
6. MISSISSIPPI RIVER

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Last updated: 10-2007

Status: Currently in Place

Wisconsin's Mississippi River reach runs 230 miles from the confluence of the St. Croix to the Illinois Border and includes a diverse array of aquatic and terrestrial habitat within this corridor. Eighty percent of this reach (182 miles) is part of the Upper Mississippi River National Wildlife and Fish Refuge, which runs from the Chippewa River mouth to Rock Island, Illinois. The U.S. Corps of Engineers maintains a 9-ft navigation channel and operates 10 locks and dams to facilitate commercial and recreational navigation traffic through Wisconsin's reach. In 1986, Congress recognized the Upper Mississippi River System (UMRS) "as a nationally significant ecosystem and a nationally significant navigation system" (Public Law 99-662). Wisconsin shares its water resource management responsibilities on the Mississippi River with adjoining states (Iowa and Minnesota) and federal agencies and participates in numerous interagency work groups, committees and associations. The Department carries out water quality, fisheries and wildlife management program functions on the Mississippi River through the operation of the Mississippi River Team at La Crosse, Wisconsin (WDNR 1992).

Wisconsin conducts water quality monitoring on the Mississippi River with state-funded programs and federal funding as part of the U.S. Corps of Engineers Environmental Management Program (EMP) Long Term Resource Monitoring Program (LTRMP) and U.S. EPA's Great Rivers Ecosystems Environmental Monitoring and Assessment Program (EMAP-GRE). Monitoring conducted with federal support is primarily conducted by the Department's field station at Onalaska, Wisconsin.

Monitoring Objectives

Clean Water Act Objectives

- Establishing, reviewing and revising water quality standards
- Determining water quality standards attainment
- Identifying impaired waters
- Identifying causes and sources of water quality impairments
- Supporting the implementation of water management programs
- Supporting the evaluation of program effectiveness

Specific objectives

Primary water monitoring objectives for the Mississippi River include:

- Collect vital water quality and aquatic biologic data to assess the river's quality and determine long term trends.
- Develop and utilize essential ecological indicators to assess the health of the Mississippi River.
- Coordinate monitoring efforts with other state, federal or local environmental agencies.
- Support and facilitate data and information sharing between agencies and the public.
- Provide water resource information to support management activities.

Wisconsin's Mississippi River monitoring effort can be grouped into basically three categories, roughly corresponding to the three Tiers of this *Strategy*: condition monitoring, problem assessment, and evaluation monitoring. Each of these categories has specific objectives that have been previously identified based on

past program guidance (WDNR 1992) and are still relevant today. These categories and monitoring objectives are described below.

Condition monitoring includes those activities that characterize the river's condition, uses and trends and identify where there are problems. Key objectives of this work include:

- Evaluate the general water quality conditions, problems and trends through the adoption of an effective water quality monitoring program.
- Determine use classifications and evaluate use support attainment.
- Complete Clean Water Act reporting requirements as defined by Sections 305(b) and 303(d).

Problem Assessment Monitoring includes specific monitoring tasks to identify the causes, sources and extent of surface water quality problems. Key objectives of this work include:

- Assess surface water impacts of point source discharges including the evaluation of receiving water characteristics (mixing zone evaluations) to develop appropriate effluent limitations to achieve water quality standards.
- Evaluate the impacts of nonpoint source pollution on the Mississippi River or its backwaters.
- Identify water quality related-problems and management activities to support and advance habitat improvement projects on the River.
- Evaluate sediment quality conditions and identify contaminated sediment problems on the River.
- Collection of fish and other tissue samples for the consumption advisory program.
- Conduct monitoring evaluations associated with the issuance of Water Quality Certifications (federal dredging activities) and other regulatory actions not specifically linked to WPDES permits.
- Conduct investigations associated with spills, kills, animal wastes and other complaints.

