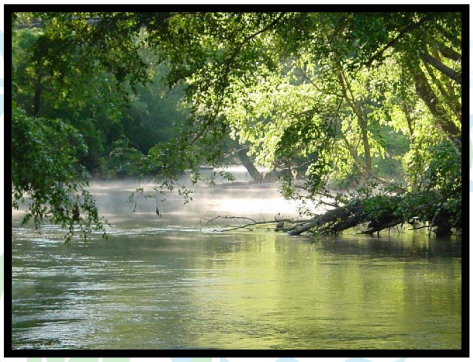
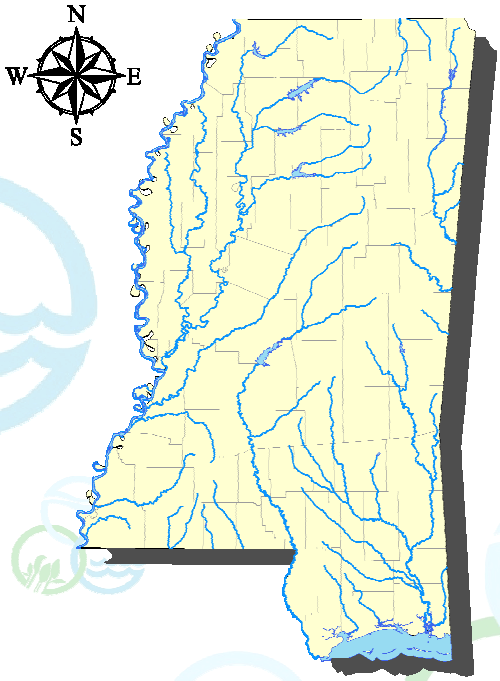
State of Mississippi
Water Quality Assessment
2006 Section 305(b) Report





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Water Quality Assessment
2006 Section 305(b) Report

Mississippi Department of
Environmental Quality

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The authors would like to express their appreciation to the staff of the Surface Water Division's Watershed Management Branch – NPS Section, GIS Section, and Basin Management Section and the TMDL Branch who contributed to this report. It should be noted that without the help and support from staff in the Ambient Data Management Branch, development of this report would not have been possible. In addition, special thanks is extended to the staff of the Field Services Division for their data collection and laboratory efforts in providing most of the data used in this §305(b) assessment, as well as for their contributions to this narrative report.

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 (USEPA), 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 2006 Water Quality Assessment §305(b) Report is to comprehensively describe for USEPA, Congress, and the public the status of the quality of the state's waters. This 2006 §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, where known, 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.

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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 (USEPA), 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. MDEQ is committed to ensuring that everyone, regardless of race, culture, or income enjoys a healthy environment in which to live, learn and work. 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 CWA was passed in 1972. 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 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 USEPA. 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. 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 separately. This report is designed to be comprehensive in nature, based upon the most current updated information applicable for statewide assessment of Mississippi's surface waters. To fulfill ground water reporting requirements according to §305(b) of the CWA, MDEQ is submitting a separate report entitled: *State of Mississippi Ground Water Quality Assessment* (MDEQ 2006).

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 2006 Water Quality Assessment §305(b) Report is therefore to comprehensively describe for USEPA, 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 for those waters identified as impaired. Additionally, Mississippi's water quality monitoring program is outlined in this report.

This 2006 §305(b) report is a comprehensive statewide report of surface water quality representing a five-year data reporting window of 2000-2004. 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 2001, 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 assessments 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 Assessment and Listing Methodology (CALM) are assessed (Appendix A). 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 or more designated use(s) as outlined in *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ 2003). 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 of Mexico 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 river basins with a total length of streams in excess of 83,500 miles. Of these miles, 33% are perennial characterized by flowing water throughout the year. Intermittent streams which flow during rainy seasons but are dry during summer months represent 64% 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 270,000 acres. According to landuse information, wetlands cover an estimated 2,728,000 acres with tidal marsh comprising approximately 53,000 acres of this total. The southern edge of Mississippi's contiguous land mass borders the Mississippi Sound with the coastline along the Mississippi Sound totaling approximately 84 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*	83,674
- Number of perennial river miles (subset)*	27,463
- Number of intermittent stream miles (subset)*	53,754
- Number of ditch and canal miles	2,457
Number of lakes/reservoirs/ponds (>25 acres)	1,239
Acres of lakes/reservoirs/ponds (>25 acres)	269,960
Square miles of estuaries/harbors/bays	758
Number of coastal miles	84
- Number of Public Recreational Beach Miles	40
Acres of freshwater wetlands	2,728,072
Acres of tidal wetlands	52,875

*From USEPA 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 (MDEQ 2003b) 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

	Total Size According to Classification			
Classified Use	Rivers (miles)	Lakes (acres)	Estuaries (sq. miles)	Coastal Shoreline (miles)
Fish & Wildlife[a]	82,431	140,627		
Public Water Supply[ab]	87	13,597		
Recreation[b]	1,043	93,159	728	84
P. Water Supply & Rec.[ab]		22,577		
Shellfish Harvesting[bc]			6	
Recreation/Shellfish[b]			32	
Ephemeral	113			
Total:	83,674	269,960	758	84

[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 §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 USEPA 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 2006 Section 303(d) List of Impaired Water Bodies* (MDEQ 2006) and be subject to further monitoring and/or Total Maximum Daily Load development. Assessments are necessary to answer basic questions like:

> *Does this water body support a healthy and diverse aquatic life for fish and other aquatic organisms?*
> *Is this 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 USEPA has developed, with state and public input, a national guidance document for the §305(b) assessment and §303(d) listing process. CALM, finalized by USEPA 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. USEPA recommended the use of the CALM guidance for the 2006 assessment but also allowed states flexibility and the option of using previous §305(b) guidance for water quality assessment purposes. For the Mississippi 2006 assessment, MDEQ has developed a document entitled *MISSISSIPPI CALM (Consolidated Assessment and Listing Methodology) 2006 Assessment and Listing*

Cycle (MDEQ 2006) 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 2006 §305(b) assessment and §303(d) listing cycle. Mississippi's CALM document primarily reflects USEPA CALM recommendations but also retains some elements of previous §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 USEPA designated uses for water quality assessment purposes recognized by the State of Mississippi are as follows:

Use Classification	**USEPA 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 2006 §305(b) Assessment Methodology

Water quality data and information can take many different forms, from simple observations to routine fixed network monitoring and intensive surveys with extensive water chemistry, biology, and physical data sampling. 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 USEPA §305(b) guidance, *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (§305(b) Reports) and Electronic Updates: Supplement* (USEPA 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 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 USEPA §305(b) guidance. Recognizing the varying uncertainty of data and information 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 USEPA Region 4 interpretation, any water quality impairments identified in §305(b), regardless of the confidence in the data, 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 historical 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 2006, as in 2002 and 2004, MDEQ, as a general rule, will only use site-specific monitoring data of sufficient quality and quantity for making final water quality §305(b) assessments and §303(d) listing decisions. Any remaining information and monitoring data not meeting CALM requirements for data sufficiency will be used for a non-attainment assessment decision when those data and information demonstrate compelling evidence of water quality degradation of the overall condition of a water body, as defined in Mississippi's CALM document, and data quality documentation is available. If there is no documented data quality information, data do not meet data quality objectives, and/or data demonstrate potential impairment but at a lesser degree, the water body will be placed on a targeted monitoring list to confirm the actual water quality condition.

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 classified as 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 2006 §305(b) report, this data window is from 2000-2004.

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 numeric water quality criteria as found in MDEQ's most current version of the WQS document (MDEQ 2003b). This allows MDEQ to determine which pollutant specific numeric criteria are violated. These criteria are used for aquatic life, recreation, shellfish consumption, and drinking water use assessment.

Biological data may 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 V, Intensive Surveys and Special Project Monitoring.

Bacteriological data include water column surveys for fecal coliform bacteria or other bacteriological indicators (i.e., enterococci). These data are used to assess the recreation use for waters to protect the public in swimming and other water related activities. For the 2006 §305(b) assessment, bacteriological data identified as meeting Mississippi CALM requirements were from the MDEQ Beach Monitoring Program and MDEQ special project sampling to address statewide §303(d) listed waters with pathogens indicated as the cause of impairment. A description of these bacteria monitoring projects can be found in Part V, 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.

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 within a five-year period are required for conventional parameters and 10 data points within three years are required for assessment of metals. For bacteria data, not including data from the MDEQ Beach Monitoring Program, a minimum of five fecal coliform samples collected over a 30-day period in each season (summer and winter) over two years are necessary for bacteriological assessment. For MDEQ beach monitoring data, a total of 20 enterococci samples are needed in each season over a period of two years to meet CALM requirements.

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

In accordance with recommendations from USEPA's new Consolidated §305(b) Assessment and §303(d) Listing guidance document, *Consolidated Assessment and Listing Methodology, Toward a Compendium of Best Practices* (USEPA 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, it may be determined that all data and information collection activities do 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) and the data is supported by data quality documentation. Monitoring sites identified as potentially-impaired but with less compelling evidence, a lesser degree of potential impairment, and/or lack of data quality documentation are still not dismissed. Instead, the water body is assigned to a monitoring list to be scheduled for future monitoring by MDEQ in order 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.).

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 2006 §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 water quality 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 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 USEPA's Assessment Database (ADB), which has been customized to facilitate Mississippi's assessment and reporting needs. The ADB is USEPA'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, designated use, assessment types, assessment category (1-5 according to USEPA'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. Electronic ADB files for the §305(b) assessment are submitted to USEPA for compilation with data from the other states.

All water bodies cataloged in the ADB are also geo-referenced. Using Arc Info software, in conjunction with the National Hydrograph Dataset (NHD) coverage, all water body assessments are assigned a unique identifier or assessment unit (AU) that is designated according to where the water body is located within a 12-digit subwatershed. The 12-digit subwatershed is referred to as the reporting unit (RU). The combination of the RU and the AU results in a 6 digit unique identifier that is cataloged in the ADB to store and track assessment information. The first number identifies the basin in which the water body is located. The major basins in the state are numbered 1 through 9 in alphabetical order (e.g. 1 is the Big Black River basin, and 9 is the Yazoo River Basin (Figure 1)). The next three digits in the identifier refer to the specific 12 digit subwatershed within the basin, starting with 001 (e.g. 146 located in the Big Black Basin would be 1146). The final two digits in the identifier refer to a specific stream segment within the subwatershed beginning with 11. For instance, Beaver Creek, with waterbody ID 521413 is stream segment 13 in subwatershed 214 in the Pearl River Basin. An exception to this system is found in the Yazoo River Basin. In the Yazoo, subwatersheds in the Hills region begin with 001, while subwatersheds in the Mississippi Delta begin with 500. All geo-referenced information is provided to USEPA electronically.

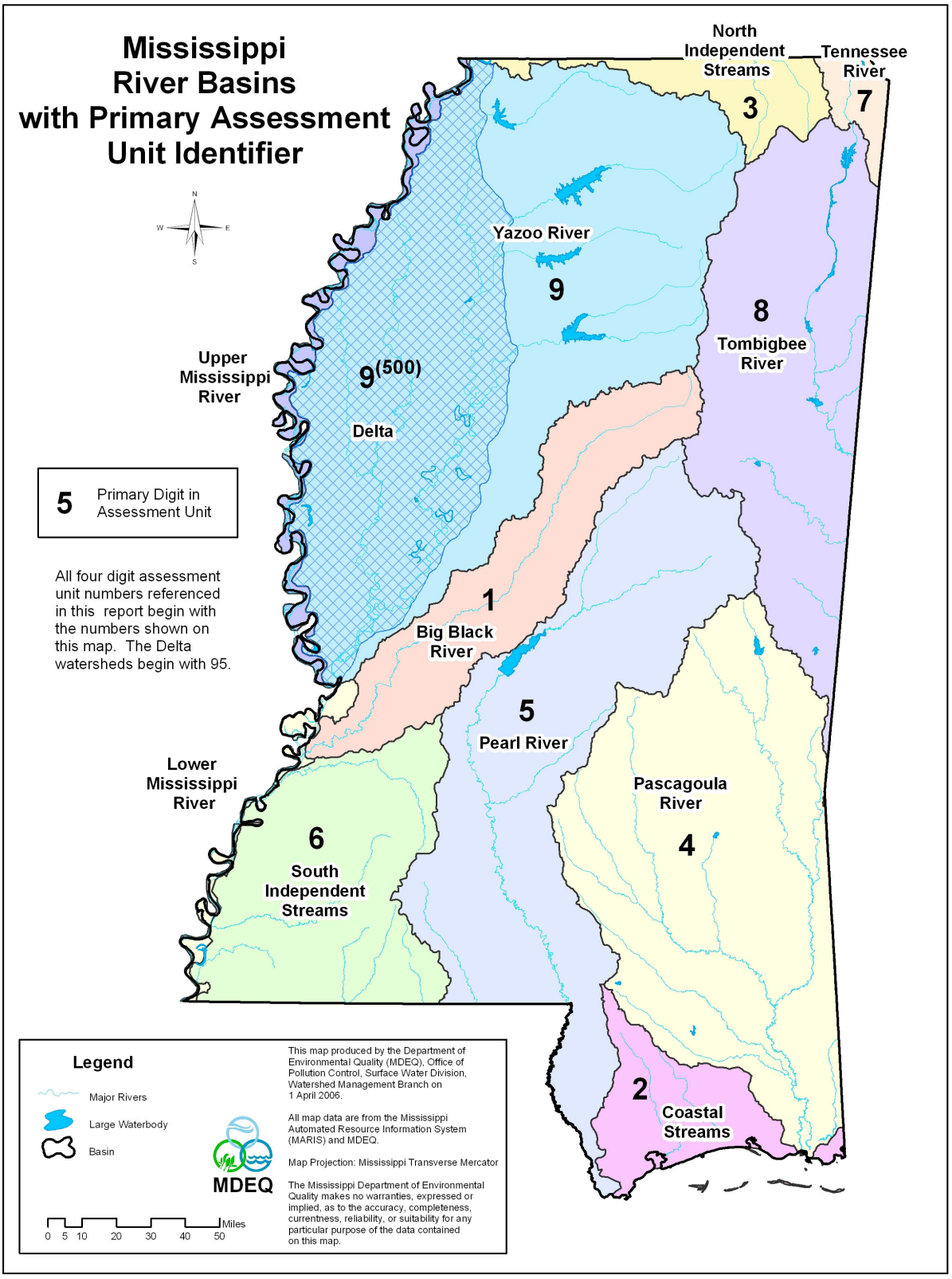


Figure 1: Mississippi River Basins and Delta

Statewide Assessment Summary

Designated Use Support-Rivers and Streams

For the 2006 §305(b) Water Quality Assessment Report, the Mississippi Department of Environmental Quality (MDEQ) assessed approximately 29% (7,880 miles) of Mississippi's total 27,463 miles of perennial streams and rivers for one or more uses. The status of water quality on the remaining 71% (19,583 miles) of the state's perennial rivers and streams is unknown.

The low percentage of assessed waters relative to the total stream and river mileage (only 9% when the total 83,674 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 72% of the state's 1,294 12-digit watersheds. These monitoring efforts entailed data collected at more than 716 sites in the state (Figure 2). In addition, MDEQ also monitored 71 sites on selected rivers and streams as part of its Ambient Fixed Station Monitoring Network, and 472 special study sites. 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 USEPA §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 84,183 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. This is 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 USEPA 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 USEPA National Coastal Assessment Program and is interested in expanding the probabilistic approach to the state's freshwater resources.

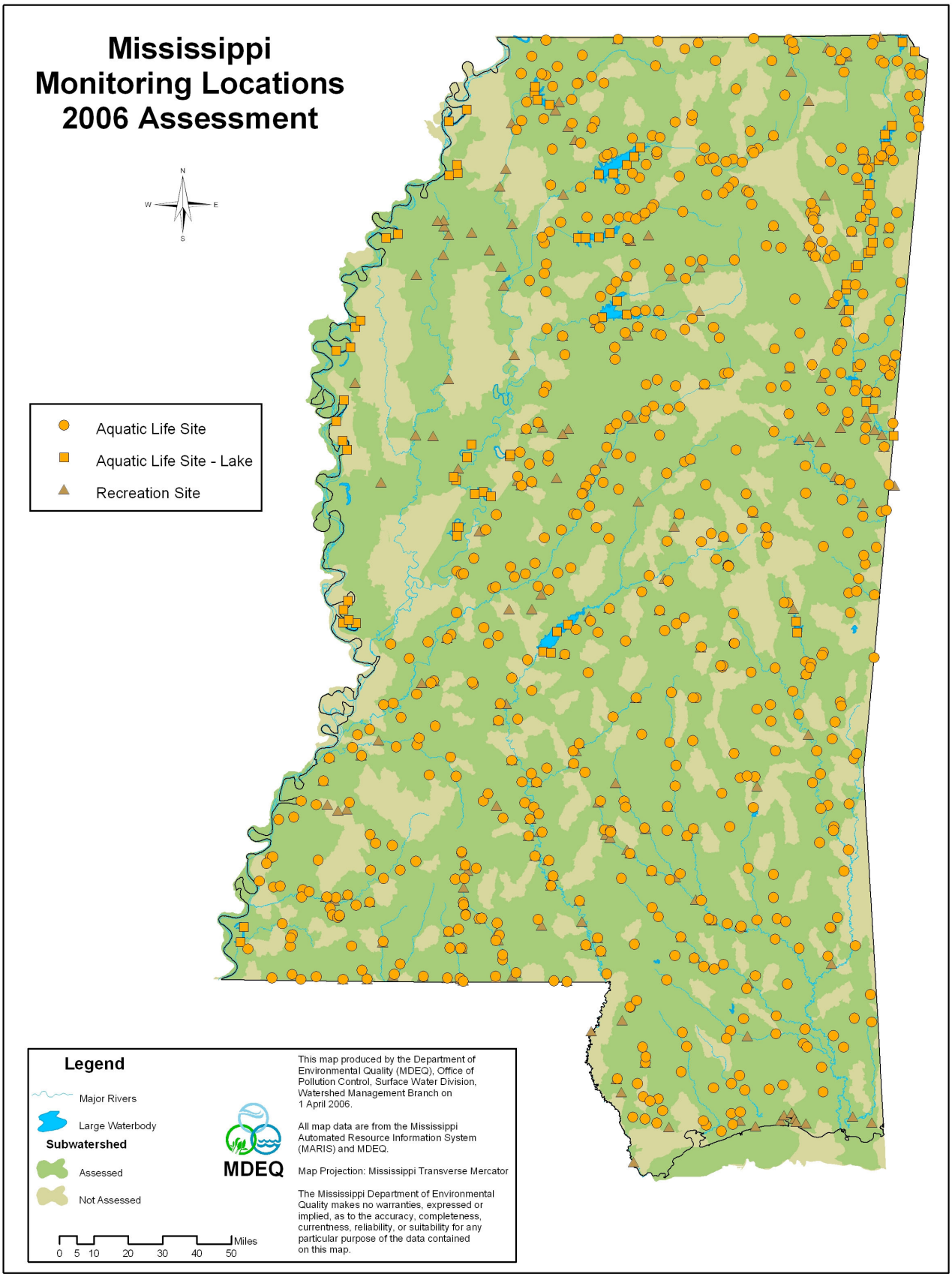


Figure 2: Monitoring Locations in Mississippi

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 use into 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

USEPA defines a Category 1 water as having sufficient data to prove there is no impairment for any potential designated use of that water body. Mississippi currently has no water bodies assigned to Category 1 due to USEPA requirements that all uses are assessed. Mississippi's assessments are placed in categories 2-5.

Of Mississippi's 27,463 total perennial stream and river miles, approximately 29% (7880 miles) were assessed (Figure 3). 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.

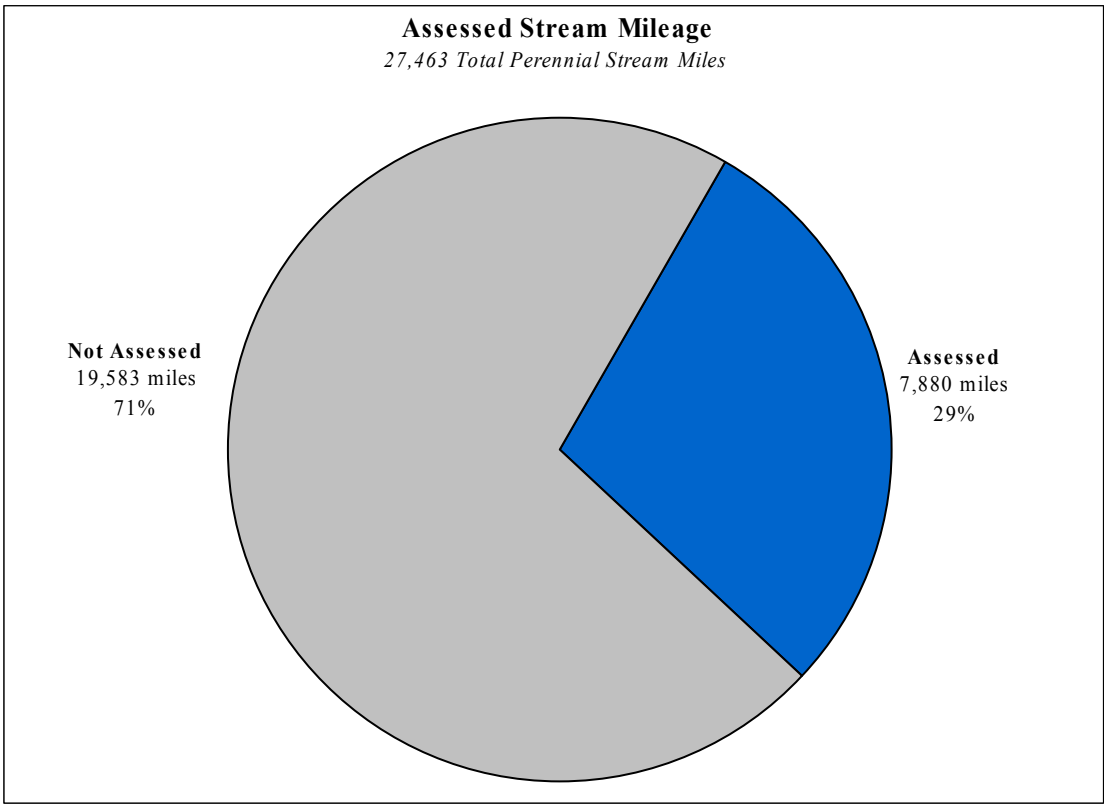


Figure 3: Assessed Stream Mileage: Perennial Rivers and Streams

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 3 and depicted in Figure 4. For the largest percentage (39%) 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 27% of the non-attaining water bodies. Other impairments were 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 considered through the Basin Management Approach.

The largest percentage of impairment was identified as biological, and the specific sources of the impairment are yet to be determined. As a result, unknown sources contribute 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 3: Summary of Use Support Impairment Causes for Rivers and Streams

Cause Categories	Total Size Miles
DDT/Toxaphene	124
Mercury	290
Organic Enrichment/Low DO	354
Sedimentation/Siltation	685
Nutrients	298
Other (Bio Impairment)**	1,953
Pathogens	1,382
Salinity/TDS/Chlorides	5
Total***	5,091

**Definitive cause identification is not possible at the time of assessment. Designation used to report on waters where biological indicators (macroinvertebrates) were used and impairment was indicated but further investigation needed to identify the cause of the impairment.

