

## 19. Findings and Recommendations

The final section of this report centers on general issues that were uncovered throughout the course of research. There are three key areas under which the monitoring inventory provided valuable information and recommendations for improving overall monitoring in the Lake Michigan basin. These include data gaps and unmet needs; underutilized resources; and monitoring coordination and information sharing. Findings are summarized below for these areas, followed by recommendations for improving monitoring infrastructure and use. For reference purposes, sections are labeled with letters and findings and recommendations are numbered.

### A. Data Gaps and Unmet Needs

This report, and the inventory on which it is based, represent the first effort to account for the range of environmental monitoring in the Lake Michigan basin. The inventory represents the initial approach toward achieving this ambitious goal. It is a framework on which a more complete inventory will eventually be built.

**(1) Finding:** There are several gaps in the inventory that are listed below and throughout the report. While some of these gaps are areas that have not been well covered in the inventory, others may represent gaps in the monitoring coverage. At this point, it is difficult to tell which are gaps in the monitoring inventory and which are actual monitoring gaps. Further improvement of the inventory database is needed to better clarify this distinction.

**(1.1) Recommendation:** *Continue to update the inventory and expand data collection to include all tributaries.* Fourteen tributaries were covered extensively in this project. The update should carry out the same research process with the other tributary watersheds in the basin.

**(2) Finding:** There are several key monitoring areas where little information was received, but where more monitoring is believed to exist. These areas include monitoring for *E. coli*, fish population characteristics, aquatic nuisance species, benthic organisms, wildlife, and habitat. We received some information about *E. coli* monitoring from county health departments and other local agencies, but believe more local agencies conduct such monitoring. For the other areas, we have some evidence to believe that state Departments of Natural Resources and federal agencies such as the U.S. Fish and Wildlife Service, U.S. Forest Service, and U.S. Department of Agriculture conduct monitoring programs in these areas. We received limited information about efforts made in specific watersheds by these agencies, but most of this information came from indirect sources. It is important that these agencies supply more complete information on their monitoring efforts to improve the overall completeness inventory.

**(2.1) Recommendation:** *Establish better lines of communication with state DNRs, USFWS, USFS, and USDA.* Further work needs to be carried out in order to obtain information from these agencies on their monitoring programs. This will fill in some of the major gaps in the inventory database.

**(2.2) Recommendation:** *Better integrate habitat and wildlife monitoring with traditional water quality monitoring.* One of the most difficult tasks needed to complete the monitoring inventory was to convince natural resource agencies that wildlife and habitat monitoring should be included in the inventory along with more traditional water quality monitoring. Agencies conducting monitoring in these areas must develop a better understanding of how all monitoring information can fit together so that policy makers, residents, and other stakeholders have access to a complete database of environmental monitoring information.

**(3) Finding:** Another result of this initial approach to the monitoring inventory for the Lake Michigan basin was that much of the information included only general information about the geographic location of monitoring sites. Many organizations reported monitoring for parameters across a broad geographic area but did not include specific site references. Locational information is critical if the inventory is to be brought online in a geographically-searchable format.

**(3.1) Recommendation:** *Improve information on the geographic location of monitoring sites.* This is especially true for monitoring programs at the local level. This will require extensive follow-up communication with those who originally reported into the inventory database.

**(4) Finding:** A further gap in the monitoring information obtained for this report, was the lack of complete and continuing coverage of Lake Michigan Mass Balance data. The Mass Balance project was a first of its kind sampling event designed to collect data across several variables in a coordinated fashion. The information produced by a project of this magnitude is valuable throughout the monitoring community. However, a project as large and complex as the Mass Balance project requires substantial time to collect, verify, validate, integrate, analyze, and report on the data. At the time the research for this report was conducted, most of the data from the Mass Balance project was not readily available for public consumption. Therefore, information contained in this report on sampling within the Lake Michigan Mass Balance project is incomplete and limited mostly to sampling location and general sampling focus. The data collected for the project has been quality assured, and, when released, will be more detailed. When these results are released, they will be added to the online version of the inventory database. Additionally, the value of coordinated sampling data (as collected in the Mass Balance project) would be greatly enhanced by a repeat of the sampling event ten years following completion of the original sampling.

**(4.1) Recommendation:** *Initiate planning for a coordinated sampling event for ten years following the initial Mass Balance project, and share data and modeling results with the public in a timely fashion through numerous outlets.*

**(5) Finding:** This initial project specifically avoided attempting to collect information about university monitoring projects. There were two reasons for this. First, much academic research is conducted in one-time, short-term projects, and therefore does not meet the need for baseline information and ongoing monitoring. Second, universities are complex environments with numerous independent research projects being conducted across each campus. However, some academic institutions conduct a number of important ongoing, long-term projects, and information on these projects should be included in the inventory. Sea Grant programs and other institutes catalog the university work they fund. Closer ties need to be established with these programs and such efforts need to be expanded throughout the basin.

**(5.1) Recommendation:** *Include academic research and data collection efforts in future updates to the monitoring inventory.*

**(6) Finding:** While a number of LaMP pollutants, such as mercury and copper, are monitored extensively across the basin, it has been difficult to find monitoring information on some of the other pollutants. These under-monitored pollutants include all the emerging LaMP pollutants, along with DDT, HCBs, toxaphene, and PAHs. The need for monitoring of these pollutants should be clarified.