Evaluation Monitoring includes all monitoring activities associated with evaluating the effectiveness of management actions to meet the goal of maintaining water quality standards, beneficial uses and habitat improvement objectives. Key objectives of this work include:

- Conduct compliance monitoring evaluations of WPDES permits and receiving water quality changes associated with point source pollution abatement activities.
- Evaluate the success of nonpoint source pollution control strategies designed to reduce impairments on the River.
- Evaluate compliance imposed by Water Quality Certifications for federal dredging projects on the River.
- Conduct post-project evaluations of habitat improvement projects to determine if project goals and objectives have been achieved.
- Evaluate the effectiveness of sediment remediation activities for the management of in-place pollutants.

Monitoring Design

Mississippi River water quality monitoring is established through the development of work plans as directed by the Water Division. State-sponsored water quality monitoring work efforts are coordinated by the Mississippi River Water Quality Specialist in La Crosse following general program guidance prepared by the Watershed Management and Fisheries Management Bureaus. Monitoring efforts conducted by the LTRMP follow operational plans, cooperative agreements and scopes of work prepared by USGS with input from federal-state partners (EMP Coordinating Committee and LTRMP Analysis Team) (USFWS, 1992).

State-sponsored monitoring activities on the Mississippi River have primarily focused on fixed station, intensive, synoptic and screening-level sampling designs. The federal LTRMP utilizes a probabilistic sampling design (stratified random sampling) as part of its monitoring in Pool 8 (also Pool 4 by MDNR). In the summer of 2004, Wisconsin also implemented monitoring activities on the river as part of the Great River Ecosystems Environmental Monitoring and Assessment Program (EMAP-GRE) in cooperation with EPA and other States. Wisconsin expects to increase use of probabilistic sampling designs on the river in the

future after further evaluations of the LTRMP effort and the EMAP-GRE. Future efforts will involve an assessment of the Department's baseline river monitoring approach on the Mississippi to monitoring efforts conducted as part of LTRMP and EMAP-GRE. In 2006, Wisconsin implemented a new EMAP-GRE-styled monitoring design with Minnesota and U.S. EPA to better assess the status of submersed aquatic vegetation in Pools 1 to 11 (Minneapolis, MN to Dubuque, IA).

Examples of specific baseline implementation activities are provided below. The extent of coverage of the Mississippi River varies according to each specific monitoring program.

- Wisconsin's Long Term Trend (LTT) program monitors at Locks and Dams 3 (Red Wing, MN), 4 (Alma, WI), 8 (Genoa, WI) and 9 (Lynxville, WI). Site-specific variables include general chemistry, field measurements (DO, temperature, pH conductance, and turbidity), low-level metals, light penetration and contaminant analysis of time-integrated composite suspended sediment samples. Sampling frequency ranges from biweekly to semi-annually depending upon the monitoring site and variable measured.
- Bimonthly and monthly fixed station sampling and quarterly stratified random sampling (SRS) of water quality of Pool 4 (Sampled by Minnesota WDNR) and Pool 8 are conducted as part of the LTRMP (Soballe and Fischer 2004). SRS provides a comprehensive pool-wide evaluation of aquatic areas including main channel, side channels, impounded and backwater areas. Monitoring components included water quality, fish, invertebrates (1992-2004 only), and aquatic vegetation. Periodic aerial photo interpretation provides measurements of changes in land use and land cover.
- In the summer of 2004, Wisconsin implemented monitoring activities on the river as part of the Great River Ecosystems Environmental Monitoring and Assessment Program (EMAP-GRE) in cooperation with EPA and 13 States. EMAP-GRE sampling is done using probabilistic sampling design with sites selected randomly within pre-defined study reaches. Twelve site visits per year are conducted by WDNR, supplemented by additional common border sites sampled by Minnesota and Iowa DNRs, for a total of 33 sites sampled each year in Wisconsin waters of the Mississippi River. Samples are taken in three aquatic areas: the main channel, near shore littoral zone, and the riparian zone. Parameters include water quality, plankton, fish, invertebrates, fish contaminant analysis, periphyton, sediment, aquatic vegetation, and riparian habitat. This program does not include impounded or backwater aquatic areas. This monitoring design is standardized by USEPA so that data can be compared from the Mississippi, Missouri and Ohio Rivers.
- Longitudinal water quality synoptic surveys assess main channel water quality and zebra mussel infestation problems during the summer months (July-September). Longitudinal sampling provides a 'snapshot' assessment of the entire main river channel by sampling at nine locations during a single day. Longitudinal zebra mussel sampling began in 1998, with water quality and bacteria added in 2004.
- Multi-agency soft-sediment macroinvertebrate sampling in selected backwater areas is conducted during the fall period.

