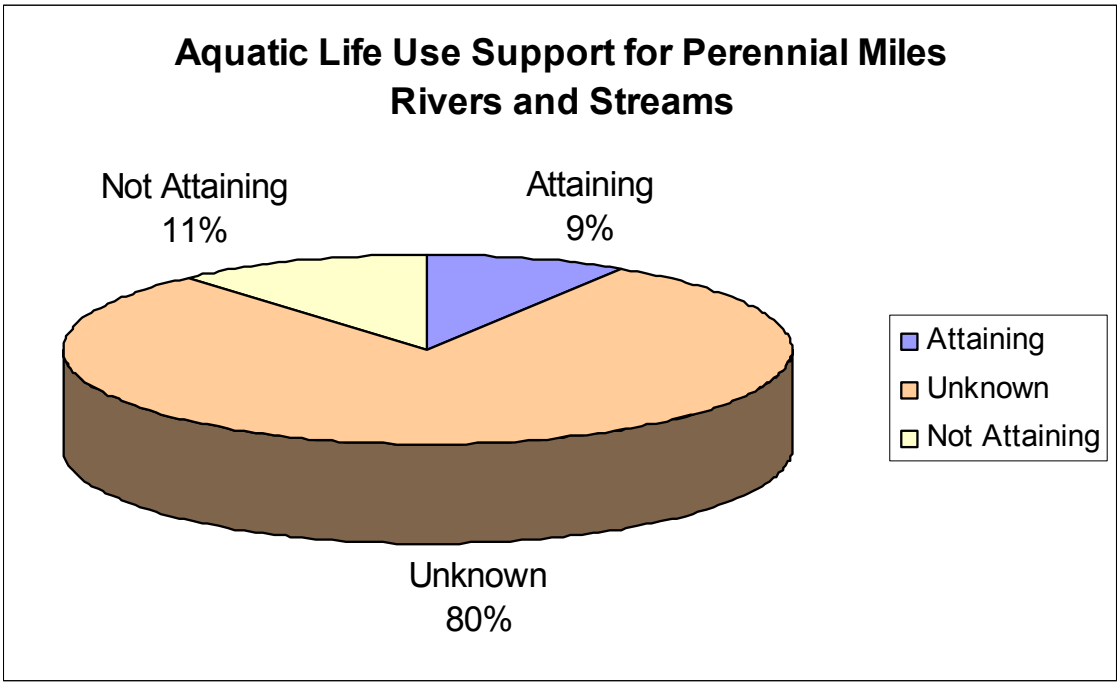


Figure 5: Aquatic Life Use Support for Perennial Miles Assessed-Rivers and Streams

Table 7: Summary of Recreation Use Support for Perennial Miles-Rivers and Streams

Status	Miles
Attaining	1,935
Unknown	28,603
Total Not Attaining	1,200
TMDL not needed	565
TMDL needed	635
Total Perennial Miles	**31,738**

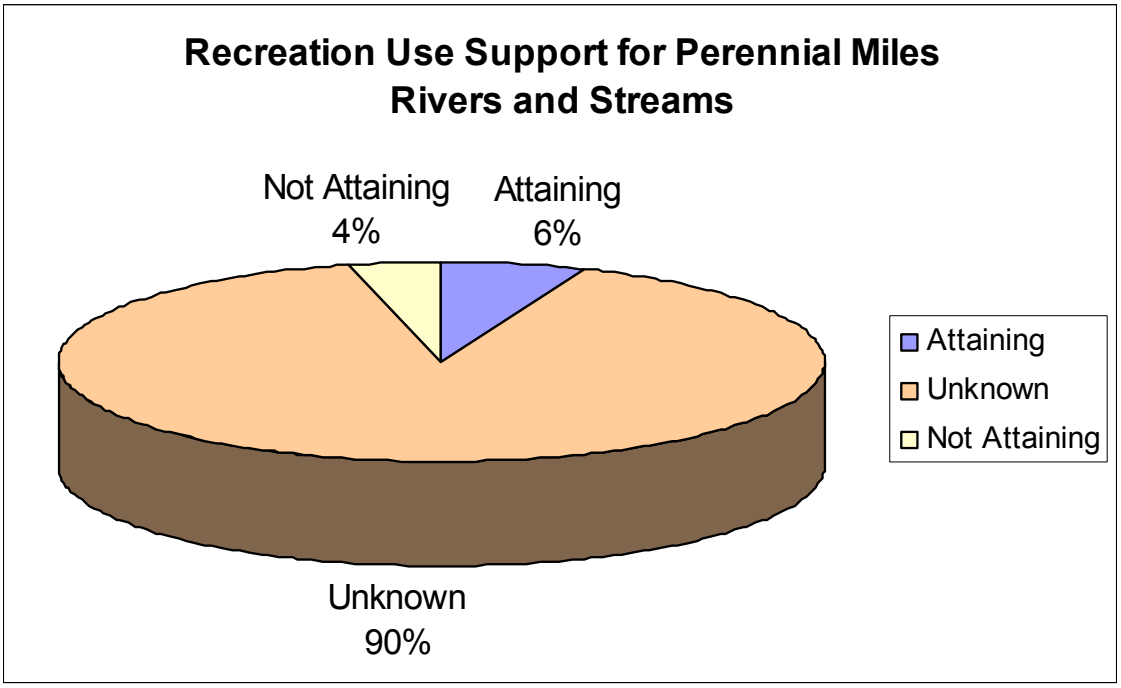


Figure 6: Recreation Use Support for Perennial Miles Assessed-Rivers and Streams

Designated Use Support – Estuaries and Coastal Waters

Mississippi has approximately 758 square miles of estuaries. Inland or bay type estuaries include St. Louis Bay, Back Bay of Biloxi, and Pascagoula Bay. The state's largest estuary (550 square miles) is the Mississippi Sound which extends from the southern edge of the state's contiguous land mass to the Barrier Islands. The state also considers the Gulf of Mexico an estuary for three miles south of the Barrier Islands.

For the 2004 §305(b) Report, MDEQ only assessed the Shellfish Consumption Use in Mississippi's estuaries and coastal waters. This low percentage of assessed waters is not a reflection of a lack of monitoring data. For estuaries and coastal waters, transitioning to new methods such as probabilistic monitoring and more rigorous CALM requirements have resulted in a significant amount of incompatible or insufficient data sets for the 2004 assessment. This situation will be rectified in the near future with the completion of this transition and modification of monitoring programs to satisfy CALM needs for more accurate §305(b) and §303(d) reporting. At that time, a comprehensive assessment of Mississippi's estuaries and coastal waters will be possible.

During this §305(b) reporting period, extensive monitoring was carried out by MDEQ and other agencies in Mississippi estuaries and coastal waters through a combination of ambient fixed station monitoring and special studies. In fact, since 2000, MDEQ has been participating in EPA's National Coastal Assessment (NCA) Program whose probabilistic design will enable assessment of 100% of Mississippi's estuarine and coastal resources. Information and data analysis for the NCA data pertinent to Mississippi's 2004 assessment were not available from EPA at the time of this §305(b) report development. EPA published a report, *National Coastal Condition Report* (EPA 2001), analyzing data from first year of sampling information for the entire Gulf of Mexico. As a result of this regional analysis, there were several indications of possible isolated water quality problems in Mississippi's coastal waters. For this §305(b) report, all available NCA data were reviewed for compelling evidence of impairment as specified by CALM but none of the data indicated conclusive evidence of impairment. MDEQ also reviewed data from the MDEQ Beach Monitoring Program and again found no compelling evidence of water quality condition indicative of catastrophic or obvious public health impacts. Upon completion of the NCA project in 2005, along with any other monitoring data that meet CALM requirements, all data collected in Mississippi's estuaries will be assessed in their entirety and pollution sources will be addressed at that time.

The current assessment includes all estuaries classified and monitored under the National Shellfish Sanitation Program (NSSP) administered by the Mississippi Department of Marine Resources. For the 37 sq.miles of shellfish harvesting reefs assessed, 9 sq.miles were attaining this use and 28 sq.miles were assessed as not attaining. TMDLs have already been developed for the 28 miles that were assessed as not attaining the shellfish harvesting use. These estuarine water bodies are periodically impacted by urban nonpoint source runoff and failing septic tanks. With the implementation of control

measures, most of these waters could support their uses and attain the fishable and swimmable goals of the Clean Water Act.

Designated Use Support – Lakes

Mississippi is covered with hundreds of publicly owned lakes, reservoirs, and ponds totaling approximately 246,000 acres. The largest lakes in Mississippi are man-made reservoirs. Grenada Reservoir; Enid Reservoir; Sardis Reservoir and Arkabutla Reservoir in the Yazoo Basin are used for flood control. The Ross Barnett Reservoir is used as a source of drinking water for the City of Jackson. All of these large reservoirs support numerous recreational activities. Pickwick Lake, in the state's northeastern corner, is part of the Tennessee River and is shared with Alabama and Tennessee. Numerous other smaller lakes and reservoirs are maintained by cities, counties, water districts, state parks and conservation agencies.

For the 2004 §305(b) Report, MDEQ did not comprehensively assess lakes and reservoirs. However, this is not a reflection of a lack of monitoring in these waters. During this period, monitoring was carried out by MDEQ and other agencies in Mississippi lakes through a combination of ambient fixed station monitoring and special studies. MDEQ is conducting extensive monitoring to develop nutrient criteria for Mississippi lakes. These data were reviewed and there was no compelling evidence of impairment. At the completion of this project, the data will be reviewed in their entirety and a formal assessment will be made.

PART III

PUBLIC HEALTH CONCERNS AND ADVISORIES

Public Health Concerns and Advisories

Introduction

Toxic pollutants and pathogenic organisms in our environment are a widespread and growing public concern. As MDEQ turns its attention more toward risk assessment and public health, levels of toxic pollutants and pathogens in water, sediment and fish tissue become increasingly important.

Monitoring for toxins and bacteriological indicators of pathogens in surface waters is accomplished through several data collection activities by MDEQ as well as other state and federal agencies. MDEQ monitoring activities for toxicants and bacteria include water column, sediment, and/or fish tissue sampling from: ambient fixed station network program monitoring, emergency response to pollutant spills or discharges, hazardous waste program investigations, and special monitoring studies for pollutants of state, regional, or national environmental concern (e.g. mercury, dioxin).

Results from these monitoring activities may lead MDEQ and/or other partnering state agencies to issue public health advisories or restrictions on the use of affected water bodies when unsafe levels of pollutants are detected. In some cases, a "blanket" public health advisory may be issued as a general precaution for areas where the pollutant(s) may impact a broad area, is pervasive, and/or the pollutant source is not readily controllable (i.e. mercury atmospheric deposition). Monitoring of the affected geographic area is continued and expanded as necessary to ensure the public health advisory is maintained as long as warranted.

Fish Tissue Contamination

Most of the water bodies in Mississippi with elevated levels of toxicants have some form of the toxicant present in the fish tissue. In addition, with one of the CWA goals being to maintain fishable waters and ensure attainment of fish consumption use, fish tissue monitoring and assessment are of primary importance in water quality management activities. Major fish toxicant issues currently under investigation by MDEQ include continued concern over pesticides in the Yazoo River Basin (Delta region) and mercury contamination in several areas of the state. To address these issues, as well as to monitor general status and trends in fish tissue contaminants, MDEQ maintains a comprehensive fish tissue monitoring program.

Ambient fish tissue sampling through the Status and Trends Network of the MDEQ Surface Water Monitoring Program occurs annually at 25 primary fixed stations across the state and at selected basin network sites. Additional fish tissue sampling for fish kill investigations, monitoring of fish advisory areas, and for special studies is also conducted. A distribution of the fish tissue sampling occurring at MDEQ for this §305(b) reporting period is shown in the table below.

Table 8: MDEQ Fish Samples Collected from 1999-2003

Type of Study	Number of Samples	Number of Fish
Ambient	285	932
Mercury	237	646
Dioxin	46	145
PCB's	31	96
Pesticides	279	861
Special Studies	11	38
Total:	**889**	**2718**

Fish Consumption Advisories and Fishing Bans

The fish consumption advisories and commercial fishing bans presently in effect are listed in Table 9 and displayed in Figure 7.

Table 9: Fish Tissue Advisories in Mississippi

MISSISSIPPI'S FISH TISSUE ADVISORIES

AND COMMERCIAL FISHING BANS

AUGUST 2001

WATERBODY	CHEMICAL	DATE ISSUED	ACTION
Little Conehoma Creek and Yockanookany River in Attala and Leake Counties. From Hwy 35 near Kosciusko, downstream to Hwy 429 near Thomastown	**PCB's**	**June 1987**	Consumption Advisory All Species Commercial Fishing Ban
Lake Susie, Oxbow Lake of Old Tallahatchie River in Panola County west of Batesville.	**PCB's**	**Nov. 1989**	Same as above
Escatawpa River from the Alabama state line to I-10.	**Mercury**	**May 1995**	Limit Consumption Advisory for largemouth bass and large catfish (>27 in.)*
Bogue Chitto River, entire length in MS.	**Mercury**	**May 1995**	Same as above
Yockanookany River, entire length.	**Mercury**	**May 1995**	Same as above
Pearl River from Hwy 25 near Carthage, downstream to the Leake County Water Park.	**Mercury**	**June 2001**	Same as above
Enid Reservoir	**Mercury**	**May 1995**	Same as above
Yocona River from Enid Reservoir downstream to the confluence with the Tallahatchie River.	**Mercury**	**Sept. 1996**	Same as above
Pascagoula River, entire length.	**Mercury**	**Sept. 1996**	Same as above
Archusa Creek Water Park	**Mercury**	**Sept. 1996**	Same as above
Grenada Lake and Yalobusha River from the dam downstream to Holcomb.	**Mercury**	**June 2001**	Same as above
Mississppi Delta - all waters from the mainline Mississippi River Levee on the West to the Bluff hills on the East.	**DDT, Toxaphene**	**June 2001**	Limit Consumption Advisory for carp, buffalo, gar, and large catfish (>22 in.)****
Roebuck Lake, LeFlore County	**DDT, Toxaphene**	**June 2001**	Limit Consumption Advisory for carp, gar, and large catfish (>22 in.)**** No Consumption of Buffalo. Commercial Fishing Ban
Yazoo National Wildlife Refuge (all waters)	**DDT, Toxaphene**	**1975**	Closed to fishing**
Gulf of Mexico	**Mercury**	**May 1998**	King Mackerel <33" - no limit, 33-39" limit consumption***, >39" - do not eat

* The Mississippi State Health Department recommends that people limit the amount of bass and large catfish that they eat from these areas, because of high levels of mercury in the fish. Children under seven and women of child bearing age should eat no more than one meal of these fish every two months. Other adults should eat no more than one meal of these fish every two weeks.

** Precautionary advisory issued by U.S. Fish and Wildlife Service

*** The Mississippi State Health Department recommends that people limit the amount of 33-39" King Mackerel they eat from the Mississippi Gulf Coast. Children under seven and women of child bearing age should eat no more than one meal of these fish every two months. Other adults should eat no more than one meal of these fish every two weeks.

**** The Mississippi Department of Health recommends that people limit their consumption of these fish to no more than one meal every two weeks.

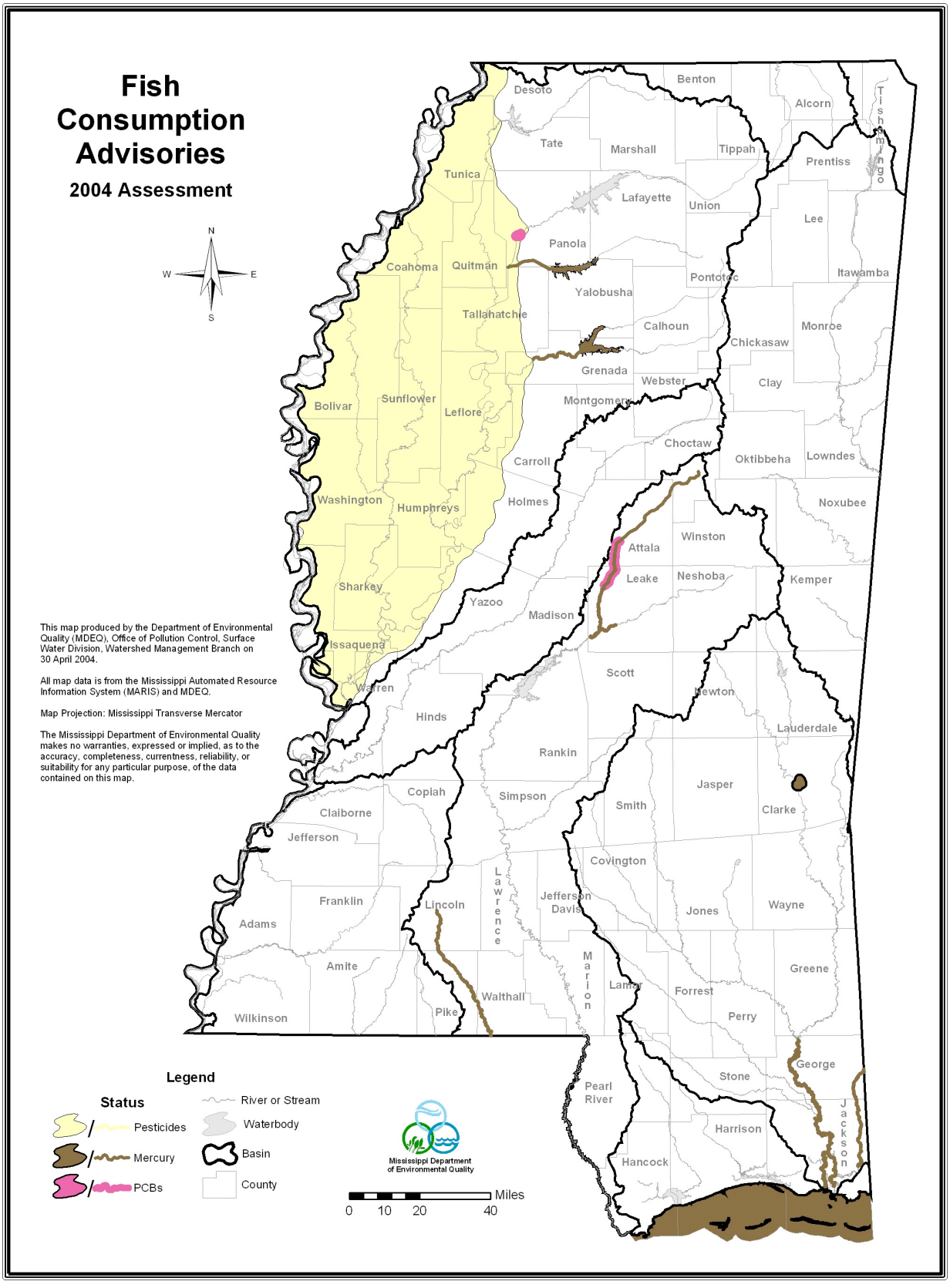


Figure 7: Map of Fish Advisories in Mississippi

Mercury Contamination in Fish Tissue

The presence of mercury in fish tissue continues to be an issue of concern to MDEQ. The agency continues to commit resources to determining the status of mercury contamination in Mississippi's waters. Mississippi currently has eleven waterbodies under fish consumption advisories for mercury including the Gulf of Mexico. The advisories are for the larger predator species such as largemouth bass and large catfish in freshwater systems and king mackerel in the Gulf. Advisories issued during this reporting period include Grenada Reservoir and the Yalobusha River and the upper portion of the Pearl River.

Current monitoring efforts are targeting additional species of different trophic levels within existing advisory areas. This includes species such as bluegill, crappie, buffalo and smaller catfish. Additional marine species are also being sampled.

The information for additional species is important because historical monitoring efforts have focused on the predator species which were known to have the highest concentrations. However, new health effects studies indicate that mercury may be harmful at lower levels than previously believed, so additional data on species with lower mercury concentrations are now critical. Additional data on marine species are important for the same reasons and because most of the existing data are for king mackerel.

Several other efforts are underway in Mississippi to address the issue of mercury in fish. The Pat Harrison Waterway District is liming Archusa Creek Reservoir in an effort to improve the water quality for fish production and to evaluate its effectiveness in reducing mercury levels. MDEQ is analyzing fish and sediment samples in support of the project. Also mercury TMDLs for the Escatawpa and Bogue Chitto Rivers and for Enid Reservoir and the Yocona River have been completed.

DDT Contamination in the Delta

DDT contamination in the Mississippi Delta has been a concern ever since the harmful effects of pesticide contamination first became a national issue. DDT was banned for use in Mississippi in 1972; and, although DDT concentrations in fish tissue have decreased ten-fold since that time, the levels remain among the highest in the nation.

The Mississippi Fish Advisory Task Force was convened in 2000 to address the protection of those who routinely consume fish from the Delta area of Mississippi. The task force consisted of scientists, engineers, and medical doctors from MDEQ, Mississippi Department of Health, Mississippi Department of Agriculture and Commerce, and Mississippi Department of Marine Resources. This group is charged with developing criteria for issuing fish consumption advisories for Mississippi. With input from a Technical Advisory Group made up of experts outside of state government in the fields of toxicology and aquatic biology, the Task Force developed new risk based

criteria for DDT, toxaphene and PCB's. A complete report on the process is provided in the document *Fish Advisory Criteria For Organochlorine Compounds* (Mississippi Fish Advisory Task Force, February 2001).

Concurrent with this criteria development, MDEQ began collecting new fish tissue data from the Delta. The specific objectives of the Mississippi Delta Fish Tissue Study were to:

- Evaluate the concentration of DDT and toxaphene in edible tissue from 10 selected sites.
- Use these data to evaluate human health risks associated with eating fish.
- Develop a species concentration gradient for DDT and toxaphene that will help focus future monitoring efforts.

To address these objectives, MDEQ collected fish tissue samples from ten sites located on 4 lakes and 5 rivers or bayous in the Mississippi Delta Region of Mississippi. These sites are listed in Table 10 and displayed in Figure 8.

