IDEM

Indiana Department of
Environmental Management

Indiana Integrated Water Monitoring and Assessment Report to the U.S. EPA

2012

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EXECUTIVE SUMMARY

Section 305(b) of the federal Clean Water Act (CWA) requires states to prepare and submit a water quality assessment report of state water resources to the U.S. Environmental Protection Agency (U.S. EPA) every two years. States are also required to develop and submit a list of impaired waters to U.S. EPA for approval under CWA Section 303(d).

IDEM used data it collected and data collected by other organizations to develop this report. IDEM's solicitation, review and use of external data are described in detail in the section of this report entitled, Assessment Methodology and Summary Data. IDEM data used to develop this report were collected in accordance with IDEM's water quality monitoring strategy (WQMS), which describes a five-year basin rotation approach to monitoring for CWA purposes. Using this strategy, one to two basins (approximately 20% of the state) were monitored each year, which provided a comprehensive statewide data set for assessments every five years. Although the WQMS was revised in 2010 to a nine-year basin rotation, the data used to develop this report were collected using the previous five-year rotating basin approach. These data were reviewed for the purposes of making 305(b) assessment and 303(d) listing decisions using IDEM's consolidated assessment and listing methodology (CALM).

A summary of IDEM's methods for determining support of beneficial uses is provided in the Assessment Methodology and Summary Data Section and IDEM's CALM is provided in its entirety with Indiana's draft 2012 303(d) Impaired Waters List. Indiana's water quality standards provide the basis for IDEM's CWA Section 305(b) water quality assessments, designating the beneficial uses that Indiana waters must support. Of the beneficial uses designated in the state's water quality standards, IDEM assesses aquatic life use support, recreational use support, and support of "fishable" uses. IDEM also assesses drinking water use support on surface waters that

serve as a public water supply. Although there are additional uses designated in Indiana's water quality standards, IDEM limits its assessments to these four uses because the criteria in place to protect them are more stringent than those necessary to protect other uses. Thus, by protecting these four uses, other uses such as agricultural and industrial uses are also supported.

IDEM completed its first comprehensive aquatic life use support assessments for the entire state in 2002 and will report similar information for recreational uses in 2012. The 2002 IR was the state's first baseline report on water quality and has been revised biennially since then. The 2012 IR provides the most recent comprehensive report on Indiana water quality to date.

Results from IDEM's comprehensive use support assessments are provided in this report. Cumulative results for IDEM's stream-specific assessments are summarized in Table 1 (Appendix A). Approximately 72 percent of the 24,232 stream miles assessed for aquatic life use were found to be fully supporting. Approximately 23 percent of the 20,804 stream miles assessed support full body contact recreational use. Almost all of Indiana's 67 miles of Lake Michigan shoreline outside the Indiana Harbor fully supports aquatic life use, while almost none of the shoreline waters support full body contact recreational use.

Causes of nonsupport (impairment) are reported for each waterbody type including rivers and lakes. Lake Michigan and its shoreline in Indiana are discussed in more detail in separate sections of this report. Pathogens are the top cause of stream impairments, impacting more than 16,000 miles of streams. Polychlorinated biphenyl (PCB) in fish tissue impacts more than 4,175 miles while mercury in fish tissue impacts nearly 2,100 miles of streams. More than 4,649 stream miles also have biological communities with measurable adverse response to pollutants.

Potential sources impacting Indiana waters include nonpoint sources that impact almost 11,700 miles of streams, while unknown sources impact nearly 6,600 miles of streams.
IDEM has several programs in place to address nonpoint source pollution. The Nonpoint Source Program and the Total Maximum Daily Load Program work towards restoring waters of the State. The Watershed Specialists promote the holistic watershed approach by working closely with locally-led watershed groups.

INTRODUCTION

States are required by the CWA to prepare a water quality assessment report of state water resources and a list of impaired waters to submit to the U.S. EPA every two years. In 2002, the U.S. EPA encouraged states to combine the information that was previously submitted as two separate reports (the 305(b) water quality monitoring and assessment report and the 303(d) list of impaired waters), into one integrated report following the two-year schedule mandated in CWA section 305(b).