While coverage of the main channel is generally comprehensive, thousands of acres of backwaters are not regularly monitored. The LTRMP sampling of Pools 4 and 8 provide a detailed assessment of the state of those specific backwaters as indicator sites. Through what is learned in from the LTRMP, EMAP-GRE, and the Department's lakes, nonwadeable rivers, and wetlands monitoring, a more comprehensive sampling design for the river may be constructed in the future if additional resources become available.

Additional Tier 2 and Tier 3 Mississippi River monitoring includes:

- Site specific intensive water quality surveys for use classifications, mixing zone evaluations, in-place pollutant evaluations, nutrient impairment problems, point source impact assessments, spill response monitoring, contaminant screening assessments and other specialized surveys and evaluations are conducted as the need arises.
- Evaluation of habitat rehabilitation projects constructed as part of EMP or Channel Maintenance Plans is conducted using general limnological (DO, temperature, conductivity, transparency, velocity) and hydrologic (velocity/discharge) monitoring (Weaver Bottoms, Pool 5).

Core and Supplemental Water Quality Indicators

Core indicators for aquatic life use support include dissolved oxygen, pH, temperature, toxics and fish. Fecal coliform bacteria and general nutrient enrichment problems (nuisance algae) are used to assess recreational use support. In addition, fish tissue contamination data (primarily PCBs and mercury) are considered when identifying impaired waters for the state's 303(d) list. Supplemental indicators include sedimentation, current velocity, nutrients and light penetration-related measurements (transparency, TSS and turbidity) which have a strong influence on the riverine ecosystem (UMRCC 2000 and River Resources Forum, 2004). Some of these indicators are also used to set goals for habitat improvement projects on the river. Future research and evaluation efforts of ongoing monitoring (LTRMP) and future efforts (EMAP-GRE and other work) will be necessary to define appropriate ecological indicators (fish, invertebrates, aquatic vegetation or other indices) for the River. Staff are working with U.S. EPA, MNDNR, and MNPCA to define best available reference condition for various indicators on the Mississippi River and to develop a bioindicator or index for aquatic macrophytes on the Mississippi River. Staff are also comparing fish sampling methods used to generate fish IBIs with the goal of developing consistent interstate sampling protocols for future IBI development and use.

Quality Assurance

Surface water quality monitoring follows program monitoring protocols as identified in the Wisconsin DNR Field Procedures Manual (<http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/table.htm>) or consistent procedures for monitoring activities not currently identified in the field procedures manual. LTRMP-sponsored monitoring activities follow quality assurance procedures and methods prepared by USGS (Soballe and Fischer 2004). Laboratory analytical methods follow standard operating procedures approved by USEPA. All new staff members receive training in EMAP-GRE and LTRMP protocols and informal annual protocol review/comparison and debriefing sessions are also done by staff before and after the field season.