***Total exceeds number of actual impaired miles due to presence of multiple impairment cause(s) per assessed water body

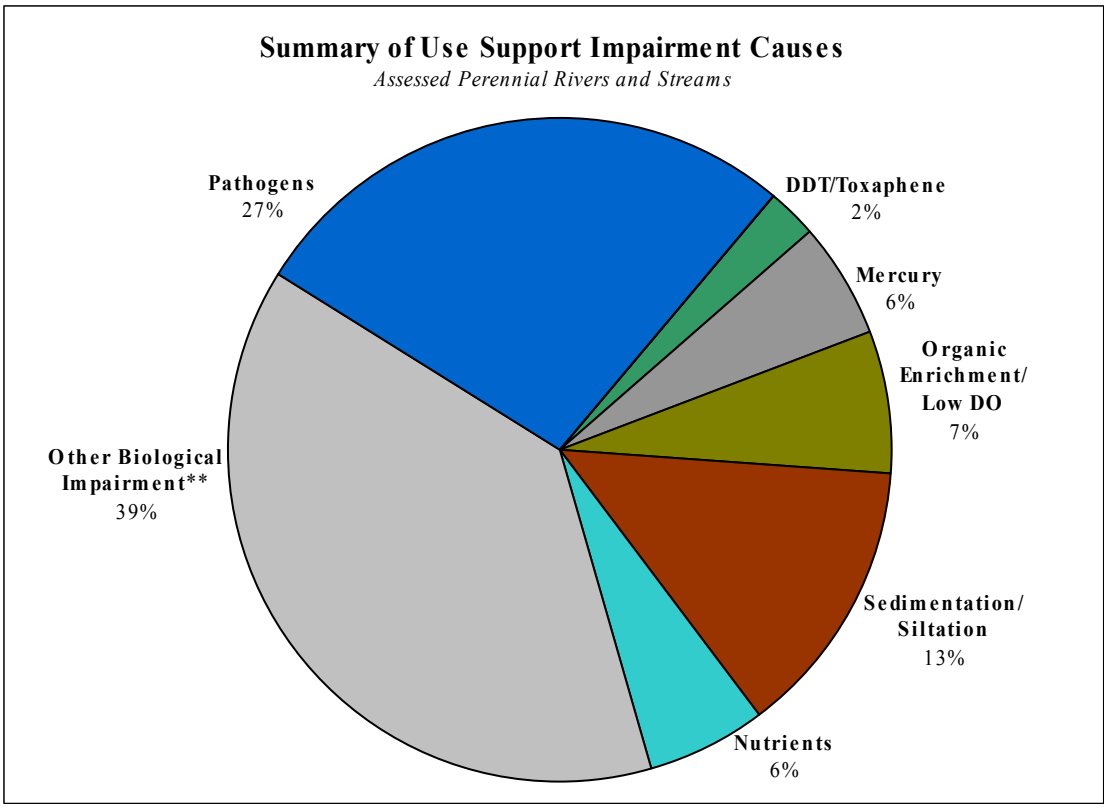


Figure 4: Summary of Use Support Impairment Causes: Rivers and Streams

Assessment Summary for ALUS and Recreation

Assessments for miles of perennial rivers and streams are cataloged by use. A water body may have several different uses assessed. Therefore, numbers represented in Tables 4 and 5 are different from the mileages presented earlier in this chapter. The following tables and figures provide the assessment summaries for Aquatic Life Use Support and Recreation Use Support. Fish Consumption use has also been assessed and can be found in Part III of this report. 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 4: Aquatic Life Use Support Summary for Perennial Rivers and Streams

Status	Miles
Attaining	3,483
Unknown	20,674
Total Not Attaining	3,306
TMDL not needed	560
TMDL needed	2,746
Total Perennial Miles	**27,463**

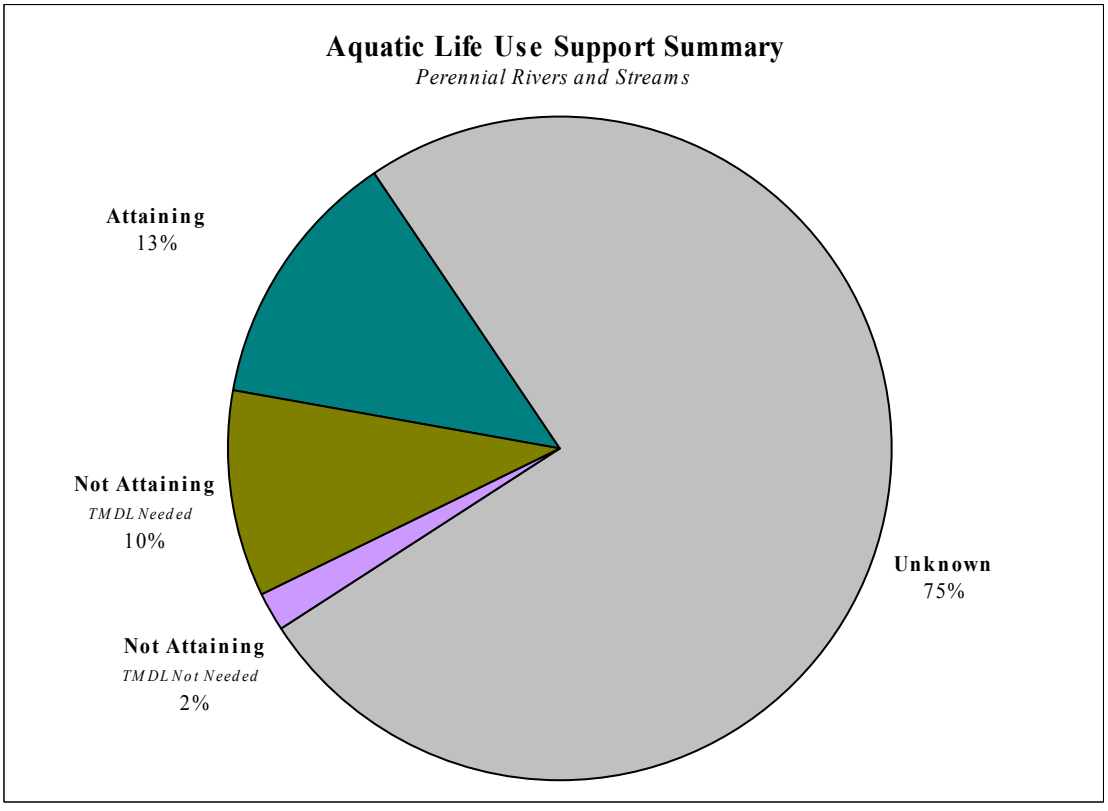


Figure 5: Aquatic Life Use Support Summary

Table 5: Recreation Use Support Summary for Perennial Rivers and Streams

Status	Miles
Attaining	1,464
Unknown	24,617
Total Not Attaining	1,382
TMDL not needed	878
TMDL needed	504
Total Perennial Miles	**27,463**

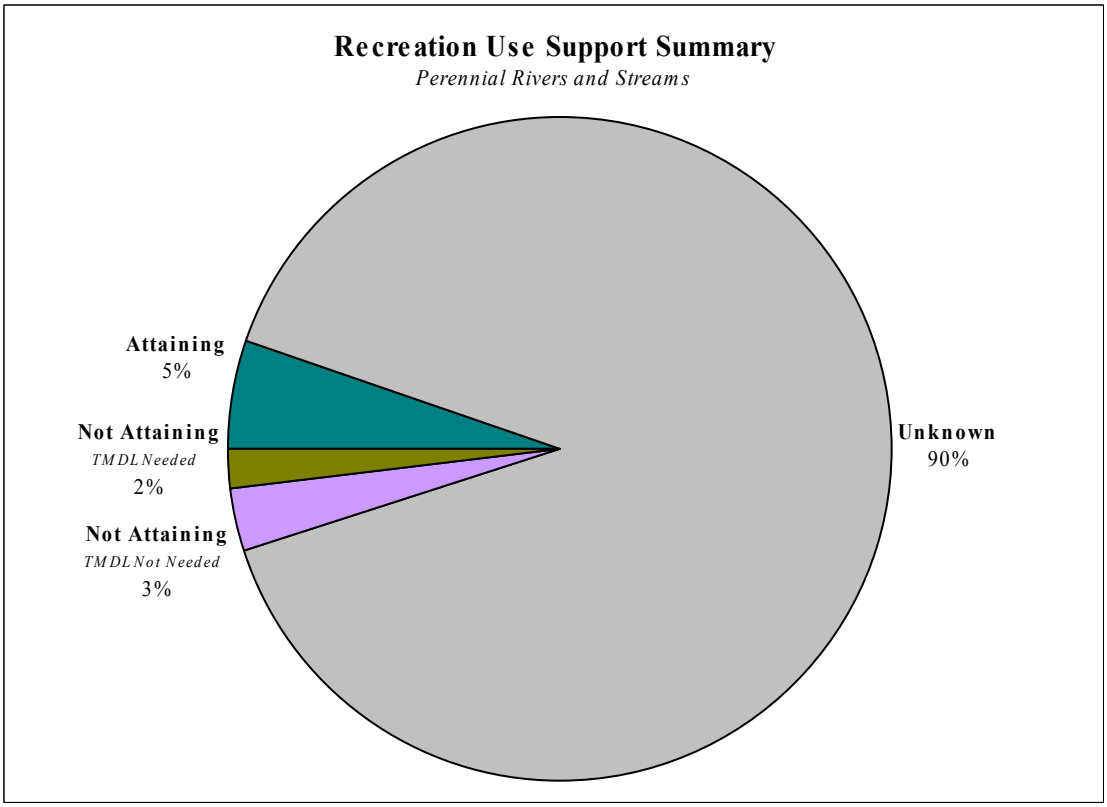


Figure 6: Recreation Use Support Summary

Designated Use Support – Estuaries and Coastal Waters

Mississippi has approximately 84 miles of coastal shoreline between the Alabama/Louisiana state boundaries and 758 square miles of coastal waters including large estuaries, smaller bays and tidal rivers, creeks, and bayous. 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 Gulf of Mexico and a chain of barrier islands (Cat, Ship, Horn, and Petit Bois Islands) located approximately 11 miles offshore. The state also classifies the Gulf of Mexico as an estuary within Mississippi waters to the state boundary located three miles south of the barrier islands.

During this §305(b) reporting period, extensive environmental monitoring was carried out by MDEQ and other State and Federal agencies and institutions in Mississippi estuaries and coastal waters through a combination of ambient fixed station trend monitoring and special studies. Rigorous CALM requirements for §305(b)/303(d) reporting, though, render part of these data unusable for §305(b) assessment due to various deficiencies in the data meeting the CALM quantity and/or quality requirements. However, all available estuarine and coastal data submitted to and/or compiled by MDEQ for the §305(b) assessment were reviewed for compelling evidence of impairment as specified by CALM. If potential impairment was noted, this was either assessed in this §305(b) report or assigned to a future monitoring list for follow-up sampling to confirm any impairment.

For the 2006 §305(b) report, MDEQ was able to assess, for the first time, 100% of the total 758 square miles of estuaries for aquatic life use. This was accomplished primarily through the use of an estuarine probability-based (random sampling) monitoring design developed by USEPA Gulf Ecology Division, National Health and Environmental Effects Research Laboratory (NHEERL), located in Gulf Breeze, Florida. This was made possible through MDEQ's participation in the National Coastal Assessment (NCA), a component of USEPA Environmental Monitoring and Assessment Program (EMAP). Additional data meeting CALM requirements for ALUS assessment in Mississippi coastal waters included intensive study data collected by MDEQ in Bayou Casotte at Pascagoula as part of a special water quality study. In addition to assessment of ALUS, MDEQ also assessed the recreation use for 40% of Mississippi's public beaches using data provided by the MDEQ Coastal Beach Monitoring Program. Shellfish consumption use was not assessed for 37 sq. miles of shellfish harvesting reefs due to damage and loss of data at MDMR from Hurricane Katrina, which drastically affected the Mississippi Gulf Coast with its August 29, 2005, landfall.

Although not part of the reporting window for this assessment, the catastrophic impact of Hurricane Katrina to Mississippi in August 2005 is of such significance that this event is noteworthy of mention in this 2006 §305(b) report. Thus, as a special inclusion to this report, a discussion of the hurricane and presentation of monitoring results regarding

post-Hurricane Katrina water quality impacts to the Mississippi Gulf Coast are provided at the end of this section.

Aquatic Life Use Support (ALUS) Assessment

Since 2000, MDEQ has been participating in USEPA's National Coastal Assessment (NCA) Program whose probabilistic design allows for assessment of 100% of the nation's estuarine and coastal resources at various geographic scales. This type of survey design consists of sampling a population of interest in a manner that allows statistically-valid statements to be made at a known confidence level about the entire population as a whole based on a sub-sample. The results of the analysis from the NCA program provide an unbiased estimate of the condition of estuarine and coastal resources and allow comprehensive assessments to be made at state, regional, bio-geographical and national levels to summarize the ecological health of coastal waters. Information and data analysis from the NCA program pertinent to aquatic life use assessment are now available and are used for the first time in Mississippi's 2006 §305(b) report development. An in-depth description of the monitoring activities involved with the NCA program can be found in Part V of this report.

Each year, a new set of 30-50 randomly selected sites are sampled from July – September by MDEQ in cooperation with the University of Southern Mississippi Gulf Coast Research Laboratory (GCRL) in the state's estuaries representing three different strata – large estuaries, small estuaries, and tidal creeks and bayous. Site selection is provided by USEPA-Gulf Breeze. For the 2006 §305(b) reporting window (2000 – 2004), a total of 235 NCA monitoring sites were available for assessment purposes.

Assessments were based on three conventional parameters: dissolved oxygen, pH, and temperature. These data were used to assess ALUS attainment. Based on NCA data analysis, approximately 98% of all Mississippi coastal waters fully support aquatic life use for these three parameters (Table 6). Results can be further broken down by water body type and are provided in Table 7.

Table 6: NCA Conventional Parameter Summary – All MS Coastal Waters

Classification	Dissolved Oxygen		Temperature		pH	
All Mississippi Coastal Waters	Attaining	96.1%	Attaining	98.7%	Attaining	98.7%
	Nonattaining	3.0%	Nonattaining	0.4%	Nonattaining	0.4%
	Unknown	0.9%	Unknown	0.9%	Unknown	0.9%

Table 7: NCA Conventional Parameter Summary – MS Coastal Waters by Strata

Classification	Dissolved Oxygen		Temperature		pH	
Large Estuaries	Attaining	95.8%	Attaining	99.2%	Attaining	99.2%
	Nonattaining	3.3%	Nonattaining	0%	Nonattaining	0%
	Unknown	0.8%	Unknown	0.8%	Unknown	0.8%
Small Estuaries	Attaining	98.9%	Attaining	97.8%	Attaining	98.9%
	Nonattaining	0%	Nonattaining	1.1%	Nonattaining	0%
	Unknown	1.1%	Unknown	1.1%	Unknown	1.1%
Tidal Creeks and Bayous	Attaining	84.2%	Attaining	100%	Attaining	94.7%
	Nonattaining	15.8%	Nonattaining	0%	Nonattaining	5.3%
	Unknown	0%	Unknown	0%	Unknown	0%

The larger percentage of low dissolved oxygen in tidal creeks and bayous is not considered problematic in Mississippi coastal waters due to several factors. The number of tidal creek/bayou sites is small in number (only 19 sites) compared to the rest of the NCA water body types. Of these, three sites had dissolved oxygen levels less than the 4.0 mg/L state water quality criterion but only one of these had a dissolved oxygen level less than 3.0 mg/L. In addition, low dissolved oxygen conditions are common in constricted coastal waters such as estuarine creeks and bayous with most of these conditions naturally occurring during the summer months. Although localized dissolved oxygen problems due to anthropogenic pollution sources can and do occur, high water temperatures, saline/freshwater stratification, and salt marsh interactions are prevalent in Mississippi estuarine waters and frequently combine to result in periods of low dissolved oxygen during this time of year.

The other data that met CALM requirements were collected by MDEQ during an intensive water quality study of Bayou Casotte located at Pascagoula. Conducted in August – October 2002, this study involved diel monitoring over a three month period to assess the impacts of an industrial facility discharge into the bayou. This heavily industrialized bayou has been the subject of chronic water quality complaints. Based on these data, Bayou Casotte was assessed as nonattaining of the aquatic life use for the upper portion of the bayou above the Bayou Casotte Turning Basin/Shipping Channel. The cause of the nonattainment is attributed to low dissolved oxygen and unionized ammonia. More information on the monitoring activities involved with this intensive study can be found in Part V.

Recreation Use Support Assessment

For the 2006 §305(b) assessment, data from the MDEQ Coastal Beach Monitoring Program were used to assess recreation use support in Mississippi estuarine and coastal shoreline waters. MDEQ, in conjunction with the GCRL, conducts routine bacteria and water chemistry sampling activities at 22 beach stations located along Mississippi's Gulf Coast. The bacterial indicator used for recreation use support assessment purposes in marine and estuarine waters is enterococci. Further information on this fixed network monitoring program can be found in Part IV: Coastal Beach Monitoring Network.

Of the 40 miles of Mississippi's public beaches, 16 miles were assessed using the MDEQ Beach Monitoring Program data. Based on these data, 0 miles or 0% of the beaches in Mississippi were attaining the recreation use while 16 miles (40%) were found to be not attaining for primary contact recreation. These elevated bacterial concentrations resulted in occasional beach closures, due primarily to urban runoff from unspecified nonpoint sources. It should be noted that this assessment represents a five-year reporting period. Beaches are routinely monitored and are safe for swimming unless a beach advisory is in effect. To learn more about Mississippi's beach advisories, see Part III of this report.

Hurricane Katrina Water Quality Impact Monitoring

On August 29, 2005, Hurricane Katrina, a Category 4 hurricane, slammed into the Louisiana and Mississippi coasts inflicting catastrophic damage of historical proportions to both states. In Mississippi, the tidal surge devastated the Mississippi Gulf Coast shoreline and inland bay areas. Following the storms, numerous federal and state agencies including the USEPA, the National Oceanic and Atmospheric Administration (NOAA), the US Food and Drug Administration (FDA), the U.S. Geological Survey (USGS), GCRL, MDMR, and MDEQ collaborated to conduct intensive monitoring of water, sediment, and fish and seafood tissue along the Mississippi Coast.

The agencies worked hard coordinating monitoring activities utilizing the strengths of each agency. This coordination provided maximum coverage with minimal overlap in a manner that maximized data comparability from site to site and from state to state across the Gulf.

- NOAA collected fish, shrimp, and oysters from the mouth of the Mississippi River to Mobile Bay, beginning September 12-13, 2005, and analyzed these samples for contaminants.
- USEPA Region 4 and MDEQ sampled 30 sites in the bays and estuaries. They analyzed water and sediment for a broad range of chemical contaminants and bacteria.
- USEPA Office of Research and Development, with assistance from MDEQ sampled 30 randomly selected sites in Mississippi Sound for water, sediment, and benthic community structure. These data can be compared to historical data from the National Coastal Assessment Program.

- USGS sampled the freshwater inflows to the bays and estuaries for contaminates.
- USGS and MDEQ sampled bacteria in the sound, bays and rivers beginning on September 19, 2005. USGS set up a temporary lab at Stennis Space Center, and sampled weekly at 45 sites.
- USEPA Region 4 sampled soil and sediment around eight high priority facilities in Mississippi to evaluate potential contamination from industrial sources.
- USEPA Region 4 sampled soil, sediment and groundwater at five National Priority List (NPL) or superfund sites in the Katrina affected area in Mississippi.
- FDA, MDEQ, MDMR, and GCRL cooperated to collect and analyze fish, shrimp and crabs from 16 sampling sites along the coast.

Some data from these studies are still being analyzed, and new reports will be coming out as this analysis is finalized, but the results reported to date indicate generally good water and sediment quality following the storm, and no increase in fish tissue contamination as a result of the storm. The few problem areas that have been seen appear to be specific, isolated issues.

The USEPA Bay/Estuary report is available at http://www.epa.gov/region4/sesd/.

The USEPA Report on the five NPL facilities is available at:
http://www.epa.gov/region4/sesd/.

Detailed results of these and other Katrina related monitoring activities by USEPA can be found at the USEPA's web site, http://www.epa.gov/katrina/index.html.

Testing results by state, county or testing site can be viewed by using EnviroMapper at: www.epa.gov/enviro/katrina/emkatrina.html.

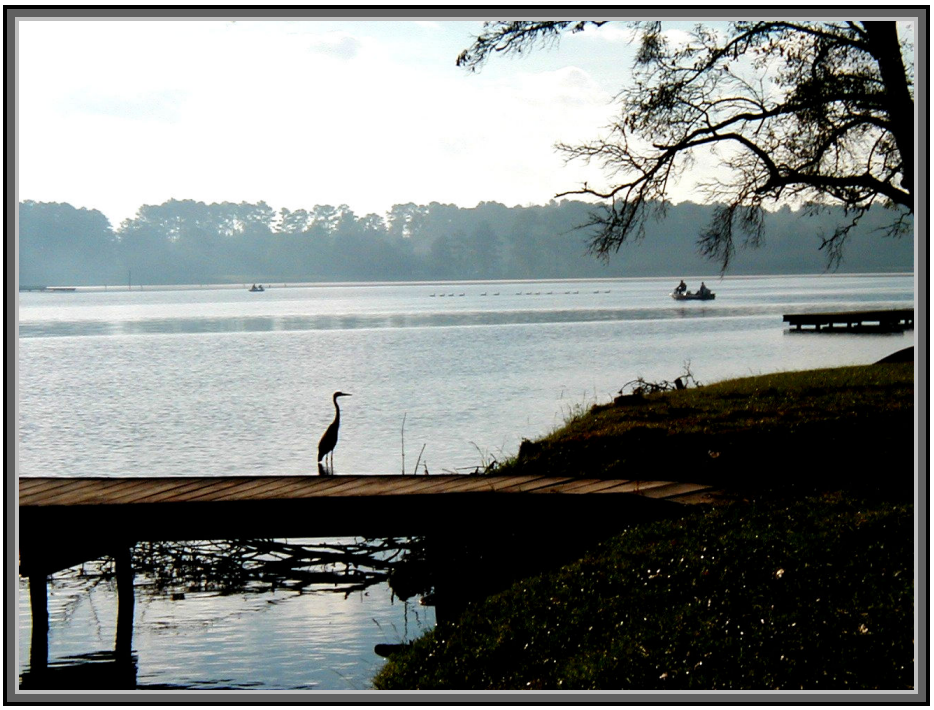
NOAA Monitoring Results are available at:
http://www.st.nmfs.noaa.gov/hurricane_katrina/water_sediment_survey.html.

USGS is planning a series of reports on their post Katrina monitoring activities.

Lakes: Statewide Assessment Summary

Lake Water Quality

Mississippi is covered with hundreds of publicly owned lakes, reservoirs, and ponds totaling approximately 270,000 acres. The largest lakes in Mississippi are man-made reservoirs. Grenada Reservoir, Enid Reservoir, Sardis Reservoir and Arkabutla Reservoir in the Yazoo River Basin are used for flood control. The Ross Barnett Reservoir (Pearl River Basin) is used as a source of drinking water for the City of Jackson. All of these large reservoirs support numerous other recreational activities. Pickwick Lake, in the state's northeast corner, is part of the Tennessee River and is shared with Alabama and Tennessee.



Use Support Determinations

For the 2006 §305(b) Water Quality Assessment report, MDEQ assessed approximately 55% of Mississippi's total 269,960 lake acres for trophic status (see discussion under Section 314 reporting) and for basic chemical parameters indicative of aquatic life use support (ALUS) attainment status. No lakes data were available for recreation use support assessment. Fish consumption use support assessment for lakes can be found in Part III of this report. In an effort to use historical data, certain lakes and sites previously sampled by MDEQ Field Services Division (FSD) were again used as sampling sites. At those lakes where there had been no historical sampling, sites were located near the outlet and near significant drainages into a lake. All the lakes were selected based on recommendations made by the Lakes Subcommittee of the Nutrient Criteria Task Force. Thirty-one large lakes were assessed during the 2006 §305(b) reporting period. For the purpose of this report, large lakes were those with at least 500 acres of surface area.