The Indiana Department of Environmental Management (IDEM), Office of Water Quality (OWQ) publishes the Indiana Integrated Water Quality Monitoring and Assessment Report (IR) every two years. Using U.S. EPA's integrated format, Indiana's IR contains two lists – the Consolidated List and the 303(d) List of Impaired Waters. While they differ in purpose and scope, together they provide a comprehensive assessment of surface water quality conditions throughout the state of Indiana. The Consolidated List contains assessment information for all waters of the state, which is developed to fulfill CWA Section 305(b) requirements. The 303(d) List of Impaired Waters is a subset of the Consolidated List and identifies only those waters that are impaired and for which total maximum daily loads (TMDLs) are required per CWA Section 303(d). In accordance with U.S. EPA guidance, the IR also contains information on trends and

trophic state of Indiana's lakes pursuant to CWA Section 314 as well as information pertaining to Indiana's ground water and wetland resources.

IDEM's OWQ prepared the 2012 IR following the guidelines provided by U.S. EPA (1997 and 2005). This report for 2012 is the sixth integrated water monitoring and assessment report published by IDEM for the purposes of meeting the reporting requirements under Sections 305(b), 303(d) and 314 of the CWA.

Most of the data used in this report come from IDEM's Probabilistic Monitoring Program, which employs a stratified random sampling (probabilistic) design to generate a representative set of sampling locations for each basin. IDEM uses probabilistic results to make comprehensive use support assessments, which are statistically valid statements about the overall water quality within a given watershed. The same data used to make comprehensive statistical assessments for a given basin are also applied to the specific stream or stream reach from which they were collected in order to make site-specific assessments.

In addition to data from the Probabilistic Monitoring Program, results from IDEM's targeted monitoring programs were used to make the water quality assessments included in this report, including the Fixed Station Monitoring Program, the Source Identification Program, the Fish Tissue Contaminant Program, and the Special Studies Program. Results from monitoring conducted by Indiana-University's Indiana Clean Lakes Program, which operates under a contractual agreement with funding from IDEM, were also used.

IDEM stores assessment information, decisions about water quality based on the data collected in the Assessment Database. The Assessment Database is continually updated with new assessment information in order to facilitate the transmittal to U.S. EPA of the most up-to-date and accurate information concerning Indiana waters.

BACKGROUND

Indiana is located on the eastern edge of the North American great interior plains. The North - South continental divide traverses through northern Indiana, draining watersheds into the Great Lakes basin and the Mississippi River and Ohio River systems. Surface water in the northern one-quarter of the state flows north into the Great Lakes and then through the St. Lawrence River to the Atlantic Ocean. The southern three-quarters of the state drains into the Ohio River or Illinois River, flows into the Mississippi River and then south to the Gulf of Mexico. Indiana has 35,673 miles of rivers, streams, ditches and drainage ways listed at the 1:100,000 scale in U.S. Environmental Protection Agency's (EPA's) River Reach File 3. State water types are described in Table 2 (Appendix A). Metadata and definitions for this report are located in Appendix B.

WATER POLLUTION CONTROL PROGRAM

Internal IDEM Coordination

IDEM employs a watershed approach in many of its Clean Water Act programs, which are aimed at protecting and improving the quality of Indiana's surface waters. These programs include monitoring and assessment, water quality standards (WQS) development, a variety of activities aimed at reducing nonpoint sources of pollution to Indiana waterways, and a robust regulatory program to control point sources of pollution. National Pollution Discharge Elimination System (NPDES) permitting is the primary point source control process used in Indiana.

Nonpoint source (NPS) pollution is addressed primarily through non-regulatory watershed management planning and implementation projects and through the development of total maximum daily loads for impaired waters. IDEM also works with the Indiana State Finance Authority (ISFA) to issue low cost loans to communities for infrastructure improvements to their wastewater and drinking water facilities. Many of these loans go to municipalities in watersheds where water quality impairments have been identified and for which total maximum daily loads (TMDLs) have been completed. It is anticipated that in time these projects will result in measureable improvements in water quality.

Watershed Approach

The watershed approach is hydrologically defined and geographically focused, providing an effective framework to address water quality issues by taking into account land, air and water stressors. Key benefits of the watershed approach are that it integrates multiple programs through coordination of public, private, and not-for-profit stakeholders and leverages limited resources to address priority concerns.