Table 10: Site List for Mississippi Delta Fish Tissue Study

Site Description	**County**
Moon Lake	Coahoma
Roebuck Lake	Leflore
Wolf / Broad Lake	Humphreys/Yazoo
Bee Lake	Holmes
Yazoo River @ Sidon	Leflore
Sunflower River @ Inverness	Sunflower
Sunflower River @ Anguilla	Sharkey
Steel Bayou near Eagle Lake	Warren
Cassidy Bayou @ Sumner	Tallahatchie
Deer Creek @ Hollandale	Washington

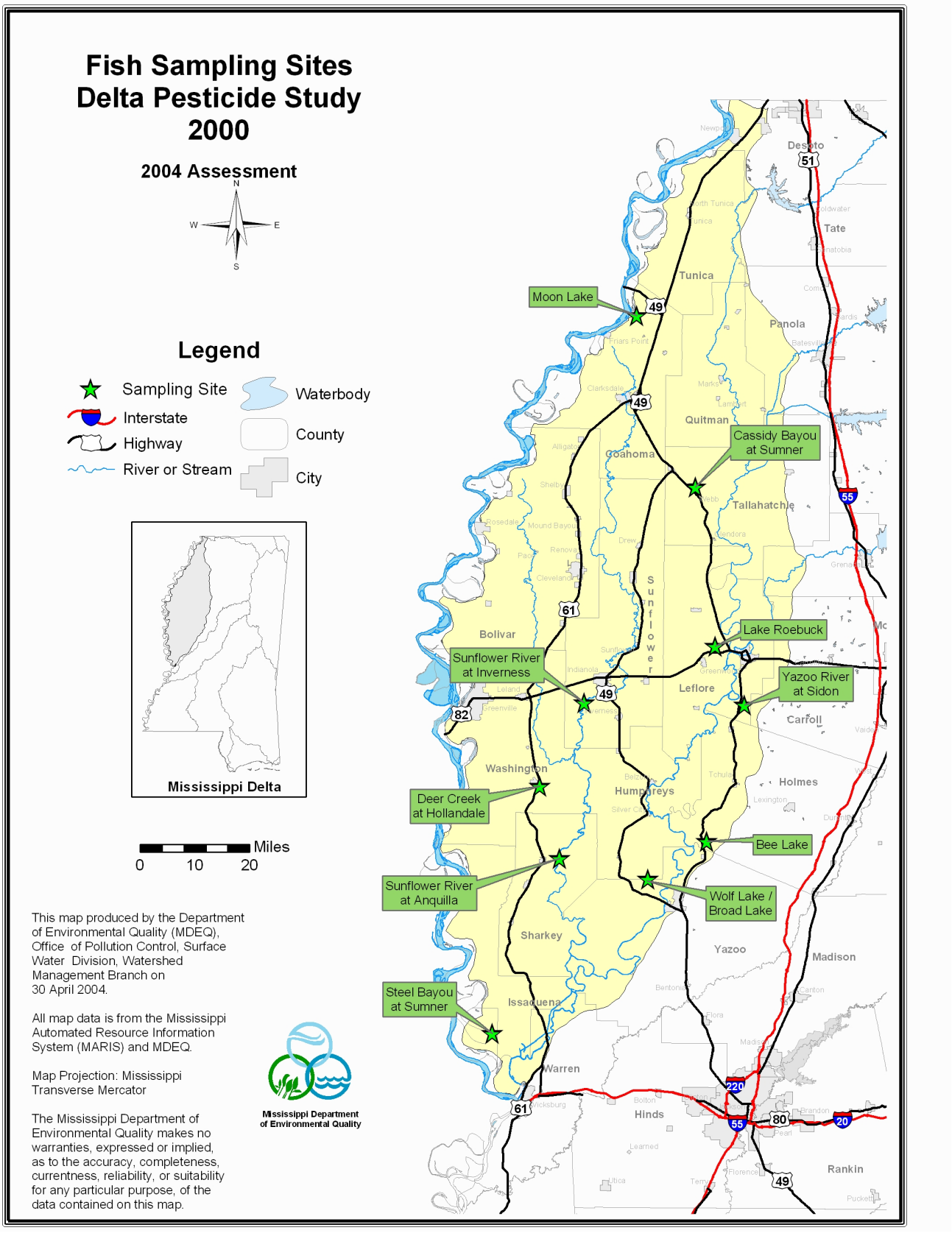


Figure 8: Sampling Sites for the Mississippi Delta 2000 Fish Tissue Study

Water bodies for this study were selected based on previous data that indicated elevated pesticide levels in whole fish and/or knowledge of areas that receive heavy fishing pressure.

Fish were analyzed as fillets with the skin and scales removed, except for shad, which were analyzed whole to evaluate potential impacts on wildlife. Samples consisted of a composite of fish of the same species and of the same relative size (e.g., 3-5 individuals that collectively provided a minimum of 450 grams of tissue). Approximately ten fish species were collected from each location using the target species listed in Table 11.

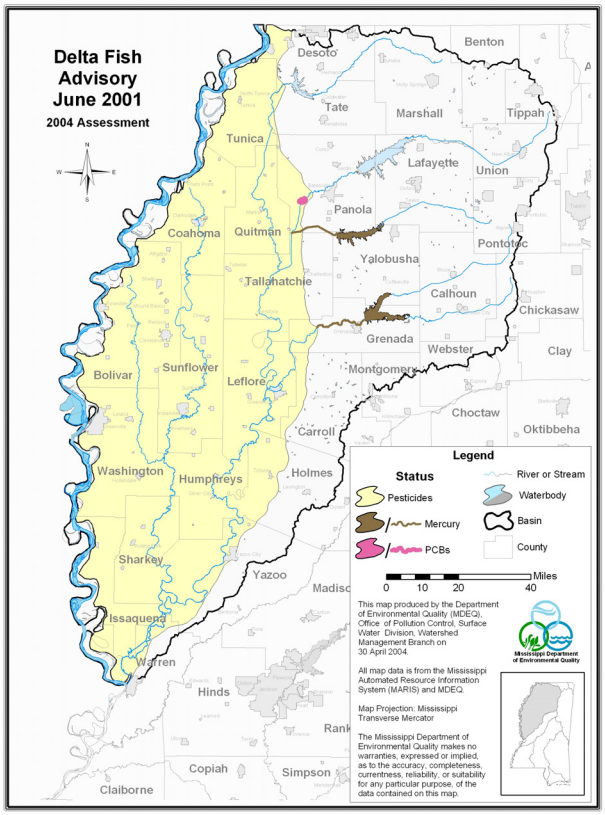
Table 11: Target Species for Mississippi Delta Fish Tissue Study

Common Name	Scientific Name
Largemouth Bass	***Micropterus salmoide***s
White Crappie	*Pomoxis annularis*
Blugill	*Lepomis macrochirus*
Freshwater Drum	*Aplodinotus grunniens*
Bowfin	*Amia calva*
Gar	*Lepisosteus sp.*
Bigmouth Buffalo	*Ictiobus cyprinellus*
Smallmouth Buffalo	*Ictiobus bubalus*
Black Buffalo	*Ictiobus niger*
Common Carp	*Cyprinus carpio*
Gizzard Shad	*Dorsoma cepadianum*
Channel Catfish	*Ictalurus punctatus*
Blue Catfish	*Ictalurus furcatus*
Flathead Catfish	*Pylodictis olivaris*

Field sampling activities were conducted during September and October 2000. Fish were collected using a boat mounted, variable voltage electrofishing unit. The sampling teams, consisting of one experienced biologist and one technician, collected, processed, and shipped all fish tissue samples to the Mississippi State Chemical Lab (MSCL) located at Mississippi State University for analysis of DDT and toxaphene.

The data from the present study were evaluated along with existing fish tissue data from MDEQ's 1999 Ambient Monitoring Program to determine the need for advisories in the Delta. The data indicated that all ten sites and all nine water bodies sampled in the present study warranted some type of advisory. Based on this information, the task force recommended a regional advisory for the Delta, rather than a patchwork of discrete advisories for each of the ten sites. The data from this study support previous data collected by MDEQ and other agencies, which indicate that these pesticide concentrations were common for this part of the state.

On June 26, 2001, MDEQ issued an advisory for the Delta region of Mississippi. This advisory recommended that people limit the amount of carp, buffalo, gar, and large catfish (catfish larger than 22") they eat to no more than two meals per month. This advisory applies to the entire Delta from Memphis to Vicksburg, from the Mississippi River Levee on the west to the bluff hills on the East. The advisory includes all natural waters including lakes, rivers, bayous and sloughs.



In addition, for Roebuck Lake in Leflore County, the advisory recommends that people do not eat buffalo from this water body. In August 2001, MDWFP issued a commercial fishing ban for Roebuck Lake. The Delta area under advisory is illustrated in Figure 8.

The Delta advisory does not apply to the Mississippi River or the river-connected oxbow lakes located west of the Mississippi River Levee, shown in green in Figure 9. These lakes rise and fall each year with the Mississippi River and are flushed out regularly. Perhaps more importantly, the periodic flooding of these areas has made them less desirable for row cropping and therefore fewer opportunities for historical application of these now banned pesticides have occurred in their watersheds.

Figure 9: Advisory Area for Delta Region of Mississippi

The advisory also does not apply to bass, bream, crappie, freshwater drum and smaller catfish (catfish < 22" in length), nor does it apply to farm raised catfish. A complete report on this study is available in the document *Mississippi Delta Fish Tissue Study 2000, Final Report* (MDEQ 2001).

Other Toxicants in Fish Tissue

In addition to the pesticides, mercury and ambient monitoring described above, MDEQ has investigated several additional water bodies for contaminants in fish. The two primary chemicals of concern have been PCBs and dioxin. Dioxin concentrations in Mississippi fish have declined markedly over the last decade, primarily as a result of changes the bleaching process in the paper industry. The dioxin advisory on the Leaf

River, which originated in 1989, was removed in 1995. Dioxin concentrations in the Escatawpa River declined as well, and the Limit Consumption Advisory for fish was removed in 1996. MDEQ continues to monitor fish from the Leaf River near New Augusta, and the Tenn-Tom Waterway near Columbus to confirm that these concentrations remain low. In addition, in 2001, MDEQ removed the fish advisory on Country Club Lake near Hattiesburg, originally issued in 1990, after multiple samplings showed dioxin levels to have declined in that water body.

PCBs continue to be a concern in industrial areas and around natural gas compressor stations. MDEQ continues to sample fish in the vicinity of existing advisories on the Yockanookany River in Attala County and Lake Susie in Panola County, and these advisories remain in effect.

During this reporting period, MDEQ has also investigated contaminants in Turkey Creek in Gulfport, St. Louis Bay near Delisle, Bayou Caddy and tributaries in Hancock County, Lake Chatauqua in Crystal Springs, and the Leaf River near Collins. None of these samplings have led to advisories.

Fish Kills

From January 1999 through December 2003, the OPC FSD investigated 79 fish kills (Figure 10). Forty-seven percent of these were associated with low dissolved oxygen levels (Figure 11). In twenty-nine percent of the investigations the cause could not be determined and 5% were associated with pesticides. Ten percent were those related to nutrient overloads, sewage spills or un-permitted discharges. Approximately 9% were miscellaneous types that are seldom investigated.

Many fish kills investigated were the result of natural causes such as low dissolved oxygen, in those cases the cause is listed as "natural". By the time many kills are reported the dead fish have deteriorated to the point that the cause is difficult to discern. When the cause can not be determined the kill is categorized as "unknown".

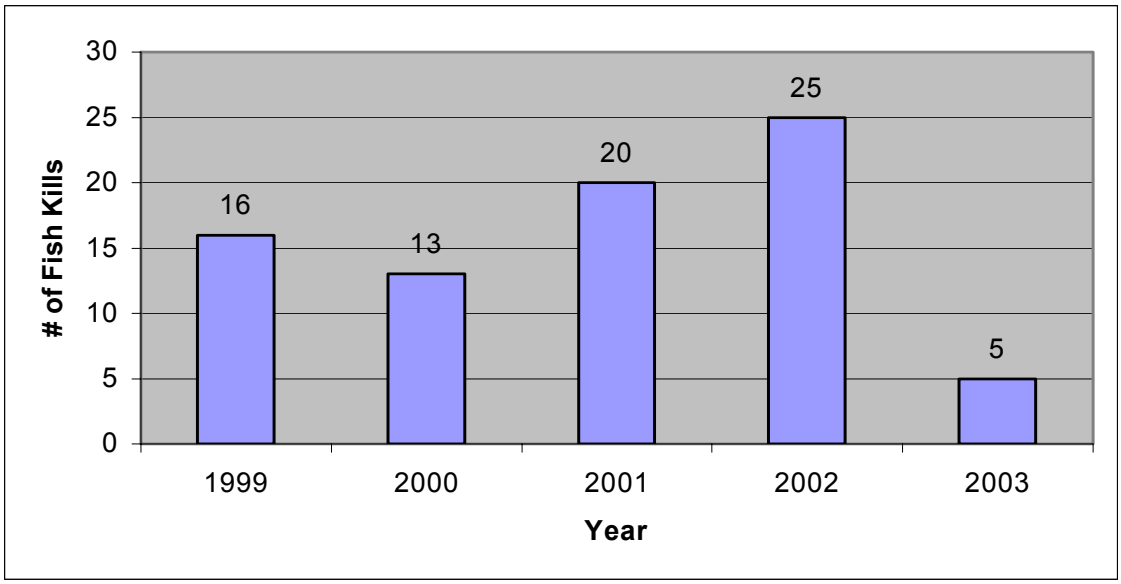


Figure 10: Annual Number of Fish Kills Investigated from 1999-2003

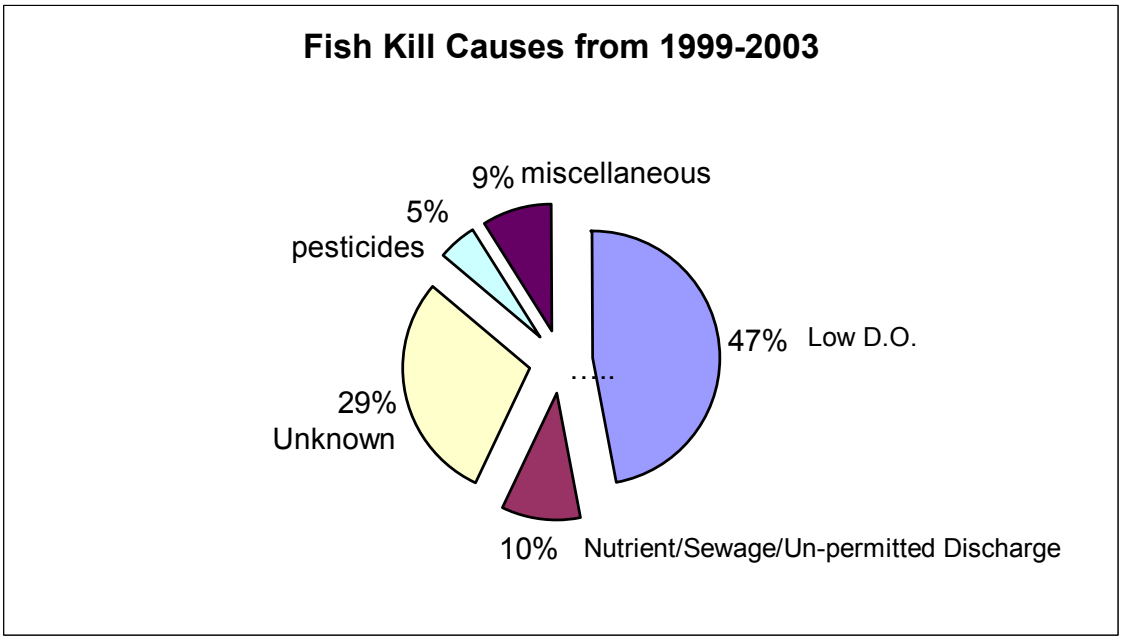


Figure 11: Distribution of Fish Kill Causes from 1999-2003

Shellfish Restrictions

The National Shellfish Sanitation Program (NSSP), administered by the MDMR, opens and closes shellfish harvesting areas according to a classification system for the coastal

waters of Mississippi. For current status of the classifications and maps of these waters, visit the MDMR web site (www.dmr.state.ms.us).

Most of the major shellfish harvesting areas in Mississippi waters are routinely classified as either "conditionally approved" or "restricted". The restrictions are due primarily to the effects of nonpoint source pollution from urban runoff and unsewered communities. Studies by MDMR of fecal coliform data, the indicator utilized by the NSSP, have historically shown wide fluctuations in fecal counts (MPN) due to rainfall and/or high river stages. This continues despite significant improvements in wastewater treatment and collection in the coastal area. These fluctuations are likely a result of private septic systems and other nonpoint pollution sources located in each watershed that drains into these waters. When coliform levels exceed water quality standards, oyster harvesting is halted by MDMR until approved conditions are met.

For some coastal waters, the restriction or prohibition classification is based solely on geographic location (i.e. proximity to a shoreline or NPDES-permitted wastewater discharge points where human contamination of shellfish beds is more likely) regardless of the fecal coliform levels measured. Due to this "semi-permanent" condition unrelated to actual water quality data, according to the MDEQ CALM, these water bodies will not be assessed.

Beach Closures

Beginning in 1997, in response to increased concern over the lack of routine bacteriological monitoring on Mississippi's coastal bathing beaches, MDEQ reestablished a coastal beach monitoring program. Sampling for fecal coliform bacteria, enterococci bacteria, and chemical water quality variables occurs weekly to monthly along the entire length of Mississippi's Gulf Coast public beaches at a total of 22 stations. Results from the sampling and information on the program are readily available to the public on a web site developed for the program. The web site is accessible through MDEQ's web site (www.deq.state.ms.us) or by accessing the USM web site (www.usm.edu/gcrl/msbeach/index.cgi).

To address public health concerns, a multi-agency task force was created composed of representatives from MDEQ, Mississippi State Department of Health, MDMR, GCRL and the EPA Gulf of Mexico Program. When notified by GCRL that there are elevated levels of fecal coliform, re-sampling of the beach takes place immediately to provide confirmation of the data. MDEQ immediately consults the task force and appropriate actions are taken to ensure that the health of beach users is protected. If the bacteria level is elevated after the second sample, MDEQ issues a beach advisory through the news media and via local officials managing the beaches and signs are posted on the affected beaches. Re-sampling of the beach continues until such time that fecal concentrations return to safe levels.

In 2000, EPA amended the Clean Water Act through the BEACH (Beaches Environmental Assessment and Coastal Health) Act to require all states to add more stringent sampling and public notification requirements to their water quality programs. MDEQ's Beach Program already met the federal requirements with the exception of the formal adoption of enterococci bacteria as the new bacterial indicator standard in MS's water quality standards (WQS). MDEQ will adopt the new enterococci standard into its WQS later this year. MDEQ will provide a comprehensive assessment of the Beach Program data with the next Coastal Basin assessment.

For the period 1999–2003, three of the 22 beaches experienced more than one extended closure. The cause of these repeated extended closures was due to urban runoff from undetermined nonpoint sources. Other short-term isolated closures were experienced at eight of the other beaches due to urban runoff, sewage line ruptures, overflows, and an illegal sewer discharge. In the latter case, an illegal connection to a storm sewer by a hotel was the identified source which led to a significant fine for the hotel.

PART IV

SURFACE WATER MONITORING AND ASSESSMENT PROGRAM SUMMARY

Plan for Comprehensive Assessment

Mississippi's plan for achieving comprehensive, statewide assessment of its surface waters involves coordination of various levels of MDEQ surface water monitoring activities and data sharing with other monitoring agencies using the agency's Basin Management Approach. Mississippi's Basin Management Approach is an effort to conduct comprehensive water quality planning and assessment and to foster the implementation of practices that will result in water quality protection on a basinwide scale. This approach recognizes the interdependence of water quality on the many related activities that occur in a drainage basin. Some of these activities include monitoring, assessment, problem identification, problem prioritization, planning, permitting, water use and land use. In Mississippi's Basin Management Approach (detailed in the document *Mississippi's Basin Approach: Framework Description* (MDEQ 1999)), these activities and their associated information are integrated by basin and result in basinwide water quality assessments, basin management plans and implementation strategies that will serve to focus water quality protection efforts. A statewide assessment can be made every five years by combining the assessment results for all ten of Mississippi's basins.

The purpose of Mississippi's Basin Management Approach is to restore and protect the quality of Mississippi's water resources by developing and implementing effective management strategies that address water quality issues while fostering sound economic growth. The majority of water quality management activities in Mississippi are now based on a repeating five-year management cycle. This management cycle is composed of five annual activity phases that are sequenced and repeated throughout the five-year interval (Figure 12).

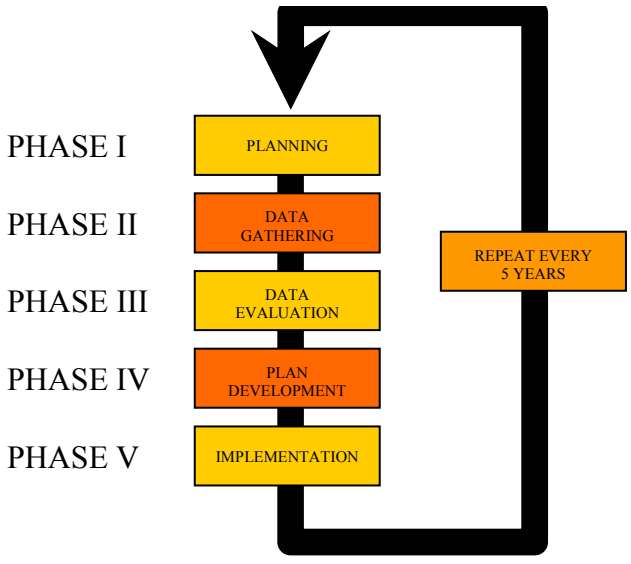


Figure 12: Basin Management Cycle

MDEQ initiated a rotating basin cycle in 1997 to manage its water programs on a basinwide scale and is developing basin management plans for Mississippi's major drainage basins. These basins serve as the hydrological boundaries that guide MDEQ's water quality activities. The waters of Mississippi are divided into ten major drainage areas or basins. These ten basins are the Big Black River Basin, Coastal Streams Basin, North Independent Streams Basin, Mississippi River Basin, Pascagoula River Basin, Pearl River Basin, South Independent Streams Basin, Tennessee River Basin, Tombigbee River Basin and Yazoo River Basin. The boundaries for each basin are shown in Figure 13.

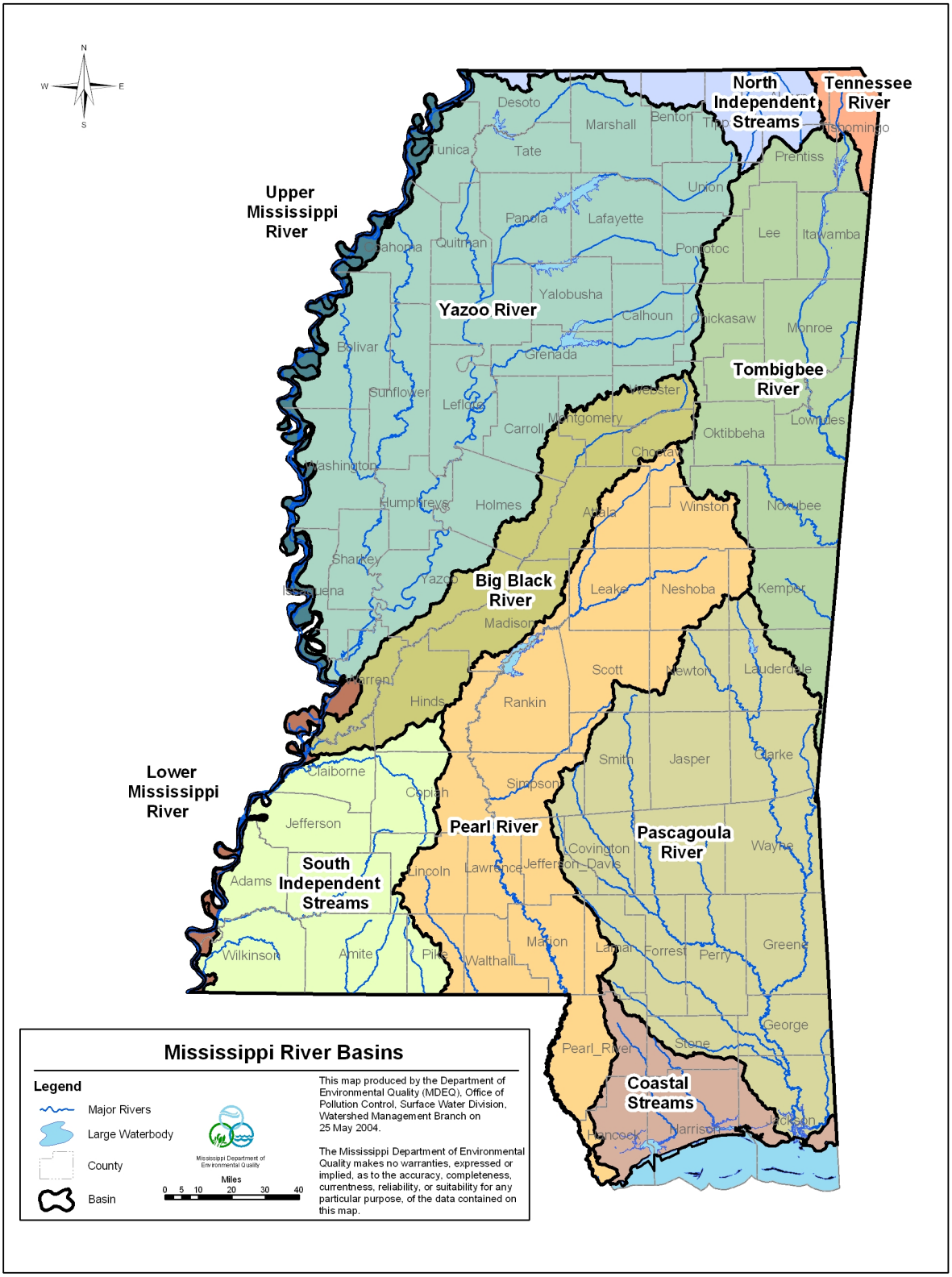


Figure 13: Mississippi's Ten Major Drainage Basins

Because of the five-year rotation, Mississippi's ten drainage basins have been placed into five basin groups, allowing all of the basins to receive equal focus. Each of these basin groups is configured to represent one-fifth of the state. Figure 14 depicts the five rotating basin groups. At the end of the five-year rotational period, Mississippi should reach its goal of comprehensive statewide assessment.

