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Wisconsin Water Science Center

Capabilities Summaries

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Wisconsin Water Science Center, Middleton, Wisconsin

Surface- and Ground-Water Monitoring

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Surface Water and Ground Water Monitoring

The USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin has significant expertise monitoring quantity and quality of surface-water and ground-water systems.

Surface-Water Quantity Monitoring

Continuous streamflow data are collected and computed using traditional and state-of-the-art acoustic methods and the data are posted on the web in real time. These data are used for flood forecasting and emergency flood response, understanding and modeling hydrologic systems, defining flood plains for planning developments, designing and operating hydroelectric, flood control, water supply, and wastewater facilities, designing and sizing bridges and culverts, managing lakes and wetlands, abating and preventing pollution, determining trends in floods and low-flows, and determining the occurrence and distribution of water.

Surface-Water Quality Monitoring

Water samples are collected to describe occurrence and distribution, trends, and modeling of certain pollutants and their relationships between natural factors, land use and water quality, and the relationship between ecological responses and water quality. The WI WSC has developed innovative monitoring capabilities associated with PCB, organics, virus, and pathogens sampling as well as in the areas of flow-composite auto sampling, small plot agricultural sampling, and urban source area sampling.

Ground-Water Quantity Monitoring

Water levels are collected from a statewide monitoring well network to provide information to determine water-level trends and their relationship to water use, climate changes, and land-use changes, and to support modeling efforts to support water use and water availability needs.

Ground-Water Quality Monitoring

Water samples are collected for describing occurrence, distribution and trends of naturally occurring compounds and certain pollutants and their relationships to natural and anthropogenic factors.

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Wisconsin Water Science Center, Middleton, Wisconsin

Aquatic Toxicity Assessments

Contact Steve Corsi (608 821-3835, srcorsi@usgs.gov) or Barbara Scudder (608 821-3832, bscudder@usgs.gov) for more information.

Aquatic Toxicity Assessments

The USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin includes staff with expertise in conducting field-and laboratory-based studies evaluating aquatic toxicity. These studies include aquatic toxicity due to single point-source contributions to receiving waters, due to diffuse nonpoint sources of contamination that may cause aquatic toxicity, or even due to low levels of dissolved oxygen. Techniques used in the WI WSC to evaluate aquatic toxicity include:

In-situ, *Flow-through Chambers*

Long term *in-situ* exposures of organisms to a water body have a distinct application in evaluation of water quality and aquatic toxicity. Continuous exposure can be used as a method to accumulate composite effects of contaminants over a specified period of time. Flow-through fish chambers were developed at the WI WSC for this purpose and can be used to study numerous different situations, including:

Mortality

For strong aquatic toxicity signals, fish are exposed to a water body with potential for toxic effects (the test site) and survival of the fish is compared against a parallel exposure in a site with relatively good water quality and little potential for toxic impact (the reference site). Reduced survival in the test site as compared to the reference site indicates toxicity. Identification of water bodies with toxic impact can then be studied in more detail with further in-situ testing or with location and time-specific sampling and subsequent laboratory-based toxicity evaluation to determine sources of toxicity.

Reproduction

To measure effects on reproduction to Fathead minnows, pairs of the minnows are exposed to the water body at the test site in flow through chambers during periods with ideal water temperature and light cycle. The number of eggs produced by each pair is counted and compared against a parallel exposure at a reference site.

Bioaccumulation

To measure the extent to which a contaminant bioaccumulates in fish, they are exposed to a water body of interest for extended time periods. Fish tissues are then analyzed for the contaminant of interest and contamination levels are compared to fish tissues from a parallel reference site exposure or laboratory exposure.

Laboratory-based toxicity evaluation

Water bodies with potential for toxic impact are evaluated by time- and location-specific sampling and sent to a range of possible laboratories for bioassay testing using various different organisms and test methods depending on the specific toxic effect under study. Sampling is targeted at specific time periods such as baseflow conditions or runoff conditions, or in reference to specific locations with potential toxic impact.