Assessment Summary for ALUS Determinations

Aquatic life use support determinations for all lakes assessed for the 2006 §305(b) report were based upon comparison of measurements of specific chemical parameters (temperature, pH, dissolved oxygen, specific conductivity and total dissolved solids) to water quality standard values presented in the Assessment Methodology section of CALM. Attainment status was based primarily upon these parameters and the 28 lakes assessed were determined to be attaining this use (Table 8).

Table 8: Assessed Lakes

PASCAGOULA RIVER BASIN	
OKATIBEE LAKE	4,243 acres
PEARL RIVER BASIN	
ROSS BARNETT	26,221 acres
SOUTHERN INDEPENDENT STREAMS BASIN	
LAKE MARY	2,765 acres
TOMBIGBEE RIVER BASIN	
ABERDEEN LAKE	1,769 acres
ALICEVILLE POOL	1,291 acres
BAY SPRINGS LAKE	6,194 acres
COLUMBUS LAKE	2,693 acres
TENN TOM POOL B	2,437 acres
TENN TOM POOL C	1,367 acres
TENN TOM POOL D	1,884 acres
TENNESSEE RIVER BASIN	
PICKWICK LAKE	2,948 acres

YAZOO RIVER BASIN	
ARKABUTLA LAKE	9,653 acres
BEE LAKE	1,357 acres
BEULAH LAKE	994 acres
DESOTO LAKE	1,432 acres
EAGLE LAKE	4,476 acres
ENID LAKE	14,641 acres
GRENADA LAKE	19,946 acres
HARD CASH LAKE	84 acres
HORSESHOE LAKE	713 acres
LAKE CHOTARD	187 acres
LAKE FERGERSON	1,888 acres
LAKE WHITTINGTON	2,135 acres
LEE LAKE	1,793 acres
MOON LAKE	2,343 acres
SARDIS LAKE	30,777 acres
WASP LAKE	505 acres
WOLF/BROAD LAKE	1,030 acres

Section 314 Reporting

Mississippi initiated its Clean Lakes Program during the summer of 1982 by conducting a Clean Lakes Classification Survey on 34 public lakes. Subsequent to the passage of the 1987 amendments to the Clean Water Act, the state completed three Phase I and one Phase II Diagnostic Feasibility Studies on large lakes in the Yazoo River Basin. Through 1996, the state maintained and benefited from a Lake Water Quality Assessment (LWQA) Program, which was supported by Section 314 grants. From 1991-1996, many of the original lakes studied in the 1982 Clean Lakes Study were re-monitored, and twenty (20) were targeted for characterization of trophic level and water quality status. Results were reported in the 1996 and 1998 water quality assessments.

Reporting Requirements

Section 314 of the Clean Water Act directs each state to prepare or establish: an identification and classification according to eutrophic conditions of all publicly-owned lakes in such state; a description of procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes; a description of methods and procedures, in conjunction with appropriate federal agencies, to restore the quality of such lakes; methods and procedures to mitigate the harmful effects of high acidity; a list and description of lakes for which uses are known to be impaired and an assessment of the status and trends of water quality in lakes.

For the 2006 §305(b) Report, lake monitoring was carried out by MDEQ through a combination of ambient fixed station monitoring and special studies. In addition to routine water quality monitoring, MDEQ is conducting extensive monitoring to develop nutrient criteria for Mississippi lakes.

Trophic Status

Section 314 of the Clean Water Act requires that all publicly owned lakes of each state be classified according to their trophic condition. The CWA also requires within §305b that each state provide a report with an analysis of the extent to which all navigable waters of a state provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. Requirements such as these have led to the development of various indices that enable researchers to classify water bodies based on the amount of biological production that is occurring within that water body (Brezonik 1984, Carlson 1977). These indices vary in approach with respect to variables and their classification index range, but they are based on the same concepts: that the trophic state of a lake is an important component in determining the productivity of a water body; that an index can be useful in determining the trophic state of a water body; and indicating whether it is suitable for fishing or swimming.

Trophic state is not synonymous with water quality. Although the terms are related, they should not be used interchangeably. Trophic state is an absolute scale that describes the biological condition of a water body based on its productivity. The trophic scale is a division of variables used in the definition of trophic state and is not subject to change because of the attitude or biases of the observer (Carlson and Simpson 1996).

The most widely used index for classifying lake trophic status is Carlson's Trophic State Index (U.S. EPA 2006). This index is based on the fact that change in nutrient levels causes change in algal biomass which results in change in lake clarity. Simply, it is a measure of a lake's trophic state from oligotrophy (very clear water, nutrient poor and with high dissolved oxygen year round) to eutrophy (more productive, more plant biomass and high nutrient level) (Carlson and Simpson 1996). Three variables are commonly used to calculate Carlson's Trophic State Index (TSI) for a lake:

- Secchi Depth;
- Chlorophyll *a*; and
- Total Phosphorus

The TSI for each parameter is calculated according to the following formulas:

Secchi Depth:
TSI = 60- [14.41 ln Secchi depth (meters)]

Chlorophyll *a*:
TSI = [9.81 ln Chlorophyll *a* (ppb)]+ 30.6

Total Phosphorus:
TSI = [14.42 ln Total Phosphorus (ppb)] +4.15

Table 9 shows the typical ranges of TSI scores and water quality parameters associated with the three trophic states of a lake.

Table 9: Carlson's Trophic State Index (Adapted from Addy and Green 1996).

	TSI	Secchi Depth (m)	Chlorophyll *a*	Total Phosphorus (ppb)
Oligotrophic	<39	>4	<2.6 ppb	<12 ppb
Mesotrophic	40-50	2-4m	2.6-7.2 ppb	12-24 ppb
Eutrophic	50-110	<2m	>7.2 ppb	>24 ppb

Carlson's index was developed to be used with lakes that:

- Have few rooted aquatic plants; and,
- Little non-algal turbidity.

Based on these assumptions, this index is not ideally suited for the majority of the Mississippi lakes. However a literature review indicated that Carlson's index is the most commonly used trophic state assessment tool in the Southeast, and it appears to be the most appropriate index currently available.

These trophic assessments are based on data collected over a two year span (2003-2004). During this period, all the public lakes in Mississippi greater than 500 acres in size were sampled. The lakes were sampled six times per year, once in the spring, once in the fall and four times during the summer. To facilitate comparisons, data from the summer growing season (June through September) were given primary focus.

Based on these data, the Carlson Index indicated that all but one of the lakes sampled were eutrophic. Bay Springs Lake on the Tennessee-Tombigbee Waterway was classified as mesotrophic. The TSI based on secchi depth seems to provide the best assessment of trophic status for Mississippi lakes. This could be due to the fact that nutrients in Mississippi often enter water bodies along with soil particles from agricultural fields or other runoff. Therefore, low secchi depth may also be correlated with increased nutrients and productivity. For example, lakes may be muddy during the spring and early summer months with limited light penetration preventing significant algal growth. However, as water clears later in the summer and fall, the available nutrients can cause rapid phytoplankton growth. The trophic status for each lake is provided in Table 10.

Clay, turbidity, and pH also affect the availability of phosphorus. Low pH reduces the solubility while phosphorus binds onto the clay preventing it from dissolving efficiently into the water column (Reicke 2005, Oldham 2003, Greenwood and Earnshaw 2002). Thus, TSI for phosphorus may not be an appropriate variable to measure in Mississippi for use in this index.

Oligotrophy vs. mesotrophy vs. eutrophy is not a reflection of whether a water body is "good," "fair," or "bad" as different trophic states are suitable for different activities. An oligotrophic lake may be more desirable for swimming, whereas a eutrophic lake may be more desirable for fishing (Addy and Green 1996). An oligotrophic or a eutrophic lake has attributes of production that remain constant no matter what the use of the water or where the lake is located (Carlson and Simpson 1996). Some lakes are naturally eutrophic, because trophic state is a reflection of a lake's physical condition. Size and shape of the lake, residence time, geology, soils and size of the watershed all play a role in trophic state. Additionally, man-made reservoirs tend to become eutrophic more rapidly than natural lakes, since there is a tendency for these reservoirs to revert back to their original states, typically a stream system or marsh. Natural eutrophication occurs over thousands of years; but human activities can accelerate the process by introducing fertilizers, pesticides and sediments (Addy and Green 1996).

Table 10: Trophic Status of Lakes

Lake	Secchi Depth (m)	Chlorophyll *a*	Total Phosphorus (ppb)	TSI Secchi Depth (m)	TSI Chlorophyll *a*	TSI Total Phosphorus (ppb)	Classification
Aberdeen Lake	0.36	9.24	0.07	74.7	52.4	32.8	Eutrophic
Arkabutla Lake	0.44	6.37	1.1	71.7	48.7	38.3	Eutrophic
Aliceville Pool	0.39	8.6	0.09	73.6	51.7	36.4	Eutrophic
Bay Springs Lake	2.17	3.18	0.03	48.7	41.9	19.9	Mesotrophic
Bee Lake	0.35	25.0	0.11	74.8	62.2	39.7	Eutrophic
Beulah Lake	0.36	30.6	0.15	74.4	64.1	43.5	Eutrophic
Bluff Lake	0.57	12.3	0.83	68.0	55.2	34.7	Eutrophic
Lake Bogue Homo	1.04	5.81	0.04	59.3	47.8	26.9	Eutrophic
Lake Bolivar	0.18	45.4	0.33	84.2	68.0	54.7	Eutrophic
Lake Chotard	0.57	31.6	0.11	67.9	64.4	39.5	Eutrophic
Columbus Lake	0.4	10.3	0.09	73.2	53.4	36.8	Eutrophic
Dalewood Shores Lake	0.98	10.0	0.03	60.1	53.2	22.2	Eutrophic
Desoto Lake	0.62	22.6	0.07	66.7	61.2	32.4	Eutrophic
Eagle Lake	0.39	41.9	0.15	73.4	67.2	43.8	Eutrophic
Elvis Presley Lake	1.39	3.4	0.02	55.1	42.6	15.8	Eutrophic
Enid Reservoir	0.8	5.97	0.06	63.1	48.1	30.6	Eutrophic
Lake Ferguson	0.74	17.2	NA	51.9	45.1	NA	Eutrophic
Flint Creek	1.75	5.9	0.02	51.8	48.0	14.1	Eutrophic
Geiger Lake	0.93	17.5	0.05	60.9	58.7	27.3	Eutrophic
Grenada Reservoir	0.52	6.39	0.06	68.8	48.8	29.9	Eutrophic
Hard Cash Lake	0.49	10.0	0.05	70	53.2	28.5	Eutrophic
Horseshoe Lake	0.49	26.1	0.13	70.1	62.6	41.8	Eutrophic
Horn Lake	0.44	31.6	0.15	71.6	64.4	43.4	Eutrophic
Kemper County Lake	1.1	7.9	0.04	58.6	50.8	25.8	Eutrophic
Lake Lamar Bruce	0.93	11.6	0.03	61.0	54.6	22.7	Eutrophic
Little Black Creek	1.29	7.45	0.02	56.3	50.3	18.9	Eutrophic

Lake	Secchi Depth (m)	Chlorophyll *a*	Total Phosphorus (ppb)	TSI Secchi Depth (m)	TSI Chlorophyll *a*	TSI Total Phosphorus (ppb)	Classification
Lake Lee	0.58	21.0	0.1	67.6	60.5	38.1	Eutrophic
Lake Lincoln	0.91	10.1	0.03	61.2	53.3	22.7	Eutrophic
Lake Mary	0.8	14.6	0.05	63.1	56.9	29.2	Eutrophic
Lake Whittington	0.68	23.0	0.08	65.4	61.3	35.6	Eutrophic
Moon Lake	0.54	8.57	0.15	68.8	51.6	44.0	Eutrophic
Natchez State Lake	0.99	13.4	0.04	60.0	56.1	24.8	Eutrophic
Okatibbee Reservoir	0.62	8.6	0.04	66.7	51.7	26.9	Eutrophic
Pickwick Reservoir	1.14	8.86	0.04	58.0	52	27.1	Eutrophic
Pool A (Tenn-Tom)	0.55	4.9	0.04	68.5	46.1	25.4	Eutrophic
Pool B (Tenn-Tom)	0.58	4.39	0.04	67.7	45.1	24.2	Eutrophic
Pool C (Tenn-Tom)	0.86	3.35	0.02	62.1	42.4	19.3	Eutrophic
Pool D (Tenn-Tom)	1.01	3.03	0.02	59.7	41.4	15.8	Eutrophic
Pool E (Tenn-Tom)	0.85	2.84	0.06	62.2	40.8	30.7	Eutrophic
Ross Barnett	0.44	11.5	0.1	71.6	54.6	37.9	Eutrophic
Roebuck Lake	0.19	13.2	0.18	83.8	55.9	46.5	Eutrophic
Sardis Reservoir	1.38	4.86	0.04	55.3	46.1	26.9	Eutrophic
Lake Tangipahoa	1.28	12.5	0.05	56.3	55.3	28.4	Eutrophic
Lake Tchula	NA	12.1	0.13	NA	55.1	41.8	Eutrophic
Tunica Cutoff	0.61	20.6	0.07	67.1	60.2	33.8	Eutrophic
Trace State Lake	0.71	9.75	0.04	64.8	52.9	26.6	Eutrophic
Turkey Fork	0.89	15.7	0.06	61.6	57.6	30.3	Eutrophic
Wolf/Broad	0.35	18.2	0.16	74.8	59.0	44.5	Eutrophic
Lake Washington	0.29	57.9	0.23	77.7	70.4	49.5	Eutrophic
Wasp Lake	0.17	21.4	0.16	85.2	60.6	44.5	Eutrophic

Lake Pollution Control Methods

Sources polluting lakes in Mississippi are controlled through several state and local programs. Point sources are regulated by MDEQ through issuance and enforcement of NPDES permits ensuring that lake water quality complies with Mississippi's water quality standards. If an existing or proposed point source discharge is found to be detrimental to a lake's water quality, alternative discharge sites are investigated. Also, if failing septic tanks are a problem, MDEQ investigates options for sewage collection and treatment with discharge directed away from the lake.

Nonpoint source pollution is by far the major source of pollution to Mississippi's lakes. Several lakes have been targeted for demonstration projects in the Nonpoint Source (NPS) Program. Mississippi's NPS Program has identified control measures to address nonpoint source problems as well as the agencies and groups which will implement the measures.

Local units of government can play an important role in protecting lakes. Counties or municipalities may adopt land use ordinances or regulations that can be more effective than statewide programs in protecting lakes.

MDEQ's Wetlands Program also plays a role in protecting lakes. Wetlands serve as valuable fish and wildlife habitat, and as effective natural filters of pollutants entering streams and lakes. MDEQ strives to minimize wetlands losses around lakes. In addition, the creation or restoration of wetland acres is a measure to control NPS pollution entering lakes.

Restoration and Protection Efforts through Section 319

Lake Hazle

Lake Hazle is a twenty-two acre lake located inside the city limits of Hazlehurst, MS. In the 1980s commercial and residential development around the lake led to significant impacts, primarily from sediment.

Studies done in 1990 and 1991 led to Lake Hazle being listed on the 1996 §303(d) list as partially supporting its Aquatic Life Use. Pollutants listed as monitored causes of impairment were nutrients, pH, siltation, organic enrichment/low dissolved oxygen, thermal modifications, oil and grease, and suspended solids.

In 1990, MDEQ awarded a §319 grant to the Mississippi Soil and Water Conservation Commission to work with the city to restore the lake. The §319 funded restoration project lasted from 1990 to 1994. During that period, six critical areas were planted, one grade stabilization structure and two water / sediment control basins were installed. The total

area stabilized by these best management practices (BMP) was 23.3 acres and this resulted in a soil savings of 2,238 tons per year. Monitoring done in 1994 showed some improvement, but it would take a few more years for the lake to show enough recovery to be proposed for delisting. In 1998, thermal modifications and suspended solids were delisted and in 2002, pH was delisted. In August of 2001 and again in 2003, follow-up monitoring was conducted. These monitoring studies showed all other pollutants were now within normal ranges and Lake Hazle was recommended for delisting in December 2003.

Bee Lake Restoration Project

Bee Lake Watershed, consisting of almost 12,000 acres of prime farmland in Holmes County, is a unique area in many ways. This 1400-acre oxbow is long and narrow, with cypress trees along both sides of the lake. Because of its beauty and relatively abundant fish population, Bee Lake is a popular recreation lake. Most of the land around the lake is owned by eleven landowners. In 2005, a large cypress tree was discovered and designated as the new National Champion Cypress Tree. Delta Wildlife has worked with landowners in the Bee Lake Watershed in the past, developing management plans, planting quail habitat, and installing water control structures for wetland habitat development. By working with those landowners, it became obvious that all were concerned about the overall health of the lake. Two teams have been established to identify concerns within the watershed. The first team consists of landowners and all private stakeholders. The second team includes technical personnel from natural resource agencies, wildlife groups, and the regulatory community. Suggestions from both teams will be used in the development of a comprehensive watershed restoration plan. Sediment was ranked as the number one problem in the lake.

Thighman Lake NPS Pollution Watershed Project

This three year BMP demonstration project to improve the water quality of Thighman Lake by addressing erosion and reducing soil loss came to a conclusion in September 2003. The Thighman Lake Watershed is a 3,853-acre sub-watershed of the Dawson-Ditchlow Bayou Watershed located in the southeastern corner of Sunflower County in the Mississippi Delta. This portion of the watershed served as a demonstration area for implementation of BMPs. The project had three objectives:

- Demonstrate the economic benefits and effectiveness of selected BMPs in targeted areas
- Apply BMPs on agricultural lands in the demonstration project area to reach the desired outcome of reduced runoff and sedimentation, and
- Inform and educate the public about BMPs and how they benefit water quality.

The BMPs, such as conservation tillage and structures for water control, achieved a savings of soil loss of 1,797 tons over 1,390 acres, or about 1.29 tons per acre. Prior to treatment, an estimated four tons of soil per acre were being lost.

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 Field Services Division (FSD) 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., atmospheric deposition mercury). 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 Table 11.

Table 11: MDEQ Fish Samples Collected from 2000-2004

Type of Study	Number of Samples	Number of Fish
Ambient	258	852
Mercury	254	574
Dioxin	56	188
PCB's	31	96
Pesticides	294	903
Special Studies	8	34
Total:	**901**	**2647**

Fish Consumption Advisories and Fishing Bans

The fish consumption advisories and commercial fishing bans presently in effect are listed in Table 12 and shown in Figure 7.

Table 12: 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.

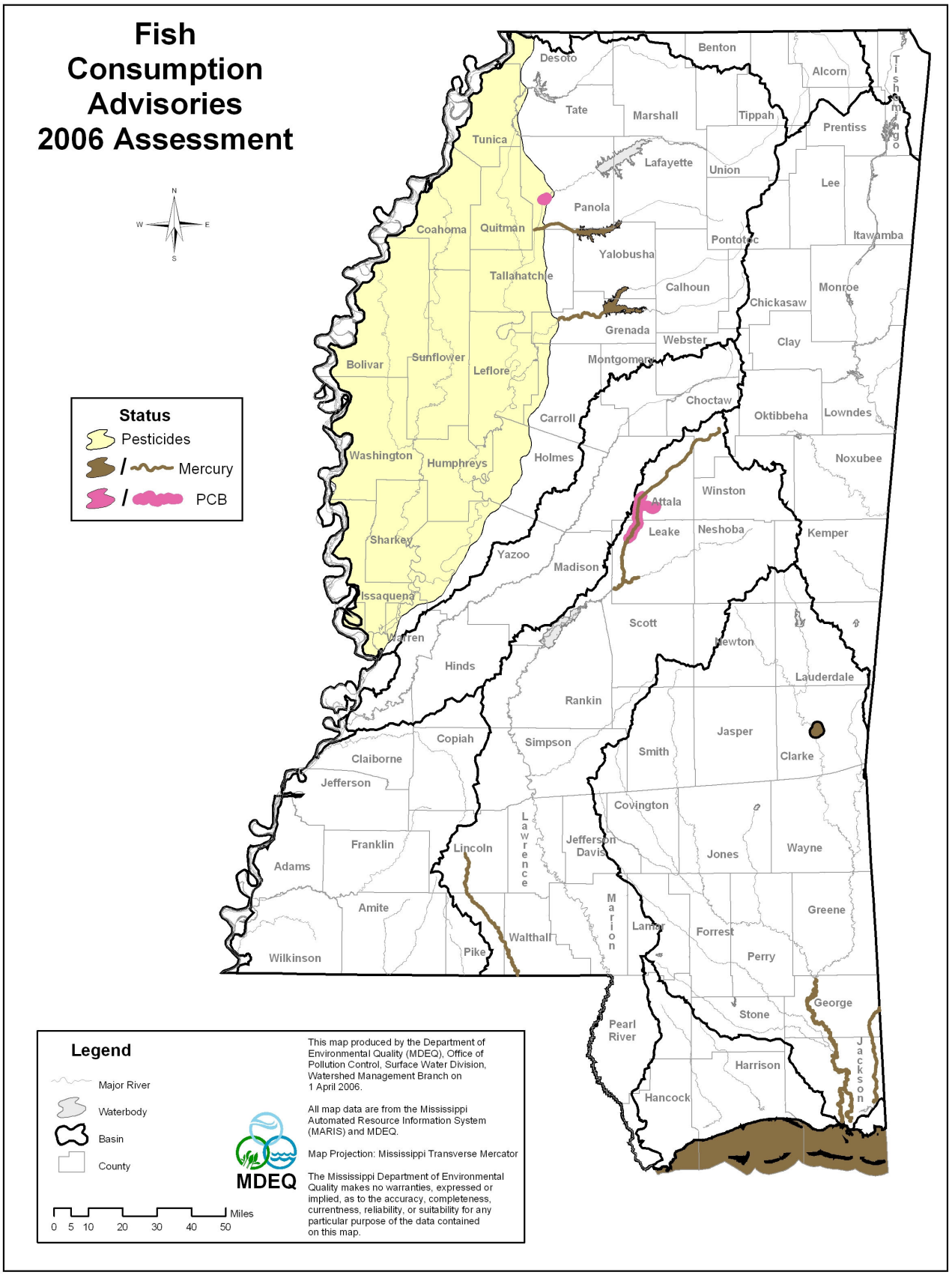


Figure 7: Map of Fish Advisories in Mississippi

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 14 water bodies 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 gained from 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. 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 FSD 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, 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, Mississippi Department of Wildlife, Fisheries and Parks, 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, 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 four lakes and five rivers or bayous in the Mississippi Delta Region of Mississippi. These sites are listed in Table 13 and Figure 8.