**(6.1) Recommendation:** *Further examine the monitoring coverage of specific LaMP critical pollutants and emerging pollutants.*

## B. Underutilized Resources

Along with the gaps in monitoring coverage identified in this project, some resources in the basin were also discovered that do not appear to be fully utilized. Monitoring is an area of environmental management that has often been underfunded in the past. Therefore, in order to achieve the most complete monitoring coverage possible, one must take advantage of all available resources. If resources, such as monitoring personnel, go unutilized, then some aspects of a complete monitoring coverage must be sacrificed. To avoid such a sacrifice, creative methods must be used to combine these underutilized resources with other monitoring programs.

**(1) Finding:** One of these underutilized resources is volunteer groups. These groups represent a vast pool of potential data collection personnel. Most of the volunteer groups currently engage in some form of monitoring, but often their efforts are not incorporated into state or regional monitoring plans, and the information collected is only reported internally or locally. These volunteers need to be better enabled to contribute to regional monitoring efforts. The challenge lies in preparing volunteers to collect environmental information in such a way that it is both accurate and relevant to regional needs, and of sufficient quality to be useful for resource managers and policy makers.

**(1.1) Recommendation:** *Take better advantage of relatively untapped volunteer monitoring resources.*

**(2) Finding:** Another group that is underutilized is local agencies. Examples of such agencies are health departments, conservation districts, and planning agencies. In many cases, these agencies are already engaged in monitoring to serve their local needs. Most of the agencies employ professionals trained to accurately monitor environmental parameters. These groups were discovered sporadically in the process of constructing the monitoring inventory. Several health departments reported monitoring of surface and ground waters for *E. coli*, coliform, and other contaminants of special interest to public health officials. Conservation districts may individually be monitoring for a number of parameters related to nonpoint source pollution, general water quality, or other issues. Planning agencies or commissions track population, mass transportation status and other land use characteristics for planning and funding purposes. It is likely that other similar agencies are also conducting monitoring programs. Information on these programs needs to be incorporated into the inventory. Also, there is an opportunity to link these agencies into basinwide monitoring efforts.

**(2.1) Recommendation:** *Take better advantage of local agencies such as health departments, conservation districts and planning agencies.*

**(3) Finding:** To best capitalize on these underutilized resources, it is important that these local groups (both volunteer groups and local agencies) be linked into basinwide efforts, but at the same time retain their local focus and discretion. Much of the energy that maintains these groups arises from a focus on local problems. While this is important, the value of their data to the larger basin is often overlooked. Linkages need to be made between local groups throughout the basin. However, such a basinwide focus needs to incorporate local data collectors in a way that is locally-driven.

**(3.1) Recommendation:** *Establish a better framework for bottom-up monitoring program linkages.*

**(4) Finding:** Part of the difficulty in using data collected at the local level is that there are few standards at the basinwide level to knit the data together. The local focus of the data collection effort often will leave the data incompatible with other data from neighboring localities. In order to use locally-driven data, the aspects of the collection and reporting processes need to be standardized across the basin. This standardization will

make local monitoring results more widely usable and allow for aggregation and analysis across the basin as a whole.

**(4.1) Recommendation:** *Standardize data collection and reporting.*

## **C. Monitoring Coordination and Information Sharing**

The final issue area does not involve direct monitoring, but responds to the need to coordinate monitoring efforts. As should be obvious from this report, there are a wide array of organizations involved in monitoring at the federal, state and local levels. However, no single organization is responsible for planning, coordinating, or disseminating monitoring efforts for the entire Lake Michigan basin. In the absence of a single organization, a council of organizations has formed to take on this task — the Lake Michigan Monitoring Coordination Council. The council's task — to coordinate monitoring efforts for basinwide goals — is a difficult one. However, several steps could be taken to improve the prospects of this coordination.

**(1) Finding:** A major coordination problem is the lack of a central source for monitoring information. The inventory that this report evaluates is the first step toward creating such a central source. However, this one-time inventory is currently not universally accessible and may quickly become dated if the database is not continually updated by monitoring organizations in the basin. Therefore, these monitoring organizations need to be encouraged to report on their monitoring projects continually into a universally-accessible database. This database should contain proper metadata about the monitoring program and the data that is reported. Eventually, this database should directly link to monitoring data, wherever possible. The database should be developed for the Internet and allow for the metadata to be searched geographically and by metadata content.

**(1.1) Recommendation:** *Encourage state, federal, tribal, and local agencies to report monitoring coverage and results to a meta-database with universal access.*

**(1.2) Recommendation:** *Develop an online database of monitoring information that is geographically-based, and content-searchable.*

**(2) Finding:** Beyond creating and reporting to a shared database of monitoring program information, it would be most effective to link monitoring programs into a coordinated network. As it is, organizations make most, if not all, decisions about their monitoring programs based on goals for their local coverage area. Rarely does this area cover the entire Lake Michigan basin. Without a coordinated network, basinwide goals may go unmet. Several actions must be taken to make sure this network can successfully address basinwide goals. First, the network must contain all the necessary components for complete coverage. This means that common indicators need to be agreed upon for the basin, and all organizations monitoring for indicator data need to be included in the network. State of the Lake Ecosystem Conference (SOLEC) and LaMP indicators have already been established and should be adapted or condensed for use in the network. After this, a set of standard methods should be established for monitoring the agreed upon indicators within the basin. Standard methods will ensure that data is comparable and able to be combined for analysis across the basin.

**(2.1) Recommendation:** *Develop and coordinate the implementation of comparable methods to collect indicator data in a coordinated network.*