Semi-Permeable Membrane Devices (SPMDs)

Semi-permeable membrane devices (SPMDs) mimic biological membranes, such as the gills of fish, and the devices contain a synthetic lipid solution similar to that found in fish. SPMDs are deployed for approximately four weeks in streams and are used to provide time-integrated information on the presence of dissolved (biologically available) hydrophobic organic contaminants in water. Toxicity tests followed by chemical analyses are done using the lipid solutions extracted from the SPMDs. Staff at the WI WSC have experience in interpretation of SPMD results as well as SPMD deployment.

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Wisconsin Water Science Center, Middleton, Wisconsin

Hydrologic Characterization to Understand the Source and Transport of Pathogens

Contact Steve Corsi (608 821-3835, srcorsi@usgs.gov); Randy Hunt (608 821-3847, rjhunt@usgs.gov); Rob Waschbusch (608 821-3868, rjwaschb@usgs.gov); Peter Hughes (608 821-3835, pehughes@usgs.gov); Michelle Lutz (608 821-3816, malutz@usgs.gov); or John Walker (608 821-3853, jfwalker@usgs.gov) for more information.

Hydrologic Characterization to Understand the Source and Transport of Pathogens

The USGS Wisconsin Water Science Center (WI WSC) staff have extensive experience in developing instrumentation and collecting and processing hydrologic data for biological applications. The WI WSC extends industry-standard approaches to develop hydrologic understanding that is commensurate to the biological drivers that affect pathogen source and transport. The experience of the staff emphasizes application of innovative approaches and best available technologies, and employs a variety of commercial and research instrumentation and data processing procedures. Currently, the WI WSC is involved in projects on a local, regional, and national scope, with cooperators both inside and outside of the USGS. The experience of the WI WSC in this field is evidenced by publication of peer-reviewed reports and scientific journal articles. Specific areas of expertise include:

Hydrologic Instrumentation for Pathogen Source and Transport

The WI WSC has developed several sampling designs for intensive characterization of pathogens in surface water. Techniques are based on consideration of hydrologic conditions and specific sampling protocol for individual pathogens such as *Cryptosporidium, Giardia, E. coli* O157:H7, *Salmonella*, and enteric viruses. Stream cross-section integrated manual sampling can be used under steady stream-flow conditions while automatic sampling systems have been designed for unattended sampling during dynamically changing hydrologic conditions to provide comprehensive coverage throughout runoff events. The automatic sampling systems used range from "clean" adaptations of commercially available automatic samplers to in-house designs developed for filtration of large volume samples over extended time periods. These automatic filtration systems include real-time pH adjustment to improve filtration efficiencies and maximize recoveries of viruses.

Hydrologic Characterization for Beach Pathogen Source and Transport

The WI WSC has extended beach sampling beyond traditional indicator organisms such as *E. coli* and fecal coliform to include pathogens with potential to cause human illness through exposure to recreational waters. Traditional beach evaluations have been augmented using specially designed automatic sampling systems triggered during different environmental threshold conditions based on measurements such as rainfall, wave height, wind speed, wind direction, and solar radiation. Relating pathogen occurrence to environmental conditions is important for source identification. Moreover, continuous measurements of environmental conditions can also predict levels of indicator organisms on a real-time basis, thus reducing the reliance on laboratory methods that commonly take 24 hours to produce results.

Hydrologic Characterization for Virus Source and Transport

The WI WSC has used a variety of approaches to relate understanding of the hydrologic system to virus source and transport. Techniques include state-of-the-art ground-water flow models, source-water characterization using water isotopes, age-dating of water, and concurrent analysis of temperature transport. Traditional age-dating chemical techniques can be problematic in studies involving viruses because viral viability in the subsurface is thought to be less than two years. The WI WSC developed and published innovative methods of processing water isotope and temperature data to better constrain the time of transport of recently infiltrated water.

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Ground-Water/Surface-Water Modeling

Contact Charles Dunning (608 821-3827, cdunning@usgs.gov); Randy Hunt (608 821-3847, rjhunt@usgs.gov); Daniel Feinstein (494-962-2582, dtfeinst@usgs.gov); or Steve Westenbroek (608 821-3888, smwesten@usgs.gov) for more information.