Table 13: 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

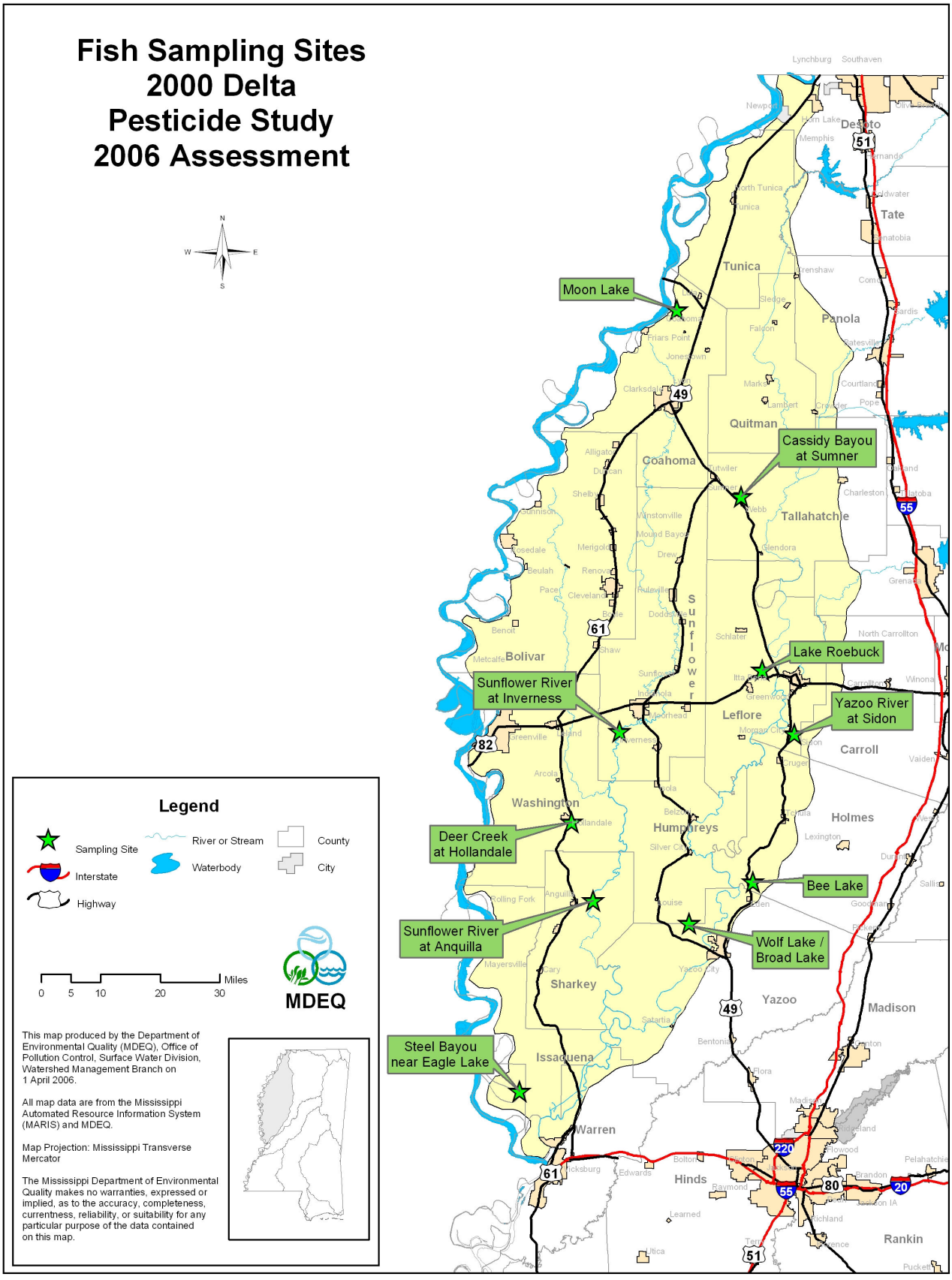


Figure 8: Sampling Sites for the Mississippi Delta 2000 Fish Tissue Study

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 14.

Table 14: Target Species for Mississippi Delta Fish Tissue Study

Common Name	Scientific Name
Largemouth Bass	*Micropterus salmoides*
White Crappie	*Pomoxis annularis*
Bluegill	*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*

MDEQ FSD biologists conducted field sampling activities 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 study warranted some type of advisory. Based on this information, the task force recommended a regional advisory for the Delta (Figure 9), 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.

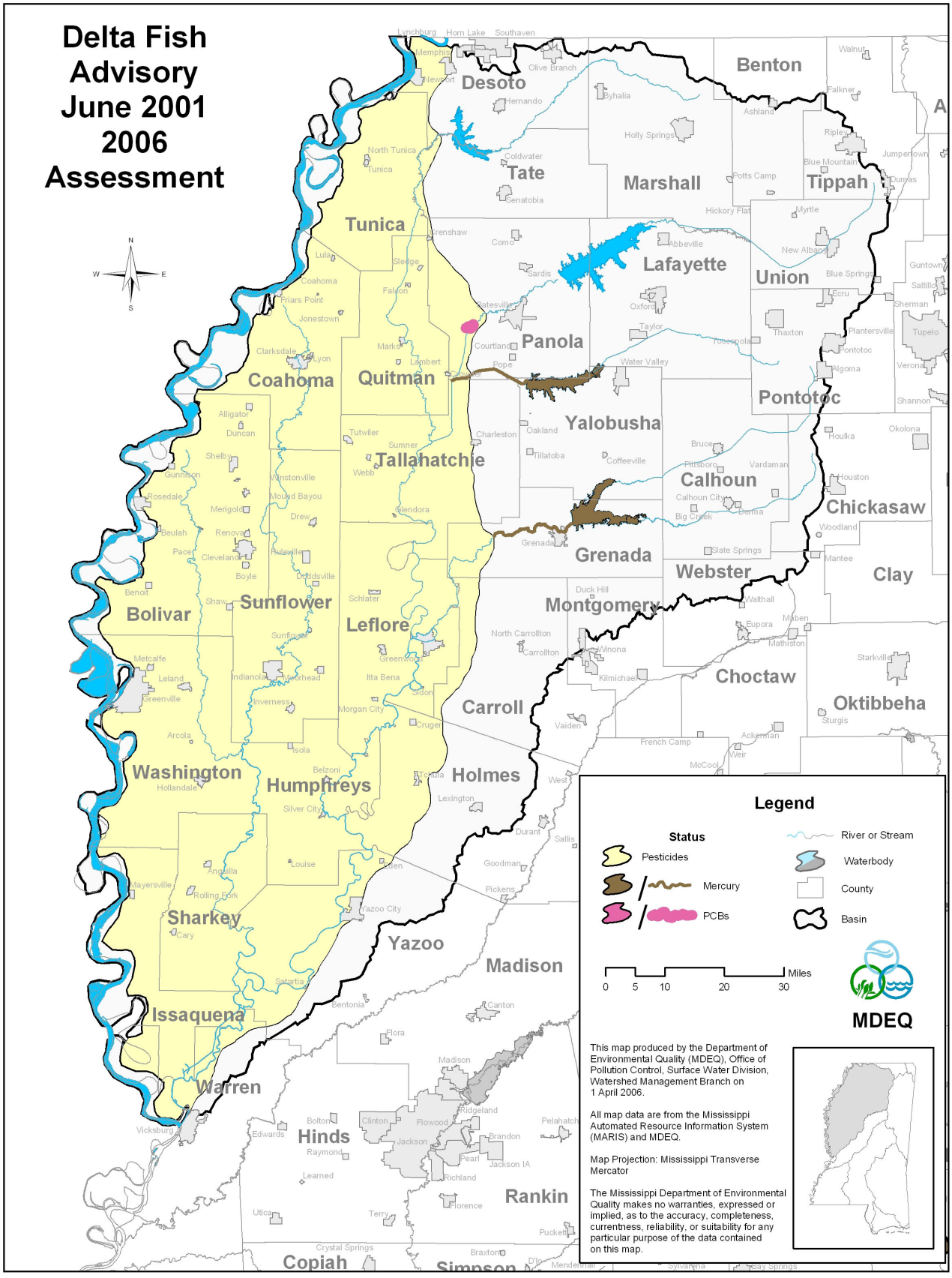


Figure 9: Advisory Area for Delta Region of Mississippi

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 advisory does not apply to the Mississippi River or the river-connected oxbow lakes located west of the Mississippi River Levee. 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 there has been less historical application of these now banned pesticides. 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 in 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 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 2000 through December 2004, the OPC FSD investigated 69 fish kills (Figure 10). Thirty-one percent of these were associated with low dissolved oxygen levels and other natural causes (Figure 11). In 52% percent of the investigations the cause could not be determined and two percent were associated with pesticides. Fifteen percent were those related to nutrient overloads, sewage spills or un-permitted discharges.

In most of the fish kills investigated the fish had deteriorated to the point that the cause was difficult or impossible to discern. When the cause could not be determined the kill was categorized as "unknown". The second leading cause of kills was attributed to natural causes such as low dissolved oxygen, in those cases the cause was listed as "low D.O./natural". Following Hurricanes Katrina and Rita, there were numerous fish kills. These fish kills were concentrated in the Pascagoula River Basin and Mississippi Delta respectively. The most probable cause was oxygen depletion due to thermal turnover caused by heavy rainfall.

Figure 10: Annual Number of Fish Kills Investigated from 2000 – 2004

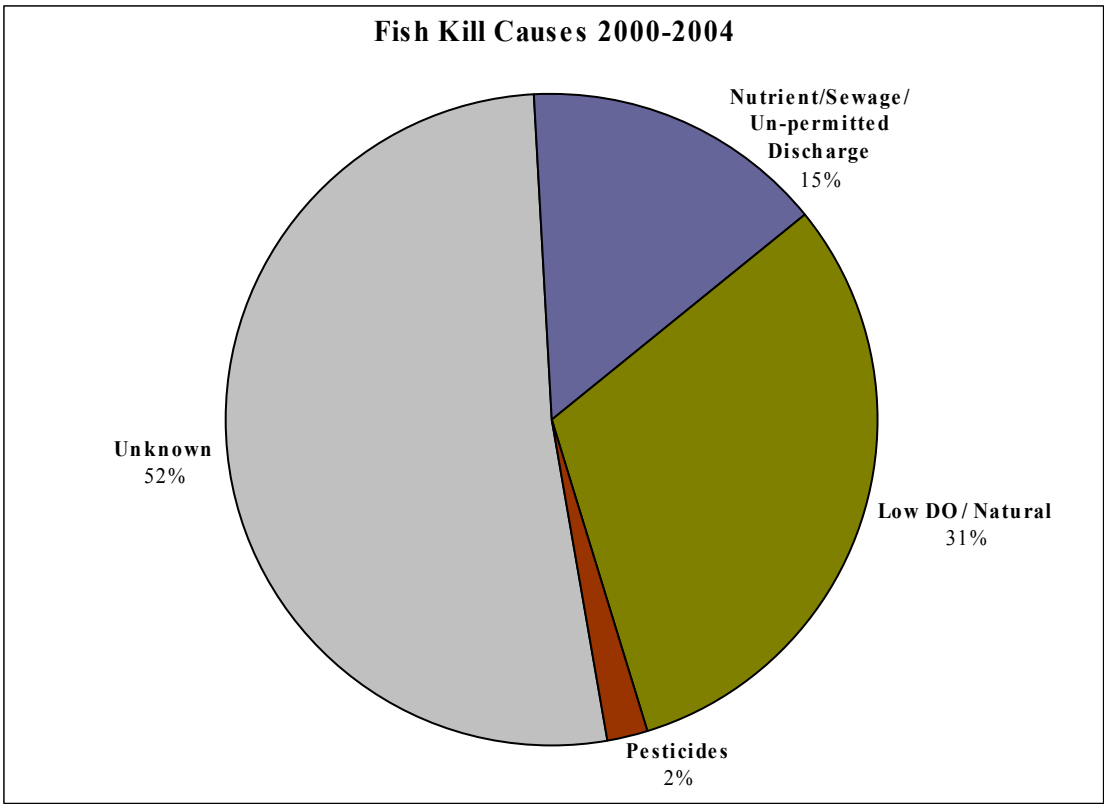


Figure 11: Distribution of Fish Kill Causes from 2000 – 2004

Shellfish Restrictions

The National Shellfish Sanitation Program (NSSP), administered by 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 systems in the coastal area. These fluctuations are likely a result of private septic systems and other nonpoint pollution sources located in watersheds that drain 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. For the 37 sq. miles of shellfish harvesting areas, TMDLs have already been developed for 28 sq. miles that were assessed as not attaining the shellfish harvesting use in 2004. These estuarine water bodies are periodically impacted by urban nonpoint source runoff and failing septic tanks.

Because of hurricane damage sustained in 2005, all shellfish beds are closed. The Shellfish Harvesting Use was not assessed for this report due to data loss at MDMR during Hurricane Katrina.

Beach Advisories

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 USEPA Gulf of Mexico Program. When notified by GCRL that there are elevated levels of bacteria, 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. Sampling of the beach continues until such time that bacterial concentrations return to safe levels.

In 2000, USEPA 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 in state's water quality standards (WQS). MDEQ implemented the new enterococci criteria during 2005. The new enterococci criteria will be adopted into the Mississippi WQS in 2006.

For the period 2004 – 2005, 12 of the 22 beaches experienced a total of 24 advisories resulting from high bacteria levels. The cause of most of these advisories was urban runoff following storm events; however, seven advisories were caused by sewer leaks.

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).

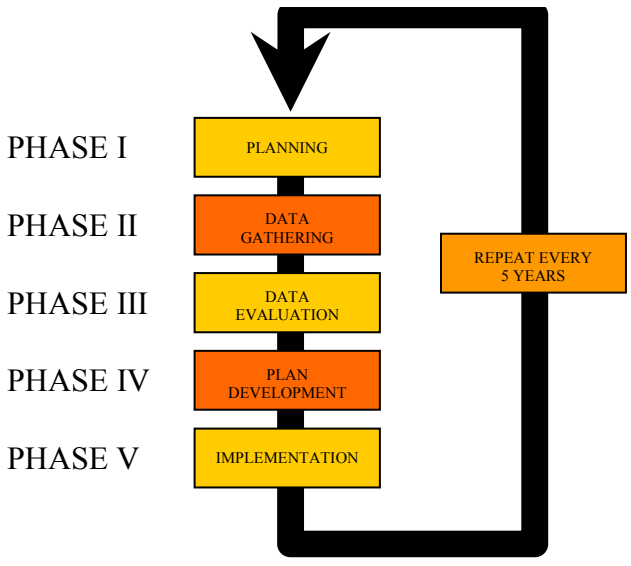


Figure 12: Basin Management Cycle

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.

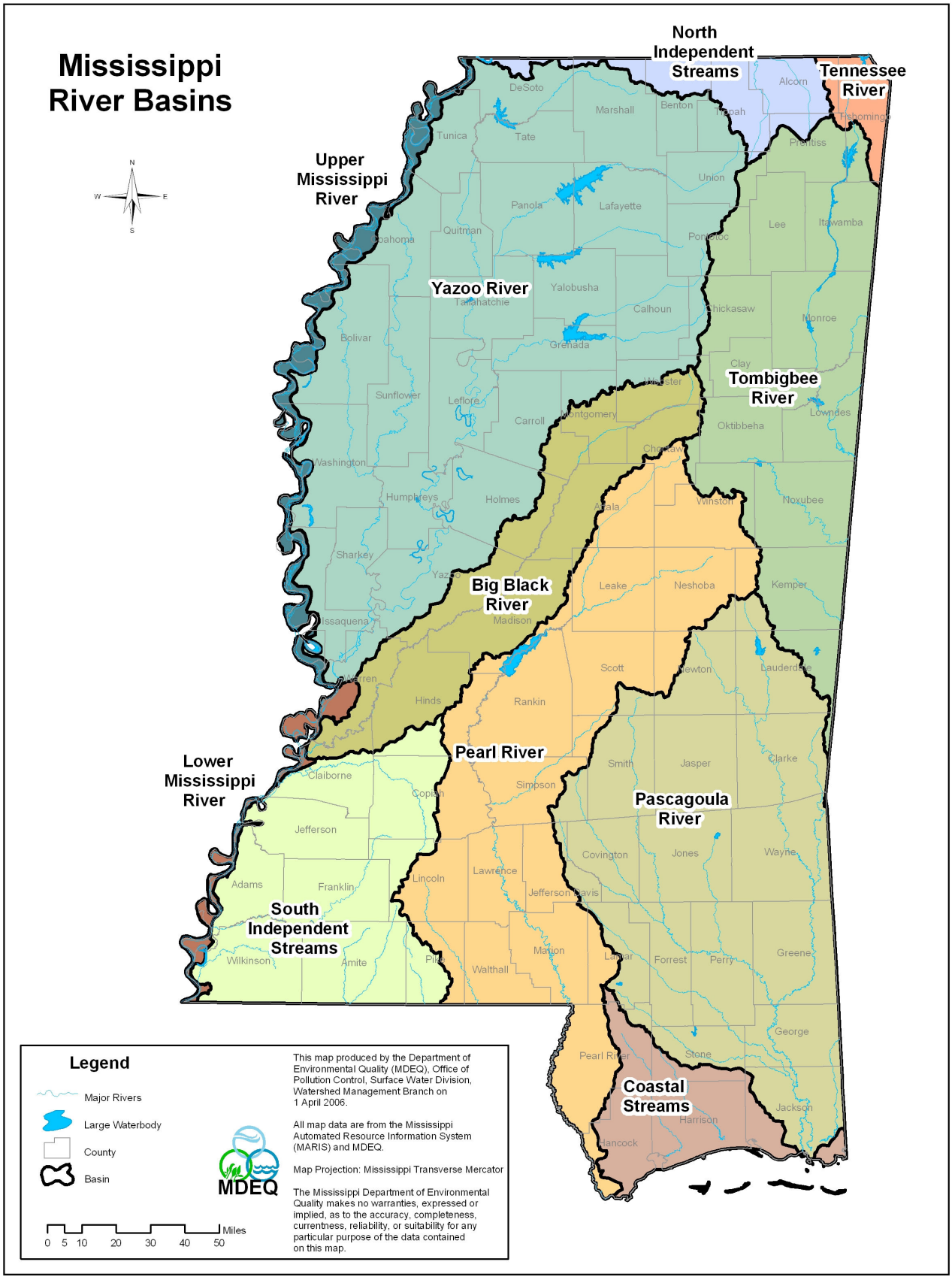


Figure 13: Mississippi's Ten Major Drainage Basins

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 approximately one-fifth of the state. Figure 14 depicts the five rotating basin groups. At the end of the five-year rotational period, Mississippi plans to reach its goal of comprehensive statewide assessment. 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 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 USEPA rapid bioassessment protocols. In addition, the basin monitoring effort involves sampling of multiple parameters (water chemistry, bacteria, algae, fish and/or sediment) needed to address basin data collection needs. For 2001-2005, 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 developed an Index of Biological Integrity for wadeable streams. This is 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 2006 §305(b) Water Quality Assessment Report and the 2006 §303(d) list

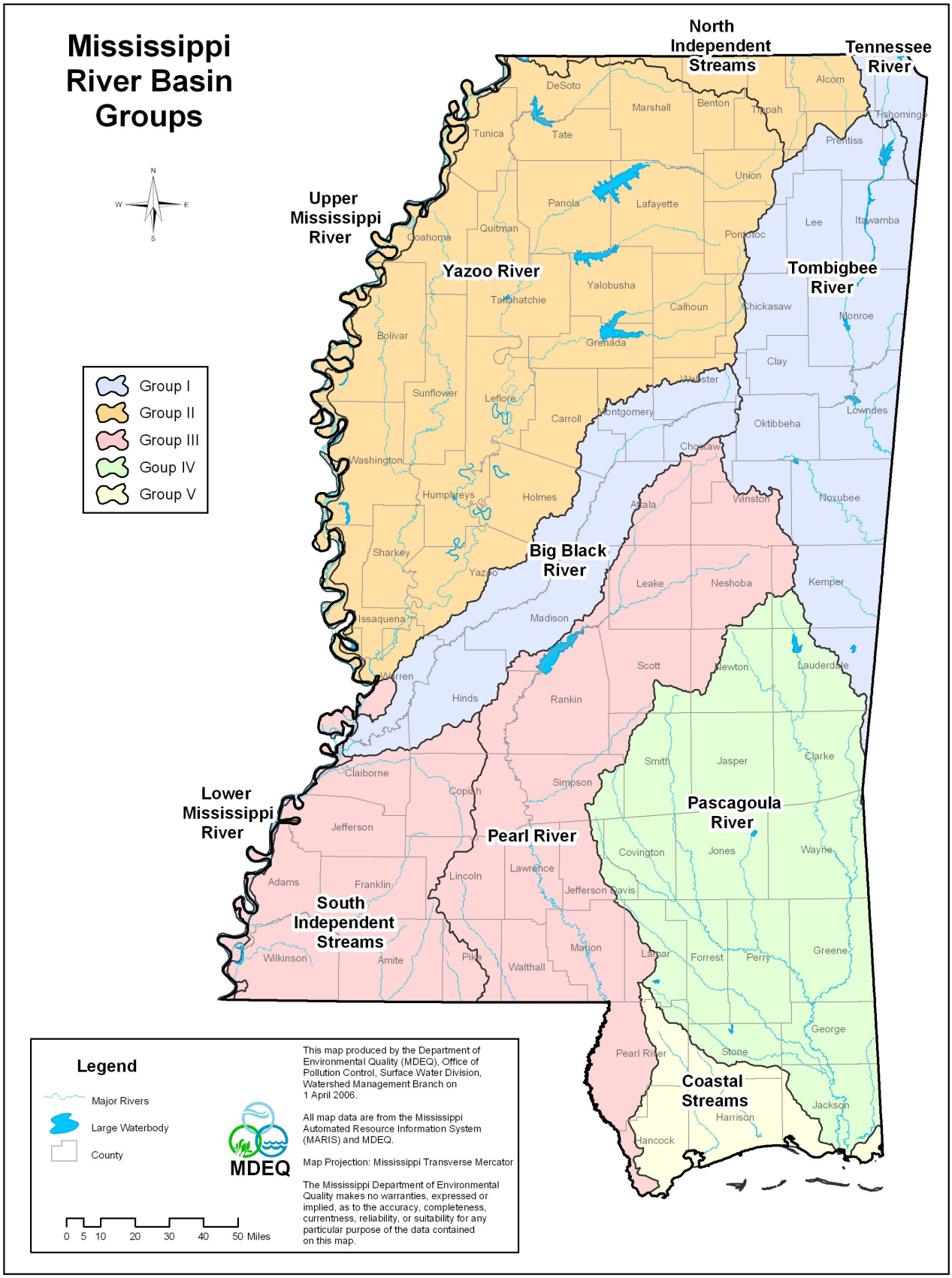


Figure 14: Mississippi Basin Groups

MDEQ Surface Water Monitoring Program

Introduction

Surface water monitoring activities provide the foundation for assessment of the water quality condition in 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, 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. This is accomplished through the use of the agency's Basin Management Approach in which the various state, federal, and private representatives partner with MDEQ in this water management planning process.

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 monitoring activities carried out in support of program objectives. MDEQ's SWMP strategy, *Mississippi Department of Environmental Quality's Surface Water Monitoring Program Strategy for Fiscal Year 2005* (MDEQ 2004), 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. The Surface Water Division (SWD) and FSD in consultation are responsible for planning the MDEQ SWMP. Implementation of the MDEQ SWMP is the direct responsibility of OPC's FSD 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 USEPA monitoring guidance, *Elements of a State Water Monitoring and Assessment Program* (USEPA 2003). This guidance defines the necessary elements of a state water monitoring program and is used by USEPA to determine if a state program meets the prerequisites of CWA Section 106(e)(1) in maintaining an adequate state monitoring program. The ten basic state monitoring program elements are:

- Monitoring Program Strategy
- Monitoring Objectives
- Monitoring Design
- Core and Supplemental Indicators
- Quality Assurance
- Data Management
- Data Analysis/Assessment
- Reporting
- Programmatic Evaluation
- General Support and Infrastructure Planning

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 of Mississippi's waters.

MDEQ's SWMP is a long-term plan with full implementation scheduled to be accomplished within ten years. Most of the ten basic elements outlined by USEPA are already in place, but continual refinement and improvements to SWMP activities are necessary to fully and accurately achieve the comprehensive and nationally-consistent surface water monitoring and assessment goals set forth by USEPA for state waters by 2014. Specific needs and improvements related to MDEQ's SWMP are identified in the SWMP strategy plan. To track MDEQ's progress in meeting state water monitoring and assessment program goals, annual monitoring work plans are prepared and submitted to USEPA that identify monitoring projects, milestones, and status in accomplishing the various program elements within each annual monitoring and assessment cycle. Sampling locations, parameters, methods, and time frame for individual monitoring projects and program element developments are also included in the annual work plans. In addition, every three years, the overall strategy undergoes a full review and is updated.