Data Management

Currently, the main functional centralized database for state-sponsored sediment and water quality monitoring on the Mississippi River is the Lab Portal Database used to manage analytical laboratory results reported to the Department by the Wisconsin State Laboratory of Hygiene. In addition, the Department maintains a Fish/Sediment Contaminant database. These databases are not available to the public or external agencies. The SWIMS system will hold and facilitate easy access to all Mississippi River chemistry data currently held in the lab portal. PC-based Mississippi River data can be migrated to SWIMS in 2006. It is anticipated that the Department will implement EPA's new STORET system in the future to facilitate external transfer of this data. Substantial electronic data records (primarily spreadsheet files) are compiled and maintained in the field office and are made available to other Department programs, the public and other agencies when requested. Continuous water quality and physical measurements are logged electronically in the field and transferred to PCs and external media upon return from field monitoring episodes. Sampling coordinate information has not been standardized but generally follows Legacy STORET procedures using hand held GPS/DGPS equipment. For the Mississippi River, the coordinate system uses latitude longitude or UTM (NAD 83 or NAD 27 datums) because of their common use by other resource agencies on the Mississippi River.

The LTRMP maintains an extensive database on the Internet through a web-based browser (<http://www.umesc.usgs.gov/ltrmp.html#ltrmpdata>) and also makes its information available to partnering agencies and the public on a CD (Spatial Query Tool). LTRMP uses UTM (NAD 27) as its geo-location standard.

EMAP-GRE data will be available to partner agencies in the SWIMS database. EMAP-GRE data is validated by field crew leaders who collected the data and is also evaluated and verified by EPA staff for consistency and completeness with standard USEPA protocols following this initial validation by field staff. Any problems that surface in the process are resolved prior to final data verification.

Data Analysis/Assessment

Water quality monitoring data collected on the Mississippi River have been reported in the State's 305(b) report (future integrated 303(d)/305(b) Report) and through the preparation of site specific or program-related monitoring reports. An updated Use Support Assessment (attainment of water quality standards) for the Mississippi River has not been completed since the original assessment described in the 1996 305(b) Report as a result of insufficient program guidance, especially the determination of the level of use support (i.e. full, threatened, partial and not supported). Similarly, the Department's 303(d) listing process also lacks clear guidance for defining specific impairment problems (i.e. sedimentation, nutrients etc.) or for removing waters from the list. Past efforts for use support or impairment identifications have primarily relied on best professional judgment. There is a current effort underway to provide consistent statewide guidance for preparing future Use Support assessments or Impairment decisions. Further, greater interstate coordination of Mississippi River Clean Water Act assessment and reporting requirements are being evaluated through work efforts by the Upper Mississippi Basin Association Water Quality Task Force (UMRBA 2004).

LTRMP offers substantial information on water quality, fisheries, vegetation, invertebrate and other environmental data. However, only a few water quality variables (DO, pH, ammonia) have specific water quality criteria from which to assess standard exceedances. This should be addressed by the upcoming guidance on Water Quality Standards. Further, there are no generally recognized biologic criteria or other ecological indicators identified for the River from which to assess attainment with state water quality standards. Future evaluations of LTRMP, EMAP-GRE and other state data (large river IBI/HBI etc) will be necessary to define key ecological indices for defining ecosystem health on the River. Once these ecological indicators are documented and accepted, they then can be considered for future narrative or numeric criteria as well as used in future Clean Water Act assessment and reporting requirements. Stated goals of the EMAP-GRE program include working towards developing quantitative, numeric criteria and standards, with emphasis on developing appropriate biocriteria and best available/best attainable reference condition for great rivers.

Reporting

State-sponsored water quality monitoring activities on the Mississippi River are reported through numerous activities including the integrated 303(d)/305(b) Report, receiving water use classification surveys, responses to WPDES/NPDES permit reviews, technical and summary project reports, web-based reporting, professional meetings, and intra- and interagency data requests. Sullivan (2000) has described a summary of the WDNR's long-term water quality trends evaluation on the Mississippi River for the period 1977 to 1998. Reports on state-sponsored water quality monitoring work on the Mississippi River are available from the Mississippi River Team in La Crosse or the WDNR's Central Library in Madison.

WDNR participates extensively with partnering agencies to prepare water quality assessment work and related documents through the Upper Mississippi River Conservation Committee Water Quality Technical Section and Upper Mississippi River Basin Association Water Quality Task Force. Recent examples of interagency reporting activities include a multi-agency water quality assessment of the Mississippi River by the UMRCC (http://www.epa.gov/r5water/umr_wq_assess.htm) and proposed water quality criteria for protecting submersed aquatic vegetation on the Mississippi River (<http://www.mississippi-river.com/umrcc/>).