Ground-Water and Surface-Water Modeling for Science Support

The USGS Wisconsin Water Science Center (WI WSC) staff have extensive experience in ground-water and surface-water modeling for decision making. The WI WSC uses industry-standard approaches as well as the latest high-end modeling technologies to address local-, watershed-, and regional-scale water resources issues. The experience of the staff emphasizes application of the best technologies available, and has employed a variety of commercial and research codes. The WI WSC has experience with system characterization modeling as well as tailoring modeling tools to specific water resource or ecologic questions. Currently, the WI WSC is involved in projects on a local, regional, and national scope, with cooperators both inside and outside of the USGS. The experience of the WI WSC in this field is evidenced by over 50 peer-reviewed scientific journal articles and USGS reports. Specific areas of expertise include:

Ground-Water-Flow Modeling

The WI WSC focuses on applying state-of-the-art finite-difference (MODFLOW) and analytic element (GFLOW) models to water resources questions. The WI WSC staff have experience with high-end ground-water modeling tools such as sophisticated packages for MODFLOW (LAK, SFR, UZF, GWM), Stochastic MODFLOW and MODPATH, and the Lake and Stream Elements for GFLOW. Emphasis is placed on providing model results in user-accessible formats using two-dimensional and three-dimensional visualization tools such as ModelViewer and ArcView. Both shallow and deep ground-water systems have been simulated in steady-state and transient models.

Coupled Ground-Water/Surface-Water Modeling

The WI WSC work has often explicitly incorporated ground water and surface water as a "single resource"; thus coupled simulation of both systems is needed to answer many water resources problems. The WI WSC has experience with continuous simulations of watershed flow systems using surface-water codes such as MMS and PRMS, and with coupling results of these codes to ground-water simulations using MODFLOW. WI WSC projects have also served as a primary testing ground for the soon-to-be-released USGS code GSFLOW, which couples the surface-water code PRMS to the ground-water code MODFLOW. Staff are also collaborating with the author of the MODFLOW2005 Local Grid Refinement package to develop a tutorial in a setting that highlights the package's ability to improve simulation of the effects of pumping wells near streams.

Transport and Fate Modeling

WI WSC staff have expertise in contaminant simulations that ranges from reactive transport modeling (MT3D, RT3D) to PCB transport models for numerous river systems throughout the state. WI WSC staff have also contributed to model framework development for codes such as EPA's IPX model framework, designed for use in evaluating contaminated sediments.

Model Calibration and Prediction

The WI WSC has extensive experience with calibration and prediction tools such as the parameter estimation codes PEST and UCODE. Due to this experience, WI WSC staff have served as technical resources for model calibration for researchers in and out of the USGS. The WI WSC has a state-of-the-art 10-machine parallel computing array that is dedicated to model calibration and prediction uncertainty evaluations.

Modeling in support of hydroecological studies

The field of hydroecology is relatively new and rapidly evolving, and has become important for linking the underlying hydrologic system to the biota that society holds important. The WI WSC is working with Federal, State, and academic collaborators to develop tools and approaches for characterizing hydrologic systems in ways that are appropriate for ecological investigations and decision making. The WI WSC work has ranged from applications using ground-water/surface-water modeling to understand virus transport to drinking water wells to identification of gaining and losing stretches of streams for stream invertebrate investigation. This work is facilitated by the interdisciplinary strengths of the USGS.

Mercury Research

Contact David Krabbenhoft (608 821-3843, dpkrabbe@usgs.gov); or http://infotrek.er.usgs.gov/mercury for more information.