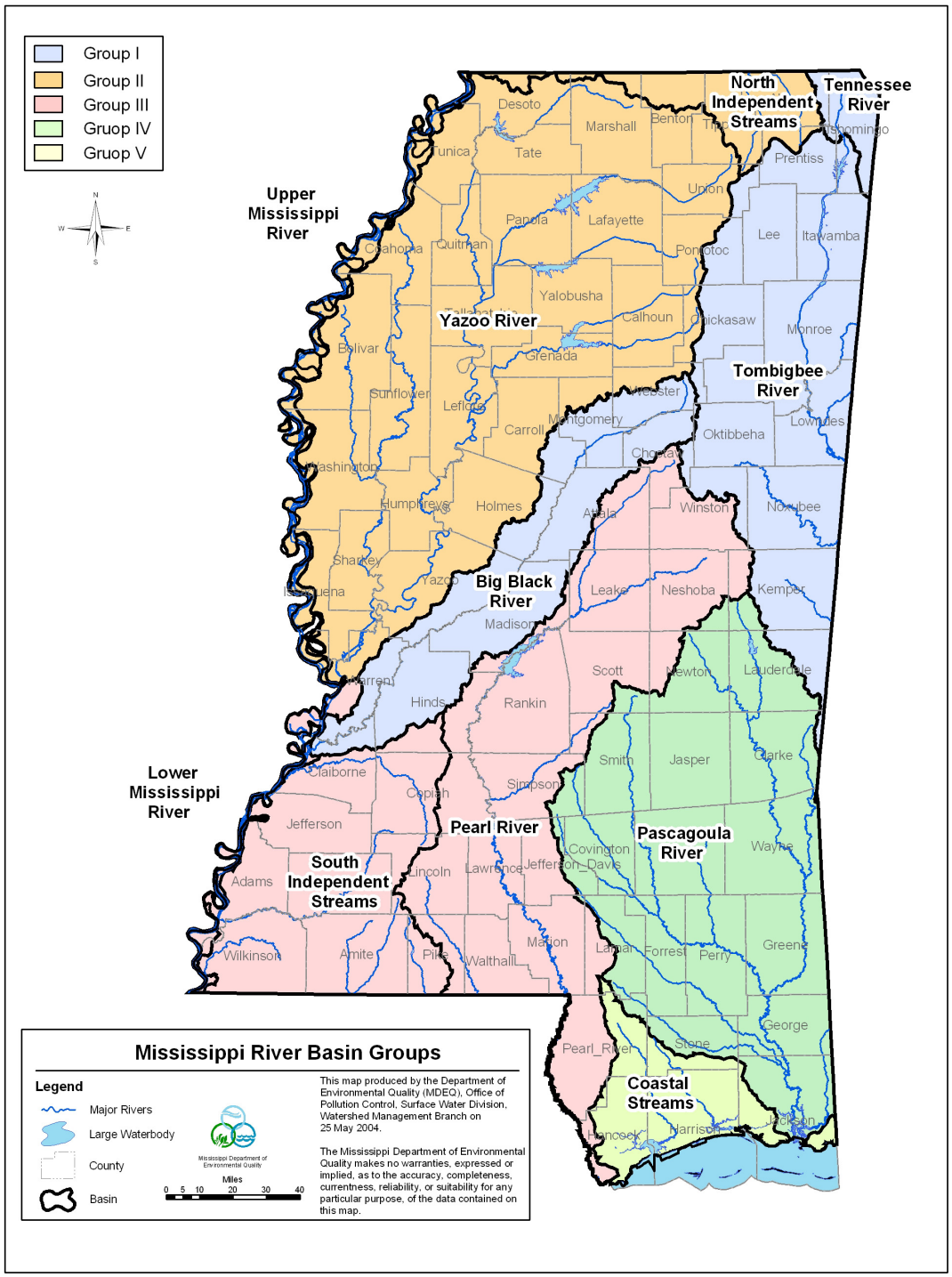


Figure 14: Mississippi Basin Groups

The Basin Management Approach strategy is supported by various water quality monitoring activities that take place as part of a basin fixed-station monitoring network and augments the statewide primary ambient fixed station network with supplemental monitoring sites in the large drainage basins. One objective of the basin monitoring network is to increase the total aerial coverage of waters monitored in Mississippi and fill data gaps identified in the planning phase of the basin cycle. Concentrating monitoring and assessment resources in specific drainage basins maximizes sampling efficiency to achieve this objective. As a result, basin management plans and implementation strategies, as well as comprehensive basinwide assessments are developed. Another short-term major objective of the basin network is to verify the actual quality of waters historically assessed as "potentially impaired" in the §305(b) process. These assessments were based on evaluations rather than actual monitoring data. Such verification by monitoring ultimately confirms the accuracy of the state's list of impaired water bodies that is required pursuant to §303(d) of the Clean Water Act.

Supplemental basin sampling is rotated annually among the five major basin groups (Figure II) in the state resulting in each basin group being intensively monitored every five years. This monitoring takes place during the data gathering phase of the basin management cycle. The predominant sampling tool used by MDEQ for the basin stations is biological monitoring for benthic macroinvertebrates using modified EPA rapid bioassessment protocols. In addition, the basin monitoring effort utilizes multi-media sampling involving limited water chemistry, bacteria, algae, fish and/or sediment sampling as needed to address basin data collection needs. Primary selection criteria for basin stations to achieve basinwide geographic coverage are the mainstem tributaries in each of the NRCS 11-digit watersheds in the targeted basin. For 2001-2003, in lieu of statewide historical ambient fixed network and discreet basin network monitoring, MDEQ focused resources to conduct a statewide biological monitoring project to verify §303(d) evaluated impairments as well as to develop an Index of Biological Integrity for Mississippi wadeable streams now known as the Mississippi Benthic Index of Stream Quality (M-BISQ). Data collected as part of this monitoring effort were used in the development of this 2004 §305(b) Water Quality Assessment Report and the 2004 §303(d) list.

MDEQ Surface Water Monitoring Program

Introduction

Surface water monitoring activities provide the foundation for assessment of the water quality condition in the Mississippi's waters. Without monitoring data and information, the state's water quality management and regulatory programs cannot accurately and effectively report on the status of the state's water resources, identify and solve problems, characterize water pollution causes and effects, and/or evaluate the overall effectiveness of state management regulatory actions.

MDEQ's Office of Pollution Control (OPC) is the state agency responsible for the conservation of the quality of the natural resources of Mississippi and has primary responsibility for providing an effective statewide surface water monitoring and assessment program. This responsibility, coupled with legislative mandates set forth by the Mississippi Air and Water Pollution Control Law (Sections 49-17-1 to 49-17-43) and the Federal Clean Water Act (Sections 106, 204, 303, 305, and 314), serve as the main purpose for development and implementation of the Surface Water Monitoring Program (SWMP). Other state and federal government agencies and public/private groups are also involved in monitoring surface water quality. MDEQ actively solicits their contribution of information to the evaluation and assessment of Mississippi waters.

Surface Water Monitoring Strategy

In order to successfully develop, implement and maintain a surface water monitoring program, a strategy is necessary to steer and guide the broad range of multi-faceted monitoring activities carried out in support of program objectives. MDEQ's SWMP strategy, *Mississippi Department of Environmental Quality's Surface Water Monitoring Program* (MDEQ 2002), fulfills this need. The strategy provides an outline of program elements and establishes the overall goals and objectives of the SWMP. It also provides a plan to protect, maintain and improve the physical, chemical and biological integrity of Mississippi's water resources.

A primary objective of the SWMP is to ensure that MDEQ meets the requirements outlined in §106 of the CWA and to monitor, assess and report on the quality of

Mississippi's surface waters according to §305(b) of the CWA. As a result of assessment activities, water bodies that are not attaining their designated use(s) will be identified, in keeping with §303(d) of the CWA, and the causes/sources of impairment will be determined. Other objectives of the SWMP are to support monitoring and assessment activities within other OPC programs, to evaluate the effectiveness of those programs, and to address water quality issues of primary importance to the public. Lastly, the SWMP should determine better ways of monitoring and better methods for assessing the state's surface water resources. Planning and implementation of the SWMP is the direct responsibility of OPC's Field Services Division which consists of the MDEQ OPC laboratory located in Pearl, Mississippi and three regional field offices located in Oxford, Pearl, and Biloxi.

Elements of MDEQ's SWMP

The key elements of the SWMP include clearly defined objectives and an outline of the overall strategy used to meet the objectives. Strategy elements are designed to meet guidelines for national and state monitoring and assessment needs as expressed in EPA monitoring guidance, *Elements of a State Water Monitoring and Assessment Program* (EPA 2003). This guidance defines the necessary elements of a state water monitoring program and is used by EPA to determine if a state program meets the prerequisites of CWA Section 106(e)(1) in maintaining an adequate state monitoring program.

MDEQ carries out a broad range of monitoring activities before and after implementing pollution control programs to accomplish the objectives of the SWMP. These multi-faceted activities consist of the actual measurement of water quality parameters in state waters followed by the investigation and evaluation of factors contributing to these water quality findings. Finally, the monitoring process culminates with an overall assessment of the beneficial uses Mississippi's waters.

Strategy Components

A comprehensive monitoring program strategy should address all water quality management needs in all waters of the state, *Important Concepts and Elements of an Adequate State Watershed Monitoring and Assessment Program*, (Yoder 1997). MDEQ's SWMP strategy is geared to address the monitoring elements outlined below:

- Conceptual Monitoring Design
- Core Indicators
- Laboratory Analytical Support
- Quality Assurance
- Data Acquisition/Sharing With Other Monitoring Agencies
- Data Management
- Data Analysis/Assessment
- Reporting

SWMP Conceptual Monitoring Design

Program objectives drive the conceptual monitoring design which is multifaceted; incorporating several approaches for site selection, indicators, intensity levels of monitoring, magnitude and frequency of data collection, and monitoring schedules. To ensure that the design is clearly understood and represented in an organized fashion, the structure of the design is presented as a tiered model. The tiered model is structured to group monitoring activities that mutually address management needs. The tiered model includes primary, secondary and tertiary levels with the Primary tier representing the broadest grouping of activities. All three tiers of the SWMP are shown in Figure 15.

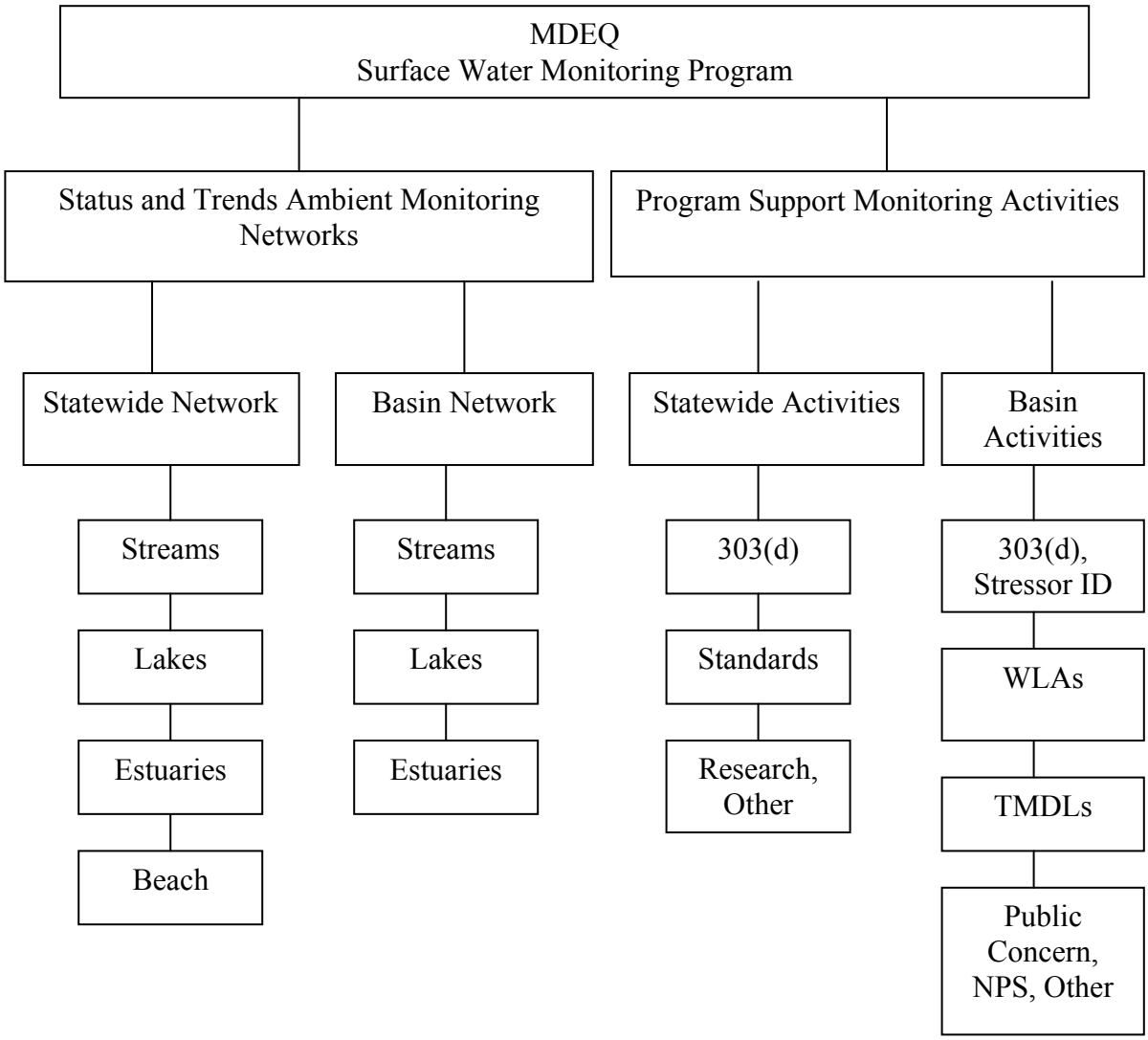


Figure 15: Tiered Surface Water Monitoring Program Design

The common thread of activities in the Status and Trends Ambient Monitoring Networks is that they are designed to address comprehensive water quality status and trends

management questions (i.e. what percentage of waterbodies are meeting their designated uses) and are continuous in duration. Data collected from these networks can also be used to make general statements about specific broad scale questions (i.e. what are the main causes and sources of impairment of Mississippi waters).

The Status and Trends Ambient Monitoring Networks encompasses a Statewide Network and a rotating Basin Network. The reason for sampling and the approach used for site selection is the main difference between these two networks. The Statewide Network is mainly composed of historical fixed stations that were targeted for long-term routine monitoring for a specific reason and are monitored on a static yearly schedule. The rotating Basin Network is composed of random sites that are selected using a targeted or probabilistic approach in each of five basin groups and are monitored on a rotating five-year basin schedule according to the Basin Management Approach. The tertiary tier is groupings of water body types that are monitored using similar methods, indicators and frequencies. Because MDEQ devoted all available monitoring resources to pressing §303(d) and WQS program issues, MDEQ suspended the Status and Trends Ambient Networks in 2001.

The Program Support Monitoring Activity component is designed to address immediate and specific water quality monitoring and assessment questions (i.e. what is the cause and source of impairment of a specific water body) dictated by other MDEQ Programs (i.e. TMDL, Standards, Nonpoint Source Pollution, NPDES Permitting). These monitoring activities involve a short term monitoring strategy and are narrow in scope.

SWMP Core Indicators

To assess the overall health of water bodies and to answer specific water quality questions, the SWMP utilizes a suite of water quality indicators. Each indicator or parameter is designed to either measure a general or specific cause of pollution (i.e. nutrients, DDT) or measure a general or specific response to pollution (biological integrity, fish kill). The SWMP samples a core group of indicators that is used to represent each applicable designated use of a water body (aquatic life support, contact recreation, fish consumption, and drinking water supply) and a supplemental group that is used on a site or project specific basis. Table 12 outlines the core group of indicators used in MDEQ's SWMP.

Table 12: List of Core Indicators Used in the SWMP

Physical/Chemical		**Biological**	
General		Pathogens	
			Fecal Coliform
	Water Temperature		Enterrococci
	pH	Fish Tissue	
	Alkalinity		Hexachlorobenzene
	Hardness		alpha BHC
Oxygen Demand			gamma BHC
	Total Organic Carbon		Aldrin
	Biological Oxygen Demand		Dieldrin
	Chemical Oxygen Demand		Endrin
Dissolved Oxygen			Total DDT
	Dissolved Oxygen		o,p-DDE
Water Clarity			p,p-DDE
	Turbidity		o,p-DDD
	Total Suspended Solids		p,p-DDD
	Transparency		o,p-DDT
Dissolved Substances			p,p-DDT
	Specific Conductance		Toxaphene
	Total Dissolved Solids		Methoxychlor
	Salinity		Total PCB's
	Chlorides		PCB 1221
Nutrients			PCB 1232
	Nitrate + Nitrite		PCB 1248
	TKN		PCB 1254
	Ammonia		PCB 1260
	Total Phosphorus		PCB 1262
Toxics			PCB 1016/1242
	Aluminum		Chlordane
	Arsenic		Pentachlorophenol
	Cadmium		Cadmium
	Chromium		Chromium
	Copper		Copper
	Lead		Lead
	Manganese		Arsenic
	Mercury		Mercury
	Nickel	Biological	
	Selenium		Macroinvertebrates
	Zinc	Nutrient Response	
	Phenols		Chlorophyll a
Hydrological			
	Flow		
Habitat			
	Habitat Assessment		
	Sediment Particle Size		

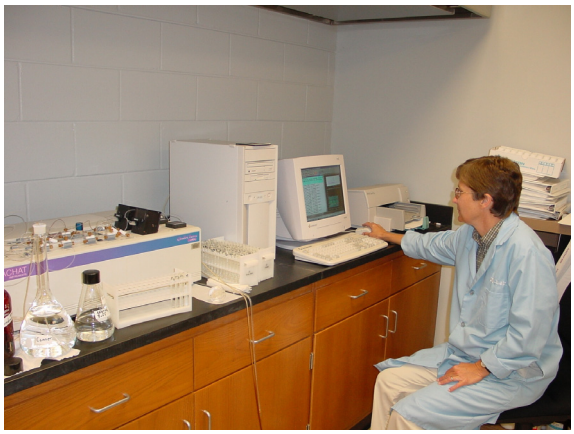
Laboratory Analytical Support

The MDEQ Office of Pollution Control (OPC) Laboratory, under the supervision of the OPC Field Services Division, performs a wide array of water quality analyses including nutrients, minerals, oxygen demands, trace metals, pesticide residue, volatile and semi-volatile organics, microbiological testing, and biological determinations. These analyses are performed on a variety of sample matrices, including water, wastewater, leachate, soil, sediment, chemical wastes, and fish tissue. The laboratory also performs analyses of air samples for particulates and lead, as well as asbestos identification on construction materials.

Biological determinations routinely performed by the laboratory staff include sampling and analyses of fish and the benthic macroinvertebrate community. Analyses of the structure and function of the benthic community are used to assess water quality conditions. The lab staff also prepares and analyzes fish tissue samples for pesticide and heavy metals analyses. The lab analyzes samples of periphyton and phytoplankton for chlorophyll to estimate algal productivity.

OPC laboratory services are primarily provided from a single laboratory complex located in Pearl, Mississippi near the capital city of Jackson in the central part of the state. Over the last decade MDEQ has upgraded its lab facilities in phases. In 1992, the new biology lab was completed. In 1998, the chemistry lab was added, and OPC is currently adding additional office space, boat storage space, and a hazardous materials storage building.

The lab equipment inventory now includes the following major pieces of analytical equipment: four gas chromatographs (GC), two atomic absorption spectrometers (AA), one inductively coupled plasma spectrometer, two GC/mass spectrometers (GCMS), one gel permeation chromatograph (GPC), one accelerated solvent extractor (ASE), three flow injection auto analyzers, and a total organic carbon analyzer. The lab improved its data handling and information technology capabilities by installing local area networks (LANs) at both the laboratory and at the regional offices. All the Field Services locations are connected to each other and to MDEQ main offices in Jackson via a wide area network (WAN). A new laboratory information management system (LIMS) went on line in January 2001 to improve data handling and sample tracking capabilities within the lab. The lab also set



up an environmentally controlled weighing facility to support the PM2.5 air monitoring program, and has recently added an automated filter weighing system.

Quality Assurance

Many of the decisions made by OPC in its pollution control programs are based on analytical data collected in the field and analyzed in the laboratory. Therefore, it is imperative that the validity of the data be assured and documented. This is necessary to be able to demonstrate that all environmental data generated, processed, or used for MDEQ management and regulatory purposes will be scientifically valid, defensible, and of known and acceptable precision and accuracy. A strong quality assurance program provides that guarantee and is an absolute necessity for operation of an effective water quality monitoring program. This validation of data is the foundation of the entire analytical process, from the planning stages through sample collection, analysis, and dissemination of data. Quality assurance and validity of results are stressed in all monitoring program activities undertaken or reviewed by the agency. All areas of environmental monitoring require rigorous adherence to the use of validated methods and repetitive quality control procedures.

The central element in an effective quality assurance program is the routine and rigorous use of standard operating procedures. MDEQ has established an agency Quality Assurance Committee that oversees the development and implementation of the agency Quality Management Plan (QMP). QMP was revised in January 2004. The QMP strives to ensure quality assurance/quality control programs are uniformly applied throughout the agency. The OPC laboratory has served as the focal point of the agency quality assurance program in the past, and its standard operating procedures are detailed in the November 1999 document, *Laboratory Quality Assurance Manual/Standard Operating Procedures*. The manual, primarily emphasizing compliance monitoring and chemical laboratory practices, was originally reviewed and approved by EPA in 1983 and is periodically updated to reflect changes in analytical methodologies and in the Code of Federal Regulations. The latest revision was reviewed by EPA in 2002 as part of their triennial laboratory audit. Currently, this document is undergoing another revision and is expected to be completed in 2005. This document will be more comprehensive in nature and is being expanded to also include biological and more detailed ambient water quality monitoring SOPs. In addition the lab has developed and updated a QA Manual titled: *Quality Assurance Manual Revison 2, August 2002*. In general, all measurements are made by MDEQ using EPA approved methods and/or according to 40CFR 136. Samples are collected and analyzed within required holding times unless noted on reports and all proper sampling containers, preservation techniques, and transportation guidelines are employed.

In order to evaluate and better report the quality of environmental data, MDEQ has recently upgraded its SWMP Quality Assurance/Quality Control (QA/QC) Program to complement all SWMP components. One objective of the SWMP QA/QC Program is to structure the framework and design of SWMP activities so that MDEQ can minimize, isolate, identify and correct problems in either process or design that produce error and

increase data variability. Another objective is to evaluate and report the quality of all data as well as the type and amount of uncertainty associated with all data.