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 document provides a description of program elements, establishes the overall goals and objectives of the SWMP, and 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 multi-faceted; incorporating several approaches for site selection, indicators, intensity 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 in a manner 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 and the tertiary tier, the narrowest grouping. All three tiers of the SWMP are shown in Figure 15.

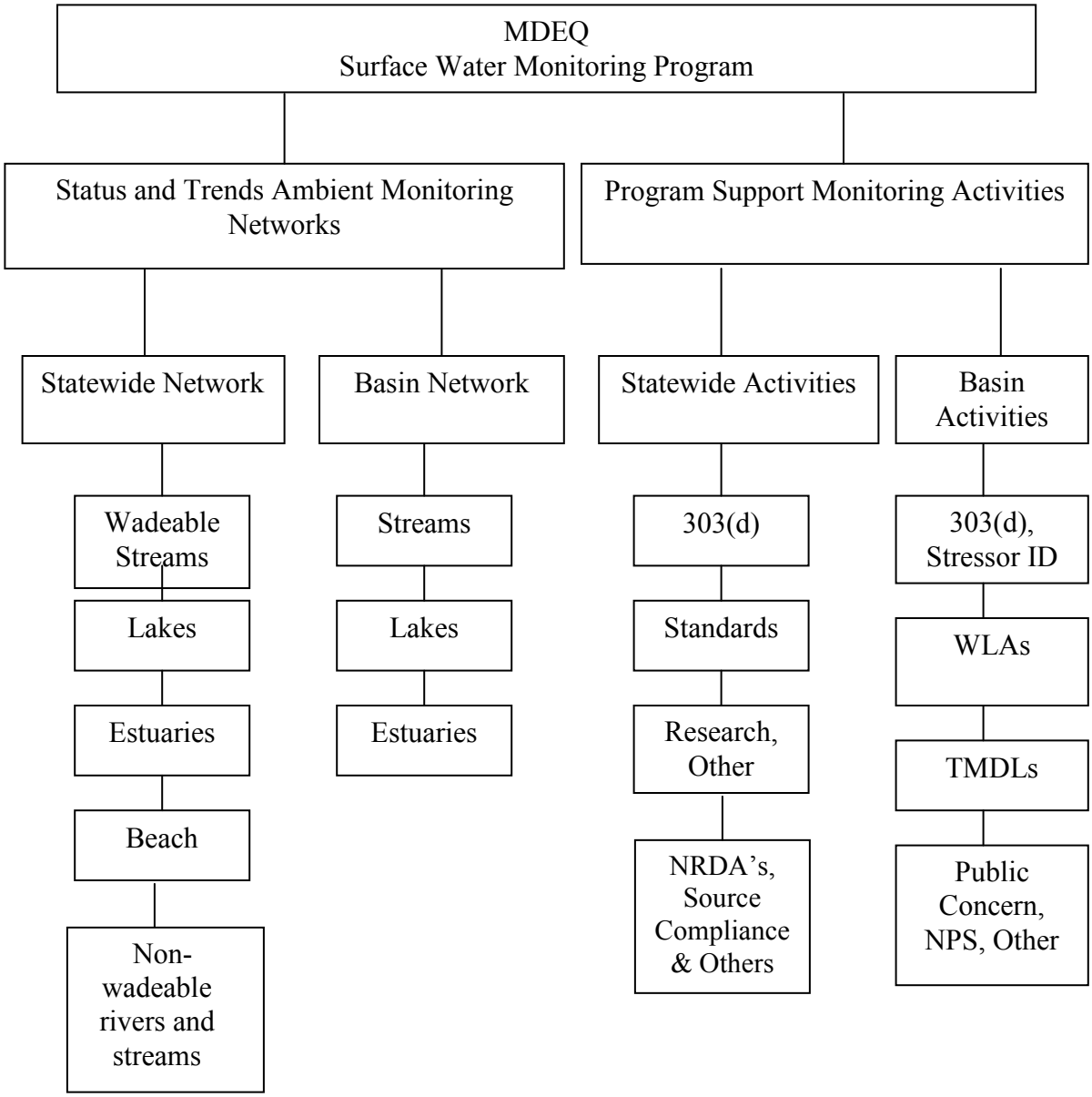


Figure 15: Tiered Surface Water Monitoring Program Design

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 water bodies are meeting their designated use(s), and/or is water quality getting better or worse over time) for all water body types (i.e., streams, rivers, lakes, estuaries, and coastal waters). These networks provide routine data collection and are continuous in duration. Data collected 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 encompass 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 primarily composed of historical fixed stations that are targeted for long-term routine monitoring 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. In order to devote 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, WQS, NPS, NPDES Permitting). These monitoring activities involve a short term monitoring strategy, are narrow in scope, and dynamic in nature (i.e., intensive synoptic surveys or screening-level monitoring as opposed to static routine monitoring), usually with a focused design to answer site-specific or parameter-specific questions.

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. While physicochemical parameter analyses may allow for the predictability of water quality condition(s), assessment based upon biological indicators allows for a measure of the effect(s). Table 15 outlines the core group of indicators used in MDEQ's SWMP.

Table 15: List of Core Indicators Used in the SWMP

Physical/Chemical		**Biological**	
General		Pathogens	
			Fecal Coliform
	Water Temperature		Enterococci
	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		

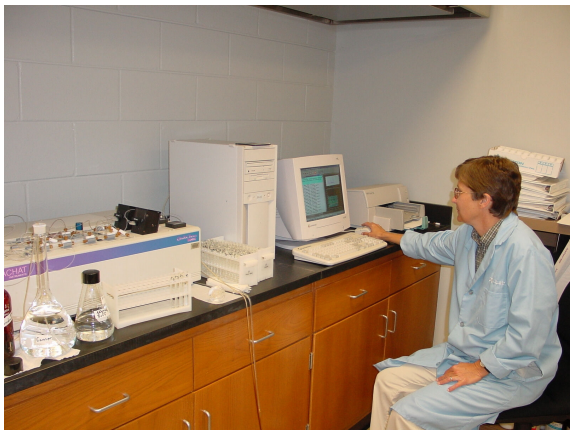
Laboratory Analytical Support

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 tissue and the benthic macroinvertebrate community. The lab staff also prepares and analyzes fish tissue samples for pesticide and heavy metals analyses as well as analyzes samples of periphyton and phytoplankton for chlorophyll *a* to estimate algal productivity.

OPC laboratory services are primarily provided from a single laboratory complex located in Pearl, Mississippi. 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 in 2005, OPC added 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 (ICP), 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 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

The ability to make meaningful and scientifically defensible statements about the condition of a water body depends directly on the quantity and quality of data collected, analyzed, and reported. 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 FSD laboratory. Therefore, it is imperative that the validity of the data be assured and documented. This is necessary to demonstrate that all environmental data generated, processed, and used for MDEQ management and regulatory purposes is scientifically defensible and of known and acceptable precision and accuracy. All data, including that provided by other agencies, institutions, environmental groups, and individuals, should be of the quality necessary for MDEQ 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 (SOPs) recognized by state and USEPA quality assurance (QA) programs. As such, no data will be assessed for §305(b)/§303(d) purposes from data-reporting entities that do not provide QA/QC summary information and/or documented SOPs or procedures as requested by MDEQ.

A strong quality assurance program is an absolute necessity for operation of an effective water quality monitoring program. 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.

FSD made two significant personnel moves to improve its Quality Assurance/Quality Control (QA/QC) program during this reporting cycle. As part of a reengineering effort, a Quality Assurance Manager position was created at the division level along with a position for a Quality Assurance Officer at the laboratory. The FSD QA manager oversees the QA program for the laboratory and the regional offices. The laboratory QA officer is responsible for the QA/QC activities of the laboratory. Creation of these positions reflects MDEQ's continued commitment to generating valid, defensible data.

In order to better evaluate and report the quality of environmental data, MDEQ has recently upgraded its SWMP QA/QC Program to complement all SWMP components. The objectives of the QA/QC Program are 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; and
- Evaluate and report the quality of all data as well as the type and amount of uncertainty associated with the 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 project plans are developed, maintained, and reviewed to ensure the scientific defensibility of monitoring and laboratory activities, and 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. USEPA Order 5360.1 requires USEPA-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 *USEPA Requirements for Quality Assurance Project Plans* (USEPA 2001). The QAPP includes detailed descriptions of:

- Project Management
- Data Generation and Acquisition
- Assessment and Oversight
- Data Validation and Usability

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). Updated and revised in January 2004, the QMP strives to ensure that quality assurance/quality control programs are uniformly applied throughout MDEQ. 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* (1999a). This manual, primarily emphasizing compliance monitoring and chemical laboratory practices, was originally reviewed and approved by USEPA in 1983 and is periodically updated to reflect changes in analytical methodologies and the Code of Federal Regulations. The latest revision was reviewed by USEPA in 2002 as part of their triennial laboratory audit. Currently, this document is undergoing another revision. This document will be more comprehensive in nature and is being expanded to include biological and detailed ambient water quality monitoring SOPs. In addition, the lab has developed and updated a QA Manual titled: *Quality Assurance Manual Revison 2* (2002b). In general, all measurements are made by MDEQ using USEPA 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 addition to QAPPs, SOPs have been developed, reviewed, and maintained for all data collection and analysis activities. 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:

- Accuracy/bias
- Precision
- Representativeness
- Completeness
- Comparability

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, reduces replication of services, and ensures efficient use of MDEQ's limited surface water monitoring resources. Other monitoring organizations include the USGS, United States Army Corps of Engineers (USACE), Tennessee Valley Authority (TVA), USEPA, NOAA, 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), United States National Park Service (NPS), Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP), and 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 implementation and monitoring efforts by the agencies and MDEQ. Data solicited and obtained from these agencies for the 2006 §305(b) Report was provided by 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 has designated the OPC FSD Assessment Section to serve as the clearinghouse for information on all MDEQ SWMP activities. In this capacity, the Assessment Section oversees the compilation of all SWMP data and centralizes these data and any associated reports for ready access and facilitates data entry into and retrieval from MDEQ computer databases and the MDEQ website. 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 the laboratory. These forms are specifically designed to capture all necessary information and to facilitate accurate data entry. Upon sample arrival at the OPC lab, these forms and accompanying chain-of-custody forms are signed by lab staff initiating the sample login process. All samplers keep copies of the original form as completed in the field. Information from the forms is then entered by lab staff into the Laboratory Information Management System (LIMS), a laboratory sample tracking software used to track OPC laboratory samples from sample receipt, through sample handling, processing, and laboratory analyses. As laboratory analyses are completed, analytical results are entered into LIMS. After all analyses have been completed, QA checks and validation documented, all field and lab surface water data are then entered into integrated MDEQ databases:

- 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 have historically been transferred to USEPA's national water quality data Storage and Retrieval database system (STORET). With USEPA'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. 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. In addition, sediment chemistry, fish community, and habitat assessment data already in WADES and/or EDAS will also be uploaded to STORET. MDEQ historical water chemistry and bacteria data through 1998 can be found in the USEPA STORET Legacy Data Center (LDC) database system. Since 1998, only data from the MDEQ Beach Monitoring Program has been successfully uploaded from MDEQ into Modernized STORET. The majority of MDEQ data resides currently either in WADES or LIMS. Efforts are continuing with USEPA support to remedy this data transfer issue to STORET. Both the Modernized and LDC STORET databases are accessible on-line from USEPA's STORET web site (http://www.epa.gov/storet/) or via a link from MDEQ's web site http:www.deq.state.ms.us). MDEQ water quality data, is also available directly from

MDEQ and can be provided electronically to USEPA, 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 FSD Assessment staff through the MDEQ website (Assessment Questions) or seek general assistance and other MDEQ contacts at the following link: http://deq.state.ms.us.

Data Analysis/Assessment

Surface water quality data analyses and 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. 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. Mississippi's water quality standards (WQS) specify the appropriate levels for which various water quality parameters support a water body's designated uses. The water quality assessment process is designed to determine:

- Water quality condition, whether a water body is attaining its designated use; and
- Water bodies identified as not attaining their use in the §305(b) assessment process are said to be impaired and are listed on the state's §303(d) List of Impaired Water Bodies.

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 Appendix A.

Reporting

MDEQ's main reporting avenue for SWMP and other water quality monitoring and assessment data is through the §305(b) Report. All MDEQ SWMP data, as well as data solicited from and provided by other agencies, institutions, and private entities that conduct monitoring in the state, are considered for assessment. However, only water quality data that meet data quantity and quality requirements according to the state's Consolidated Assessment and Listing Methodology (CALM) are assessed and reported in the §305(b) report. By compiling and summarizing the reports submitted from the states, USEPA can summarize the status of the quality of the nation's waters. This report is required of each state by §305(b) of the CWA on a biennial basis and is developed as per

guidance provided by USEPA. MDEQ makes the report available to the public via its web site at (http://www.deq.state.ms.us.

In addition to the §305(b) Report, MDEQ provides a list of all impaired water bodies, required pursuant to §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 the MDEQ web page. They are utilized for the purpose of stakeholder outreach, education, public information, and to meet other federal grant and/or state legislative requirements.

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. Subsequently, waters identified as impaired 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, non-point 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 USEPA 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, to

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 USEPA'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 USEPA's court ordered TMDL deadlines and conducted special project monitoring to address other critical data collection needs. However, the statewide fish tissue monitoring component of the Status & Trends Network, the Coastal Beach Monitoring Network and the National Coastal Assessment were the only three parts of the Status & Trends Surface Water Monitoring Network that were continuously monitored since 2002.

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 FSD biologists.

MDEQ's Primary Fixed Station Network consists of 146 stations across the state (Figure 16). 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 state's major lakes and reservoirs, as well as the open waters of the Mississippi Sound and its associated bays.

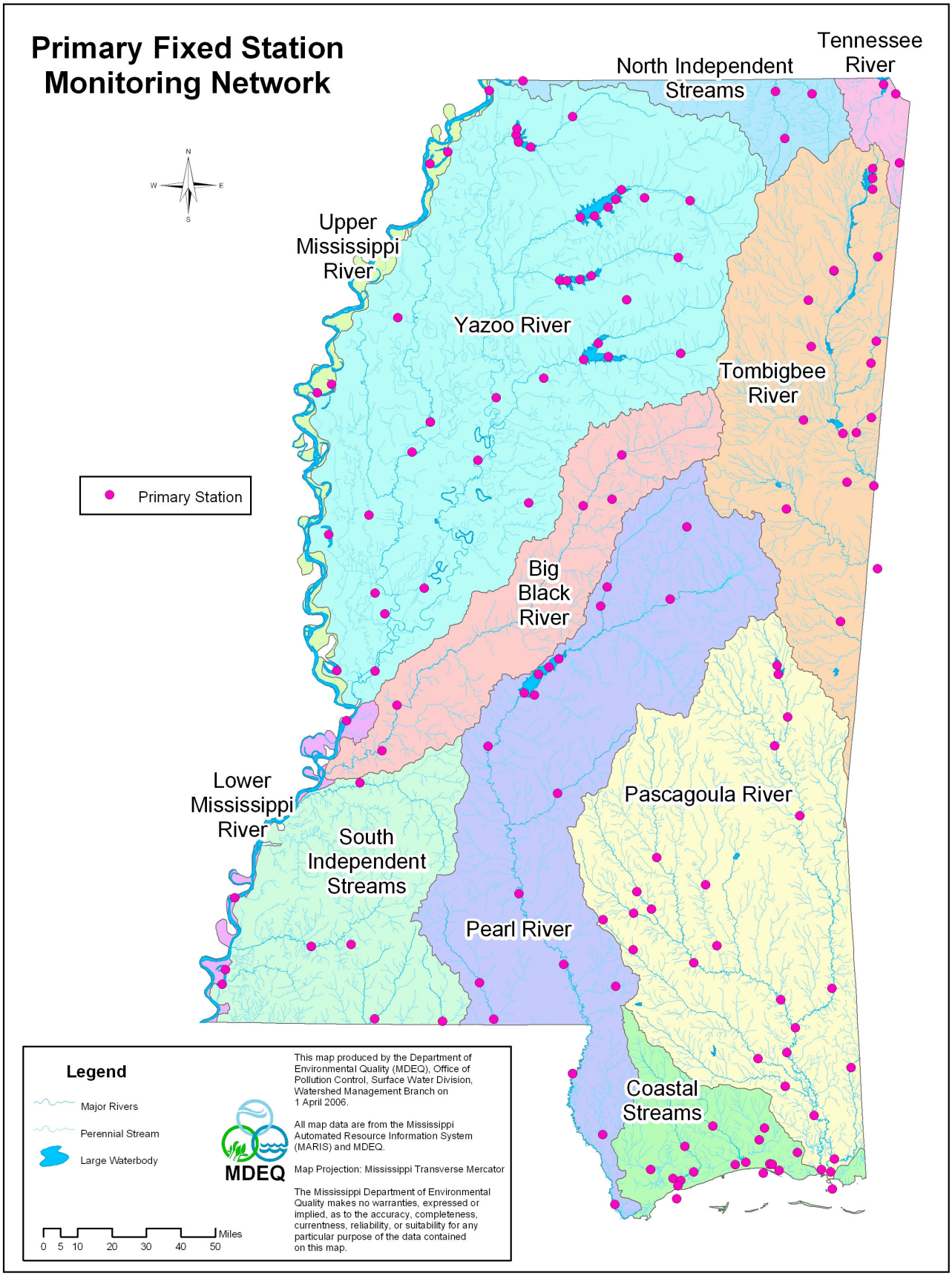


Figure 16: Statewide Fixed Station Monitoring Network

To be included in the Statewide Fixed Monitoring Network, each station not only had to meet the monitoring objectives of the program but also had to meet specific selection criteria for station locations. The specific criteria utilized for the location and establishment of Statewide Fixed Stations are:

> Major perennial stream, major lake or estuary; at or close to a hydrological recording station (required for most physical/chemical stations); strategic basin location (lower end of basin, confluence of major streams, mouth of major tributary, maximum spatial coverage, etc.); high recreational activity or designated use; interstate waters; of some ecological, public health or economic significance (below major pollution sources, fish advisory area, ecoregional reference site, high quality waters, endangered/threatened species, high economic interest, etc.); other logistical and administrative criteria (safety, accessibility, multi-agency coordination, historical data record).

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 largemouth 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. The FSD laboratory has the capability to analyze fish tissue samples for approximately 36 organic compounds, PCBs, PCP and seven heavy metals.

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 longterm 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 USEPA 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.

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 standard 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. To date, 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 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.

Coastal Beach Monitoring Network

MDEQ's Coastal Beach Monitoring Program, operated in conjunction with the University of Southern Mississippi's Gulf Coast Research Laboratory (GCRL), 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 the USEPA Gulf of Mexico Program, Mississippi Department of Marine Resources, GCRL, and the Mississippi Department of Health. This Beach Monitoring Task Force oversees the program and issues beach advisories when needed.

MDEQ and the Beach Monitoring Task Force rely on data collected under this program to assess health and safety issues for users of Mississippi's recreational beaches. When enterococci bacteria concentrations reach unsafe levels, beach advisories are issued. In addition, the monitoring 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 webpage developed by GCRL that can be accessed via the MDEQ homepage (http://www.deq.state.ms.us). This website contains beach advisory status, location of monitored sites, data associated with those monitored locations, and a history of beach advisories.

There are sixteen 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 enterococci bacteria levels exceed

104 colonies/100ml. For a complete list of parameters monitored as part of this program, see Table 16 below.

Table 16: MDEQ Beach Monitoring Parameters

Water Quality Indicators	
Water Profiles	Water Samples
Temperature	Enterococci counts (MF)
Salinity	Stage of river nearest station
Dissolved Oxygen	Rainfall and /or cloud cover
pH	Tidal Stage
Turbidity	Conventional WQ Parameters

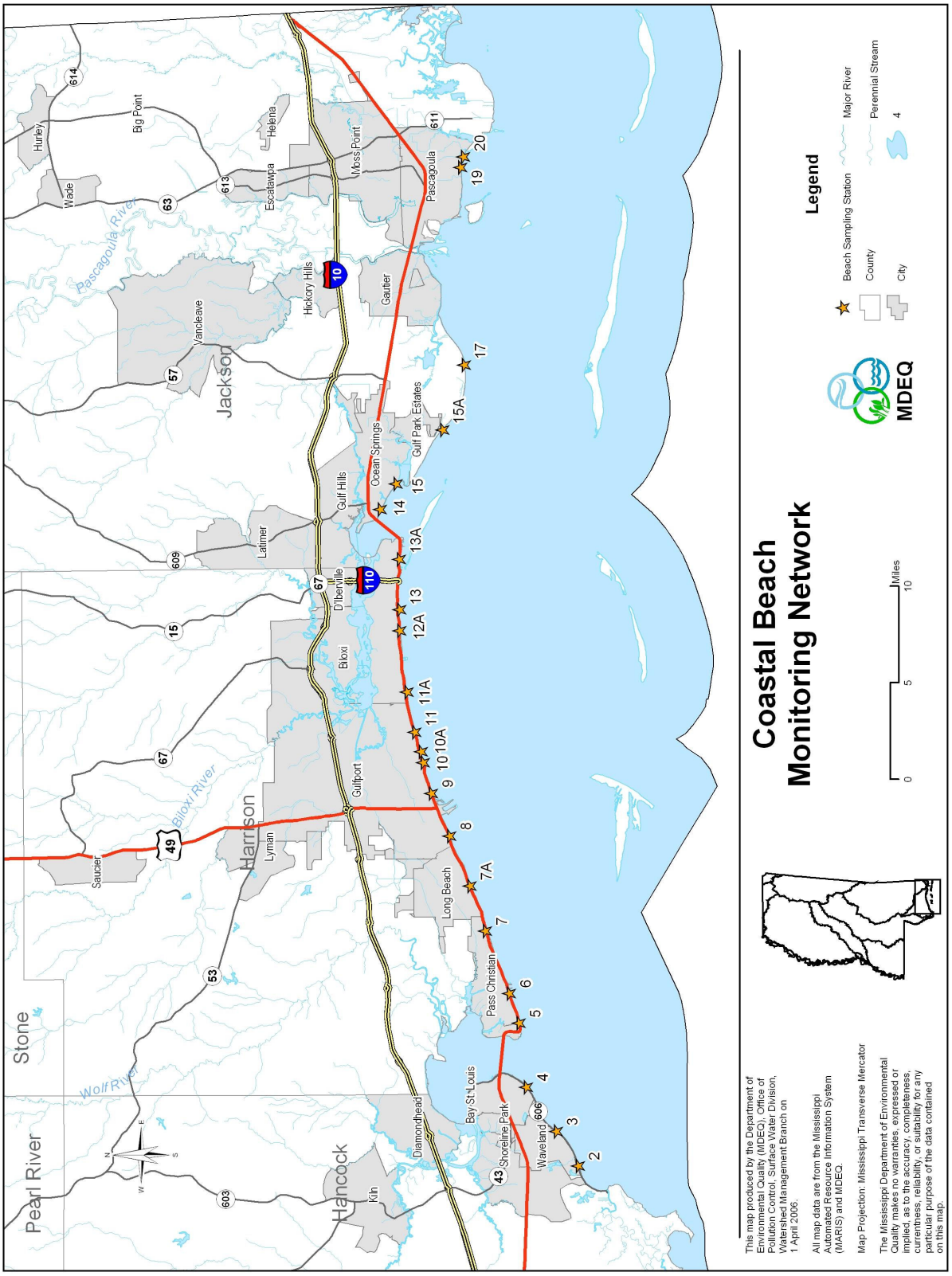


Figure 17: MDEQ Coastal Beach Monitoring Network

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 often 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 2001b) 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 limited or nonexistent. They are also used to investigate known or suspected water quality problems 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 prior to TMDL development, and water quality criteria/standards development.