Science Support for Mercury Research

Mercury is an issue that is currently confronting resource managers and regulators in the US and globally. As recently as ten years ago it would have been difficult to consider remediation strategies, but with a rapidly increasing scientific understanding, possible solutions are now being discussed. The Mercury Research Lab (WMRL) in the USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin is a national leader in mercury research and a major contributor in many areas of advancing scientific understanding. The WMRL provides expert assistance to the USGS and other State and Federal agencies. Assistance is provided through execution of studies, sample analysis for the Bureau and other federal and state agencies, methods development for field and lab procedures, interpreting data, and drafting reports. We strive to provide the best possible data and service by remaining on the cutting edge of mercury research, and maintaining a state-of-the-art mercury analysis laboratory.

Low-Level Speciation Analysis

As recently as 15 years ago, researchers could not reliably measure the concentration of mercury in environmental samples due to the very low levels generally observed. The WMRL has a well-established, international reputation for excellence in the quantification and speciation of mercury in all forms of environmental samples (water, sediment, biota, and air). We have developed and published papers for most of our methods, but will always continue to strive to improve our capabilities. As new approaches or ideas come forth and provide promise for improved speciation, sensitivity, or sample through-put, the WMRL will seek to employ these procedures.

Scientific Leadership, Study Design, and Execution

The WMRL is involved in studies from Alaska to Florida, and from California to Maine. Our studies are always on the leading edge among researchers internationally, and often are done collaboratively with large research teams both within the USGS and outside the Bureau. Often our projects are designed to provide an answer to land-resource management questions from DOI agencies or other state and federal agencies. Researchers from the WMRL are available to provide scientific consultation regarding local and regional mercury issues.

Geomorphic and Sediment Assessments

Contact Faith Fitzpatrick (608 821-3818, fafitzpa@usgs.gov); Peter Hughes (608 821-3833, pehughes@usgs.gov) for more information.

Geomorphic and Sediment Assessments

The USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin has uniquely experienced staff for field-based geomorphic assessments and sediment transfer studies. These studies cover a range of issues and scales from historical trends in habitat to restoration monitoring and tracking transport of contaminants. The multi-disciplinary backgrounds of the team include the fields of geomorphology, hydraulics, engineering, geology, physical geography, hydrology, ecology, and GIS.

Historical geomorphic assessments

Historical geomorphic assessments study the movement of sediment and changes in geomorphic processes associated with land-cover change within the context of local geologic setting, drainage network position, and flood history. The studies involve determinations of human versus natural changes in sediment sources and sinks, causes for habitat degradation, and predicting geomorphic response and sensitivity to future changes in runoff or channel conditions. Studies typically compare pre-European settlement or Holocene conditions with present conditions. These studies tend to involve a combination of GIS mapping and field surveying and coring. These studies may also involve modeling channel hydraulics, watershed runoff, and sediment transport.

Geomorphic Monitoring

The staff is experienced at geomorphic, hydrologic, and sediment transport monitoring associated with restoration/rehabilitation projects and best management practices.

Contaminants in Sediment

The staff is experienced in sampling sediment for organic compounds and trace elements associated with contaminant studies. Techniques include sampling inundated, dry, exposed, and buried sediment. The deposits typically are described in terms of their geomorphic context, age, and flood history. Many studies have involved impoundment surveys of sediment volume and thickness.

Habitat Assessments

The staff is capable of conducting a variety of habitat assessments. Typically these are done in concert with a multidisciplinary water quality, sediment transport, or geomorphic study. Familiar methods include national and state, semi-quantitative and qualitative techniques.

Drilling Operations Group

Contact Jim Rauman (608 821-3871, jmrauman@usgs.gov); or Chuck Dunning (608 821-3827, cdunning@usgs.gov) for more information.

Drilling Operations

The Drilling Operations Group in the USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin provides site characterization for a broad spectrum of hydrologic studies and support for state and national hydrologic research. The Group is made up of experienced personnel who understand the strict scientific objectives of field investigations. The Group provides drilling and testing expertise, and the onsite flexibility necessary to achieve scientific objectives. An extensive collection of equipment is on hand to provide a full range of drilling, augering, direct push, sample recovery, and aquifer-testing capabilities.

Soil Profiling

Soil profiling is conducted with either of two Geoprobes (ATV-mounted Geoprobe 4220 and track-mounted Geoprobe 66DT). State-of-the-art geoprobe equipment and techniques are used to assess and recover soil-profile samples, identify water-table levels, and recover water samples for water-quality analyses.