Structuring the framework and design of SWMP activities includes the generation and implementation of quality assurance project plans (QAPPs) and standard operating procedures (SOPs). Quality Assurance Program/Project Plans are developed, maintained and reviewed to ensure the scientific defensibility of monitoring and laboratory activities, and to ensure that the quality of all reported data are known and reported in a comprehensive and consistent manner. These plans outline the level of data quality that is appropriate for the specific uses of the data. EPA Order 5360.1 requires EPA-approved QAPPs for all projects and activities involving the collection and analysis of environmental data (40CFR 31.45). The requirements for QAPPs are given in *EPA Requirements for Quality Assurance Project Plans* (EPA 2001).

In addition to QAPPs, standard operating procedures (SOPs) have been developed, reviewed, and maintained for all data collection and analysis activities including field and laboratory SOPs. This includes biological field and laboratory analytical SOPs and other previously undocumented procedures.

Evaluation of data quality involves establishing data quality objectives (DQOs), evaluating program design for whether the objectives can be met, and establishing assessment and measurement performance criteria that are used to evaluate the quality of the data. To evaluate data quality, the following indicators are used: precision, accuracy/bias, representativeness, completeness, and comparability. The implementation of MDEQ's QA/QC Program, as well as the development and use of QAPPs and SOPs in the SWMP, result in the generation of scientifically defensible data capable of supporting MDEQ management decisions.

Data Acquisition/Sharing with Other Monitoring Agencies

In addition to the previous ambient monitoring components outlined in this strategy and implemented by MDEQ, other government agencies and institutions throughout Mississippi perform extensive monitoring. A considerable effort has been made by MDEQ to identify, obtain information from, and work with the many other organizations collecting water quality data. This provides additional monitoring data for use in assessing state water bodies, and also reduces, if not eliminates, replication of services and ensures efficient use of MDEQ's limited surface water monitoring resources. These other monitoring organizations include the United States Geological Survey (USGS), United States Army Corps of Engineers (USACE), Tennessee Valley Authority (TVA), United States Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), Mississippi Department of Marine Resources (MDMR), Mississippi Band of Choctaw Indians, United States Department of Agriculture (USDA) National Sedimentation Lab, USDA Forest Service, USDA Natural Resource and Conservation Service, United States Fish and Wildlife Service (USFWS), Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP), Gulf Coast

Research Laboratory (GCRL) as well as other federal, state and local agencies, research institutions, universities and private groups.

Most of these organizations provide representatives to serve on Basin Planning Teams in MDEQ's Basin Management Approach. These Basin Teams provide a forum for sharing information and discussion of work implementation and monitoring efforts by the agencies and MDEQ. Data solicited and obtained from these agencies for the 2004 §305(b) Report was accomplished through the individual agency Basin Team representatives. MDEQ gratefully acknowledges the information and partnership efforts of these groups in protecting Mississippi's natural resources.

Data Management

The dissemination of accurate information is a major objective of a monitoring program. To meet this need, MDEQ compiles all SWMP data as well as data from outside sources and centralizes these data for ready access and to facilitate data entry into and retrieval from computer databases. With a central repository for monitoring data, information can be more easily supplied to MDEQ staff, federal and state agencies and the public. Water quality monitoring assessments can also be more easily conducted and water quality summary reports generated.

Most physical, chemical, and biological data collected under the SWMP are entered on surface water monitoring forms as analyses are completed in the field and in the laboratory. These forms are specifically designed to capture all necessary information and to facilitate accurate database entry. These forms are then screened, checked for accuracy and completeness, validated, and sorted. All persons performing sampling and/or analysis keep copies of the original form as completed in the field and the lab. All surface water data are then entered into MDEQ databases:

- Laboratory Information Management System (LIMS) – used to track MDEQ chemical laboratory samples through the sample handling and laboratory analysis phase
- Surface Water Information Management System (SWIMS) – application for displaying all MDEQ data and sampling locations through a single Geographic Information System (GIS) based platform, user friendly and comprehensive for agency and future public use
- Water Assessment Data Entry System (WADES) – permanent in-house MDEQ water quality storage and retrieval system for all SWMP data, developed to be STORET-compatible
- Ecological Data Application System (EDAS) – application for storage, analyses and assessment of biological data
- Assessment Data Base (ADB) – application for 305(b) assessment and reporting

MDEQ surface water chemical and bacteriological data has historically been routinely transferred to EPA's national water quality data Storage and Retrieval database system (STORET). With EPA's modernization and development of the new STORET system in

the late 90's, uploading of data into Modernized STORET has been temporarily suspended due to data migration issues between WADES and STORET that are still unresolved. Consequently, no MDEQ water quality data are available in the Modernized STORET system at this time. When the migration issues are resolved, it is the intent of MDEQ to not only continue to upload this water chemistry/bacteria type data to STORET but also to migrate biological and fish tissue data, previously maintained only in-house, to Modernized STORET. MDEQ historical water chemistry and bacteria data through 1998 can be found in the EPA STORET Legacy Data Center (LDC) database system. Both the Modernized and LDC STORET databases are accessible on-line from EPA's STORET web site (http://www.epa.gov/storet/) or via a link from MDEQ's web site (http://deq.state.ms.us). Recent MDEQ water quality data, however, is available directly from MDEQ and is provided electronically to EPA, other state and federal agencies, and the public as needed for required reporting and on an individual request basis. For information requests for water quality data, you may contact Assessment staff through the MDEQ web site (http://deq.state.ms.ust) or seek general assistance and other MDEQ contacts at the following link: http://deq.state.ms.us.

Data Analysis/Assessment

Analysis and assessment of surface water quality in Mississippi is carried out through comparison of monitoring data and information to established biological reference conditions and chemical, physical, and bacteriological water quality criteria established for Mississippi waters. Through this assessment, a determination of whether a water body is attaining its designated use or uses is made. A description of the Mississippi's water body use classifications and water quality standards can be found in the in Mississippi's WQS. Within the water quality assessment process, a certain degree of uncertainty is inherent with any assessment decision made. The accuracy of the data analysis is directly dependent on study design, data quantity, data quality, and the accuracy and rigor of the methods used in collection, laboratory analysis, and the assessment methodology process itself. A complete description of the CALM assessment methodology developed and used by MDEQ to analyze and assess all SWMP and other water quality data for the §305(b) assessment and §303(d) listing process is described in this report.

Reporting

MDEQ's main reporting avenue for SWMP and other water quality monitoring and assessment data is through the §305(b) Report. The purpose of the §305(b) report is to describe the status of the quality of the state's surface and ground waters for EPA, Congress, and the public. Through compilation and summarization of the reports submitted from the states, EPA can summarize the status of the quality of the Nation's waters. The §305(b) Report is required of each state by §305(b) of the Federal Clean Water Act (CWA). MDEQ makes the report available to the public via its Web site at (www.deq.state.ms.us).

In addition to the §305(b) Report, MDEQ provides a list of all impaired waterbodies, required pursuant to Section 303(d) of the CWA. The §303(d) List is a prioritized listing of water body use impairment along with the causes of the impairment. Upon being reported on the §303(d) List, a Total Maximum Daily Load (TMDL) is developed for the cause(s) and strategies for restoring the water body back to fully supporting its designated use(s) are developed. When the TMDL has been completed or monitoring data show that the water body is no longer impaired, the water body is taken off the §303(d) list.

Besides the §305(b) and §303(d) reporting processes, MDEQ also reports on SWMP activities and water quality issues through various other formats. These other reporting formats are presented in, project-specific technical reports, brochures, posters, oral presentation, newspaper articles, and MDEQ Internet access are utilized for the purpose of stakeholder outreach, education, public information, and to meet other federal grant and/or state legislative requirements. MDEQ also responds to individual requests from phone, web, or personal inquiries for water quality data and information.

Description of MDEQ Fixed Sampling Networks

Monitoring information from multiple programs is needed to fully achieve a comprehensive understanding of water quality in Mississippi's surface waters. Both routine ambient and special project monitoring activities administered by MDEQ contribute information for the evaluation and assessment of water quality in Mississippi. While all of these monitoring efforts contribute information for use in the §305(b) Water Quality Assessment Report, the fixed station ambient monitoring networks serve as the foundation for the statewide water quality assessment process.

Status & Trends Ambient Monitoring Networks

In Mississippi, ambient fixed station monitoring is designed to characterize and assess statewide water quality status and trends in the state's streams, lakes, estuaries and coastal waters for general reporting in the §305(b) report. As a result, impaired waters are placed on the state's §303(d) list. Fixed station monitoring also supports the design and implementation of MDEQ's surface water management programs including NPDES, nonpoint source, water quality standards, TMDL development, basin initiatives and water quality planning/management. This type of monitoring is also used by MDEQ to evaluate program effectiveness and to address economic development interests and concerns.

MDEQ maintains a fixed network of monitoring stations as part of the Surface Water Monitoring Program (SWMP) that are sampled routinely for a broad range of water quality parameters and indices. Parametric coverage at the stations includes physical, chemical, bacteriological, biological and/or fish tissue components. In 1997, MDEQ redesigned its' SWMP that had been significantly reduced in the early 90's due to funding cutbacks. The impetus behind this redesign was a critical need to increase the amount of assessed waters in Mississippi and the presence of increased monitoring resources to meet this and other EPA and state water program needs. This resulted in a major increase in the number of ambient fixed network monitoring stations relative to the number of historical MDEQ ambient fixed network stations. The redesign of the SWMP established a dual system of fixed sampling stations which now consists of a statewide Fixed Monitoring Network and a rotating Basin Fixed Monitoring Network. To provide better information for assessment and public health issues along Mississippi's coastal beaches, a new revamped Beach Monitoring Network was also established in 1999 as a third tier of MDEQ's SWMP Ambient Fixed Monitoring Network system.

In 2002, the SWMP adjusted its' monitoring activities to collect additional water quality data needed to address high priority management issues. Monitoring was conducted to support nutrient water quality criteria development for Mississippi water bodies,

determine if waters on the §303(d) list were actually impaired, and to provide data for specific §303(d) issues (i.e. fecal coliform impairment confirmation, stressor identification, TMDL model development) to ensure that the state could meet TMDL development deadlines. The institution of EPA's National Coastal Assessment Program added a new monitoring element to MDEQ's SWMP and development is also underway to establish appropriate biological indicators and assessment methodologies specific to the Mississippi Delta and large rivers in the state. :

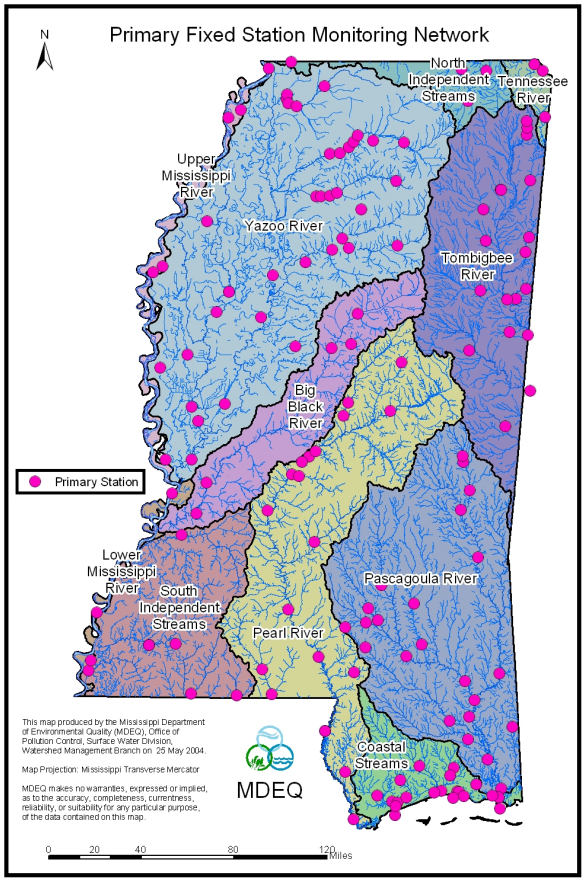
With this redirection, the Status & Trends Surface Water Monitoring Network, which included routine sampling of a statewide Ambient Fixed Station Network and a rotating Basin Network, was suspended in 2002. In its place, MDEQ has dedicated sampling resources (staff and funding) to comply with EPA's court ordered TMDL deadlines and conducted special project monitoring to address other critical data collection needs. Monitoring as part of routine statewide and rotating basin networks, and biological and pathogen monitoring for rivers, streams, lakes and estuaries have been suspended. The statewide fish tissue monitoring component of the Status & Trends Network and the Coastal Beach Monitoring Network are the only parts of the Status & Trends Surface Water Monitoring Network that were continuously monitored since 2002. The entire statewide Status & Trends Ambient Monitoring Network is anticipated for reactivation in 2005.

Statewide Fixed Station Monitoring Network

Primary fixed network stations are distributed throughout the northern, central, and southern regions of the state in streams, rivers, bayous and estuaries. This network consists of unpolluted streams to establish baseline conditions and streams below critical discharges to establish long-term trends and/or observe improvements where pollution control measures are implemented. Streams representing a composite of a large watershed allow broad evaluations of overall abatement programs and waters of general concern (i.e., major streams entering or leaving the state and near-coastal waters). Several stations in the sampling network are historical stations that have monitoring dating back to the 1970's.

The Statewide Fixed Monitoring Network design is conventional (i.e. targeted). Each station is required to meet the monitoring objectives and selection criteria for station locations. The network of statewide ambient primary fixed stations was established for systematic water quality sampling at regular intervals and for uniform parametric coverage to monitor water quality status and trends over a long-term period. Sampling is carried out by MDEQ Field Services Division (FSD) biologists from each of three regional offices (northern, central, and southern regions). Each office is responsible for the stations in its region. Laboratory analyses for water and biological samples are carried out by MDEQ's laboratory located in Pearl, Mississippi.

The locations of statewide fixed monitoring stations are shown in Figure 16. MDEQ's Primary Fixed Station Network consists of 143 stations across the state. Prior to 1997,



MDEQ's ambient monitoring network only sampled approximately 25 stations in any given year. In addition, the expanded network has enabled, MDEQ to conduct routine, comprehensive long-term ambient monitoring of the states' major lakes and reservoirs, as well as the open waters of the Mississippi Sound and its associated bays.

Figure 16: Statewide Fixed Station Ambient Monitoring Network

Physical, chemical, bacteriological, biological, and fish tissue parameters are monitored at network stations. The ambient fixed stations targeted for physical, chemical and bacteriological sampling are sampled either monthly (bridge sites) or quarterly (boat sites) depending on the designated access. Biological and fish tissue sampling occurs annually at selected sites.

Ambient fish tissue sampling occurs annually at 24 primary fixed stations across the state and at selected basin network sites. Fish tissue sampling for fish kill investigations, monitoring of fish advisory areas, and special studies requires more resources and results in more monitoring than ambient fixed station network sampling. Fish samples are normally collected from early spring through fall depending on ambient conditions. Target species include one predator or carnivore such as flathead catfish or large mouth bass, and one bottom feeder or omnivorous species such as channel catfish or smallmouth buffalo. Ideally, fillet composite samples consisting of five individuals are analyzed where all fish in the composite are at least 75% of the weight of the largest fish in the composite. The FSD laboratory has the capability to analyze fish tissue samples for approximately 36 organic compounds, PCBs, PCP and seven heavy metals, although it is rare for a sample to be analyzed for all parameters.

In addition to extensive water chemistry and fish tissue analyses, the MDEQ Status and Trends Ambient Monitoring Network relies heavily on the use of biological indicators. The purpose of ambient biological monitoring is to assess the health or biological integrity of the aquatic community as a long-term indicator of stream water quality. The MDEQ ambient biological monitoring program uses benthic macroinvertebrate community surveys in wadeable freshwater streams; and chlorophyll a levels in lentic, marine and estuarine waters. In 1996, the entire historical biological ambient monitoring network was re-evaluated and modified. As a result, approximately 40 fixed sites were established as macroinvertebrate monitoring sites for the new MDEQ Surface Water Monitoring Program. Sampling at these Primary Fixed Station Network macroinvertebrate sites began in 1997. Sites were sampled on an annual basis using modified EPA rapid bioassessment techniques and habitat assessments were performed. In 2001, MDEQ changed its' biological monitoring methodology in response to §303(d) issues and workloads. This initiative led to the development of a Mississippi-calibrated Index of Biological Integrity (IBI) for use in assessment of wadeable streams in Mississippi and resulted in monitoring efforts that have greatly increased the number of biological assessments conducted on state waters. The Mississippi Benthic Index of Stream Quality (M-BISQ) and its established sampling and analytical methodology now serves as the foundation for routine biological monitoring in the MDEQ statewide Status and Trends Ambient Monitoring Network.

Since 1997, a significant increase in phytoplankton assessments has occurred in the SWMP. Determination of chlorophyll a levels is now a routine part of the water quality assessments done on lentic systems. Phytoplankton is routinely sampled in 24 lakes and reservoirs in the statewide Ambient Monitoring Network on a quarterly basis for chlorophyll a analysis. Also, quarterly collections of phytoplankton at nine estuarine and marine sites are used for chlorophyll a analysis in coastal waters.

As mentioned earlier, the statewide ambient status and trend network has been temporarily suspended since 2001. Reactivation of this network is anticipated in 2005.

Basin Monitoring Network

The MDEQ Basinwide Approach to Water Quality Management strategy is supported by a basin fixed station monitoring network which augments the statewide primary fixed station network by adding monitoring sites in specific drainage basins or watersheds.

There are several fundamental differences between the basin fixed station monitoring network and the primary fixed station network. The primary fixed station network is static with a rigid set of parameters, routine sampling intervals, and is designed to study long-term water quality trends across the entire state. In contrast, the basin network is dynamic, sampling is relatively short-term and the monitoring is basin/watershed specific. Due to its dynamic nature, the basin network is subject to more variation in station selection, parameters sampled and sampling frequency.

One objective of the basin monitoring network is to increase the total aerial coverage of waters monitored in Mississippi. This objective is achieved by concentrating monitoring and assessment resources in specific drainage basins thereby maximizing sampling efficiency. Another major objective of the basin network is to provide specific information on a program by program basis to fill data gaps identified by MDEQ regulatory and management programs. As a consequence, basin management plans and implementation strategies are developed.

Basin sampling is rotated annually among the five major basin groups in the state to ensure that each basin group is monitored every five years. The annual sampling period for each year's targeted basin runs from January to December in a calendar year. Currently, basin network stations have been of a conventional (i.e. targeted) design with station selection criteria dictated by the program requesting the monitoring. Sampling of basin network stations is conducted through a coordinated effort between the FSD regional office biologists and Central Laboratory biologists and chemists. Parametric coverage for these stations generally includes screening-level biological/habitat assessments in combination with chemical/physical, bacteriological, algal, fish tissue and/or sediment monitoring.

As with the statewide network, the Basin Monitoring Network has been suspended since 2001 to focus monitoring resources on other high priority statewide environmental issues. Reactivation of this routine monitoring network is anticipated for 2005.

Coastal Beach Monitoring Network

MDEQ's Coastal Beach Monitoring Program, operated in conjunction with the University of Southern Mississippi's (USM) Gulf Coast Research Laboratory, conducts routine bacteria and water chemistry sampling at 22 beach stations located along Mississippi's Gulf Coast (Figure 17). MDEQ is just one partner within a multi-agency Beach Monitoring Task Force composed of, EPA Gulf of Mexico Program, Mississippi Department of Marine Resources, and the Mississippi State Department of Health. This Beach Monitoring Task Force oversees the program and actually issues beach advisories/closings if needed.

MDEQ and the Beach Monitoring Task Force rely on data collected under this program to assess health safety issues for users of Mississippi's recreational beaches. When fecal coliform concentrations reach unsafe levels, beach advisories or closures are issued. In

addition, the data provide information concerning the seasonal water quality conditions of the immediately accessible waters along the public bathing beaches. Beach water quality conditions are made available to the public via a Beach Monitoring Web page developed by USM that can be accessed via the MDEQ Homepage (www.deq.state.ms.us). This web site contains beach advisory status, location of monitored sites, data associated with those monitored locations, and a history of beach closures.

There are eleven core stations that are sampled approximately ten times a month during the recreational season. Non-core stations are sampled weekly during the recreational season (May – October). Any station is re-sampled if fecal coliform levels exceed 2000 colonies/100ml. For a complete list of parameters monitored as part of this program, see Table 13 below.

Table 13: MDEQ Beach Monitoring Parameters

Water Quality Indicators	
Water Profiles	Water Samples
Temperature	Fecal coliform counts (MF and MPN)
Salinity	E.*Coli* counts (MF)
Dissolved Oxygen	Enterococci counts (MF)
pH	
Turbidity	
Tide Stage	
Rainfall and /or cloud cover	
Stage of river nearest station	

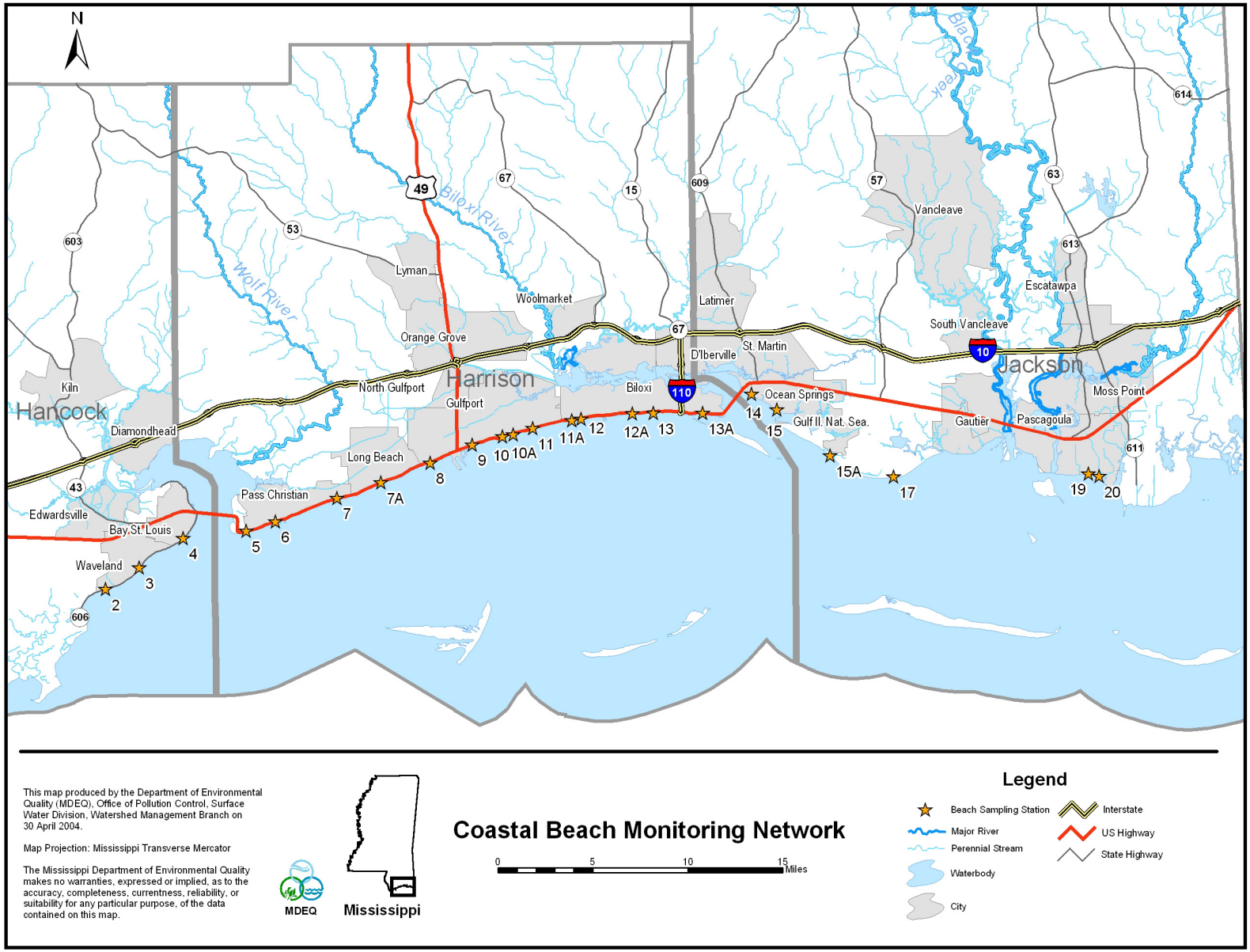


Figure 17: MDEQ Coastal Beach Monitoring Network

PART V

MDEQ INTENSIVE SURVEYS AND SPECIAL PROJECT MONITORING

MDEQ Intensive Surveys and Special Project Monitoring Overview

Introduction

Intensive surveys and special project monitoring are conducted to meet a variety of site-specific surface water quality needs. These monitoring efforts are usually conducted at the request of sections within MDEQ, other agencies, the regulated community, or the general public. Intensive surveys and special projects are planned, where possible, to coincide with MDEQ's Basinwide Approach strategy, and are scheduled and conducted during the data collection phase of the five-year basin rotation cycle.

