



# Wisconsin Water Science Center



## Capabilities Summaries

## Lake Studies

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## Limnological Studies

The Lake Studies Team in the USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin has expertise in hydrologic data-collection in lake settings, water and nutrient budget development, source-loading analysis, and lake water-quality modeling. The Lakes Team is involved in projects of local, regional, and national interest, with a large number of cooperators. The Team provides the scientifically based information needed to:

- describe current and historical characteristics and trophic condition of lakes,
- identify and understand lake water-quality problems,
- provide an understanding of in-lake processes and watershed inputs, and
- determine the effective management actions to protect or restore lakes.

Specific areas of expertise include:

### Monitoring

Lakes are monitored to define their current water quality and trophic status. Lake stage and tributary inflows are monitored to assist in developing water and nutrient budgets. Inflowing streams are monitored by traditional techniques or with acoustic Doppler velocity meters in backwater situations commonly encountered at the mouths of tributaries to lakes. Water-quality sampling in streams is often conducted with automated water samplers. Water-quality problems identified in monitoring projects may provide the basis for proceeding with lake-rehabilitation efforts or a diagnostic study.

### Ground-water interactions

Groundwater can be an important component of lake budgets and must be quantified in order to compile water and nutrient budgets. The team employs groundwater monitoring and modeling where needed to better under-



stand the hydrologic system and a lake's interaction with groundwater.

### Water and Nutrient Budgets

Accurate water and nutrient budgets are needed to identify nutrient sources or causes of water-quality problems in lakes and are necessary for modeling the response in lake water quality to potential changes in nutrient loading. The team is experienced in computing detailed water and nutrient budgets, which account for all major and most minor components of the budgets. Better knowledge of nutrient sources allows planners to focus remediation efforts on those sources where loading reduction will most benefit lake water quality.

### Modeling

Many lakes experience multiple water-quality problems and are in need of rehabilitation measures, or the evaluation of measures already implemented. Lake models are useful in understanding specific processes and estimating how a lake will respond to management actions without the costs of implementing the actions. The Lake Studies Team is experienced in employing eutrophication models such as those contained in the Wisconsin Lake Modeling Suite (WILMS) and BATHTUB to assess changes in water quality in response to changes in nutrient loading. The Lake Studies Team is also experienced in applying process-driven watershed, hydrodynamic, and water-quality models to provide a better understanding of the physical and water-quality dynamics, oxygen distribution, productivity in lakes, and mixing associated with lake aeration.