Well and piezometer installation

The complete range of well and piezometer installation, and unconsolidated and hardrock core recovery, is conducted using a CME 75 Drill Rig.

Aquifer Testing

An extensive collection of inflatable packers, down-hole pumps, and pressure transducers are utilized for a wide range of aquifer testing using a Smeal 5-ton Hoisting/Packer Rig.

Innovative field applications

The Drilling Operations Group capabilities are continually expanded through innovative field applications developed through projects undertaken with other USGS Science Centers, other federal agencies, state and university partners, and colleagues in private industry.

Non-Point Evaluation Studies

Contact Dave Graczyk (608 821-3840, dgraczyk@usgs.gov); or Bill Selbig (608 821-3823, wrselbig@usgs.gov) for more information.

Non-Point Evaluation Studies

The Non-Point Evaluation Monitoring Team (NPE) in the USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin provides expertise in instrumentation, data collection, and data analyses for both rural and urban non-point source research projects. These research efforts are adding to the comprehensive database needed by the non-point research community to help resolve the most pressing non-point issues on both a local and national scale. Data is being collected at plot, field, and whole watersheds scales.

Urban Monitoring

The team is evaluating single practices and end-of-the-pipe treatment devices. These devices are being used in urban areas by municipalities to improve urban storm-water quality and to meet permit requirements mandated by State and Federal legislation. The team is a leader in evaluating street sweeping as one of these practices to improve water quality in urban areas.

Rural Monitoring

The NPE team is evaluating best management practices and their effect on water quality in rural watersheds. Rural watersheds are being monitored for streamflow and water quality during the pre- and post- implementation periods. The data is being used to determine if water quality has improved and if these changes can be attributed to the implementation of BMP's.

Instrumentation

The NPE is a leader in the utilization of equipment for monitoring water quality of urban and rural watersheds. The NPE has used innovative techniques to monitor snowmelt runoff at remote field sites. The NPE is also monitoring storm-water flows in closed storm sewers and collecting water-quality samples at the inlets and outlets of single-treatment devices.

Modeling

The NPE continues to collect data that are used in calibration and verification of the SLAMM model. The SLAMM model is used extensively by consultants for urban non-point evaluation efforts in Wisconsin. The model is continually being enhanced using actual field data collected by the team.

Database Applications

Contact Harry House (608 821-3876, hrhouse@usgs.gov); Nate Booth (608 821-3822, nlbooth@ usgs.gov); or http://infotrek.er.usgs.gov for more information.

Database Applications for Science Support

The Middleton Data Center (MDC) Team in the USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin is dedicated to the deployment of high-end information technology products to enhance data storage and access methods against natural resources datasets. The MDC emphasizes out-of-the box solutions whenever practical, and browser-based access to database servers via the World Wide Web. Currently, the MDC is involved in projects on a local, regional, and national scope, with cooperators both inside and outside of the USGS. Specific areas of expertise include:

Data Warehousing

The MDC is experienced in all aspects of small to medium-size data warehouse projects. This includes requirements gathering, data modeling, data cleansing and loading, application development, and user support. Data loading is typically performed via Informatica Powercenter technology. The MDC has experience with data reporting through Oracle Discoverer and Oracle Developer Reports. Additionally, seamless interactions between ad-hoc query, mapping, and charting can be built into a single application.

Transactional Data Systems

The MDC provides transactional data system support for a variety of regional and national level projects. The MDC has expertise in creating data entry forms with technologies including Oracle Developer Forms, Oracle Designer Webserver Generator forms, Oracle Applications Express, and custom-coded Java.

Geospatial Applications

The MDC uses Oracle Spatial technology to create dynamic mapping applications that run in a browser window and require no special software. Oracle Spatial technology places geospatial data directly in the database alongside measured result values, allowing spatial criteria, such as the intersection of a watershed and management area, to be used as selection criteria for statistical data analysis. Unlike traditional spatial systems, geospatial data and analytical operations are accessed via SQL, opening the data to any application that can pass SQL to the database.