Data generated from intensive surveys are primarily used for calibration and verification of mathematical computer models. These models are used to develop wasteload allocations (WLA) for wastewater discharges to predict impacts of pollutants from these sources on the state's freshwater and estuarine water bodies as well as to determine pollutant total maximum daily loads (TMDLs) for receiving streams. The water quality-based effluent limitation (WQBEL) process as described in the MDEQ document *Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification* (MDEQ 2001) sets forth the conditions in which these mathematical models are needed.

MDEQ special project monitoring studies address numerous water quality issues. These projects range from one-time limited parametric surveys to in-depth ecological assessments involving physical, chemical, bacteriological, biological, and fish tissue monitoring. Special projects are conducted to gather water quality information for various MDEQ programs in areas where surface water data is nonexistent. They are also used to investigate known or suspected water quality problem areas below both point and nonpoint pollution sources, and to resolve public health issues. Some examples of surface water special projects conducted by MDEQ are: WLA studies below point source discharges, specialized monitoring for public health/aquatic life concerns, §303(d) impaired waters confirmation, and water quality criteria development.

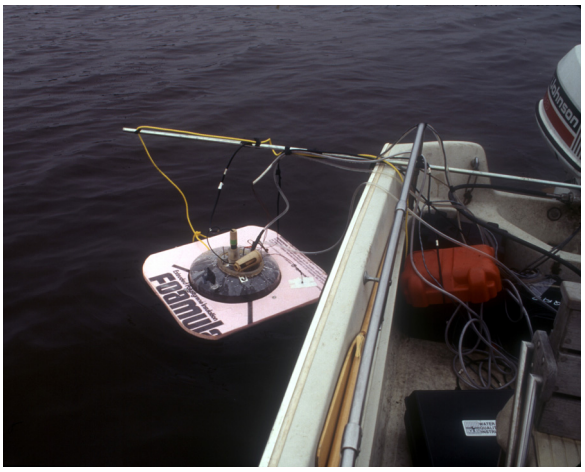
Descriptions of MDEQ SWMP intensive surveys and special projects conducted or presently on-going since 1999 are presented in the following sections:

- Model Calibration/Verification Surveys for WLAs and TMDLs
- WLA Investigation Studies
- Special Water Quality Assessment and §303(d) Impaired Waters Monitoring
- Water Quality Criteria Development Support Monitoring
- Water Quality Studies for Parameters of Special Concern
- Source Compliance and Environmental Damage Assessment Monitoring
- Volunteer Monitoring

Model Calibration/Verification Surveys

Intensive field surveys for model calibration/verification studies are conducted by MDEQ with support periodically from the U.S. EPA Region IV Science and Ecosystem Support Division (SESD) based in Athens, Georgia. These surveys are generally conducted in two data windows representing an intensive short-term data collection effort in the low stream flow, warm temperature months (August-October) and a second data collection effort under a different climatological and hydraulic regime. One data set is used for calibration of the model and the other data set for verification of the model. Both of these data collection phases are resource-intensive and involve multi-parameter, multi-station, frequent water quality sampling over a period of several days or weeks.

After considerable reconnaissance and preliminary monitoring in the proposed study area, the intensive hydraulic and water quality field data collection effort is conducted during the two data collection windows. The data collection effort involves sampling at both the wastewater effluent from the NPDES industrial or municipal facility under scrutiny, if point sources are present, and at numerous sites along the receiving stream both upstream and downstream of the discharge or problem area. Hydraulic data collection usually includes a time of travel, dispersion and/or flow determination dye tracer study. Extensive physical and chemical data collection over a diel (24-48 hour) period using the deployment of multi-parameter dataloggers or sondes and manual water quality sampling for such parameters as dissolved oxygen, temperature, specific conductance/salinity, BOD_5, ultimate BOD and nutrients is conducted. Other data such as biological community metabolism (primary productivity, respiration, and sediment oxygen demand) and biological assessment data are also obtained. When the field studies are completed, data are entered into a computer model and used to reflect actual field conditions, resulting in the development of a model that will protect water quality in the receiving stream.



WLA Investigations and other Special Studies

One of the most cost-effective and comprehensive methodologies for documenting the effect of a potential point source discharge is to gather in-stream biological and physical/chemical data prior to effluent release and then compare it to data collected after the point source begins discharging. These studies are excellent tools for cause and effect comparisons at existing facilities and are used by MDEQ for complaint investigations, enforcement actions, and §303(d) listing/delisting decisions. WLA investigation studies,

in particular, have seen increased usage over the years as part of the WQBEL process for NPDES discharges. Although not as rigorous in data collection as a model calibration study, these studies provide valuable and cost-effective water quality information for use in WLA and §303(d) decision-making. The in-stream data coupled with the outputs from MDEQ's empirical WLA computer model more accurately ensure the protection of in-stream water quality standards and the biological community.

WLA and §303(d) confirmation studies in freshwater streams collect biological data to assess the health of the instream benthic macroinvertebrate community. These studies also collect stream flow measurements, land use survey information, and limited physical/chemical data both instream and in the effluent. Multi-parameter dataloggers or sondes are deployed to monitor dissolved oxygen, temperature, pH, and specific conductance/salinity/total dissolved solids at hourly intervals for a 24 - 48 hour period to determine the diurnal fluctuations in these parameters. During this same period, chemical sampling of the effluent and in-stream locations is carried out manually or through the use of automatic ISCO samplers to collect conventional water quality parameters such as biochemical oxygen demand, nutrients, solids and turbidity. Each study involves sampling at two to three sites in the receiving stream at the following locations: an upstream (control) site for background conditions, a mixing zone site in the area of expected maximum pollutant assimilation, and at a site further downstream in the recovery zone. These studies are normally conducted between May and November during low-flow, warm temperature conditions to reflect the most critical period in a receiving stream. Screening level biological monitoring is also conducted during this time along with a comprehensive benthic macroinvertebrate survey occurring in the preceding or following winter index period. This allows for a comparison to the M-BISQ discussed later in this section. Studies of this type are scheduled by basin according to the Basinwide Approach cycle wherever possible.

From 1999 to 2003, MDEQ conducted 30 investigations throughout the state to provide supporting information for decisions on NPDES permit limitations and WLA/TMDLs. Those sites studied are outlined later in this report.

Frequently, a number of water quality studies carried out by MDEQ provide site-specific, non-routine, supplemental information as needed for water quality assessment and §303(d) impaired waters listing. In recent years, the vast majority of MDEQ SWMP

resources have been directed to these special projects to provide the data needed by MDEQ to address critical environmental concerns and mandates. These resource-intensive projects included §303(d) monitoring, benthic IBI development in wadeable rivers and streams, and fecal coliform monitoring for §303(d) listing/delisting decisions.

Water Quality Criteria Development Support Monitoring

Mississippi's water quality standards serve as the foundation for the §305(b) assessment process and provide the criteria for which monitoring data are compared to make decisions on whether a water body is attaining or not attaining its designated uses(s). MDEQ has developed water quality criteria to protect the designated use(s) of all waters in the state. Re-issued every three years, the state is required to review its water quality standards and consider amendments to the standards in response to new EPA guidance or new information. Periodically, monitoring activities are necessary to provide data to support the water quality criteria development process. During this §305(b) reporting period, significant monitoring efforts have been directed to nutrient monitoring to meet EPA requirements for national nutrient criteria development in streams, river, lakes, and estuaries.

The EPA has developed a national strategy that describes the agency's approach to obtain nutrient information. This information will be used by states to adopt nutrient criteria into the water quality standards program. As part of this strategy, States and/or EPA must develop and implement nutrient criteria for surface waters. In response to this initiative, Mississippi is aggressively moving forward to develop numeric criteria that will characterize natural nutrient concentrations in Mississippi water bodies. The purpose of this project is to gather scientifically defensible data for use in developing numeric nutrient criteria for streams and rivers, both wadeable and non-wadeable, lakes, and coastal estuaries. The ultimate objective is to reduce the anthropogenic component of nutrient over-enrichment to levels that restore beneficial uses, described as designated uses by the Clean Water Act, and to prevent nutrient pollution. The project is also intended to facilitate a better understanding of cause-and-effect relationships in these complex systems.

To assist with nutrient criteria development, MDEQ has formed a multi-agency Nutrient Criteria Task Force (NCTF) to provide technical advice and guidance in the development and implementation of nutrient criteria for the waters of the state. Within this task force, three subcommittees have been formed to specifically address the three principal water body types: lakes, streams and rivers, and estuaries. The work outlined for this project includes historical water quality data analysis, water quality monitoring, laboratory analyses, and database development. Water column sampling for all water body types includes total nitrogen [TN], total phosphorus [TP], algal biomass [measured as chlorophyll *a*], turbidity, and traditional water chemistry parameters such as dissolved

oxygen, temperature, specific conductance, and suspended solids. A briefing of activities by water body type can be found later in this report.

Water Quality Monitoring for Pollutants of Special Concern

Toxic pollutants and pathogenic organisms in our environment are a growing public concern. As tremendous progress has been made over the years in environmental protection in Mississippi and the United States, risk assessment and public health issues are receiving greater attention. Special monitoring activities to address levels of these pollutants in water, fish/shellfish tissue and sediment are periodically undertaken by MDEQ usually in cooperation with other state and federal agencies. Examples of past studies of this type have included investigations for such contaminants as mercury, dioxin, and PCB's in water, sediment, and fish tissue.

Source Compliance and Environmental Damage Assessment Monitoring

Proper treatment of industrial, domestic, and municipal wastewater must be accomplished prior to discharge into Mississippi's streams and rivers. Pollutants in effluent discharges, as well as in stormwater runoff and unpermitted or uncontrolled sources, must be removed or reduced to levels which will protect the uses of the receiving stream. MDEQ permit compliance monitoring of discharges and facility in-stream monitoring provides the necessary information to ensure compliance and enforcement of NPDES permit limitations while environmental damage assessment monitoring ensures accurate documentation of complaint and emergency response investigations.

NPDES Permit Compliance Monitoring

NPDES permit compliance monitoring is the principal instrument used to enforce effluent discharge limitations from municipal, industrial, and/or commercial facilities. This program is administered by the MDEQ Environmental Compliance and Enforcement Division (ECED) and includes several monitoring components. Self-monitoring by the permitted facility in the form of effluent discharge monitoring reports is a condition of the NPDES permit and reports are submitted routinely to MDEQ. In addition, a number of state and federal inspections as well as compliance sampling are conducted on the facility directly by MDEQ's ECED and Field Services Division regional office staff.

A regulatory surface water monitoring tool used increasingly is facility or permittee in-stream water quality monitoring. This tool is used primarily for industrial NPDES

facilities and hazardous waste sites but has also been incorporated into NPDES permit requirements at municipal facilities. Using this tool, facilities have to document compliance with water quality criteria (physical, chemical and biological) in the receiving stream below the facility discharge and submit an in-stream monitoring plan which is reviewed and approved by MDEQ. Monitoring is generally carried out by the facility or its designee and the results are submitted to the applicable MDEQ division for review and data storage.

Environmental Damage Assessment Monitoring

Environmental damage assessment (EDA) monitoring refers to environmental monitoring performed as a result of complaints, fish kills, hazardous waste remediations/mitigations and emergency response investigations in surface waters. These incidents can result from either point or nonpoint source pollution releases. Initial responding divisions of MDEQ may be the Field Services Division, the Hazardous Waste Division, and/or the Emergency Response Division. All responses are carried out as promptly as possible but investigations may be prioritized as the situation demands. The three regional offices are strategically located in the state to meet this need and to provide closer and more rapid response to a pollution incident.

Surface water samples, sediment, fish and/or a biological assessment of the affected water bodies as well as on-site soil, waste and groundwater sampling are collected as part of these investigations. Analyses of the information and/or data collected during the initial response investigation can frequently trigger more intensive monitoring to better define water quality and public health impacts and to support enforcement actions. Water bodies with recurrent complaints or prolonged contamination are examined and may be targeted for more extensive, long-term monitoring.

MDEQ biologists assist with these investigations by documenting the severity and extent of environmental damage to the resident biological community by the pollutant spill or release. Biotic communities affected by the spill are compared with communities from ecoregional reference sites or control sites. These comparisons help ensure that no long-term damage has occurred in the state's waters. Sampling protocols for EDAs are designed on a case by case basis, depending on the habitat type and environmental conditions at the site. To determine potential damage to the ecosystem, the spilled chemical, the characteristics of the water body, and many other factors dictate the methodology employed and the parameters measured.

Volunteer Monitoring

The MDEQ Office of Pollution Control, in cooperation with the Mississippi Wildlife Federation (MWF), has developed the Adopt-A-Stream Volunteer Monitoring Program in Mississippi. This program trains volunteers to conduct water quality monitoring on streams and rivers in the state and educates them on the relationship between point and

nonpoint source pollution and water quality. This program seeks to foster a relationship between MDEQ and the public to enhance awareness of and appreciation for our natural resources.

Participants are taught to conduct biological and chemical monitoring, read topographic maps, implement BMPs, survey watersheds for point and nonpoint source impacts, and map watersheds. After leaving the workshop, the volunteers understand and appreciate the intricate relationship between the environment's biological, chemical, and physical components. In addition, MDEQ has completed a field guide as a supplement to the workshops and an Adopt-A-Stream staff member conducts a follow-up visit with each volunteer onsite before monitoring begins.

The first Adopt-A-Stream workshop was held in December 1993 with two workshops geneally conducted each year. In addition to the workshops, many people are exposed to the Adopt-A-Stream program through talks, exhibits, and news releases. The MDEQ enters the data collected by the Adopt-A-Stream volunteers into a database to aid in review and analysis.

To date, approximately 420 people have been educated at workshops and chemical and/or biological monitoring data has been received from 74 streams. Volunteer monitoring data collected as part of the Adopt-A-Stream program were reviewed for the 2004 §305(b) assessment process. No data collected as part of this program showed compelling evidence of impairment.

Rivers and Streams - Intensive Surveys and Special Project Monitoring

Development of Mississippi's Benthic Index of Stream Quality (M-BISQ)

An effort was begun in 2000 to develop a more reliable and scientifically defensible biological assessment methodology for wadeable streams and rivers in Mississippi. TMDL/§303(d) issues facing the state were the impetus for this effort. As a result of these critical issues, a statewide biological monitoring project was implemented with two main objectives: to obtain monitoring data from §303(d) listed wadeable streams and rivers and to assess these data using an Index of Biological Integrity (IBI).

For this project, after consultation with state and federal biological experts, MDEQ redesigned its biological monitoring program to produce higher quality data allowing the state to develop a more scientifically defensible assessment methodology. As a result, MDEQ's historical biological program was modified resulting in the adoption of new biological field and laboratory methods (modified multi-habitat proportional sampling with laboratory sub-sampling and taxonomy) and a new index period (winter, December - February) was selected for benthic sampling. Rigorous QA/QC protocols were also employed including development of a comprehensive Quality Assurance Plan (QAPP) with detailed standard operating procedures, revisions to data entry and biological database management procedures, and documentation of data quality characteristics throughout the entire data collection and assessment process.

Phase I of the monitoring project, initiated in the winter of 2001, involved a one-time sampling of over 475 streams (Figure 18), statewide with the exception of streams in the Mississippi Alluvial Plains Ecoregion (Mississippi Delta region). Monitoring teams, consisting of MDEQ personnel and private contractors, collected biological (benthic communities), physical (habitat assessment, Wohlman pebble count, flow), and chemical (in-situ measurements, nutrients, solids) data at all stations. The MDEQ Lab performed the chemical analyses and biological sub-sampling while Tetra Tech, a private contractor, performed the biological taxonomy. Analyses of Phase I data were completed in 2002.

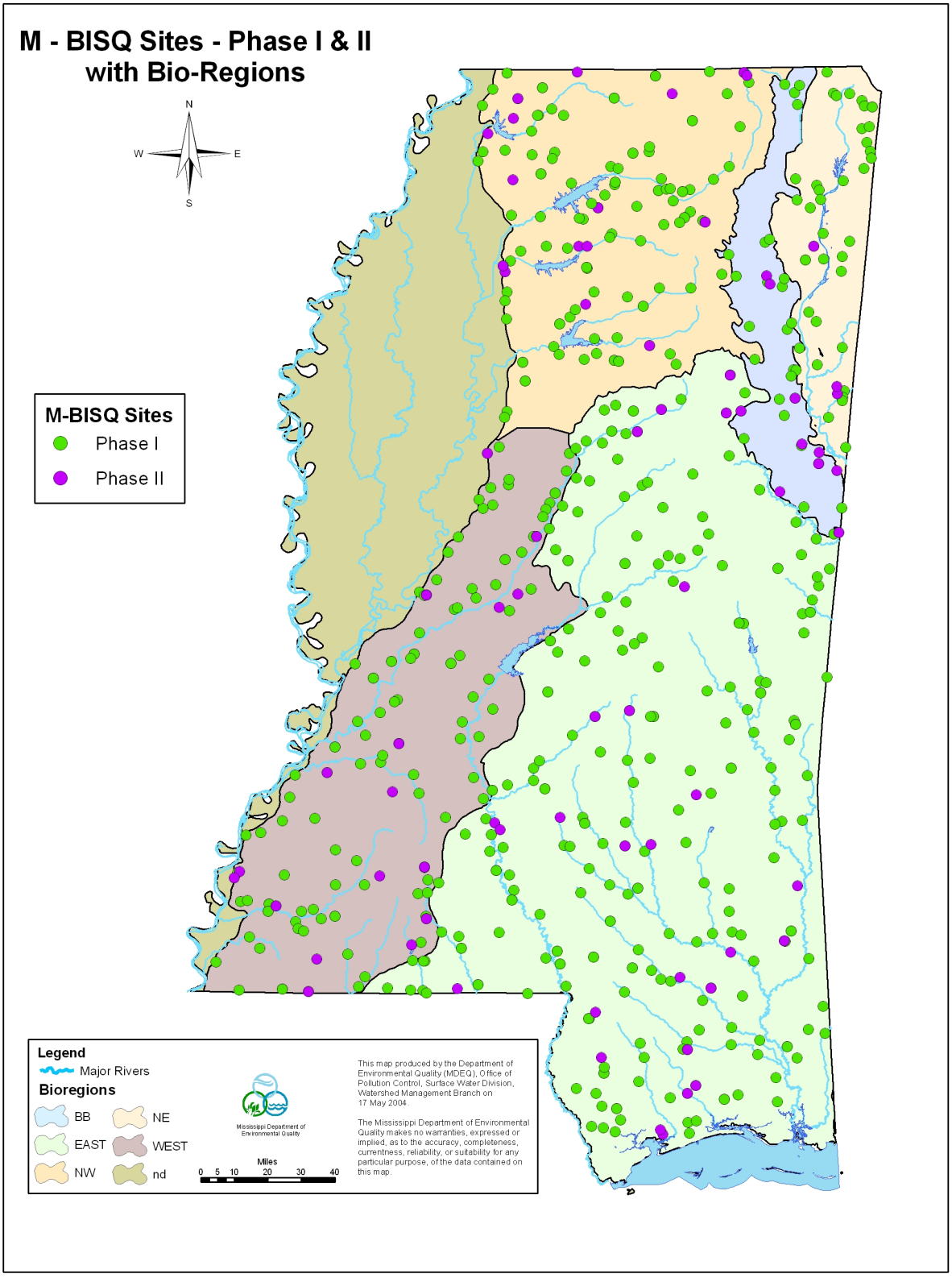


Figure 18: Locations of M-BISQ IBI Phase I and Phase II Stations

As a result of this sampling effort, biological reference conditions were defined for five "bioregions" in the state and summarized in the form of an IBI using a suite of metrics found to discriminate between sites of different ecological integrity. The resulting regionally-calibrated IBI is known as the Mississippi Benthic Index of Stream Quality (M-BISQ). The design of the M-BISQ provides the state with a sound scientific methodology for accurately assessing the overall ecological condition of wadeable streams. A detailed discussion of the M-BISQ development effort is provided in the publication *Development and Application of the Mississippi Benthic Index of Stream Quality (M-BISQ)*, (MDEQ 2003) which is available on the MDEQ web site (www.deq.state.ms.us).

Sampling has continued for this project to pick up a number of targeted §303(d) listed wadeable streams and rivers that were not sampled during Phase I of the §303d/IBI. In addition, new sites continue to be added for WLA investigations which have incorporated use of M-BISQ data. Phase II was initiated in January–February 2002, and data were collected at 92 sites. In Phase III, conducted in December-February 2003, data were collected at 100 sites. Similar to the first year's collection effort, these sites are located statewide with the exception of the Mississippi Alluvial Plain, which is the focus of a separate monitoring effort discussed later in this section. Data collection was conducted by MDEQ for both Phase II and III, and DEQ, with help from Tetra Tech, conducted the sub-sampling and taxonomic efforts in the laboratory. Data analyses for the 2002 data set were completed in 2003 using the newly developed M-BISQ. Phase III data analysis is still underway.

Results from the M-BISQ effort are being used to assess the status of §303(d) listed water bodies and to steer future biological monitoring and assessment activities focused on wadeable streams and rivers. Much of the basis for the Mississippi 2004 §305(b) water quality assessment is from data collected and analyzed from Phases I and II of the M-BISQ monitoring project.

Fecal Coliform §303(d) Monitoring and Assessment Project

Mississippi's 1998 §303(d) list identifies numerous water bodies as being potentially impaired by pathogens based on evaluated assessments for which no actual monitoring data have been collected. For each water body on the §303(d) list, evaluated or monitored, the state is required to develop a TMDL for those pollutants impairing any use of the water body. For the evaluated §303(d) water bodies, MDEQ is committed to determining whether these waters are actually impaired before resources are allocated to develop TMDL's. In addition, more data are needed for the monitored §303(d) water bodies to identify potential bacteria sources. Three projects were initiated in 2001, and continued through 2003, to collect the data needed to verify §303(d) pathogen listings and develop pathogen TMDL's in Mississippi.

Bacteria (fecal coliform) samples were collected at approximately 180 sites statewide (Figure 19). At each site, six samples were collected over a two-year period during four separate thirty-day sampling periods. Sampling was conducted annually once during the winter (wet) season, and once annually during the summer (dry) season. Samples were not generally collected immediately following a rain event in the watershed to ensure that the samples indicated fecal coliform bacteria levels at baseflow conditions. Data collection activities also included conducting tape-downs at each station at the time of sample collection, taking digital photographs of each station, as well as recording the latitude and longitude of each station. The SOP developed for this project required field duplicates, field blanks, and split samples. Upon completion of each project, the data were assessed according to the MDEQ CALM. Water bodies assessed as impaired are reflected in the state's 2004 §303(d) list and water bodies that were assessed as non-impaired will be submitted for de-listing. Additionally, development of TMDL's for impaired water bodies is ongoing.