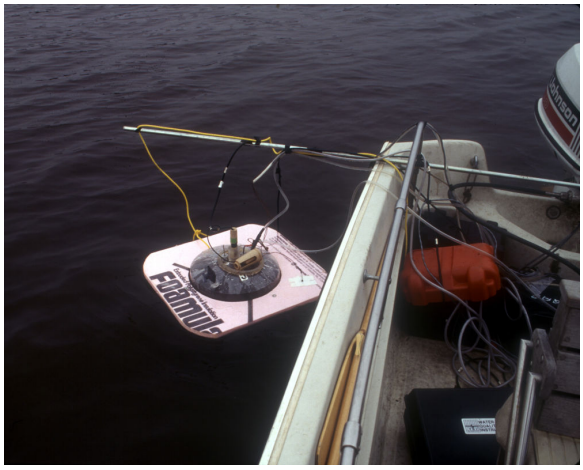
Descriptions of MDEQ SWMP intensive surveys and special projects conducted or presently on-going from 2000 - 2005 are presented in the following sections:

- 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 USEPA Region 4 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 (biological oxygen demand), 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 instream data coupled with the outputs from MDEQ's empirical WLA computer model more accurately ensure the protection of instream water quality standards and the biological community.

WLA and §303(d) confirmation studies in freshwater streams involve the collection of biological data to assess the benthic macroinvertebrate community. These studies also collect stream flow measurements, land use survey information, and limited physical/chemical data both in-stream 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. Studies of this type are scheduled by basin according to the Basinwide Approach cycle wherever possible.

From 2001 to 2005, MDEQ conducted 35 investigations throughout the state to provide supporting information for decisions on NPDES permit limitations and WLA/TMDLs. These investigations are discussed later in this section by water body type.

Frequently water quality studies carried out by MDEQ provide site-specific, non-routine, supplemental information as needed for water quality assessment and for §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 to 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. Every three years, the state is required to review its water quality standards and consider modifications to the standards in response to new USEPA 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 USEPA requirements for nutrient criteria development in streams, river, lakes, and estuaries.

As required by USEPA, the state must develop and implement nutrient criteria for surface waters. In response to this requirement, Mississippi is moving forward to develop numeric criteria that will characterize natural nutrient concentrations in Mississippi water bodies. The purpose of this project is to gather data for use in developing scientifically defensible 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 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.

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, often 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 Enforcement 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 storm water 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 enforcement 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 permitted facilities directly by MDEQ's ECED and FSD 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.

Enforcement Monitoring

This type of 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 FSD, or Groundwater Assessment and Remediation Division (GARD). 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.

These investigations may include samples of surface water, sediment, fish and/or a biological assessment of the affected water bodies. They may also entail an on-site assessment of soil, waste and groundwater. Analyses of the information and/or data collected during the initial response investigation may 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 as a result of 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 these studies 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 Best Management Practices, 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 on-site before monitoring begins.

The first Adopt-A-Stream workshop was held in December 1993 with two workshops generally conducted each year. In addition to the workshops, many people are exposed to the Adopt-A-Stream program through presentations, exhibits, and news releases.

To date, approximately 500 people have been educated at workshops, and chemical and/or biological monitoring data has been received from 77 streams.

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. 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. 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 (December - February) was selected for benthic sampling. Rigorous QA/QC protocols were also employed including development of a comprehensive Quality Assurance Project 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 by MDEQ with contractor support of over 475 streams statewide with the exception of streams in the Mississippi Alluvial Plains Ecoregion (Mississippi Delta region). Analysis of Phase I data was completed in 2002.

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 2003a) which is available on the MDEQ web site (http://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 70 sites. In Phase III, conducted in December 2002 - February 2003, data were collected at 116 sites. Phase IV, conducted January-February 2004, included 70 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. The locations of the 731 sites sampled in Phases I-IV are presented in Figure 18. Data collections were conducted by MDEQ FSD for Phases II through IV, and the sub-sampling and taxonomic efforts were conducted by the laboratory, with the help of outside contractors. Data analyses for the 2002 data set were completed in 2003 using the newly developed M-BISQ. Phase III and IV data analysis was completed in January 2006.

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 for wadeable streams and rivers. Much of the basis for the Mississippi 2006 §305(b) water quality assessment is from data collected and analyzed from Phases I through IV of the M-BISQ monitoring project.

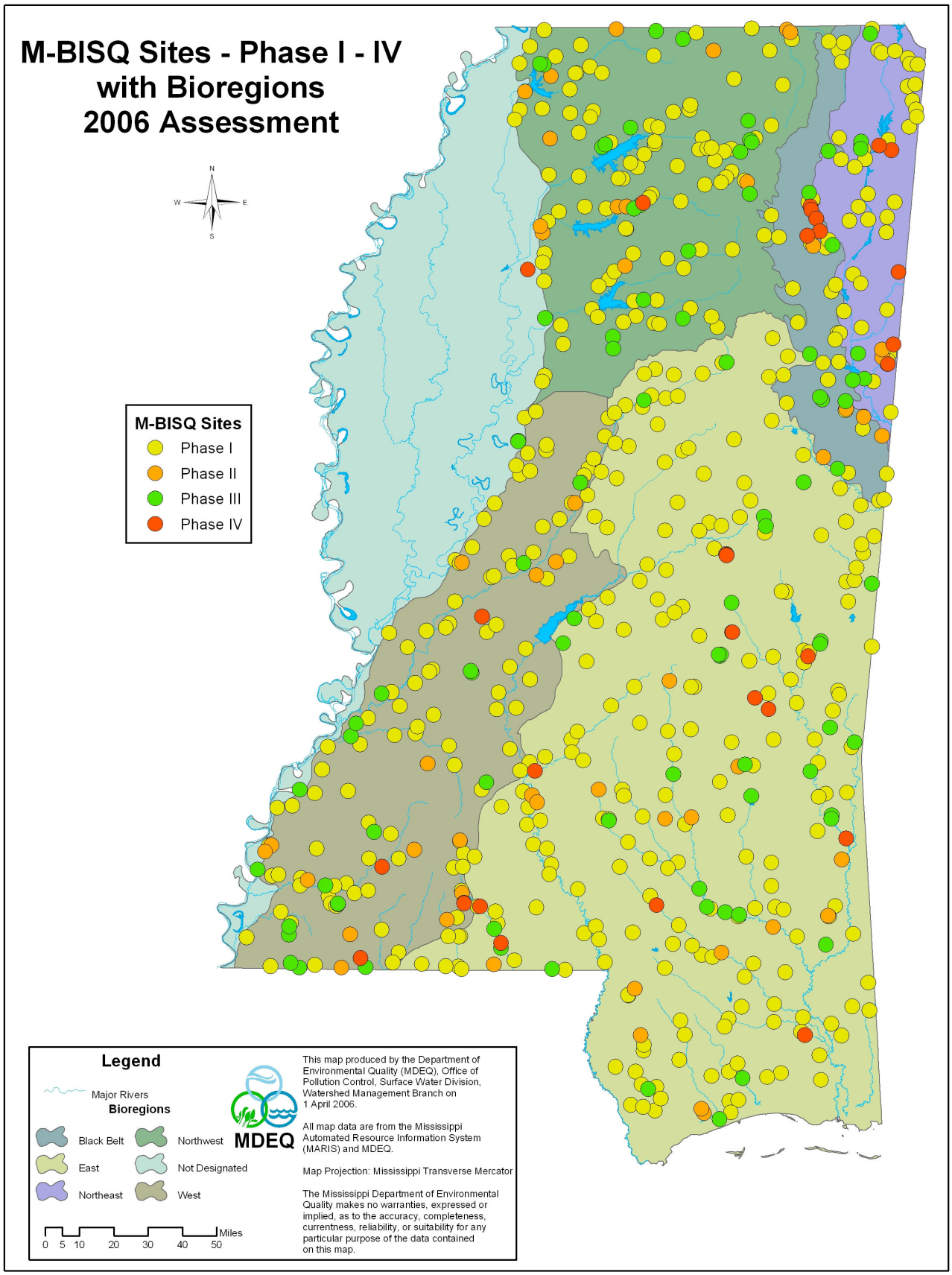


Figure 18: Locations of M-BISQ IBI Phases I - IV

Fecal Coliform §303(d) Monitoring and Assessment Project

Mississippi's 1998 §303(d) list identified numerous water bodies as being potentially impaired by pathogens based on evaluated assessments for which no actual monitoring data were 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 TMDLs. In addition, more data are needed for the monitored §303(d) water bodies to identify potential bacteria sources. Three projects were initiated in 2003, and continued through 2006, to collect the data needed to verify §303(d) pathogen listings and develop pathogen TMDLs in Mississippi.

Bacteria (fecal coliform) samples were collected at approximately 106 sites statewide (Figure 19). Specific water quality sampling methods, field data collection activities and laboratory analyses are described in the *Quality Assurance Project Plan (QAPP) for Water Quality Sampling and Analysis For Fecal Coliform at Targeted Pathogen TMDL Locations In the Coastal, Pascagoula, Pearl, Tombigbee, Big Black, Tennessee and Northern Independent Stream Basins* (MDEQ 2002a) and addendums. This QAPP was used to ensure that the data collected, compiled and/or generated for these projects were complete, accurate, and of the type, quantity, and quality required for its use. 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 2006 §303(d) list and water bodies that were assessed as non-impaired will be submitted for de-listing. Additionally, development of TMDLs for impaired water bodies is ongoing.

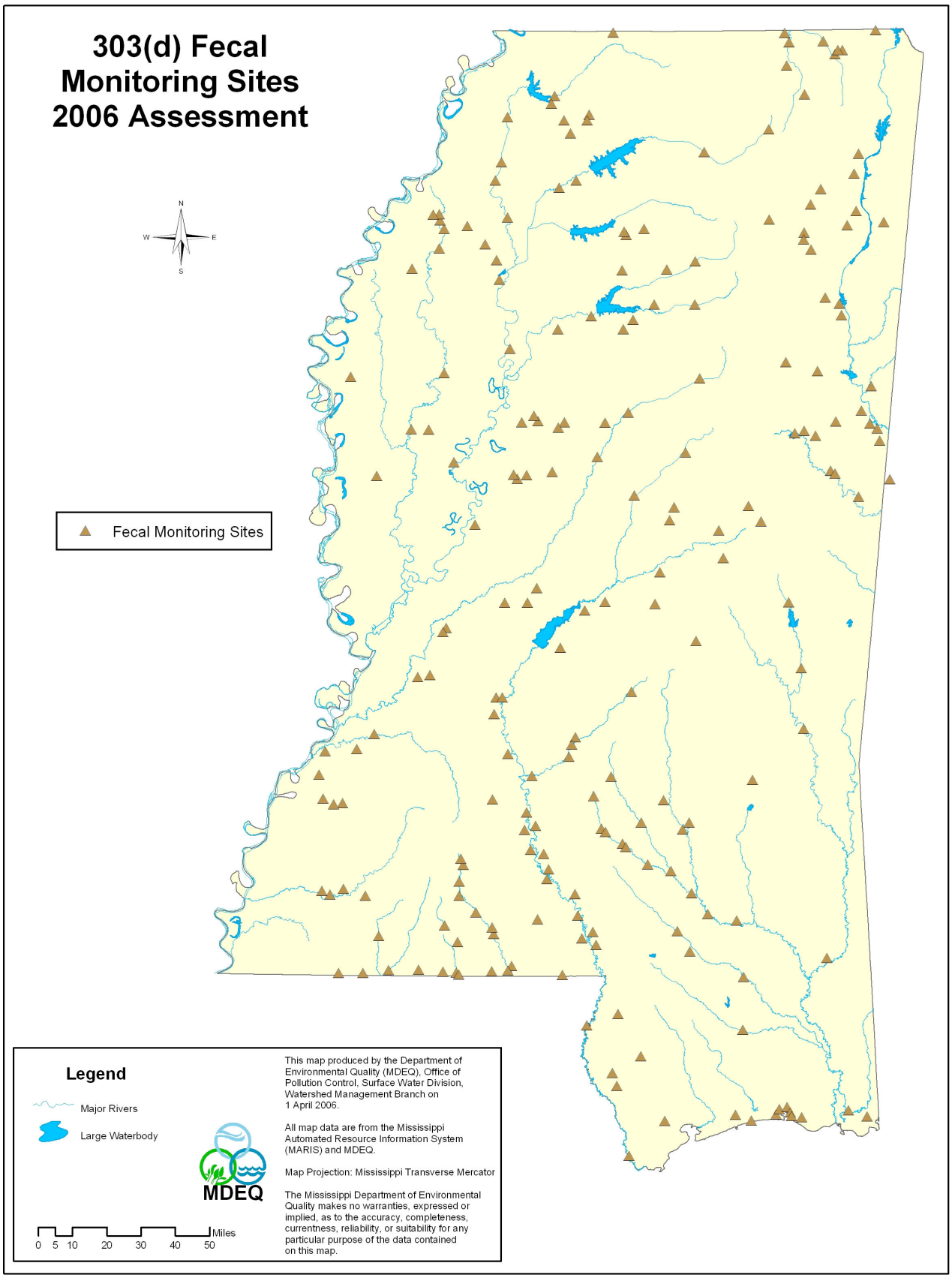


Figure 19: Fecal Coliform §303(d) Sampling 2000-2005

Mississippi Alluvial Plains Ecoregion (73) Monitoring Strategy Project

Section 303(d) of the Clean Water Act (CWA) requires that states maintain a list of waters not meeting state water quality standards and for which Total Maximum Daily Loads (TMDLs) are needed. MDEQ used data varying levels of quality and quantity in developing its early impaired waters lists (1996 and 1998). In fact, many of the impaired waters listings were based solely on anecdotal information supplied by state and federal agricultural agencies. Consequently, for these listings there were no monitoring data and the true ecological conditions of these waters were unknown. This was true for impaired waters listings across all the major river basins in the state including that portion of the Yazoo River Basin known as the Mississippi Alluvial Plain or Delta (Eco-region 73 after Omernik 1987).

Because of the unique hydrology and physiography of the Delta, MDEQ formed a work group in 2001 of state and federal resource agencies to assist with the development of a scientifically defensible method for monitoring and assessing the ecological condition of these slow moving low gradient streams in the Delta and to define target conditions to serve as endpoints for ecological integrity. Representatives on the work group include: MDEQ, USGS, USACE Engineer Research and Development Center (ERDC), MDWFP, Natural Resource Conservation Service (NRCS), USFWS, Yazoo Mississippi Delta Joint Water Management District (YMD), USDA National Sedimentation Lab, and USEPA Region 4. The work group recommended that MDEQ initiate a pilot project to test and evaluate several techniques and approaches suggested during the meetings for assessing the ecological condition of Delta streams. The monitoring that followed during 2002 through 2003 included benthic invertebrates, fish assemblages, habitat analyses, chemical sampling and sampling for chlorophyll *a*. Benthic invertebrates were collected using the current MDEQ wadeable streams methodology developed for M-BISQ and Hester-Dendy multi-plate samplers. 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. Invertebrate samples were processed and identified by Tetra Tech, Inc. Fish samples were processed and identified by ERDC and the University of Louisiana at Monroe Museum of Zoology. The data were collected over two years in different seasons at sites on 35 to 50 perennial streams and rivers.

In 2005 the work group reviewed both the benthic and fish community data collected during the pilot project. Benthic data showed promise for the establishment of an IBI for small perennial streams. However, the fish community data indicated that a fish community IBI was possible for all stream sizes (with the exception of large regulated streams) using the methodologies of the pilot project. In fact, ERDC developed a preliminary Index of Biological Integrity using the fish assemblage data collected during the pilot study. As a result of the pilot project and due to the extensive historical set of fish data available from numerous other Delta streams, fish assemblage was selected as the target biological community to determine use support for assessment and §303(d) listing purposes.

Fish community data from §303(d) listed, but previously unmonitored streams, will be collected in the spring of 2006 at approximately 46 wadeable sites. The fish community data from these sites will then be compared to ERDC's fish IBI to assess the ecological condition of the streams and thus, support assessment of §303(d) listed streams in the Delta. In this comparison, the fish IBI will act as a surrogate narrative water quality criteria. In addition, the IBI previously developed by ERDC may be refined based on the findings of this additional monitoring, especially if any of the previously unmonitored sites prove to be of reference site quality. Other sampling sites included in this project consist of several streams in the Delta portion of the Coldwater River system previously identified by ERDC as reference sites. In summary, approximately 76 sites will be monitored during this project. This count includes 46 previously unmonitored §303(d) listings, 10 QA/QC duplicates, re-sampling of several streams thought to be reference sites, additional sites to assess the effects of hurricanes Katrina and Rita, and any new sites determined to be reference quality. Sampling will be conducted during April through June of 2006.

Development of Index of Biological Integrity (IBI) for Large Rivers and Non-Wadeable Streams - Intensive Surveys and Special Project Monitoring

A pilot project was initiated to develop an assessment tool for monitoring the non-wadable streams and rivers of Mississippi. In 2005, three large river systems, the Big Black, Pascagoula and Tombigbee, were selected to be sampled. Forty sites, 10 in the Big Black, 20 in the Pascagoula, and 10 in the Tombigbee were scheduled to be sampled during the summer low flow index period of August and September. Teams documented

stream characteristics during the field sampling effort and performed reach delineations, multi-probe deployments (dissolved oxygen, pH, temperature, specific conductance, total dissolved solids (calculated from specific conductance), turbidity, and total dissolved solids measurements), and visually conducted physical habitat assessments. They also determined substrate particle size distribution (sounding pole method), obtained global positioning system (GPS) coordinates, and acquired water surface elevation measurements for future use in calculation of flows; and site photographs. Additionally, biological and chemical samples were collected at each site.

Sample collection was completed for the Tombigbee and most of the Big Black River Basins before being interrupted by Hurricane Katrina. The study will resume in 2006.

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

The objective of this effort is to conduct stressor identification (SI) analyses on §303(d) waters listed as biologically impaired. SI studies are needed to identify the specific stressor(s) in these water bodies. There are approximately 275 streams needing SI 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 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 USEPA document *Stressor Identification Guidance Document* (USEPA 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 Cane 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.

In order to complete the numerous remaining SI analyses, MDEQ formed an inter-disciplinary stressor identification team that has been addressing the remaining biological impairment listings on a rotating basin schedule in accordance with the TMDL

development deadlines. The results of the completed SIs are provided in the tables below (Tables 17-20).

Table 17: Pascagoula River Basin Stressor IDs

	Water Body Name	303(d) Water Body ID	IBI Site(s)	Probable Stressor(s) needing TMDLs
1	Bluff Creek	MS098BE	544	Sediment
2	Bogue Homo	MS091E	487	DO/Nutrients
3	Bostick Branch	MS063E1	343	Sediment
4	Chickasawhay River	MSUCHKRE1	419,550	Sediment
5	Dry Creek	MS082E	394	Sediment
6	Leaf River (Upper)	MS073UE	718	Sediment
7	Leaf River	MS086E	478,494	Sediment, DO/Nutrients
8	Mason Creek	MS071ME	504	Sediment
9	Oakahay Creek	MS076E	399	Sediment, DO/Nutrients
10	Red Creek	MS102RE	485	DO/Nutrients
11	Skiffer Creek	MS081SE	714	Sediment
12	Thompson Creek	MS093T2E	492	Sediment
13	West Little Thompson Creek	MS093T1E	489	Sediment
14	West Tallahala Creek	MS074E	401,329	Sediment
15	Whiskey Creek	MS097E	502	Sediment

Table 18: North Independent/Tennessee River Basins Stressor IDs

	Water Body Name	303(d) Water Body ID	IBI Site(s)	Probable Stressor(s) needing TMDLs
1	Bear Creek	MS194E	75	Sediment
2	Bridge Creek	MS203BE	61	DO/Nutrients
3	Chambers Creek	MS198E	58	Sediment
4	Elam Creek	MS204E	62	DO/Nutrients
5	Horn Lake Creek	MS217HE	7	Sediment, DO/Nutrients
6	Little Hatchie River	MS201E	52	Sediment
7	Muddy Creek	MS206E	50	DO/Nutrients
8	Nonconnah	MS216NE	705	Sediment, DO/Nutrients
9	Tuscumbia River Canal	MS203TE	548	Sediment, DO/Nutrients

Table 19: Big Black/Tombigbee River Basins Stressor IDs, Group 1 (Big Black and West Bioregion)

	Water Body Name	303(d) Water Body ID	IBI Site(s)	Probable Stressor(s) needing TMDLs
1	Bear Creek	MS431BE	702	Sediment, DO/Nutrients
2	Big Cypress Creek	MS428E	241	Sediment
3	Box Creek/Green's Creek	MS424BE	237	Sediment
4	Clear Creek	MS439E	292	Sediment
5	Cox Creek	MS437E	299	Sediment, DO/Nutrients
6	Cypress Creek	MS433CE	222	Sediment, DO/Nutrients
7	Deer Creek	MS433DE	223	Sediment, DO/Nutrients
8	Ellison Creek	MS430E	243	Sediment
9	Fourteen Mile Creek	MS441FE	304	Sediment, DO/Nutrients
10	Hays Creek	MS417HE	163	Sediment
11	Indian Creek	MS433IE	226	Sediment
12	Kennison Creek	MS444E	356	Sediment
13	Tackett Creek	MS426E	239	Sediment
14	Tilda Bogue Creek	MS431TE	309	Sediment, DO/Nutrients
15	Walesheba Creek	MS433WE	227	Sediment, DO/Nutrients
16	Big Creek*	MS159E	305	Sediment, DO/Nutrients

*Located in Pearl Basin, done out of sequence to accommodate WLA issue

Table 20: Big Black/Tombigbee River Basins Stressor IDs, Group 2 (Big Black/Tombigbee & East Bioregion)

	Water Body Name	303(d) Water Body ID	IBI Site(s)	Probable Stressor(s) needing TMDLs
1	Apookta Creek	MS421AE	234	Sediment
2	Betsy Creek	MS417UE	557	Sediment, DO/Nutrients
3	Calabrella Creek	MS411E	173	Sediment
4	Lewis Creek	MS416LE	174	Sediment
5	Mulberry Creek	MS415E	175	Sediment
6	Cypress Creek	MS036E	191	Sediment
7	Line Creek	MS024E	185	Sediment
8	Scooba Creek	MS044E	566	Sediment
9	Shy Hammock Creek	MS045E	289	Sediment, DO/Nutrients
10	Woodward Creek	MS043E	286	Sediment, DO/Nutrients

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 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 wadable 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. Approximately 100 M-BISQ sites (50 stressed and 50 reference) were sampled statewide in the spring of 2004. Another round occurred in August and September (100 sites) of the same year that additionally included qualitative periphyton assessment (20 sites) and diel DO monitoring (10 sites) (Figure 20). This sampling was repeated in its entirety in 2005. Analysis of nutrients and other water quality parameters such as DO, temperature, pH, specific conductance, turbidity, COD, TOC, suspended solids, chlorides, alkalinity, and hardness data is underway.