Numerous LTRMP water quality monitoring reports and other monitoring component information are available in a web-based format or electronically from USGS (<http://www.umesc.usgs.gov/ltrmp.html>). USGS has recently prepared draft 10-year summary reports of their water quality, fish, vegetation and invertebrate monitoring programs.

Programmatic Evaluation

Limited internal evaluation of the WDNR's Mississippi River water quality monitoring activities occurs through program reviews, audits and performance evaluations. External programmatic reviews have been

primarily driven by EPA-funded or sponsored activities including the recent review of the Upper Mississippi River States' Clean Water Act assessment and reporting procedures prepared by the UMRBA Water Quality Task Force (2004).

The LTRMP monitoring activities are evaluated internally by USGS and the US Corps of Engineers (funding agency) and external partners (EMPCC and LTRMP Analysis Team). Monitoring oversight for EMAP-GRE is primarily carried out by U.S. EPA's National Health and Environmental Effects Research Laboratory at Duluth, Minnesota.

General Support and Infrastructure Planning

Staffing - State-sponsored water quality monitoring and assessment work on the Mississippi River is coordinated and carried out by the Mississippi River Water Quality Specialist position with assistance from Mississippi River Team staff (Water Quality Planner, Wildlife Management and Fish and Habitat Programs) when possible. The water quality specialist position's time for conducting monitoring and assessment activities has become restricted as a result of greater involvement and assignment to interagency work activities in recent years (UMRCC Water Quality Technical Section, UMRBA Water Quality Task Force, EMP Analysis Team, Great River Ecosystem EMAP coordination and planning). There is a need for additional water quality staff assistance to carry out water monitoring objectives identified for the Mississippi River. Opportunities for volunteer assistance may be available. Federally sponsored monitoring is largely carried out by the Department's field station consisting of six permanent staff plus up to four Limited Term Employees during spring, summer, and fall sampling.

Laboratory/Funding - Statewide funding for lab support services for state-sponsored Mississippi River monitoring activities has greatly diminished in recent years. Currently only quarterly low-level metals analysis at two sites (Lock and Dams 3 & 4) is funded by the WDNR's statewide long-term trends program. The remaining analytical support needs (ambient monitoring, sediment analysis, nutrient impairment and other special studies) are funded by annual allocations to the Mississippi River Team's Watershed Management program. There will be greater need for lab support services in order to carry out an effective water quality monitoring program on the river in the future. This will be especially true if we employ greater use of probabilistic sampling, analyze for pesticides, "emerging" contaminants or implement new biological monitoring programs to assess use support decisions (i.e. invertebrate enumeration and identification).

The basic monitoring portion of Long Term Resource Monitoring Program (LTRMP) is a Corps of Engineers funded program that sustains five full time employees for Wisconsin DNR. In federal FY08, the LTRM budget provides funding for 4.32 permanent and 0.6 LTE positions. The funding can be subject to annual increases or decreases due to federal budget appropriations. Therefore, Wisconsin DNR staff have supplemented this base funding with Additional Program Elements which is the targeted research portion of the LTRMP. Further funding is also received through the Environmental Monitoring Assessment Program – Great Rivers Ecosystems (EMAP – GRE) which is funded by EPA to assess conditions for the Clean Water Act in the large rivers of the Ohio, Missouri and the Mississippi. EMAP-GRE not only provides a source of additional funding but it also provides different field sampling opportunities for the Wisconsin DNR LTRMP staff. Funding reductions to EPA in January, 2007 have necessitated amending the EMAP grant to reduce work and cost. An initial disbursement of \$495,574 is now covering work in 2006-2009 and an additional \$49,000 has been promised by EPA in 2008 to assure completion of the work and a final report drafted by the end of calendar year 2010.

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