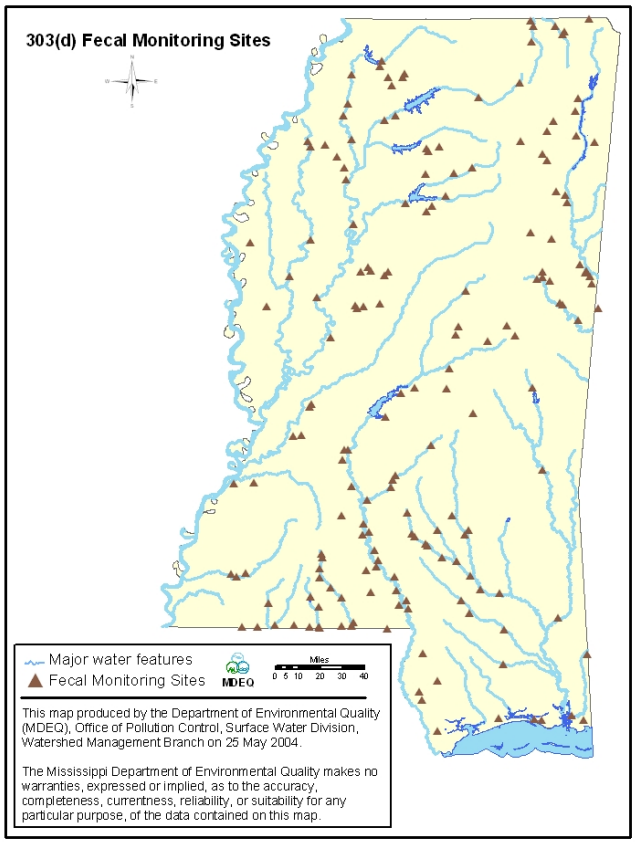


Figure 19: Fecal Coliform §303(d) Sampling 2001-2003

Mississippi Alluvial Plains Ecoregion (73) Monitoring Strategy Project

This is a pilot project attempting to test and develop monitoring methods for the Mississippi Alluvial Plain or Delta Ecoregion (# 73 after Omernik), a portion of Mississippi's Yazoo River Basin. This effort resulted from pressing §303(d) list and TMDL issues facing this region, and from uncertainty regarding an appropriate monitoring and assessment strategy for this unique ecological region. In 2001, a multi-agency work group consisting of scientists from various state and federal agencies was formed by MDEQ to develop an appropriate monitoring strategy for the Mississippi Delta. The work group designed a pilot study and developed a Quality Assurance Project Plan. The objectives were to examine the utility of macroinvertebrate and fish community data as ecological indicators, and to test data collection, analysis and interpretation methods in this region.

The work group recommended biological methods be tested in the Mississippi Delta in two index periods: winter 2001, and summer 2002. This study was a joint effort between the United States Geological Survey (USGS), U.S. Corps of Engineers Engineering Research and Development Center (ERDC), and MDEQ. Macroinvertebrate samples were collected using the current MDEQ wadeable streams methodology developed for the M-BISQ Project and Hester-Dendy multiplate samplers at 27 sites during the winter index period and 47 sites during the summer index period. Water sample collection and physico-chemical determinations were conducted by USGS personnel and were analyzed by the USGS Laboratory. Fish sampling was conducted by ERDC. Macroinvertebrate samples are being processed and identified by Tetra Tech, Inc. and data from these samples are pending. Fish community data are also pending.

Development of Biological Indicators and Reference Conditions for Large, Non-wadeable Rivers and Streams in Mississippi

Similar to the M-BISQ project, a major effort is underway to develop biological indicators and reference conditions for large (non-wadeable) rivers in Mississippi. Information generated from this project will be used to assess the water quality status of these water bodies. First, research was done on current methods of monitoring and assessing the ecological integrity of large rivers and the results were used to design a pilot study. Next, the design for the pilot study will be submitted for review to the Mississippi Large River Technical Advisory Group composed of state, federal, and academic specialists. At that point, a pilot study plan will be implemented. At completion of the pilot study, data will be reviewed to determine appropriate indicators and data collection methods. Finally, reference conditions will be established and a

classification system for large rivers will be defined. This process will allow the state to accurately monitor and assess the status large rivers on the §303(d) list.

In 2002, the multi-agency Mississippi Large River Technical Advisory Group (TAG) was established and formulated ideas for a pilot monitoring strategy. This strategy has been drafted into a proposed Sampling and Analysis Plan and is currently under review.

Section 319 Non-Point Source Monitoring

In an effort to evaluate the effectiveness of Best Management Practices (BMPs) in improving water quality, six watersheds with BMPs in place were selected by the NPS Section of the SWD Water Quality Management Branch for monitoring and evaluation. Funded by EPA Section 319 Nonpoint Source (NPS) Grants, this was a joint effort by MDEQ, the Mississippi Soil and Water Conservation Commission, EPA, the Natural Resource Conservation Service, and the County Soil and Water Conservation Districts. The targeted watersheds were Moon Lake, Cane/Mussacunna Creeks, West Fork Pushepatapa Creek, Twentymile/Donivan Creeks, Upper Bogue Phalia Creek, and Souinlovey Creek. Sites were selected within each of these watersheds to evaluate the effectiveness of the BMPs and to document any changes in ambient water quality. Monitoring was conducted by MDEQ Field Services Division at multiple sites within these watersheds between 1998 and 2002. Sampling consisted of semi-annual to quarterly monitoring of in-situ physico-chemical parameters, water chemistry, and biology (benthic macroinvertebrates) where applicable. All studies were completed and reports have been finalized and furnished to EPA.

Stressor Identification for §303(d) Biologically-Impaired Waters

The objective of this effort is to conduct stressor identification (SI) analyses on §303(d) listed biologically impaired water bodies. SI studies are needed to identify the specific stressor(s) in water bodies listed as biologically impaired on the Mississippi 2002 Section 303(d) List of Water Bodies. There are approximately 275 streams needing stressor identification studies before a TMDL can be developed. This project will analyze existing water quality data and other pertinent watershed information like landuse/landcover, hydrology data, permitted discharge data, and agriculture census data to identify stressors and potential sources of impairment. Where needed, ground-truthing of study area characteristics will also be conducted to evaluate the quality of older geographical and spatial information. Also, if resources allow, actual field monitoring may take place in targeted §303(d) listed waters to fill data gaps. The SI results will directly support MDEQ's commitment to submit TMDLs by consent decree deadlines. Data generated from the SI process will be used to support both the NPDES and NPS regulatory/management programs, and to help direct future surface water monitoring program activities.

Stressor identification is a complex process and involves, by necessity, the consideration of both point and non-point pollution sources. A thorough analysis of potential stressors that includes strong consideration of all source loads and causal agents is needed. The stressor identification analyses follow guidelines as outlined in the EPA document *Stressor Identification Guidance Document* (EPA 2000). In general, the strategy used in identification of stressors through causal analysis will be to logically eliminate causes, diagnose causes when able, and use strength of evidence to identify the most likely cause of impairment through a documented and consistent process.

In 2002, Mississippi's first SI analyses were conducted for two streams, Short Fork Creek in DeSoto County and De Lisle Bayou in Hancock County. In 2003, SI analyses were conducted for Hurricane Creek in Rankin and Scott Counties, Red Cane Creek in Rankin County, and Little Tangipahoa River in Pike County. Hurricane Creek was identified as being biologically impaired based on a screening level bioassessment performed as part of a MDEQ nonpoint source (NPS) evaluation in 1993. Red Crane Creek and the Little Tangipahoa River were identified as biologically impaired from data collected as part of M-BISQ project in 2001. SI analyses for these streams were completed in October 2003 to meet TMDL development deadlines. Numerous SI analyses will be needed to address the remaining biological impairment listings from the 2002 §303(d) list as well as newly identified impaired water bodies from future lists.

Nutrient Criteria Development – Rivers and Streams

The Streams and Rivers Subcommittee of the Nutrient Criteria Task Force (NCTF) was established in 2001. A major focus of nutrient criteria development for streams and rivers is placed on obtaining an understanding of the cause and effect relationship between nutrient and biological indicators, primarily benthic macroinvertebrates. The project is intended to benefit not only Mississippi but also the National Nutrient Strategy by providing additional water quality data from Mississippi Level 3 Ecoregions. The subcommittee has identified and recommended correlating existing biological information from the MDEQ statewide M-BISQ project with additional chemical and biological data collection efforts at sites throughout the state representing stressed and reference water quality conditions. Data gaps have been identified (i.e. limited nutrient data at most M-BISQ sites was based on only 1 sample collected during that project) and a monitoring strategy is being developed.

With a new deadline of 2008 for streams and rivers nutrient criteria development, more time is available to allow further existing data review and planning for the formal monitoring strategy which will ultimately result in defensible nutrient criteria development. In the interim, with the limited nutrient data available for the many streams and rivers in the state, MDEQ and the subcommittee are moving ahead with an initial pilot monitoring effort to provide additional nutrient data and information for this project. A QAPP has been developed for this pilot project and a private contractor was selected to conduct the sample collection. Approximately 100 M-BISQ sites (50 stressed and 50

reference) have been targeted statewide for sampling in the spring of 2004. Analysis of nutrients and other water quality parameters such as DO, temperature, pH, specific conductance, turbidity, COD, TOC, suspended solids, chlorides, alkalinity, and hardness will be done. MDEQ will perform the laboratory analyses for this effort.

Yazoo River Basin §303(d) List Metals Sampling Project

The State of Mississippi 1998 §303(d) List of Water Bodies identifies numerous water bodies as being impaired due to metals based on evaluated assessments for which limited monitoring data are available. The available monitoring data on which these assessments were based were collected by the USGS using screening-level sampling techniques. Water samples analyzed for metals content that are not collected using "clean sampling" techniques have the potential to be erroneously high due to the possibility of contamination during the sample collection process. Thus, water samples collected using clean sampling techniques are needed to accurately determine if metals are causing impairment in a water body.

MDEQ is committed to determining if each of the §303(d) listed evaluated waters are actually impaired by metals prior to initiation of TMDL development. Monitoring of §303(d) listed evaluated waters occurs on a rotating basin schedule. For the Yazoo River Basin, there were three water bodies listed on the §303(d) list for metals. A contract with a private consulting firm was established in order to collect the data needed for water bodies listed for metals in the Yazoo River Basin. Table 14 lists the water bodies, respective USGS stations, and metals of concern.

Table 14: 1998 §303(d) Descriptions of Water Body Locations in the Yazoo Basin with Metals Impairments Based on Evaluated Assessments

Water Body Name	USGS Station Number	Water Body ID	Metals of Concern
Senatobia Creek	07277730	MS304M2	Copper and Zinc
Hickahala Creek	07277700	MS303M4	Copper , Lead, and Zinc
Yazoo River	07288800	MS400M	Copper and Cadmiun

At each USGS station, 10 samples were collected quarterly for a period of one year by an MDEQ contractor. Data were collected from January 1, 2002 through December 31, 2002. Project samples were collected as total recoverable in accordance with *Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996). After the samples were collected, they were shipped to EPA Region IV's Science and Ecosystems Support Division in Athens Georgia for laboratory analysis.

The results were converted to total dissolved and compared to the acute criteria that were calculated using hardness values collected at each site. According to the data, there was no indication of impairment in any of the samples. Based on these results, Senatobia Creek, Hickahala Creek, and the Yazoo River were delisted for metals from the 2002 §303(d) list.

Yazoo River Basin Model Wet-Weather Monitoring (1999-2001)

MDEQ in cooperation with EPA Region IV and the EPA Gulf of Mexico Program have joined together in the development of a nutrient model for the Yazoo River Basin. The model will be used to assess the total load of nutrients, specifically nitrogen and phosphorus, contributed by the Yazoo River Basin to the Mississippi River. The model was also used to support of the development of TMDLs for impaired water bodies in the basin. A major data gap revealed in the review of water quality data for the basin was during wet-weather conditions. Consequently, in 1999, MDEQ contracted with a private consulting firm to collect wet-weather data for use in model calibration.

The monitoring activities for this project consisted of wet-weather (storm event) monitoring and base flow monitoring. A total of seven monitoring stations were monitored using a combination of automated monitoring and grab sampling. Wet-weather samples were collected using automatic samplers installed at six sites. Base flow sampling was conducted quarterly at all sites. Parameters measured included nutrients, total suspended solids, BOD_5, COD, TOC, chlorophyll-a, and fecal coliform bacteria. In-situ parameters including DO, temperature, pH, and specific conductance were monitored continuously at the automated sites. Instream water level and rainfall were also measured at the automated sites. The six sites with automated sampling were located on Ark Bayou, Fannegusha Creek, Hickahala Creek, Otoucalofa Creek, Tillatoba Creek, and the Quiver River. The seventh site was located on Bogue Phalia and was monitored manually every two weeks and once during each storm event. Sampling began in October 1999 and ended in January 2001. Approximately eight storm events were monitored at each station during the sampling period.

The contractor conducted an analysis of the monitoring data. The data analysis activities consisted of calculating parameter loadings during wet-weather events, calculating annual and seasonal loads of total nitrogen, total phosphorous, and total suspended solids, and comparing these loads to the landuse information within the monitored watersheds. In addition, the parameter concentrations were compared with Mississippi water quality criteria for DO and fecal coliform bacteria and water quality targets for nitrogen and phosphorous species. Export coefficients for total nitrogen, total phosphorous, and total suspended solids for various landuse types were calculated from the load estimates. It was determined that the percent of cropland in the watershed is a good predictor of the relative loading of total nitrogen and total phosphorous for waters in the Yazoo River Basin.

Escatawpa River Use-Attainability Model Studies (1997, 1999, and 2003)

The Escatawpa River near Moss Point is a stratified estuarine river with historic water quality impairment. The Escatawpa River is currently assigned a dissolved oxygen (DO) criterion variance of 3.0 mg/L in the lower reach prior to the confluence with the Pascagoula River. Natural conditions, current industrial and past municipal discharges, in combination with the poor flushing action of this estuarine portion of the river have necessitated the presence of this variance. As a result of this sustained impairment, MDEQ has been supporting EPA Region IV in conducting a Use Attainability Analysis (UAA) for the Escatawpa River. There are several discharges in the area of the Escatawpa River with the DO variance including a significant discharge from the Jackson County Port Authority. This discharge included the industrial wastewater from International Paper Company (IPC) mill in Moss Point which has since been closed. The issue of present and future wasteload allocation is of crucial importance to any remediation plans to improve water quality in that area of the Escatawpa River.

In September 1997, an intensive survey was conducted on the Escatawpa River by EPA with assistance from the MDEQ OPC Water Quality Assessment Branch (WQAB), OPC

Field Services Division - South Regional Office, Biological Services Section, the OPC laboratory, and MDEQ Office of Land and Water Resources. The primary objective of this survey was to collect a data set to callibrate the development of a water quality model for the Escatawpa River. A total of 14 stations were established in the study area which included the Escatawpa River, Pascagoula River, West Pascagoula River, and a station in the Mississippi Sound. Monitoring activities during the nine day study period included tide-phased water quality sampling for BOD5, ultimate BOD, nitrogen series, and total and ortho-phosphorus, and in-situ profiling of DO, salinity and temperature. Other study components included effluent monitoring, continuous DO monitoring with Hydrolab multiparameter dataloggers, production and respiration measurements, sediment oxygen demand, diffusion/reaeration measurements, a dye dilution study, and hydrological/meteorological monitoring.

A second intensive survey was conducted in the spring of 1999. The purpose of this study was to collect an additional set of data to verify the model for the use-attainability study. MDEQ WQAB and Biological Services Section staff joined EPA staff to conduct the second round of sampling. Water quality and hydrodynamic data were collected for several days in May. Samples were collected and analyzed for the same hydrodynamic, meteorological and water quality parameters as the September 1997 study and included nutrients, oxygen demand, solids, turbidity, community metabolism, and in-situ water quality measurements.

In the summer of 2003, a third less intensive study was conducted by the EPA in response to the shutdown of the IPC mill. This study was initiated to gather additional DO data under low flow conditions in the river without the significant wastewater flow from the IPC mill which closed in 2002.

The 1997 and 1999 study data provided enough information to develop phase one TMDLs for the Escatawpa River. These data, along with additional data collected in 2003, are currently being used to calibrate and validate the new improved hydrodynamic and water quality models. The models will be used in the development of appropriate water quality standards and TMDLs.

Escatawpa River Mercury Monitoring Project (2001-2004)

The fresh water portions of the Escatawpa River have a fish consumption use impairment due to mercury. Tissue data from largemouth bass and catfish caught in these segments indicate impairment due to levels of mercury in the fish flesh that exceeds the FDA Action level.

The Escatawpa River Phase One Mercury TMDL completed by MDEQ used only information from point source contributions to lower estuarine portion of the water body. While there are no NPDES permitted dischargers currently in the freshwater section of

the Escatawpa River, several NPDES permitted dischargers are located in the lower estuarine portion of the Escatawpa River. As a result of the Phase One Mercury TMDL, all of the point source contributors have voluntarily monitored their source water and discharge on a quarterly basis for the presence of mercury. The voluntary sampling program along with additional water column sampling completed by a MDEQ contractor were needed to provide a basis for distinguishing between mercury contamination from point and nonpoint sources.

MDEQ's contractor collected water samples from August 2001 to March 2004 at three stations in the Escatawpa River to better define the background conditions for mercury in that water body. MDEQ coordinated the sampling to collect the water samples at the same time and in the same way as the point source monitoring. MDEQ's contractor sampled these water quality sampling stations for Total Mercury using clean sampling techniques as outlined in EPA Method 1669. A total of ten sampling events occurred at each station over the study period. The samples were analyzed using EPA Method 1631 and were accompanied by applicable quality control samples. Results of this sampling indicated no Escatawpa River water column samples with mercury concentrations above state water quality criteria.

Big Black River TMDL Model Study (2003)

In 2001, MDEQ established water quality based effluent limitations (WQBELs) for the proposed Canton Municipal Utilities Beattie's Bluff Wastewater Treatment Facility (CMU) to discharge treated wastewater into the Big Black River. This new 8 MGD facility is being constructed to serve the city of Canton, the new Nissan Automotive Plant, and to support future needs for the anticipated economic growth in this area. For verification of the WQBELs, EPA Region IV Science and Ecosystem Support Division and MDEQ selected a 46.4 mile segment of the Big Black River between Canton, MS and Bentonia, MS for an intensive study.

Hydrologic, water quality, and biological data will be collected during two week long studies. The phase one data collection efforts, which occurred during September 2002, focused on low flow conditions prior to the onset of discharge from the new CMU facility. A total of 14 stations located on the main stem and significant tributaries were sampled along with five existing wastewater treatment facilities located in the watershed. The intent of the study was to address organic enrichment/low dissolved oxygen within this segment of the Big Black River. Data collected during the study included: dissolved oxygen and community oxygen metabolism, water column oxygen production and respiration, reaeration measurements, physiographic measurements, meteorologic measurements, and time of travel monitoring. Data from the study were used to assemble a calibrated QUAL2E model of the water body. The second phase of the intensive study has been scheduled for summer 2005. The data collection efforts during the second phase will focus on any changes to the system after the addition of the CMU discharge.

WLA/Special Studies

From 1999 to 2003, MDEQ conducted 25 WLA/Special Study investigations in streams and rivers throughout the state. Most of these were done as part of wasteload allocation (WLA) and §303(d) investigations to provide supporting information for decisions on NPDES permit limitations and TMDLs. All of these studies involved the collection of biological, physical, and/or chemical data used to determine the status of the water bodies. Those sites studied are outlined in Table 15.

Table 15: WLA/Special Studies in Rivers and Streams (1999-2003)

Site	Date	Facility Name	Purpose
Pickens Creek Attala County	1999	City of French Camp POTW	WLA Investigation and 303(d) Listing Confirmation
Bogue Chitto Creek Madison County	1999	City of Clinton POTWs	WLA Investigation and 303(d) Listing Confirmation
Joe's Creek Noxubee County	1999	City of Brooksville POTW	WLA Investigation and 303(d) Listing Confirmation
Unnamed tributary to Tallahaga Creek Winston County	1999	City of Noxapater POTW	WLA Investigation
Big Brown Creek Prentiss County	1999	City of Marietta POTW	WLA Investigation
Town Creek Lee County	1999	City of Tupelo POTW	WLA Investigation and 303(d) Listing Confirmation
Unnamed tributary to Big Black River Holmes County	1999 2001	City of Durant POTW	WLA Investigation and 303(d) Listing Confirmation
Town Creek Madison County	1999 2001	City of Bentonia POTW	303(d) Listing Confirmation
Unnamed trib. to Chiwapa Creek Lee County	1999 2001	City of Shannon POTW	WLA Investigation and 303(d) Listing Confirmation
Howard/Mayhew Creeks Lowndes County	1999 2001	NA	303(d) Listing Confirmation
Muddy Creek Tippah County	2000	NA	303(d) Listing Confirmation
Moorhead Bayou Sunflower County	2001	Allen Canning	WLA Investigation
James Creek Monroe County	2001	NA	303(d) Listing Confirmation

Gin Bayou Leflore County	2001	MS Valley State University	WLA Investigation
Leflore Creek Attala County	2001	City of Ethel POTW	WLA Investigation
Yockanookany River Choctaw County	2001	City of Ackerman POTW	WLA Investigation
Snake Creek Bolivar County	2001	Bolivar County Correctional Facility	WLA Investigation
Second Creek Adams County	2001	Beau Pre S/D	WLA Investigation
Unnamed tributary to Pigeon Roost Creek Oktibbeha County	2001	City of Maben POTW	WLA Investigation and 303(d) Listing Confirmation
Unnamed trib. to Tenn-Tom Waterway Lowndes County	2001	Eka Nobel Columbus	WLA Investigation and 303(d) Listing Confirmation
Kentawka Canal Neshoba County	2001	City of Philadelphia POTW	WLA Investigation and 303(d) Listing Confirmation
Oaklimeter Creek Marshall County	2001	City of Potts Camp POTW	WLA Investigation
Unnamed Trib. to Lead Bayou Bolivar County	2001	City of Cleveland POTW	WLA Investigation
Clabber Creek Pike County	2003	City of Summit North POTW	WLA Investigation
Little Bear Creek Madison County	2003	Deerfield S/D	WLA Investigation

Lakes - Intensive Surveys and Special Project Monitoring

Nutrient Criteria Development – Lakes

The Lakes Subcommittee of the Nutrient Criteria Task Force, established in 2001, was put on a fast-track to develop a monitoring plan for nutrient data collection by the end of 2002. This was necessary because the EPA had, at that time, established a deadline of 2004 for states to develop nutrient criteria for lakes/reservoirs in advance of the other water body types. This deadline was later extended to 2008. The subcommittee reviewed existing nutrient data to identify data gaps, and determined that gaps existed particularly during the growing seasons. The subcommittee recommended additional data collection and MDEQ took the lead in developing a data collection plan for subcommittee approval in order for the agency to proceed with lake nutrient criteria development. Following plan approval, a QAPP was developed and MDEQ began sampling in October 2002.