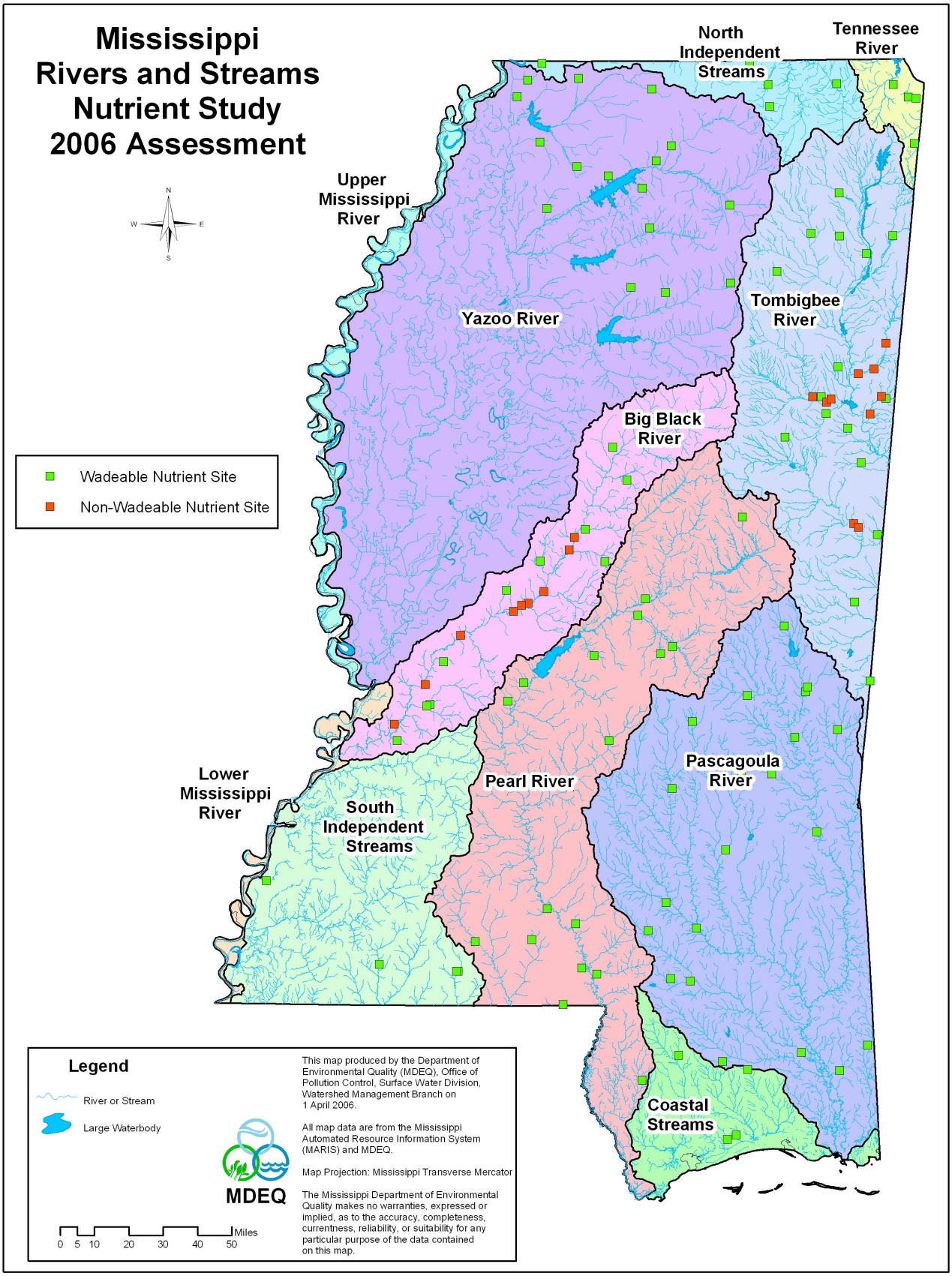


Figure 20: Rivers and Streams Nutrient Criteria Development Sites

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 on the §303(d) list for metals. A contract with a private consulting firm was established in order to collect the data using clean techniques needed for water bodies listed for metals in the Yazoo River Basin. Table 21 lists the water bodies, respective USGS stations, and metals of concern.

Table 21: 1998 §303(d) Water Bodies 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 Cadmium

At each USGS station, 10 samples were collected from January 1, 2002, through December 1, 2002, by a MDEQ contractor using clean techniques. Project samples were collected as total recoverable in accordance with *Method 1669, Sampling Ambient Water for Trace Metals at USEPA Water Quality Criteria Levels* (USEPA 1996). After the samples were collected, they were shipped to USEPA Region 4'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, USEPA Region 4, and the USEPA Gulf of Mexico Program have joined together in the development of a nutrient model for the Yazoo River Basin. The model was 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 the development of TMDLs for impaired water bodies in the basin. The major data gap identified was the lack of water quality data collected during wet-weather conditions. Consequently, in 1999, MDEQ contracted with a private consulting firm to collect wet-weather data for use in model calibration.

Monitoring activities for this project consisted of wet-weather (storm event) and base flow monitoring. A total of seven 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, chemical oxygen demand (COD), total organic carbon (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.

A private contractor conducted an analysis of monitoring data. 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 landuse information within monitored watersheds. In addition, 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 load estimates. It was determined that percent of cropland in the watershed was a good predictor of 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. Escatawpa River is currently assigned a dissolved oxygen (DO) criterion variance of 3.0 mg/L in the lower reach prior to confluence with Pascagoula River. Natural conditions, current and past industrial and municipal discharges, in combination with poor flushing action of this estuarine portion of river necessitated the presence of this variance. As a result of this sustained impairment, MDEQ has been supporting USEPA Region 4 in conducting a Use Attainability Analysis (UAA) for Escatawpa River. There are several discharges in the area of Escatawpa River with the DO variance including a significant discharge from the Jackson County Port Authority. At one time, this discharge included industrial wastewater from International Paper Company (IPC) mill in Moss Point which is now 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 Escatawpa River.

In September 1997, an intensive survey was conducted on Escatawpa River by USEPA 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 calibrate the development of a water quality model for Escatawpa River. A total of 14 stations were established in the study area which included the Escatawpa, Pascagoula, and West Pascagoula Rivers, and a station in the Mississippi Sound. Monitoring activities during the nine day study period included tide-phased water quality sampling for BOD_5, 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 USEPA 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 in 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 USEPA 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)

Fresh water portions of Escatawpa River in south Mississippi 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 fish flesh that exceed the FDA Action level.

The Escatawpa River Phase One Mercury TMDL completed by MDEQ used only information from point source contributions to the lower estuarine portion of the water body. While there are no NPDES permitted dischargers currently in the freshwater section of Escatawpa River, several NPDES permitted dischargers are located in the lower estuarine portion. As a result of the Phase One Mercury TMDL, all of the point source contributors have voluntarily monitored their source waters and wastewater discharges on a quarterly basis for the presence of mercury. This 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 Escatawpa River to better define background conditions for mercury in that water body. MDEQ coordinated sampling to collect water samples at the same time and in the same way as the point source monitoring was conducted. MDEQ's contractor sampled these water quality sampling stations for Total Mercury using clean sampling techniques as outlined in USEPA Method 1669. A total of ten sampling events occurred at each station over the study period. Samples were analyzed using USEPA 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 eight million gallon per day (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, USEPA Region 4 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. 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. Fourteen 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 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. Phase two of the intensive study has been scheduled for summer 2006. Data collection efforts during the second phase will focus on any changes to the river after addition of the CMU discharge.

WLA/Special Studies Streams and Rivers

From 2001 to 2005, MDEQ conducted 30 WLA/Special Study investigations in streams and rivers throughout the state. Most of these were done as part of 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 to determine the status of the water bodies. Those sites studied are outlined in Table 22.

Table 22: WLA/Special Studies in Rivers and Streams (2001-2005)

Site	Date	Facility Name	Purpose
Hopson Bayou Tallahatchie County	2001	City of Tutwiler POTW	WLA Investigation
Howard/Mayhew Creeks Lowndes County	2001	NA	303(d) Listing Confirmation
James Creek Monroe County	2001	NA	303(d) Listing Confirmation
Kentawka Canal Neshoba County	2001	City of Philadelphia POTW	WLA Investigation and 303(d) Listing Confirmation
Leflore Creek Attala County	2001	City of Ethel POTW	WLA Investigation
Moorhead Bayou Sunflower County	2001 2004	Allen Canning, City of Moorhead POTW	WLA Investigation
Oaklimeter Creek Marshall County	2001	City of Potts Camp POTW	WLA Investigation
Second Creek Adams County	2001	Beau Pre Subdivison	WLA Investigation
Snake Creek Bolivar County	2001	Bolivar County Correctional Facility	WLA Investigation
Town Creek Madison County	2001	City of Bentonia POTW	303(d) Listing Confirmation
Unnamed Tributary to Chiwapa Creek Lee County	2001	City of Shannon POTW	WLA Investigation and 303(d) Listing Confirmation
Unnamed Tributary to Gin Bayou Leflore County	2001	MS Valley State University	WLA Investigation
Unnamed Tributary to Lead Bayou Bolivar County	2001	City of Cleveland POTW	WLA Investigation
Unnamed Tributary to Pigeon Roost Creek Oktibbeha County	2001	City of Maben POTW	WLA Investigation and 303(d) Listing Confirmation

Unnamed Tributary to Tenn-Tom Waterway Lowndes County	2001	Eka Nobel WWTF	WLA Investigation and 303(d) Listing Confirmation
Unnamed Tributary to the Big Black River Holmes County	2001	City of Durant POTW	WLA Investigation and 303(d) Listing Confirmation
Yockanookany River Choctaw County	2001	City of Ackerman POTW	WLA Investigation
Fords Creek Wilkinson County	2002	Wilkinson County Correctional Facility	WLA Investigation
Little Bear Creek Madison Creek	2002	Deerfield Subdivision	WLA Investigation
Unnamed Tributary to Holiday Creek Jefferson Davis County	2002	City of Bassfield POTW	WLA Investigation
Clabber Creek Pike County	2003	City of Summit POTW (North and East Facilities)	WLA Investigation
Redding Creek Wilkinson Creek	2003	City of Crosby POTW	WLA Investigation
Anderson Branch Union County	2004	City of Decatur South POTW	WLA Investigation
Bowie River Forrest County	2004	City of Hattiesburg North POTW	WLA Investigation
Reese Creek Forrest County	2004	Sherwood Forest Subdivision	WLA Investigation
Stafford Creek Amite County	2004	City of Centreville South POTW	WLA Investigation
Fourmile Branch Lafayette County	2005	Brittany Woods Subdivision Rolling Woods Subdivision	WLA Investigation
**Mill Creek Pearl River County	2005	City of Picayune POTW (possible relocation of discharge)	WLA Investigaton
**Perkins Creek Lamar County	2005	Canebrake Subdivision Fieldstone/Bent Creek Subdivision	WLA Investigation

**Data collection was completed for this study. However, conditions present during the data collection were determined to not accurately represent critical conditions. The study will be repeated.

Lakes - Intensive Surveys and Special Project Monitoring

Nutrient Criteria Development – Lakes

The Lakes Subcommittee of the Nutrient Criteria Task Force, established in 2001, developed a monitoring plan for nutrient data collection in 2002. The purpose of monitoring Mississippi's lakes is to provide nutrient data adequate for developing nutrient water quality criteria by 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 consisted of seasonal monitoring over two years at 50 lakes and reservoirs. In the first phase of this project, all publicly owned lakes of at least 500 acres in size were sampled, along with 10 managed lakes fertilized for fish production. These lakes were sampled six times per year: once in the fall (October-November) once in the spring (March-April) and four times during the summer growing season (June-September). Parameters monitored included 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 seasonal sampling, more intensive inflow and outflow monitoring also occurred for selected lakes/reservoirs. Sampling for this project was completed for the >500 acre site class in fall of 2004 (Figure 21).

The same monitoring of smaller lakes (100-500 acre) began in November 2004, and ran through the summer of 2005. Monitoring was suspended after one year due to resource constraints.

WLA/Special Studies Lakes

From 2001 to 2005, MDEQ conducted two WLA/Special Study investigations in Lake Hazle. These investigations were conducted to provide supporting information for decisions on §303(d) listing/delisting issues and TMDL development. Biological, physical, and chemical data were collected and used to determine the attainment status of the water body.

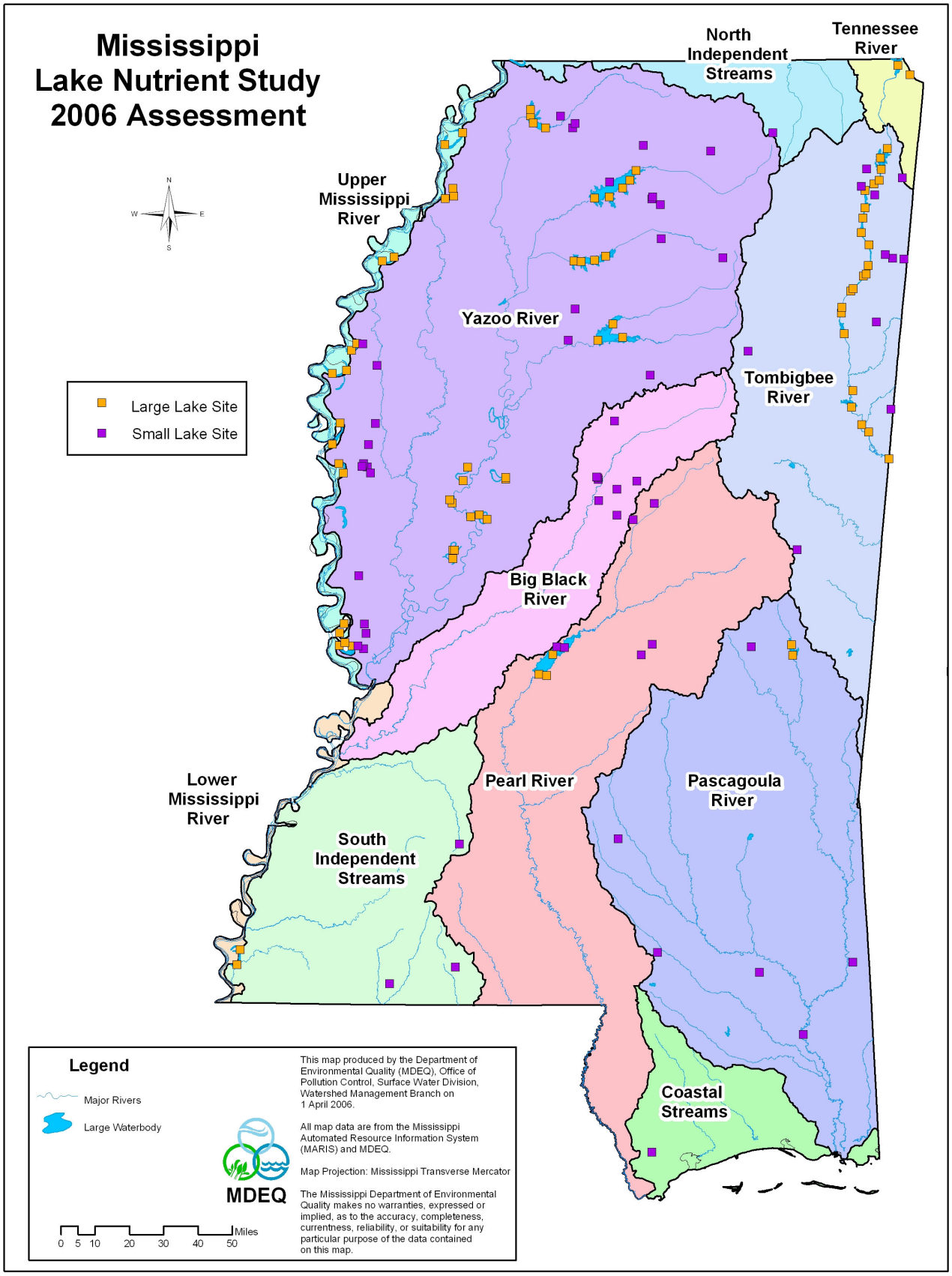


Figure 21: Lakes Station Monitoring

Estuaries and Coastal Waters - Intensive Surveys and Special Project Monitoring

USEPA National Coastal Assessment Program

In 2000, MDEQ began participation in USEPA's National Coastal Assessment Program (NCA). The purpose of NCA, a component of the National USEPA 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 USEPA 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 took place over a five-year period (2000–2004) using an USEPA EMAP probability-based sampling approach. Annual sampling was 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 30-50 randomly selected sites throughout Mississippi coastal waters were sampled each year during the summer index period (Figure 22). 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 for the structure of the biological community (see Table 23).

Sample analyses through year 5 have been completed. After entry into the MDEQ database, data generated for this project are sent to USEPA's Gulf Ecology Division, in Gulf Breeze, Florida for data analysis.

Table 23: 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 Contaminants		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					

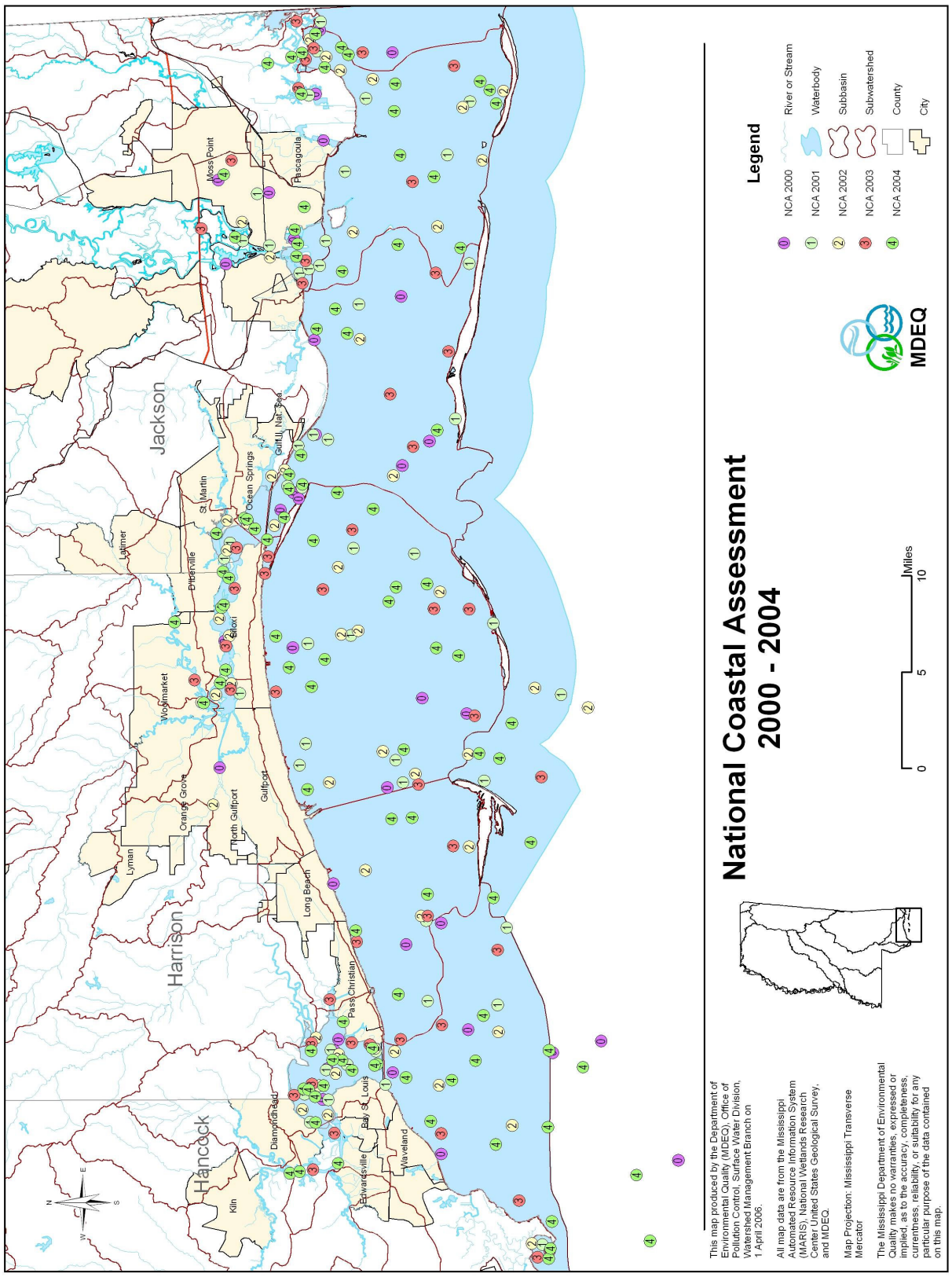


Figure 22: Mississippi NCA Monitoring Stations 2000-2004

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, 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 USEPA's NCA Program and the Coastal Beach Monitoring Program. MDEQ, in conjunction with USM GCRL, developed a QAPP that was approved by the subcommittee. The data collection plan identifies 28 sites (Figure 23) for quarterly monitoring in coastal bays, tidal rivers, and estuaries of Mississippi Sound. Monitoring, conducted by GCRL, began in the spring of 2003. Sampling and analysis was 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 diel study was conducted in the spring of 2004 under high flow conditions. A second 24 hour study was conducted under low flow conditions in November of 2005. Monitoring was completed in 2005.

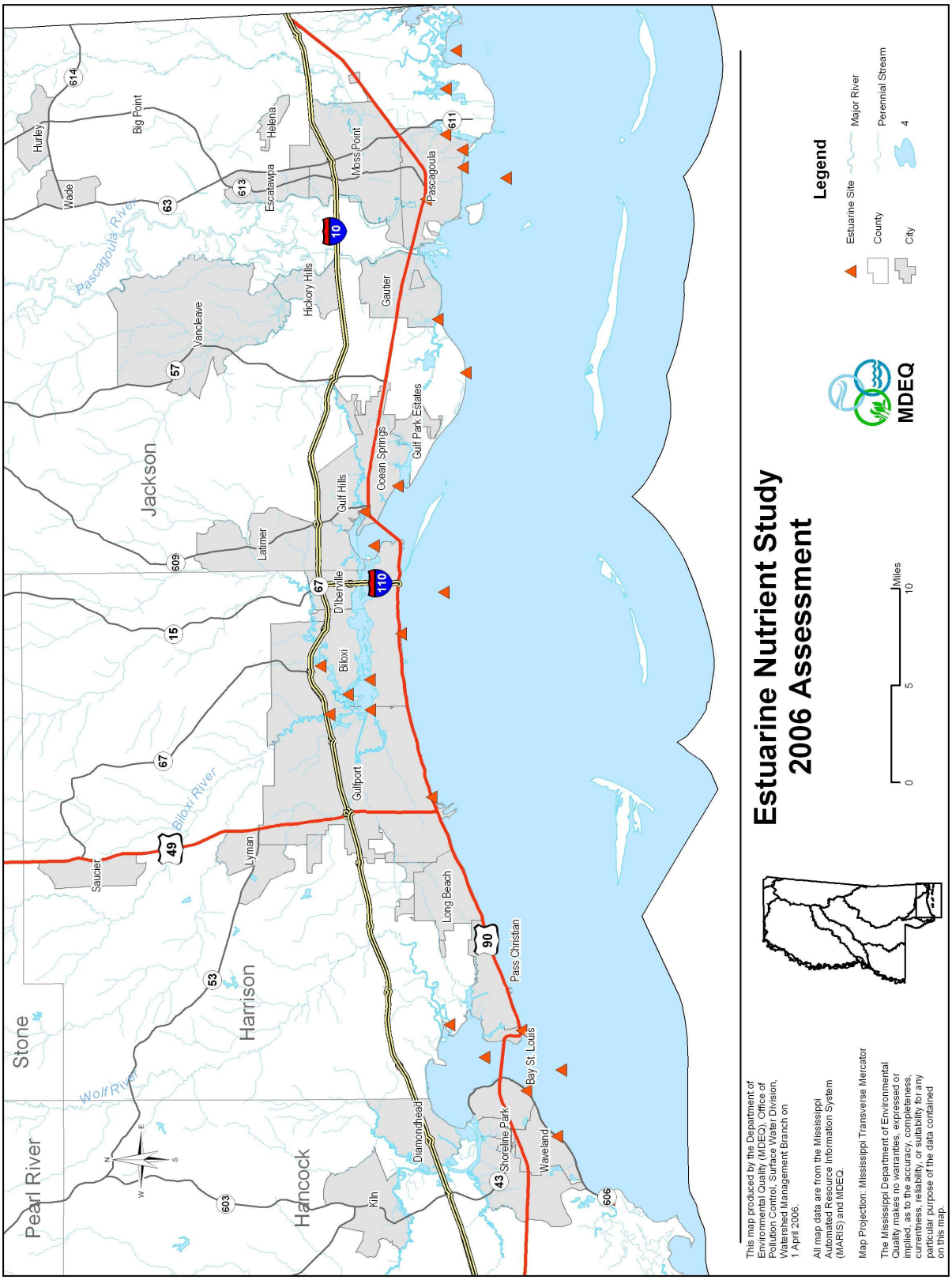


Figure 23: Estuarine Nutrient Criteria Development

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, such models are useful tools for the production of 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 with quick responses to ensure that samples were collected during the storm events. In addition, flow measurements, that are vital for analysis and interpretation of water quality samples, were taken. 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 monitoring data suggesting water quality problems, several water quality studies were conducted to evaluate 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 TMDLs for the water body. Data were needed to address low dissolved oxygen, toxicity 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 periodic violations of the DO criteria in Bayou Casotte and nutrient levels above those observed at the Bayou Cumbest reference location.

