

# The Lake Michigan Watershed

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# Issues

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Major management issues in Lake Michigan and the surrounding watersheds relate to sustaining beneficial uses through continued remediation in ten “Areas of Concern” that are experiencing:

- Degradation of benthos
- Impaired food webs because of invasive species
- Fish advisories
- Restricted water supplies
- Loss of habitat (especially coastal wetlands)
- Elevated nutrient loadings and undesirable algae
- Beach closings because of potential pathogenic organisms



# Nutrient issues:

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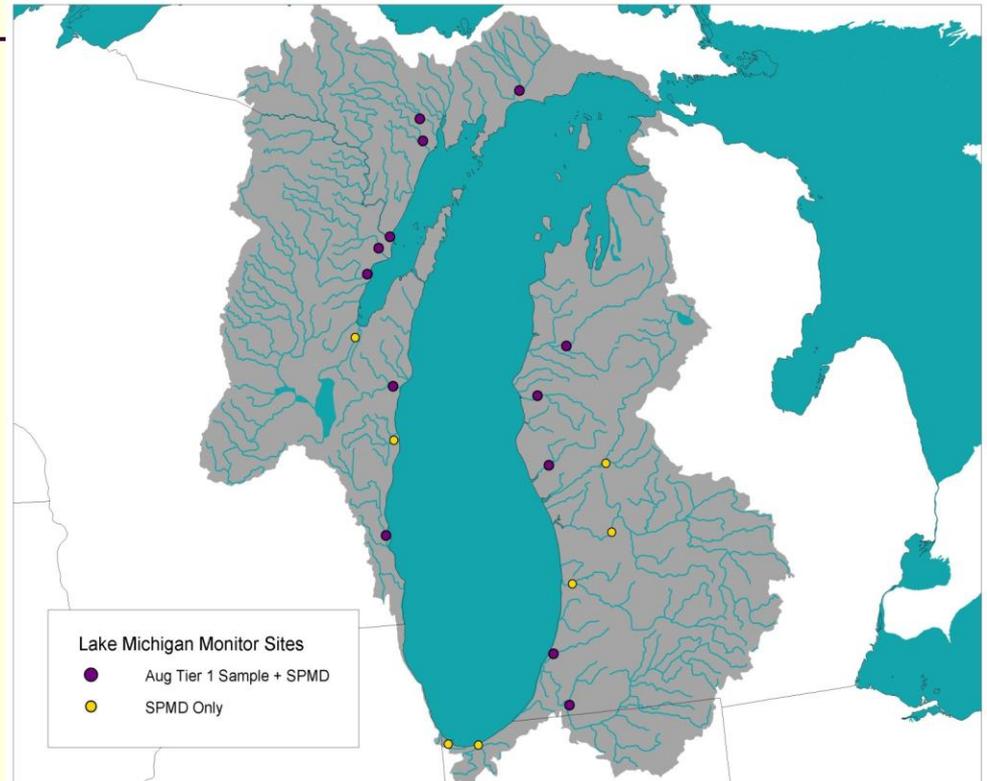
- Elevated nutrient loadings from point and nonpoint sources of pollution from agricultural and urban land and the atmosphere are resulting in excessive growth of algae and other nuisance plants (eutrophication).
- Phosphorus has been identified as the primary nutrient of concern and hence “targets” for phosphorus loads were established in the 1970s and 1980s through Great Lake Water Quality Agreements.
- Subsequent actions resulted in decreased phosphorus loadings that have reduced eutrophication in the open lake.
- Since 1980, phosphorus loadings to Lake Michigan have remained below the targeted loads. Eutrophication issues, however, such as related to nuisance growth of cladophora, now occur in some nearshore areas and embayments.
- Continued monitoring and tracking of nutrient sources and loads from the upstream watersheds and water quality in the nearshore are therefore critical.

# Lake Michigan Rivers Network

Network activities have been ongoing in Lake Michigan since 2007, funded by USGS in support of the Ocean Research Priorities Plan, as well as through the Lake Michigan Monitoring Coordination Council, Great Lakes Restoration Initiative, and other partnerships with local, state, regional, and federal organizations.

A major activity involves monitoring of flow and concentrations of nutrients and other constituents at 20 sites.

Such monitoring (1) enables direct assessment of about 70 percent of total inflow to Lake Michigan; (2) provides information for key geographic and potential pollution-source areas that have not been previously monitored; and, (3) helps to more comprehensively track loadings from the watersheds to the near-shore environments and Lake Michigan.



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**Continuous and real-time monitoring with sensors is conducted at selected sites, including for:**

- **Turbidity**
- **Temperature**
- **Conductivity**
- **Chlorophyll**
- **Dissolved Oxygen**
- **pH**
- **ORP**



**Semi-Permeable Membrane Devices (SPMDs) have been deployed to assess potential toxicity from hydrophobic organic contaminants, such as DDT and other organochlorine pesticides and polychlorinated biphenyls (PCBs).**

**SPMDs are passive samplers for assessing trace levels of hydrophobic organic contaminants and are designed to mimic biological membranes, such as the gills of fish.**





**Automated underwater vehicles (AUVs) are used in the bay of Green Bay and the Milwaukee harbor environments, and produce a continuous stream of high-resolution data for chlorophyll *a*, temperature, conductivity, dissolved oxygen, pH, turbidity, and blue-green algae.**

**The continuous data are integrated with field chemistry samples to develop baseline water-quality monitoring surveys, and mapping of bathymetry, point and non-point sources, and substrate. The AUV technology also will be tested as a possible mechanism to track plumes from tributary mouths through embayments and into the nearshore.**

**(Note: AUVs, such as the YSI Ecomapper shown above, are available from a variety of manufacturers.)**

# Possible Future Efforts

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- Monitor water borne viruses and pathways of contamination.
- Develop statistical relationships (through regressions) between continuously measured parameters and constituents of interest in tributaries and embayments.
- Develop Chromoformic Dissolved Organic Matter (CDOM) sensor technology for embayment and near-shore chemistry

## Lake Michigan Monitoring Coordination Council

**Network data are integrated in a data-management and web services system that is coordinated through the Great Lakes Restoration Initiative.**

**In addition, Network-supported efforts and information contribute to the Near Shore Monitoring Plan of the Lake Michigan Monitoring Coordination Council (LMCC).**

**This Plan describes coordinated monitoring and assessments for tributaries, embayments, and near-shore environments, which will help to track nonpoint sources of nutrients, pesticides, and heavy metals to near-shore environments.**

**In addition, this information will enable evaluation of the health of coastal ecosystems and changes over time, all of which will provide information necessary for managers to make informed decisions, adapt their actions as needed, and assure effective stewardship of Lake Michigan.**

## Web Access:

Lake Michigan Monitoring Coordination Council:

<http://wi.water.usgs.gov/lmmcc/>

Great Lakes Restoration Initiative:

<http://www.epa.gov/glnpo/glri/>

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*Hydrologists prepare to measure streamflow at the mouth of the Milwaukee River before it enters Lake Michigan.*