Sampling consists of quarterly monitoring over two years at 50 lakes and reservoirs in the first of at least two site classes (>500 acres and 100–500 acres). The larger lakes/reservoirs are being sampled initially with sampling to follow at lakes/reservoirs in the 100-500 acre size range. Parameters monitored include chemical oxygen demand (COD), total organic carbon (TOC), total phosphorus, total nitrogen, suspended solids, alkalinity, chlorides, hardness, chlorophyll-a, secchi depth, turbidity, and typical water quality in-situ parameters such as dissolved oxygen (DO), temperature, pH, and specific conductance. In addition to the quarterly sampling, more intensive inflow and outflow monitoring also occurs at selected lakes/reservoirs. Sampling for this project will be completed for the >500 acre site class in fall of 2004. Monitoring will take place for the other site class or classes after 2004.

WLA/Special Studies

From 1999 to 2003, MDEQ conducted two WLA/Special Study investigations in lakes. These investigations were conducted to provide supporting information for decisions on §303(d) listing/delisting issues and TMDL development. Biological, physical, and/or chemical data were collected and used to determine the attainment status of the water body. The sites studied are outlined in Table 16.

Table 16: WLA/Special Studies for Lakes (1999-2003)

Site	Date	Facility Name	Purpose
Lake Hazle Copiah County	2001	NA	303(d) Listing Confirmation
Lake Hazle Copiah County	2003	NA	303(d) Listing Confirmation

Estuaries and Coastal Waters - Intensive Surveys and Special Project Monitoring

EPA National Coastal Assessment Program

In 2000, MDEQ began participation in EPA's National Coastal Assessment Program (NCA). The purpose of NCA, a component of the National EPA Environmental Monitoring and Assessment Program (EMAP), is to provide a quantitative assessment of ecological condition on a regional scale for the nation's estuarine ecosystems. All 24 coastal states and Puerto Rico are partnering with EPA in this effort. This program is a five-year study to monitor and assess the status and trends of estuarine and coastal resources in the United States. This monitoring is scheduled to take place over a five-year period (2000–2004) using an EPA EMAP probability-based sampling approach. Annual sampling is conducted during a late summer index period (July–September) with all participants collecting a common suite of indicators using comparable methods. The NCA program is intended to develop and demonstrate the advantage of ecosystem level monitoring using multi-tier designs and multi-scale data that can be aggregated across tiers and resources. Assessments will be made at state, regional, bio-geographical and national levels to summarize the ecological health of coastal waters. This program provides an unbiased estimate of the condition of estuarine and coastal resources, a ranking of the relative importance of various stressors on these resources, and an opportunity to build partnerships among agencies for more effective monitoring and assessment in the future. Specific environmental problems targeted by NCA are: low dissolved oxygen concentrations, eutrophication, chemical and biological contamination, habitat modification, and cumulative impacts of stressors.

This 5-year effort for Mississippi's coastal waters is being coordinated by MDEQ. Field and lab assistance is being provided to MDEQ by the University of Southern Mississippi's Gulf Coast Research Laboratory. A total of fifty randomly selected sites throughout Mississippi coastal waters are sampled each year during the summer index period (Figure 20). Sampling involves a full spectrum of physico-chemical parameters, water, sediment, fish, and benthic organisms for a full range of analyses (in-situ and

laboratory) as well as community structure determinations (see Table 17). Sample analyses from year 1 and year 2 have been completed with year 3 and 4 data still pending. After entry into the MDEQ database, data generated for this project are sent to EPA's Gulf Ecology Division, in Gulf Breeze, Florida for data analysis.

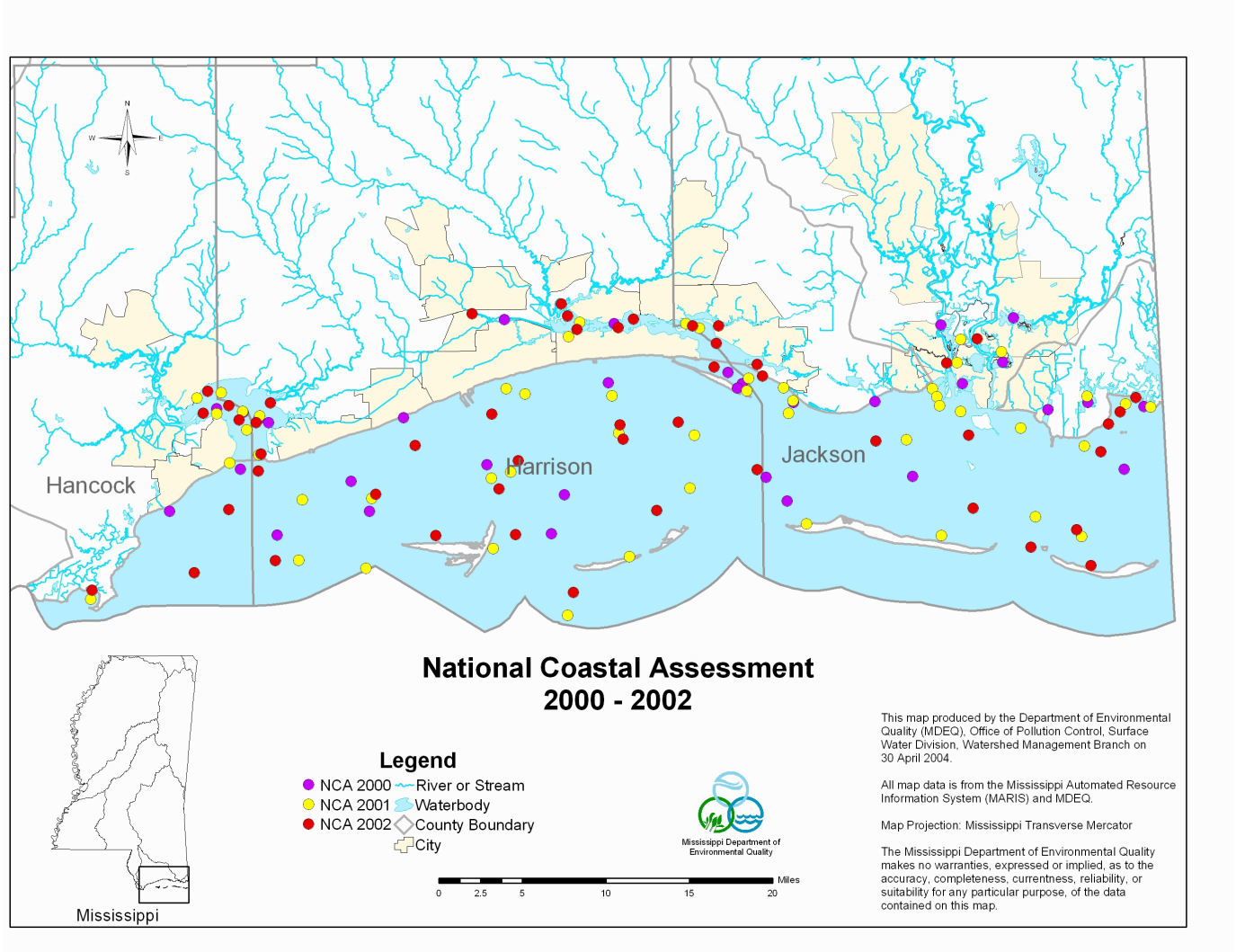


Figure 20: Mississippi NCA Monitoring Stations 2000-2002

Table 17: List of Core Ecological Indicators Measured by NCA.

Water Quality Indicators		**Sediment Quality**	**Biota**		**Habitat**
Water Profile	**Water Samples**	**Composited Surficial Sediments**	**Fish/Shellfish**	**Benthos**	
Dissolved Oxygen (DO)	Total Nutrients	Sediment Contaminants	Community Structure	Community Structure	Submerged Aquatic Vegetation
pH	Dissolved Nutrients	Sediment Toxicity	Tissue Contamiants		Type (tidal, open water, harbor, etc.)
Salinity	Chlorophyll-*a*	Percent Silt/Clay	Presence of External Pathology		Presence of Marine Debris
Temperature	TSS				
Depth					
Light Attenuation					
Secchi Depth					

Nutrient Criteria Development – Estuaries and Coastal Waters

The Estuary and Coastal Waters Subcommittee of the Mississippi Nutrient Criteria Task Force began meeting in 2002 and, like the other subcommittees, have reviewed existing data and developed a data collection plan to fill data gaps. A major emphasis and recommendation from this subcommittee was to use comparable methods and data sharing with current undergoing efforts in the EPA's NCA Program and the Coastal Beach Monitoring Program. MDEQ in conjunction with USM's Gulf Coast Research Lab (GCRL) developed a QAPP that was approved by the subcommittee. The data collection plan identifies 50 sites for quarterly monitoring in the coastal bays, tidal rivers, and estuaries of Mississippi Sound. Monitoring, conducted by GCRL, began in the summer of 2003. Sampling and analysis is being conducted for algal taxonomy, total nitrogen, total phosphorus, chlorophyll-a, suspended solids, turbidity, and traditional water chemistry parameters such as DO, temperature, pH, specific conductance, and salinity. A 24-hour DO monitoring component is also scheduled for spring and summer 2004 at a subset sites to provide diel information. Monitoring is scheduled for completion in 2005 with an MDEQ/EPA deadline of 2008 for estuarine nutrient criteria development.

St. Louis Bay Model Verification Study (1998 and 1999)

The St. Louis Bay estuary on Mississippi's Gulf Coast is a vital water resource that supports a diverse ecosystem. Although there are several municipal discharges, the bay is a minimally impacted system. The presence of this water body on the 1998 §303(d) list and the need to protect this resource prompted MDEQ to initiate a fecal coliform based total maximum daily load (TMDL) survey of St. Louis Bay in 1998. The issue of present and future waste load allocations is of crucial importance to maintaining good water quality in the bay. In concert with EPA SESD, MDEQ expanded the study into a more expansive water quality survey. A total of 30 stations were monitored in the week-long study conducted in July 1998 in St. Louis Bay and associated bayous and rivers draining into the bay. This initial survey provided a water quality based model calibration data set. Monitoring activities during the study period included tide-phased water quality sampling for BOD_5, ultimate BOD, nitrogen series, fecal coliform, and total and ortho-phosphorus along with in-situ profiling of DO, salinity and temperature. Other study components included effluent monitoring, continuous DO monitoring with Hydrolab multiparameter dataloggers, production and respiration measurements, sediment oxygen demand, diffusion/reaeration measurements, a dye dilution study as well as hydrological and meteorological monitoring.

The second phase of the St. Louis Bay TMDL intensive survey was conducted in April 1999 to provide data collected under high-flow conditions used to verify the water quality model developed by Mississippi State University. The first synoptic survey had been conducted under low-flow conditions in July 1998. Similar to the previous study, staff from various sections of MDEQ along with representatives from EPA Region IV sampled St. Louis Bay, its freshwater inputs, and wastewater discharges to the Bay for several days. Samples were collected and analyzed for the same hydrodynamic, meteorological and water quality parameters including bacteria, nutrients, oxygen demand, sediment, solids, turbidity, community metabolism, in-situ water quality measurements, and sediment toxics. It was hoped that sampling in the spring would produce higher tributary flows and more storm events, but significant increased flow conditions were not encountered due to the beginnings of a drought year. Subsequently, a third phase of this intensive survey was undertaken to provide a wet-weather data set for incorporation into the model.

The 1998 and 1999 study data provided sufficient information to calibrate and verifiy the hydrodynamic and water quality models used to develop the pathogen TMDLs for St. Louis Bay and other water bodies in the watershed. The additional wet-weather water quality data collected for the St. Louis Bay watershed will be used to expand the models to include DO and nutrients. Further data collection for soils and runoff properties in the watershed is currently ongoing to continue to improve the comprehensive model.

St. Louis Bay Model Wet-Weather Monitoring (2000-2001)

The St. Louis Bay wet-weather monitoring project was initiated to provide useful data for calibrating and verifying watershed and water quality models, which are useful tools for both, the production of Total Maximum Daily Loads (TMDLs), and the evaluation of Best Management Practices (BMPs). The wet-weather monitoring project included sample collection and analysis, and data processing and management at sixteen monitoring stations in the St. Louis Bay watershed and other sites in the Coastal Streams Basin. MDEQ entered into a contract with the Gulf Coast Research Laboratory to provide sample collection and analyses for this effort.

The wet-weather project focused on sampling for fecal coliform, solids, nutrients, and related parameters during base flow conditions and during a range of storm events. This study involved an intense water quality monitoring effort requiring extensive manpower for manual sampling and quick responses to ensure that samples were collected during the storm events. In addition, flow information, which is vital for analysis and interpretation of water quality samples, was monitored. The base flow and storm event data were collected over the ten month period from November, 2000 through August, 2001.

Bayou Casotte Water Quality Study

Due to recurring complaints, public concerns, and data suggesting water quality problems, several water quality studies have been initiated to confirm the status of water quality in Bayou Casotte. Bayou Casotte is a heavily industrialized coastal bayou listed on the state's 1998 §303(d) list as impaired based on evaluative data and information only. Both MDEQ and Mississippi Phosphate Corporation, a major industrial facility with an NPDES discharge into the bayou, began data collection efforts in 2000 to provide data for assessment of potential water quality impacts and to support the completion of potential TMDLs for the water body. More data were needed to address the low dissolved oxygen, toxic issues, and ammonia loads in the water body.

Mississippi Phosphate Corporation (MP) began monitoring Bayou Casotte and closely related bayous bimonthly starting in January 2000. Periodically, MDEQ Biological Services Section staff assisted with the water quality monitoring, and split samples with MP. During the summer months, three 24-hour sample runs took place where dissolved oxygen was the primary parameter observed. Results of this study showed violations of the DO criteria in Bayou Casotte periodically and elevated nutrients above those observed at the Bayou Cumbest reference location.

EPA's SESD from Athens, Georgia conducted a sediment survey in the bayou in August 2002. The purpose of this study was to provide a screening level evaluation of sediments to study the existing environmental health of the bayou and to identify any additional

sampling efforts needed. Eight sites in Bayou Casotte and three locations in Bayou Cumbest, a selected reference water body, were sampled for metals, grain size, and various inorganic and organic compounds. Results of this survey indicated the presence of several compounds in Bayou Casotte sediments including PAH's, metals, phthalates, ammonia, and organochlorine pesticides. However, only cadmium, zinc, and chlordane were detected at levels above EPA screening levels.

The eight sites on Bayou Casotte and three sites on Bayou Cumbest (a control site) were selected for several 24-hour water quality studies conducted by MDEQ beginning in 2002. Three 24-hour water quality monitoring events were conducted in 2002 and two more were repeated in 2003. During one of the 2002 sampling events, MP was conducting a by-pass of its wastewater treatment system, which lasted over 3 months due to heavy rainfall. The following ecological data were collected approximately every four hours over the 24-hour time span of each study.

Table 18: Water Quality Indicators Sampled in Bayou Casotte

Water Quality Indicators	
Depth Profiles	**Water Samples**
Dissolved Oxygen (DO)	Total Organic Carbon (TOC)
pH	Total Phophorus
Salinity	Chlorophyll-*a*
Temperature	Total Kjeldahl Nitrogen (TKN)
Depth	Nitrites+Nitrates
Tide Stage	Ammonia
Secchi Depth	BOD_5

In September 2003, diel monitoring was conducted by MDEQ in Bayou Casotte using sondes placed in the upper portion of the bayou and in the turning basin south of the MP discharge for a 24-hour period. The mooring line for the sonde located in the turning basin was severed during the diel period probably due to ship traffic. The sonde was later recovered in the Mississippi Sound just outside Bayou Casotte with the data for the diel period intact. The data set was subsequently voided due to this anomalous event.

Data from the 2002 and 2003 sampling events will be used in the development of the TMDL for the bayou. In 2004, EPA SESD is scheduled to return to conduct a mixing zone study in Bayou Casotte. These data will be used to provide information to define applicable effluent mixing zone boundaries for the MP discharge. The mixing zone information will be used to establish NPDES permit limits recommended by the TMDL.

WLA/Special Studies

From 1999 to 2003, MDEQ conducted four WLA/Special Study investigations in estuaries and coastal waters. All of these were done as part of §303(d) investigations to provide information for decisions on §303(d) listing/delisting issues and TMDL development. These types of studies involve the collection of biological, physical, and/or chemical data to be used to determine the status of the water bodies. The sites studied are outlined in Table 19.

Table 19: WLA/Special Studies for Estuaries (1999-2003)

Site	Date	Facility Name	Purpose
MS Sound - Pascagoula Jackson County	2000	NA	303(d) Listing Confirmation
Bangs Lake Jackson County	2001	NA	303(d) Listing Confirmation
Bayou Heron Jackson County	2001	NA	303(d) Listing Confirmation
Tidewater Bayou Jackson County	2001	NA	303(d) Listing Confirmation

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APPENDIX A

MISSISSIPPI CALM

MISSISSIPPI CALM
(Consolidated Assessment and Listing Methodology)

2004 Assessment and Listing Cycle

Data Requirements and Assessment and Listing Methodology to Fulfill the Requirements of Sections 305(b) and 303(d) of the Clean Water Act (CWA)

INTRODUCTION

This document represents the Mississippi Department of Environmental Quality's (MDEQ) initial efforts to develop a CALM process. While this document is Mississippi's CALM for the 2004 reporting cycle, it is subject to revision in subsequent reporting cycles.

A primary goal of surface water quality assessments, as required by Section 305(b) of the CWA, is to describe the condition of the state's surface waters to EPA and the public. A secondary goal of the §305(b) assessment process is to provide the necessary assessment information for use in the development of the state's CWA Section 303(d) List of Water Bodies. To achieve these goals, it is necessary to have requirements and guidelines for how water quality data are collected, analyzed, and assessed. The purpose of this document is to specify MDEQ's data requirements and assessment guidelines for the 2004 §305(b) assessment and §303(d) listing cycle. In addition to using its own data, MDEQ solicits and considers all readily available data and information collected by other agencies and the public for the most recent five years prior to the assessment. For the 2004 Section 305(b) Report, the data window was from 1999-2003. This data solicitation effort is facilitated through Mississippi's Basin Management Approach. In addition, MDEQ will contact federal and state resource agencies that have contributed data in previous assessment and listing cycles. In addition, the public may submit water quality data for consideration through the §303(d) public participation process. All data used to make formal assessments of the quality of the state's waters, regardless of its source, will be evaluated in keeping with the requirements and guidelines contained herein. These assessments involve comparing data to the state's Water Quality Standards (State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters) {WQS} to make decisions on whether a water body is attaining or not attaining its designated use(s). These uses include aquatic life support, contact recreation, fish/shellfish consumption, and drinking water uses. Where data and information of appropriate quality and quantity indicate non-attainment of a designated use or uses for an assessed water body, the water body will be placed on Mississippi's 2004 Section 303(d) List of Water Bodies.

All data and information collection activities may not meet the exact quality, quantity, and sampling frequency requirements given below. However, these data and information collection activities serve a useful purpose. Consequently, MDEQ will not disregard

these data in the §305(b) assessment process. Data and information that do not meet the requirements stated in this methodology will be used for a listing decision when those data demonstrate *compelling evidence* of the degradation of a water body and are supported by data quality information. MDEQ defines *compelling evidence* as significant and recurrent violations of water quality standards, especially evidence of catastrophic or obvious environmental or public health impacts. If data quality is not documented or data quality issues are identified, these data will not be disregarded. Instead, the water body will be assigned to a list for future monitoring to confirm the water quality condition. In addition, these data and information may be used in other MDEQ programs (e.g., permitting, nonpoint source, complaint response and resolution, etc.).

MDEQ will utilize the following guidelines for Data Quality, Data Quantity, and Data Assessment for data used in the §305(b) assessment and §303(d) listing process. These guidelines apply, as appropriate, to rivers, streams, lakes, estuaries, and coastal waters.

MDEQ's ability to make meaningful and scientifically defensible statements about the overall water quality of a water body depends directly on the vigor and quality under which the water quality data are collected, analyzed, and reported. Data generated by MDEQ, other agencies, and individuals should be of the quality necessary to make credible and realistic assessment decisions on the condition of the state's waters. Whenever possible, data need to be of the highest quality and developed using sampling and analytical protocols and standard operating procedures recognized by state and EPA quality assurance (QA) program plans. However, no data will be assessed from data-reporting entities that do not provide information or documented SOPs or procedures, if requested.

AQUATIC LIFE USE SUPPORT (ALUS)

The aquatic life designated use is indicative of healthy aquatic life for such organisms as fish, benthic macroinvertebrates, and periphyton (algae). Indicators appropriate for use in ALUS determinations include biological, chemical, physical, and toxicological data. Biological community surveys are the most desirable for ALUS determinations since they directly measure the overall biological or ecological condition of a water body. MDEQ will give greater weight to biological community data when making ALUS use support determinations. For 2004, ALUS determinations will be primarily based on benthic macroinvertebrate data.

Biological Community Data

Data Quantity:

Minimum of one benthic macroinvertebrate community (i.e., bottom-dwelling aquatic insects, worms, clams, etc.) survey within the applicable 5-year §305(b) reporting period.

2. Sample collection methods, and lab processing, taxonomy and enumeration methods are compatible with MDEQ SOPs used to develop the Mississippi Benthic Index of Stream Quality (M-BISQ).

Assessment Methodology:

MDEQ recently developed M-BISQ to provide the state with a sound scientific methodology for accurately monitoring and assessing the overall ecological condition of most of the state's wadeable streams (streams in the Delta are not presently included) using benthic macroinvertebrates. The detailed assessment methodology based on M-BISQ for Aquatic Life Use Support and used for the 2004 §303(d) list is found in Appendix A.

Attaining:

Sites where the M-BISQ score is at or above the 25th percentile of the bioregional reference condition.

Not Attaining:

Sites where the M-BISQ score is below the minimum score of the bioregional reference condition.

Note: See Appendix A for clarification of the methodology used to assess waters with M-BISQ scores that fall between the 25th percentile and the minimum score of the bioregional reference condition.

Water Chemistry

Only data for parameters for which Mississippi has adopted numeric water quality criteria in Mississippi's WQS will be used for making a water body §305(b) use support determination and/or a §303(d) listing. Other parameters for which numeric criteria have not been adopted (e.g., nutrients) will be shown as impairment causes only if there is an identified association with violations of a parameter for which the state has a numeric criterion (e.g., elevated nutrients causing violations of the dissolved oxygen criterion). In addition, where data indicate only a slight variation from a criterion, the magnitude of the variation, as well as other site-specific natural influences (e.g., low pH in geographic regions with natural acidic soils and blackwater streams), will be taken into consideration. Professional judgment will be used for making use support determinations in these cases. Furthermore, no monitoring location will be assessed as not attaining water quality standards based on the results of a single chemical sampling event. This is due to the possibility of an anomalous environmental condition. No water body will be assessed as attaining ALUS using a set of water chemistry data that does not include dissolved oxygen (DO) data, a critical piece of environmental information for ALUS in the absence of biological community data.

Dissolved Oxygen (DO)

Mississippi's DO criterion is based on daily arithmetic (i.e., 24-hour) averages and an instantaneous minimum as defined in the state's water quality standards. In Mississippi streams, the minimum DO concentration is generally observed during the environmentally critical condition, which is near the sunrise hours in the summer/fall low-flow index period. Consequently, 24-hour or diel monitoring, conducted manually or using automated in-situ dataloggers or sondes, is the preferred means of data collection for dissolved oxygen in order to make a meaningful assessment. MDEQ realizes that the majority of ambient monitoring DO data are often collected instantaneously in the late morning to the early afternoon hours (i.e., 10:00 a.m. to 2:00 p.m.). Therefore, in the absence of diel monitoring data, MDEQ will compare DO data to the instantaneous minimum criterion of 4.0 mg/L when the data requirements (as outlined below) are achieved.