USEPA Region 4 Science and Ecosystem Support Division (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 determine 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, as selected reference water body, were sampled for metals, grain size, and various inorganic and organic compounds. Results of this survey indicated the presence of PAH's, metals, phthalates, ammonia, and organochlorine pesticides in Bayou Casotte sediments. However, only cadmium, zinc, and chlordane were detected at concentrations above USEPA screening levels.

Three 24-hour water quality monitoring events were conducted in 2002 and two more were conducted in 2003. During one of the 2002 sampling events, MP was conducting a by-pass of its wastewater treatment system. The following ecological data were collected approximately every four hours over the 24-hour time span of each study (Table 24).

Table 24: 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. Data from the 2002 and 2003 sampling events will be used in the development of the TMDL for the bayou.

In 2004, USEPA SESD conducted a mixing zone study in Bayou Casotte. The primary objective of this survey was to define through dye tracing the near and far field dilution of the Mississippi Phosphate discharge to Bayou Casotte. The secondary objective was to identify any toxicity or enrichment caused by excessive nutrients. In-situ monitoring

included; temperature, salinity, dissolved oxygen, and Rhodamine WT dye. Sampling in the bayou included ammonia (probe), nutrients, chlorophyll *a*, and algal growth potential (AGP) analysis.

A dye tracer (Rhodamine WT) was introduced into the discharge from Mississippi Phosphate Company in a continuous fashion for a full tidal cycle. The injection personnel were able to match the dye release to the dynamic effluent release from the outfall. The discharge was monitored at the head and mouth of the discharge channel as well as in Bayou Casotte. Monitoring was conducted for the purposes of estimating the ultimate (steady state) near and far field dye tracer concentrations.

Water quality samples were collected from selected mid channel stations to assist in the evaluation of the §303(d) listing for Bayou Casotte. Samples were collected at the one foot depth on each high and low slack tide for five consecutive days. Daily high and low tide ammonia sampling was conducted in concert with in-situ measurements of pH, temperature and salinity. Ammonia analysis was performed on site using a probe. Diurnal water quality monitoring was conducted at three stations positioned nearly equi-distant along the study reach. Nutrients, chlorophyll *a,* and AGP were also monitored.

These data will be used to:

- evaluate the §303(d) listing of Bayou Casotte,
- provide information to define applicable effluent mixing zone boundaries for the MP discharge, and
- establish NPDES permit limits recommended by the TMDL.

WLA/Special Studies - Estuaries

During this reporting period, MDEQ conducted three 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 25.

Table 25: WLA/Special Studies for Estuaries (2001-2005)

Site	Date	Facility Name	Purpose
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's Consolidated Assessment and Listing Methodology (CALM)

Mississippi Consolidated Assessment and Listing Methodology

2006 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 is Mississippi's Consolidated Listing and Assessment Methodology (CALM) for the 2006 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 Clean Water Act (CWA), is to describe the condition of the state's surface waters to the United States Environmental Protection Agency (USEPA) 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 Impaired 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 the Mississippi Department of Environmental Quality's (MDEQ) data requirements and assessment guidelines for the 2006 §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 2006 Section 305(b) Report, the data window is from 2000-2004. This data solicitation effort is facilitated through Mississippi's Basin Management Approach. 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). The designated uses include aquatic life support, contact recreation, secondary 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 2006 Section 303(d) List of Impaired Water Bodies.

All data and information collection activities may not meet the quality, quantity, and sampling frequency requirements given below. Nevertheless, these data and information collection activities serve a useful purpose and MDEQ will utilize 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 water quality degredation of a water body (such as catastrophic or obvious environmental or public health impacts) and the data is supported by data quality documentation. Monitoring sites identified as potentially-impaired but with less compelling evidence, a lesser degree of potential impairment, and/or lack of data quality documentation are also not dismissed. Instead, the water body is assigned to a monitoring list to be scheduled for future monitoring by MDEQ in order 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.). For more information about MDEQ's process of compelling evidence review, see Appendix B of this document.

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. No data will be assessed without supporting quality assurance documentation.

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 preferred for ALUS determinations. 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 2006, ALUS determinations will be primarily based on benthic macroinvertebrate data.

Biological Community Data

Data Quantity:

1. 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 developed the 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 Mississippi Alluvial Plain are not presently included) using benthic macroinvertebrates. The detailed assessment methodology based on M-BISQ for Aquatic Life Use Support and used for the 2006 §303(d) list is found in Appendix A.

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 event. 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 criteria are 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 sunrise 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, from 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 (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 which is from June through October.
   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 which is from June through October at the critical time of day (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 (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% of the samples.

Not Attaining:

Instantaneous criterion violated in greater than 10% 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 (e.g., 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 (e.g., 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% of the samples.

Not Attaining:

Instantaneous criterion violated in greater than 10% of the samples. In addition, the magnitude of the violation, as well as other site-specific natural influences (e.g., 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 use is intended for the protection of waters suitable for recreational purposes including primary water contact activities such as swimming and water skiing as well as secondary incidental water contact activities such as wading, fishing, and boating. Indicators appropriate for use in recreation use support determination include fecal coliform, enterococci, and E. coli bacteria. Enterococci are the bacteriological indicators for assessment of coastal recreational waters in 2006. Fecal coliform is the bacteriological indicator that the state has adopted to assess recreation use for inland waters in 2006.

Enterococci Bacteria (Salt Water)

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 20 samples distributed over a 6 month 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 enterococci 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 the geometric mean criterion is met in greater than 75% of the 6-month sampling events (based on a minimum of 20 samples).

Not Attaining:
If the geometric mean criterion as given in the state's water quality standards is violated in greater than 25% of the 6-month sampling events (based on a minimum of 20 samples).

Fecal Coliform Bacteria (Fresh Water)

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 75% of the 30-day sampling events (based on a minimum of 5 samples) and geometric mean criterion is met in greater than 75% 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% 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 2006 §305(b), the only assessment rendered will be that of non-attainment 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 the Mississippi Fish Advisory Task Force made up of representatives from several state agencies. Water bodies 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

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 for Aquatic Life Use Support (ALUS)

Mississippi's
2006 Section 303(d) Listing Process
For

Making Aquatic Life Use Support Decisions Using M-BISQ

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 standardized 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). 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 of the Mississippi Benthic Index of Stream Quality (M-BISQ), Mississippi Department of Environmental Quality, June 2003.

Mississippi Benthic Index of Stream Quality (M-BISQ)

According to M-BISQ methodology, the state is divided into five bioregions (i.e., areas of biological similarity): the (1) Black Belt; (2) East; (3) Northeast; (4) Northwest; and the (5) West (Figure 1). None of the sites used for bioregional delineation were specifically known to be impaired, i.e., the state had no previous monitoring data indicating non-support of aquatic life use, though not all of these sites were previously monitored.

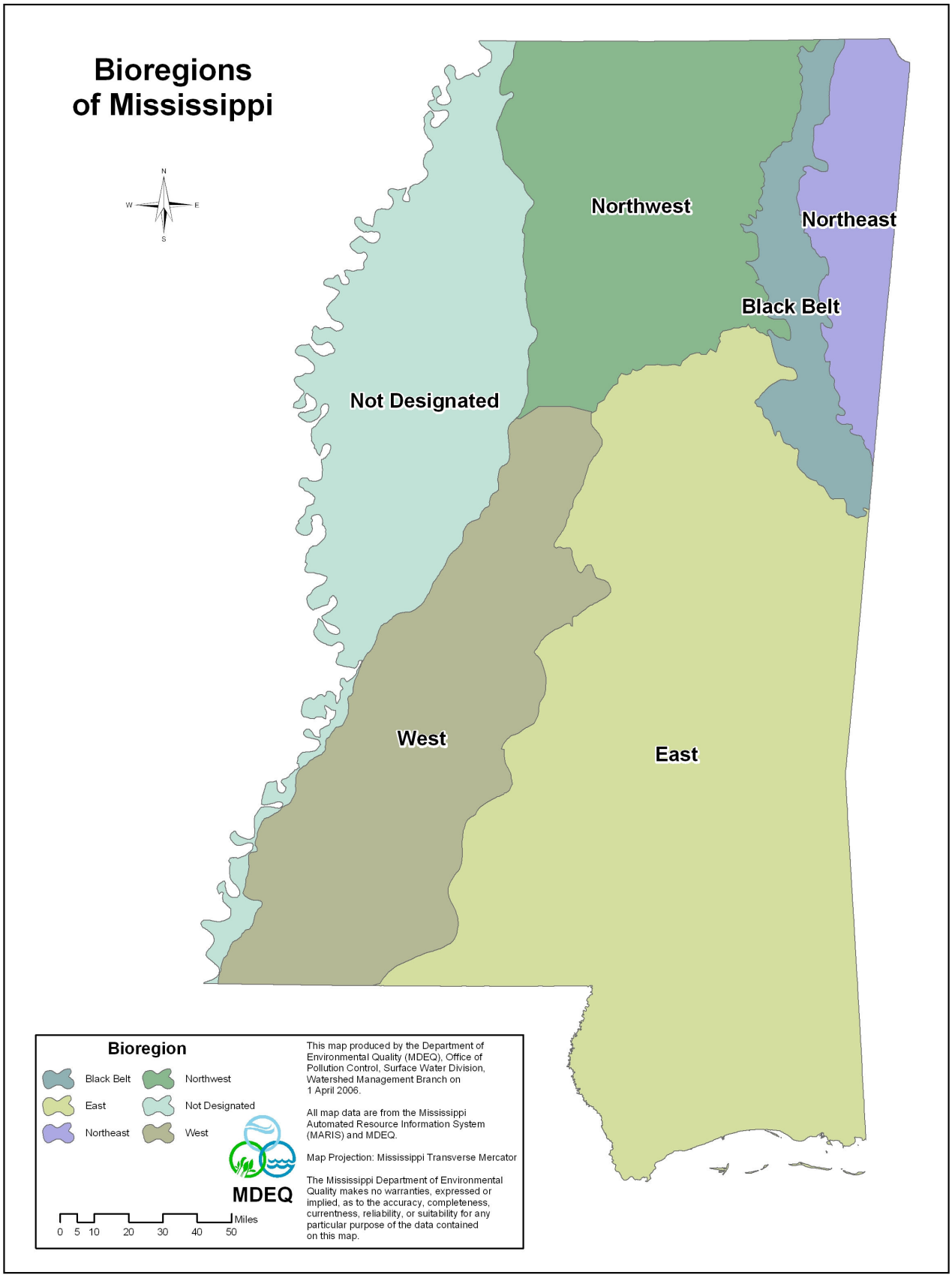

Figure 24: Mississippi's Five Bioregions

The "least disturbed" sites within each bioregion are considered as a comparison set for that bioregion. The numeric M-BISQ scores for each bioregion's comparison set make up a distribution from which a statistical reference point reflects the concept of "least disturbed" or "best attainable" conditions. The 25th percentile of the M-BISQ score distribution for each bioregional comparison set (Figure 2) is used as the reference point or threshold of attainment. The 25th percentile is considered to approximate the desired reference condition and thus serves as a threshold of attainment of ALUS. This threshold of ALUS attainment for each bioregion is used for comparing biological data collected from wadeable streams in each respective bioregion. It is also considered to capture and reflect the inherent certainty, and uncertainty, of the measurement process. To allow for the comparison to the ALUS attainment threshold, the biological data from each wadeable site sampled are combined to calculate 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 determines the assessment status for the site. A detailed explanation of the 2006 §303(d) listing process is given below in the Assessment Guidelines Section.

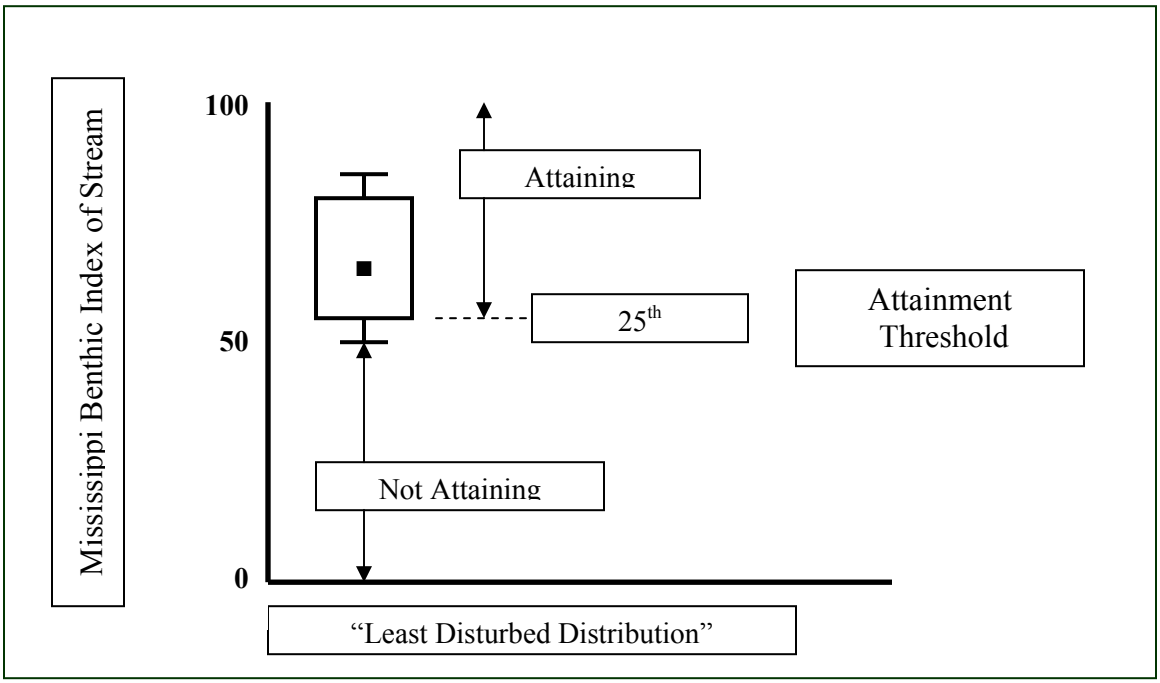

Figure 25: Sample M-BISQ Score Distribution for a Bioregional Comparison Set

M-BISQ Assessment Guidelines for the 2006 §303(d) Assessment and Listing Process

1. Streams with initial (first time monitored) 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 initial (first time monitored) 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 2006 §303(d) list.

3. Streams with initial (first time monitored) scores below the attainment threshold (25^{th} percentile) score, but between the attainment threshold score and the minimum score (within the lower quartile) of the comparison set for their respective bioregion, will be considered potentially impaired, and will be re-sampled to confirm their water quality status. These streams are also subject to the following conditions:

    a. Streams with initial M-BISQ site scores in the lower quartile of the comparison set for their respective bioregion, and currently on Mississippi's most recent §303(d) Impaired Waters List, will remain on the list. These streams will be targeted for re-sampling in the next phase of M-BISQ monitoring.

    b. Streams with initial M-BISQ site scores in the lower quartile of the comparison set for their respective bioregion, and **not** on the state's most recent §303(d) Impaired Waters List, will be re-sampled in the next round of M-BISQ sampling. MDEQ recognizes that in the interim, prior to re-sampling, waters in the lower quartile will need special consideration because of the possibility of being impaired. 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 in the lower quartile will be thoughtfully and carefully reviewed.

4. For re-sampled streams having two M-BISQ scores, both scores will be taken into account when making water quality assessment and listing decisions. Before using multiple IBI scores from a given site, the following conditions will be considered:

    - Each M-BISQ score was developed according to M-BISQ methodology and is QA-approved,
    - Each M-BISQ score was obtained within the applicable five-year data window for the §305(b) reporting period,
    - Environmental conditions (climatic and flow) were basically the same at the site for both M –BISQ sampling events.

    When these conditions are met and both scores are within 20 points of each other, and therefore, statistically, the same score (any one score alone has a confidence interval

of ±10 points), then the two scores will be averaged. Based on this average score, the site will be assessed as follows:

- If the average score falls below the 25th percentile of the comparison set, the site will be assessed as "not attaining" and the stream will be added to, or remain on, the §303(d) list provided a TMDL has not been completed.
- If the average score falls at or above the 25th percentile of the comparison set, the site will be assessed as "attaining" and removed from the §303(d) list, if previously listed.

5. Exceptions to the methodology, outlined in No. 4 above, include cases where:

    - The initial score is in the lower quartile of the comparison set (potentially "not attaining"), and the subsequent score is at or above the 25th percentile of the comparison set ("attaining") but the average score is in the lower quartile;
    - One score is above the 25th percentile of the comparison set ("attaining") and one score is below the minimum score of the comparison set ("not attaining"); or
    - The initial score is at or above the 25th percentile of the comparison set ("attaining"), and the other is in the lower quartile of the comparison set, (potentially "not attaining"), with the average also being in the lower quartile.

    In these cases no changes will be made to the initial assessment based on the first M-BISQ score developed. These sites will be targeted for re-sampling (i.e., a third sample) prior to a final assessment decision.

6. If the individual M-BISQ scores of the two sampling events at the same sampling location are substantially different (> 20 points), the difference will be investigated. The significant difference in scores may indicate that site conditions changed or that one of the scores may not be representative of the ambient condition (i.e. an anomalous event). In these cases, additional data review for the two sampling events will be performed by MDEQ's Field Services Division Biological Services Section (BSS) to evaluate possible conditions that account for the large variability and to determine which, if either, of the two scores is more representative of current water quality conditions at the site. Based on this evaluation, the following conditions will apply in using these scores for assessments:

    - If the reason for the discrepancy in scores can not be determined, the most recent score will be used and assessments made by using the 25th percentile of the comparison set.
    - If the reason for the discrepancy in scores is determined, the score most representative of current site specific water quality conditions will be used and assessments made using the 25th percentile of the comparison set.

APPENDIX B

Review of Surface Water Monitoring Data for Compelling Evidence of Water Quality Problems

Review of Surface Water Monitoring Data for Compelling Evidence of Water Quality Problems

In accordance with Mississippi's 2006 CALM for Federal Clean Water Act Section 305(b) assessment and Section 303(d) listing, MDEQ will solicit and consider all readily available water quality data and information collected by MDEQ, other State and Federal agencies, and the public for the most recent five years prior to the assessment. 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 the CALM document for data quality, quantity, and sampling frequency requirements. For data failing to meet CALM data sufficiency requirements, a documented effort will be to scientifically review "all existing and readily-available" data, both MDEQ and third-party, for compelling evidence of water quality impairment. The primary purpose of this water quality review is to identify any compelling evidence of potential impairment for a water body as indicated by chronic or severe water quality problems to ensure adequate protection of aquatic life and the public.

This technical review will specifically target the large amount of data, both MDEQ and third-party, that does not meet the rigorous quality, quantity, and sampling frequency requirements of the Mississippi CALM. For data determined to not meet CALM requirements, the data will not be disregarded and the data and information "will be used for a listing decision when those data demonstrate compelling evidence of the water quality degradation of a water body (i.e., catastrophic or obvious environmental or public health impacts) and the data is supported by data quality documentation…" Consequently, based upon the compelling evidence review, water bodies with data demonstrating potential impairment, although not meeting CALM, will be designated as non-attaining for §305(b) assessment and subsequent §303(d) listing if there is data quality documentation and strong compelling evidence of gross impairment. For sites identified through this review as potentially impaired, but with less compelling evidence or a lesser degree of potential impairment, the water body will be recommended for future additional monitoring to confirm or verify potential water quality impairment.

Data Availability for Compelling Evidence Review

Data utilized in this review will include surface water chemical/physical and chlorophyll-a data as collected statewide by MDEQ staff, MDEQ contractors and partners, and other natural resource agencies in rivers, streams, lakes, estuaries, and coastal waters during the 2006 §305(b) five year reporting data window (2000-2005). Data from a total of approximately 1500 monitoring stations will be reviewed during this compelling evidence effort. For MDEQ data, this compelling evidence review involved the following "readily-available" MDEQ data in WADES or via EXCEL spreadsheet:

- MDEQ Ambient Fixed Network Program (~112 statewide chemical stations sampled in 2000 and 2001)
- MDEQ Rotating Basin Networks (basin network sites sampled in the CY2000 Basin Planning Approach – BB, PA, PL, SI, TB, TN)

- MDEQ Beach Network (22 coastal sites with monthly water chemistry sampling from CY2000 through CY2004)
- MDEQ/EPA National Coastal Assessment (NCA) Program (~ 235 total estuarine stations sampled probabilistically in Mississippi coastal waters from CY2000 through CY2004)
- Intensive Surveys (model studies) and Special Studies for MDEQ Surface Water Programs conducted from CY2000 through CY2004 (WLA, 303(d)/TMDL, water quality standards such as nutrient criteria development – lakes, estuaries, and wadeable streams and rivers(WSR), and NPS investigations)

For the 2006 §305(b) assessment, MDEQ will also solicit monitoring data from third-party sources and queries from STORET. Based upon this solicitation and query, the only non-MDEQ surface water data available for use in the 2006 assessment will be data from the US EPA and the United States Geological Survey (USGS). If it was determined that the data did not meet Mississippi CALM quantity and sampling frequency requirements for §305(b) / §303(d) assessment, the data will be reviewed for compelling evidence of potential impairment.

Compelling Evidence Decision Guidelines

Compelling evidence of ALUS water quality degradation is defined as potential catastrophic or obvious environmental or aquatic life use impacts as identified based on best professional judgment and interpretation of chemical / physical and biological (chlorophyll-a) water quality data for the reporting period (five years). For data to be considered as indicative of compelling evidence of potential impairment of ALUS, the following general guidelines will be utilized:

1. > 25% violation or exceedence of a numeric water quality standard (WQS) criterion as specified in the current edition of the state's WQS document (State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters, MDEQ 2003).
2. Among the conventional parameters, low dissolved oxygen (DO) must be one of the violating causes in order for the water body to be considered as potentially impaired (non-attaining) for ALUS and be recommended for incorporation into the formal §305(b) assessment (i.e. if nutrients and low pH were in violation, but not DO, MDEQ will not view this as indicative of a degraded ALUS condition due to the state's lack of nutrient criteria and, the preponderance of naturally-acidic soil conditions throughout the state).
3. Greater weight for compelling evidence of potential impairment will be given for water bodies with:
    a. More than a single violation for a chemical / physical parameter
    b. Occurrence of violations in multiple parameter groups (i.e. DO, oxygen demand, water clarity, dissolved solids, nutrients, toxics)
    c. Violations of numeric WQS criteria versus violations of target levels
    d. Higher magnitudes of exceedences versus "borderline" values

The recommendation offered for the final §305(b) assessment or monitoring list decision will be made after considering the results of the compelling evidence analysis for the chemical data along with any other ALUS indicator data (i.e. biological IBI results) available for the water body.