Charting and Graphing

The MDC is experienced in developing dynamic, scientific-style charts and graphs against data warehouse content available on the Web. Visual Mining's Netcharts Pro is used as an underlying technology in this regard.

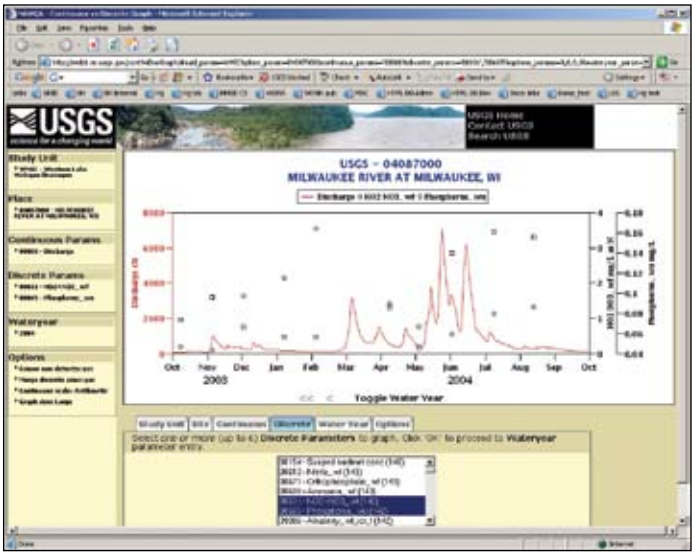
Oracle Coordination within the USGS

Oracle Database Security

The MDC Director is the lead coordinator of the USGS efforts to secure all Oracle Databases within the USGS. This includes development of a nationwide monitoring network based on Oracle Grid Control.

Oracle Technologies

The MDC Director is the leader of the USGS Oracle Technologies program. In that role, he is expected to maintain an awareness of current Oracle technologies, as well as be aware of how individual USGS personnel or groups are using various Oracle technologies. He acts as a point-of-contact to facilitate Bureau-wide Oracle initiatives, as well as disseminate timely information to the USGS Oracle community.



Lake Studies

Contact Herb Garn (608-821-3828) hsgarn@usgs.gov; Dale Robertson (608 821-3867, dzrobert@usgs.gov); or Bill Rose (608 821-3834, wjrose@usgs.gov) for more information.

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

Ground water can be an important component of lake budgets and must be quantified in order to compile water and nutrient budgets. The team employs ground-water monitoring and modeling where needed to better understand the hydrologic system and a lake's interaction with ground water.

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.

Regional Water-Quality Modeling

Contact Dale M. Robertson (608-821-3867, dzrobert@usgs.gov); or David A. Saad (608-821-3865, dasaad@usgs.gov) for more information.

Regional Water-Quality Modeling

The USGS Wisconsin Water Science Center in Middleton, Wisconsin conducts regional water-quality modeling studies of rivers and streams to: describe patterns in present and reference water-quality concentrations and loads, provide information to help develop nutrient and sediment criteria, provide information to help establish and design monitoring studies, and understand the factors affecting stream-water quality. Information from these studies can provide assistance in:

Sampling strategies and monitoring design

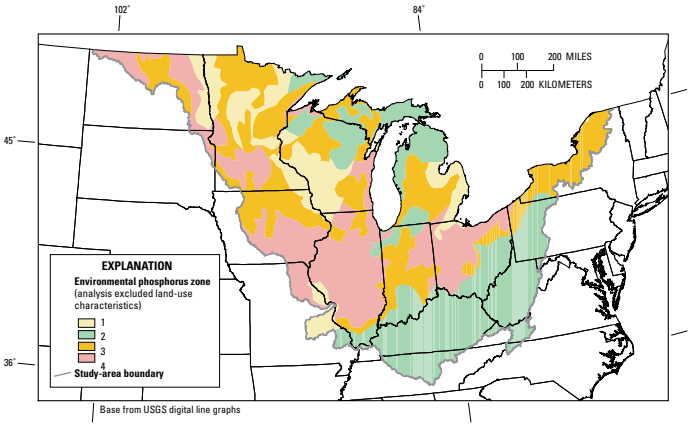
Detailed water-quality data collected at selected stream sites have been used to determine how different temporal sampling strategies affect estimated concentrations and loads. This information has been used to guide the design of State and Federal monitoring programs.