DO Data Quantity:

1. **Daily Average Measurements (i.e., diel monitoring):**
   A. A minimum of 3 sampling events distributed over a 2-year period within the 5-year §305(b) data window collected during the environmentally critical condition that generally occurs during a summer/fall index period (i.e., June 1 through October 1).
   B. A minimum of 24 consecutive hours of measurements per event. For events in excess of 24-hours, the time frame for the sampling event begins with the first measurement taken after deployment of the data sonde.
   C. Each 24-hour sampling event should be spaced at least 1 week apart. With the use of in-situ dataloggers or sondes, a minimum sampling interval of 1 measurement per hour is required. If monitoring is conducted manually, 1 measurement every 4 hours is the required minimum sampling interval.
   D. Measurements should include collection at the appropriate sample depth as specified for dissolved oxygen in Section II.7 of the state's WQS document.

2. **Instantaneous Minimum:** Instantaneous measurements of DO will be considered for use support determinations as follows:
   A. When data are collected during the environmentally critical condition which generally occurs during a summer/fall index period (i.e., June 1 to Oct 1) at the critical time of day (i.e., between 5:00 a.m. and 9:00 a.m.), and meet the following data requirements:
      1. Minimum of 20 data points within a 5-year period.
      2. No more than one-half (i.e., 10 measurements) of the data are collected in any one year.
   B. When data indicate a violation of instantaneous water quality criterion for DO at the non-critical condition (i.e., outside the summer/fall index period and time of day guidelines) and meet the following data requirements:
      1. More than 1 measurement is in violation of WQS.
      2. Measurements showing violations are spaced at least 1 week apart.
   C. Measurements should include collection at the appropriate sample depth as specified for dissolved oxygen in Section II.7 of the state's WQS document.

Assessment Methodology:

Daily Average: When assessing diel dissolved oxygen data against the daily average criterion, assessments for dissolved oxygen will be made as follows:

Attaining:
A daily average equal to or greater than 5.0 mg/L is met in 90% of the 24-hour sampling events.

Not Attaining:
A daily average of less than 5.0 mg/L is observed in greater than 10% of the 24-hour sampling events.

Instantaneous: In cases where only instantaneous DO data are collected during the critical condition, the instantaneous criterion of 4.0 mg/L will be used and assessments for dissolved oxygen will be made as follows:

Attaining:
Instantaneous criterion met in 90 percent of the samples.

Not Attaining:
Instantaneous criterion violated in greater than 10 percent of the samples. In addition, when a violation of the instantaneous criterion is observed during the non-critical time of day and a second violation is observed at a minimum of one week later, the monitoring location may be assessed as not attaining. The magnitude of the violation, as well as other site-specific natural influences (i.e., low DO in estuaries and naturally stratified waters), will be taken into consideration and professional judgment applied in making use support determinations.

Note: Where a variance or site-specific criterion exists, that criterion will be used for assessment.

Conventional Chemical Data Other Than DO

Some conventional parameters (i.e., temperature, pH, total dissolved solids, specific conductance, and chlorides) listed in the state's water quality standards do not have daily average criteria. These parameters may be measured instantaneously, but are often measured along with DO using automated equipment capable of recording diel measurements for extended periods of time. The assessment guidelines given below will be used for determining use support.

Data Quantity:

1. **Diel Measurements:**
   A. A minimum of 3 sampling events over a 2-year period within the 5-year §305(b) data window collected during the environmentally critical condition for the parameter of concern.
   B. A minimum of 24 consecutive hours of measurements per event. For events in excess of 24-hours, the time frame for the sampling event begins with the first measurement taken after deployment.
   C. Each 24-hour sampling event should be spaced at least 1 week apart. With the use of in-situ dataloggers or sondes, a minimum sampling interval of 1 measurement per hour is required. If monitoring is conducted manually, 1 measurement every 4 hours is the required minimum sampling interval.
   D. Measurements should include collection at the appropriate sample depth as specified for temperature in Section II.9 of the state's WQS document.

2. **Instantaneous Measurements:**
   A. Minimum of 20 total data points within a 5-year period.
   B. At least one-third of the data should represent the environmentally critical period for the parameter of concern.
   C. No more than one-half of the data should be collected in any one year.
   D. Measurements should include collection at the appropriate sample depth as specified for temperature in Section II.9 of the state's WQS document.

Assessment Methodology:

When assessing data for temperature, pH, TDS, specific conductance, and chlorides, use support will be assigned as follows:

Attaining:

Instantaneous criterion met in 90 percent of the samples.

Not Attaining:

Instantaneous criterion violated in greater than 10 percent of the samples. In addition, the magnitude of the violation, as well as other site-specific natural influences (i.e., low pH in naturally acidic waters, high conductivity in tidally affected freshwater streams), will be taken into consideration and professional judgment applied in making use support determinations.

Toxicants (i.e., Metals, Organics and Ammonia)

During most routine ambient monitoring, water column toxicants are measured using screening level (i.e., "unclean") sampling and analytical techniques. These data will not be used to make use support determinations for §305(b) assessments. However, these data will be reviewed as part of the §305(b) process. When concentrations above the

state's water quality criteria are observed, follow-up sampling will be scheduled utilizing "clean" sampling and analytical procedures or techniques. Data for toxicants will be assessed when data requirements (as outlined below) are achieved. In addition, MDEQ does not routinely collect in-stream data on toxicants in a manner that is comparable with stated chronic criteria (i.e., four-day average); therefore, data for toxicants will only be assessed against acute criteria (i.e., one-hour average). However, if data are collected in a manner suitable for a computation of an average 4-day chronic concentration (minimum of one sample per day for four consecutive days) of the toxicant, that data will be assessed against the chronic standard.

Data Quantity:

Minimum of 10 data points within a three-year period within the 5-year §305(b) data window collected using clean techniques.

Assessment Methodology:

Assessments will be made as follows:

Attaining:
The acute or chronic criterion met in at least 90% of the samples.

Not Attaining:
Acute or chronic criterion is violated in more than 10% of the samples.

RECREATION USE SUPPORT

The recreation designated use is intended for the protection of waters suitable for recreational purposes including such primary water contact activities as swimming and water skiing as well as secondary incidental water contact activities as wading, fishing, and boating. Indicators appropriate for use in recreation use support determination include fecal coliform, enterococci, and E. coli bacteria. Fecal coliform bacteria is the bacteriological parameter for which the state has adopted numeric criteria and will be used for assessment in 2004.

Fecal Coliform Bacteria

Data Quantity:

1. A minimum of 4 sampling events distributed over a 2-year period within the 5-year §305(b) data window.
2. A sampling event consists of a minimum of 5 samples distributed over a 30-day sampling period with each sample spaced at least 12 hours apart.
3. In each year, a minimum of 1 sampling event will be taken in each of the contact and non-contact recreational seasons defined in the state's WQS.

Assessment Methodology:

When assessing sites with more than two years of fecal coliform data, greater weight may be given to more recent sampling events during the 5-year data window. Assessments for Primary Contact Recreation or Secondary Contact Recreation will be assigned as follows:

Attaining:

Data indicate that instantaneous criterion is met in greater than 25% of the 30-day sampling events (based on a minimum of 5 samples) and geometric mean criterion is met in greater than 25% of the 30-day sampling events.

Not Attaining:

If the geometric mean criterion as given in the state's water quality standards is violated in greater than 25% of the 30-day sampling events; or, if monitoring data indicate that the instantaneous criterion for fecal coliform is exceeded more that 10 percent of the time in greater than 25% of the 30-day sampling events (based on a minimum of 5 samples).

FISH CONSUMPTION USE SUPPORT

The fish consumption designated use is intended to provide for the protection of human health from fish tissue obtained for human consumption. Indicators appropriate for fish consumption use support determinations include the actual levels of bioaccumulative chemicals in fish tissue.

For the 2004 §305(b), the only assessment rendered will be that of nonattainment of the fish consumption use. This assessment will be based on the presence of a fish consumption advisory that is supported by water body specific fish tissue monitoring. These advisories are issued by MDEQ and the Mississippi Department of Health after consultation with a Fish Advisory Task Force made up of representatives from several state agencies. Waterbodies that have fish consumption advisories (i.e., restricted or no consumption advisories), based on actual data for the specific water body, will be assessed as not attaining the Fish Consumption Use Support designation.

SHELLFISH CONSUMPTION USE SUPPORT

The shellfish consumption designated use is applicable to coastal estuarine waters in Mississippi specifically identified for shellfish harvesting in the state's WQS. This use is intended to provide for the safe propagation and harvesting of shellfish for human consumption. The National Shellfish Sanitation Program (NSSP) determines these classifications. The Mississippi Department of Marine Resources administers this program for Mississippi coastal waters. Indicators appropriate for shellfish consumption

use support determinations include the actual levels of pollutants in shellfish tissue and ambient waters.

Attainment of the Shellfish Harvesting Use is primarily assessed based on the Shellfish Classification system as defined under the NSSP and is supported by actual bacteria (fecal coliform) data for the water bodies being assessed. Waters classified as approved or conditionally approved will be assessed as attaining the shellfish consumption use. Waters classified as restricted or prohibited will be assessed as non-attaining. However, if a water body classified for shellfishing is restricted and/or prohibited solely because of its geographic location (i.e., proximity to a shoreline or a permitted wastewater discharge point), the water body will not be assessed.

DRINKING WATER SUPPLY USE SUPPORT

The drinking water supply designated use is applicable to surface waters in Mississippi specifically identified for public water supply in the state's WQS. This use is intended to provide for a safe source of raw water supply for drinking and food processing purposes. Waters that meet the drinking water supply criteria shall also be suitable for recreational uses. Indicators appropriate for use in drinking water supply use determination include chemical data. Chemical parameters as specifically denoted in the state's WQS document will be utilized for assessment. Data quantity and assessment methodology will follow the same requirements as for those parameters identified under Conventional Chemical Data Other Than DO.

APPENDIX A

Mississippi Benthic Index of Stream Quality (M-BISQ) Assessment Methodology

Mississippi's
2004 Section 303(d) Listing Process
For
Making Aquatic Life Use Support Decisions Using M-BISQ
April 16, 2003

Background

As of 1999, approximately 700 water bodies in Mississippi were listed as impaired; however, little or no quantitative data were used in establishing approximately 550 of these listings. Consequently, MDEQ initiated a project to assess many of the state's §303(d) listed streams using current biological data along with other physical and chemical information. All data were collected according to recently developed methodologies, based in large part on EPA guidance. Data from these streams were calibrated and compared to a threshold for attainment of aquatic life use support (ALUS). That threshold was determined by a process that projected a statistically based reference point, considered representative of a desired reference condition for a given biological region of the state. This effort resulted in development of the Mississippi Benthic Index of Stream Quality (M-BISQ). The M-BISQ was specifically designed for Mississippi's wadeable streams and their associated biology (benthic macroinvertebrate community), and provides the state with a sound scientific methodology for accurately assessing the overall ecological condition of recently monitored streams, as well as those streams scheduled for monitoring in the future. Specifically, macroinvertebrate assessment results from a sampled water body are used to generate a score that can be used to determine attainment or non-attainment of ALUS, and for identifying water bodies as impaired for §303(d) listing purposes. Macroinvertebrates (i.e., primarily aquatic insect larvae) are good indicators of stream health because of their responses to the presence of long-term chemical and physical pollutants and/or conditions. The design of the M-BISQ system addresses natural variability and certain historical, irreversible patterns of disturbance; and the approach allows for acceptable levels of current human disturbance (i.e., levels that do not impair the aquatic life use of the water). For a detailed discussion of the M-BISQ development effort see Development and Application if the Mississippi Benthic Index of Stream Quality (M-BISQ), Mississippi Department of Environmental Quality, June 2003.

Mississippi Benthic Index of Stream Quality (M-BISQ)

In 2000, MDEQ redesigned its biological monitoring and assessment program to develop a more defensible assessment methodology that would result in higher quality data. This included more rigorous training; field sampling; laboratory sorting, subsampling, and taxonomy; analytical methods; assessment protocols; and documentation. Also included were a comprehensive Quality Assurance Project Plan (QAPP) with detailed standard operating procedures (SOPs), revision of data entry and database management

procedures, and documentation of data quality characteristics throughout the entire data collection and assessment process. In 2001, approximately 450 wadeable stream sites were sampled statewide (with the exception of the streams in the Mississippi River Alluvial Plain Ecoregion) during a winter index period for benthic macroinvertebrates, physical habitat quality, substrate particle size distribution, and selected field and analytical chemistry. In 2004, another 80 wadeable stream sites were sampled across the state during a winter index period (again excluding the Mississippi River Alluvial Plain Ecoregion). Further sampling using this biological methodology was conducted earlier in 2003.

A separate effort is underway on a different schedule to develop appropriate methodologies to monitor and assess the waters of the Mississippi River Alluvial Plain Ecoregion.

One goal of the 2001 sampling effort was to identify sufficient stream sites that are representative of least disturbed conditions within unique site classes, or regions of the state. To do this, sites were identified across the state with high amounts of upstream forested land cover, relatively extensive upstream riparian buffer, low urban density in their watersheds, substantial distance away from upstream point source discharges of wastewater, and low concentrations of recently measured water chemistry parameters. These characteristics served as indicators, or surrogates, for likely "least disturbed" conditions, but did not directly imply, measure, or assess aquatic life use support. Using physical and chemical characteristics from these sites, the state was divided into areas of relative ecological similarity. Once samples were collected, and biological metric values (e.g., total taxa, Hilsenhoff Biotic Index, %EPT, etc.) calculated, multivariate analyses were used to document biological variability of the potential "least disturbed" sites, resulting in development of M-BISQ, a calibrated multi-metric index of biological integrity. Using multivariate analyses of the metric values, five site classes or bioregions (i.e., areas of biological similarity) were delineated: the (1) Black Belt; (2) East; (3) Northeast; (4) Northwest; and the (5) West (Figure 1). None of the sites used for site class delineation were specifically known to be impaired, i.e., the state had no previous monitored data indicating non-support of aquatic life use, though not all of these sites may have been previously monitored.

The "least disturbed" sites within each bioregion were considered as a comparison set for that bioregion. The numeric M-BISQ scores for each bioregion's comparison set made up a distribution from which a statistical reference point reflected the concept of "least disturbed" or "best attainable" conditions. The 25^{th} percentile of the M-BISQ score distribution for each bioregional comparison set (Figure 2) was selected as the reference point or threshold of attainment and was considered to approximate the desired reference condition and served as a threshold of attainment of ALUS. Thereafter, this threshold of ALUS attainment for each bioregion was used for comparing biological data collected from the previously unmonitored §303(d) listed streams in each respective bioregion. It was also considered to capture and reflect the inherent certainty, and uncertainty, of the measurement process. To allow for the comparison to the ALUS attainment reference threshold, the biological data from each §303(d) wadeable site sampled were combined

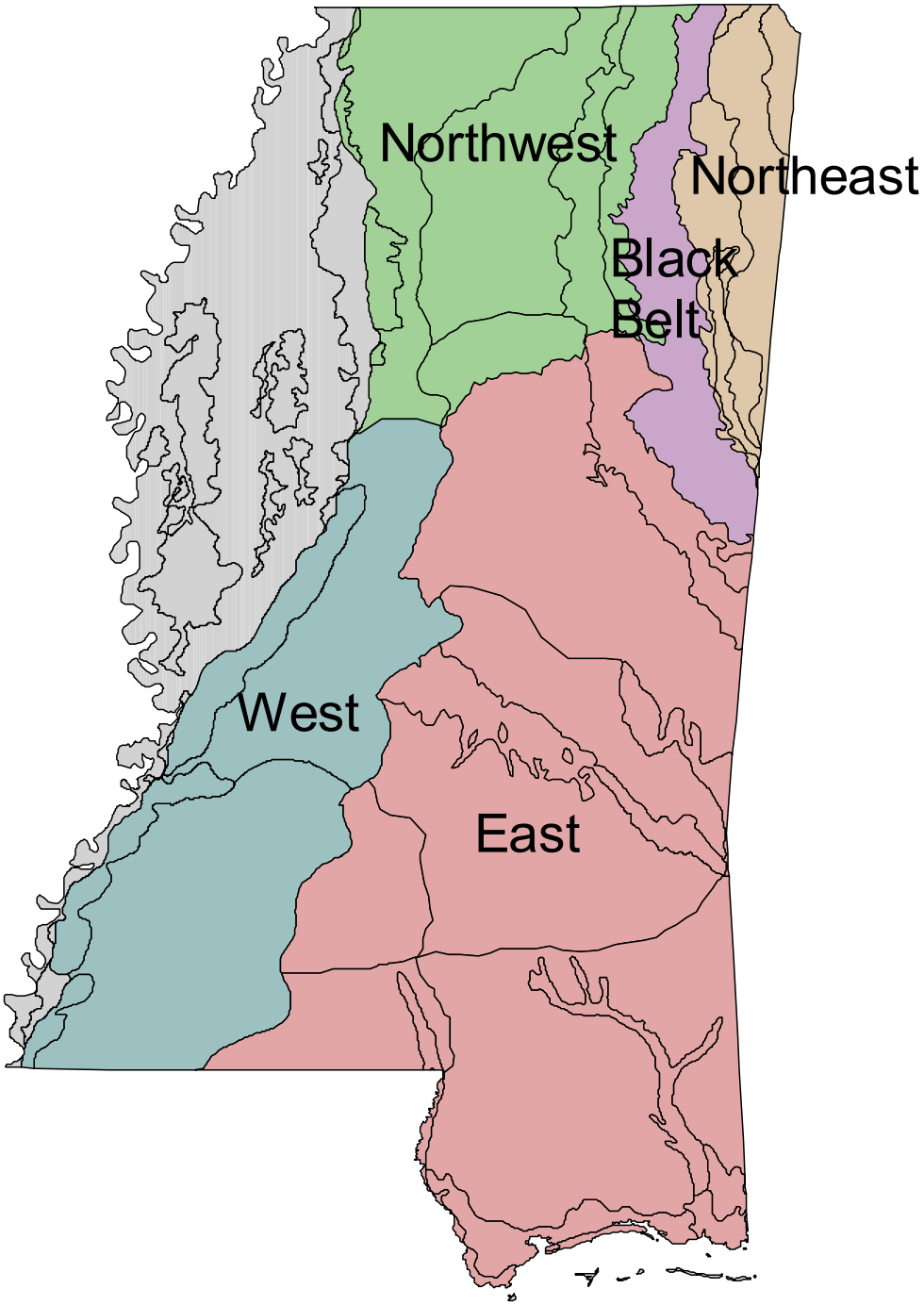

Figure 1. Mississippi's Five Bioregions

into the final multi-metric index score (M-BISQ) for each site. The relationship of the final score to the attainment threshold of the appropriate bioregion determined the assessment status for the site. A more detailed explanation of the 2004 §303(d) listing process is given below in the Assessment Guidelines section.

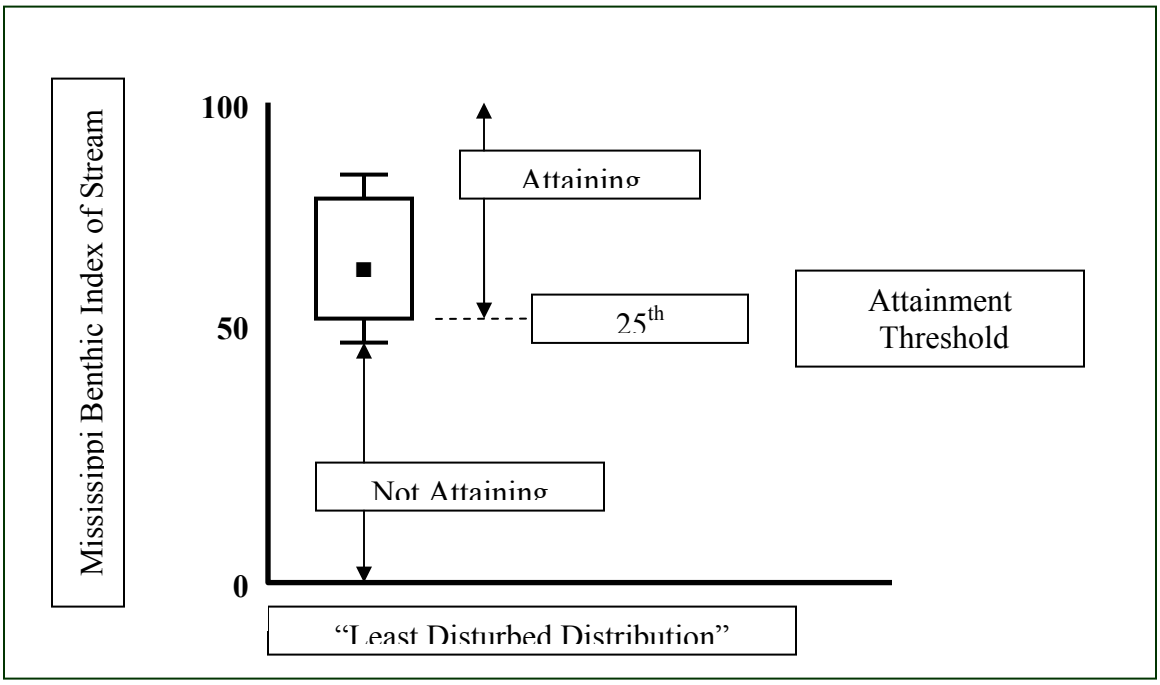

Figure 2. Sample M-BISQ Score Distribution for a Bioregional Comparison Set

M-BISQ Assessment Guidelines for the 2004 §303(d) Listing Process

1. Streams with M-BISQ site scores at or above the attainment threshold (25th percentile) score of the comparison set for their respective bioregion will be considered as ***attaining*** ALUS (not impaired) and will be removed from the §303(d) list, if previously listed.

2. Streams with M-BISQ site scores below the minimum score of the comparison set for their respective bioregion will be considered ***not attaining*** ALUS (impaired) and will remain on, or be added to the 2004 §303(d) list.

3. Streams with scores below the attainment threshold (25th percentile) score, but within the lower quartile (i.e., between the attainment threshold score and the minimum score) of the comparison set for their respective bioregion, will be considered

potentially impaired, but will be subject to re-sampling to confirm a score below the attainment threshold (25th percentile) score.

a. Streams with M-BISQ site scores in the lower quartile of the comparison set for their respective bioregion, and currently on the state's 1998 §303(d) Impaired Waters List, will remain on the list. These streams will be re-sampled in the next round of M-BISQ sampling planned for 2003.

b. Streams with M-BISQ site scores in the lower quartile of the comparison set for their respective bioregion, and **not** on the state's 1998 §303(d) Impaired Waters List, will be placed on a "Watch List" (defined below). These streams will be re-sampled in the next round of M-BISQ sampling planned for 2003.

4. The purpose of re-sampling streams with M-BISQ site scores in the lower quartile of the comparison set for their respective bioregion is to confirm whether the streams are actually impaired, (i.e., whether or not they continue to score below the attainment threshold [25th percentile] for their respective bioregion). Additional technical and policy discussions with EPA are planned prior to the development of the state's 2004 §303(d) list regarding the interpretation of M-BISQ scores from re-sampled sites.

5. Definition of MDEQ's *Watch List.* MDEQ's *watch list* is a list of water bodies targeted for priority monitoring. The *watch list* includes water bodies with M-BISQ scores in the lower quartile of their respective comparison set (but not previously listed on the §303(d) list), which is an indication of potential impairment within the precision of the M-BISQ process. Before adding a water body from the *watch list* to the §303(d) list, the state intends to confirm a water's status and potential impairment with a re-sample to address the uncertainty of the original sampling event (not the uncertainty inherent in comparison set analysis).

   MDEQ recognizes that in the interim, prior to scheduled resampling, waters on the *watch list* will need sufficient protection in consideration of their potential impairment. Careful evaluation of new or expanding point source activities that could affect the water quality of a water body on the watch list will be conducted. In particular, permit actions related to water bodies on the *watch list* will be thoughtfully and carefully reviewed. Further policy discussions related to permitting activities on these water bodies are planned between the state and EPA to insure that the water quality of water bodies on the state's *watch list* is adequately protected.