Estimating background/reference water quality in rivers and streams

Spatial Regression-Tree Analysis (SPARTA) has been used to determine the environmental factors most strongly related to stream-water quality, estimate background/reference water-quality conditions, and to delineate the geographical area each reference condition represents. This information has been used to determine if sites are degraded from background conditions and rank the sites based on their exceedence over background conditions. This information has also been used to help develop nutrient criteria for rivers and streams.

Estimating water quality in unmonitored streams and total downstream transport

Based on available water-quality and stream-flow data, the Spatially Referenced Regressions on Watershed Attributes (SPARROW) model is being used to provide estimates of nutrient and suspended sediment concentrations, yields, and transport from monitored and unmonitored watersheds throughout the upper Midwest. This information can be used to understand ranges in loading from all watersheds and rank sites based on their contributions to downstream areas.



Geographic Information Systems

Contact Jana Stewart (608-821-3855, jsstewar@usgs.gov); David Saad (608-821-3865, dasaad@usgs.gov); Nate Booth (608-821-3822, nlbooth@usgs.gov); Jim Kennedy (608-821-3813, lkennedy@usgs.gov) or Judy Horwatich (608-821-3874, jahorwat@usgs.gov) for more information.

Geographic Information Systems and spatial data

The USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin includes staff with expertise in using geographic information systems (GIS) for scientific investigations. Our expertise includes the creation and publication of spatial data as well as spatial data analysis and mapping at local, regional and national scales. The WI WSC staff has the expertise to convert spatial data into model input for many of the surface-water and ground-water models used in scientific investigations. They also have the expertise to link spatial themes to regional and national databases that can be displayed and queried via the Web.

Spatial data development, mapping, analysis, and publishing

Spatial data are used routinely by WI WSC staff in scientific investigations for characterizing and understanding hydrologic and ecological resources in relation to natural and anthropogenic factors. WI WSC staff has expertise with a variety of software programs that can be used for spatial data creation, mapping, analysis, and modeling including the widely used ArcGIS programs (ArcInfo Workstation, ArcMap, Arcview). WI WSC staff has extensive experience with creating maps for use in USGS and non-USGS publications as well as experience in preparing and publishing spatial data and associated metadata as USGS Digital Data Series reports.

Spatial data and modeling

Many of the scientific investigations undertaken by the USGS include models that simulate the environment. These models typically require a variety of spatial data for input. The WI WSC staff has the expertise to quickly and efficiently process spatial data to create input for local and regional ground-water models such as MODFLOW and GFLOW as well as surface-water models such as PRMS and SWAT. The staff also has expertise to process spatial data at regional and national scales for use with large-scale surface-water-quality models such as SPARROW and SPARTA, and for regional ecological and landscape models, such as those used as part of the Great Lakes Aquatic GAP project.

Display and query spatial data via the Web

The WI WSC Middleton Data Center staff develops web-based GIS data discovery and model-based decision support tools for local, regional and national cooperators. These interfaces generally follow an approach where project specific information is anchored in a data warehouse and supporting spatial information is provided through web services from the USGS National Map. This design allows for extending existing applications for a broad user base or into new areas of spatial information and leverages the USGS investment in a national seamless spatial data catalog. Current WI WSC projects that use these tools include: USGS NAWQA Data Warehouse, USGS NAWQA Watershed Regressions for Pesticides (WARP) Model and USGS NAWQA SPAtially Referenced Regressions On Watershed attributes (SPARROW) Decision Support Tool, WDNR Wisconsin Fish Mapper, Wisconsin Beach Health program, and Milwaukee Metropolitan Sewerage District water quality database.