The foundation of IDEM's watershed approach is internal and external collaboration across program areas via timely and effective communication and through adaptive management. IDEM's work with other state and federal agencies and other external organizations is described in more detail in later sections of this report.

Internally, IDEM's senior staff, including the commissioner, meets weekly to discuss progress on priorities as well as emerging concerns, and this information is relayed to IDEM Office of Water Quality (OWQ) managers at their weekly meeting. In turn, cross-program teams work to develop courses of action to ensure that internal resources are focused on addressing the most significant environmental issues affecting water quality.

IDEM's water quality monitoring employs a watershed approach. IDEM adopted a statewide rotating basin approach to watershed monitoring in 1996 in order to regularly update the water quality information for the entire state. From 1996-2010, IDEM monitored watersheds throughout the state on a five-year rotation, which provided a complete update once every five years.

In 2010, IDEM revised its water monitoring strategy to begin using a nine-year rotating basin approach beginning in 2011, which will result in a comprehensive and updated data set for the entire state in 2019. IDEM's reasons for changing the length of its basin rotation are explained in more detail in a later section of this report. This change does not affect the information provided for the 2012 cycle in this report, which was developed based on data collected under the previous five-year rotation. The water quality assessments included in this report are cumulative and include all waterbodies that have been assessed to date in all basins of the state. Figure 1 (Appendix C) shows the monitoring locations for all of IDEM's surface water sampling programs and illustrates the sampling density achieved through IDEM's water quality monitoring strategy over the past five years (2007-2011).

Water Quality Standards (WQS) Program

Indiana's WQS were first adopted into the Indiana Administrative Code (IAC) in 1986 and underwent significant revisions in 1990. At that time, Indiana adopted numeric criteria into its WQS for all pollutants for which U.S. EPA had developed ambient water quality criteria to protect either human health or aquatic life. Procedures for developing additional criteria were also included in these rules.

Another significant change was that beneficial uses, which are the uses that the waterbody should support, were designated to all waters. With a few exceptions[1], all waters in Indiana were designated for warm water aquatic life use, full body contact recreational use, public water supply (where there are drinking water intakes from surface waters), industrial uses and agricultural uses.

[1]There are 34 streams or stream reaches designated for limited use in 327 IAC 2-1-11(a) and 327 IAC 2-1-1.5-19(a). These waters were placed in this category after use attainability analyses confirmed their inability to fully support aquatic life use due to natural low flow conditions throughout much of the year. In 2007, another limited use designation was added to Indiana's WQS in 327 IAC 2-1-3.1, which is applicable only to waters receiving wet weather discharges from combined sewer overflows. There are no waters currently designated for this use because to date, no communities with combined sewer overflows have completed the use attainability analyses and other steps required to receive this designation. Indiana's WQS also include waters that are designated as outstanding state resources in 327 IAC 2-1.5-19(b), 327 IAC 2-1.3-3(d) and 327 IAC 2-1-11(b). Thus, all waters in the state are currently designated for uses consistent with the requirements of the Clean Water Act or U.S. EPA's implementing regulations and have criteria appropriate to determine support of these uses.

Certain waters, where natural temperature conditions will support cold water fisheries were so designated. For those waters where multiple uses exist, the criteria that support the most stringent uses must be met. Because the most stringent criteria in Indiana's WQS were established to protect aquatic life use, recreational uses for all Indiana waters and public water supply where applicable, IDEM's water quality assessments focus primarily on these uses and are based on the narrative and numeric criteria in the WQS established to protect them.

NPDES permits are also based on Indiana's WQS. In 1993, the rules and regulations that guide the implementation of Indiana's WQS through NPDES permits were extensively revised. Although this revision resulted in significant changes to these rules, only minor changes were made to Indiana's WQS.

With the issuance of the final Great Lakes Water Quality Guidance in 1995, IDEM began the process of revising the WQS and implementation regulations for those waters in Indiana's Great Lakes system. This rulemaking, for the most part, had no immediate effect on Indiana's waters located outside the Great Lakes system. These revisions incorporated the various criteria and procedures identified in the guidance into Indiana's WQS. As a part of this rulemaking, IDEM also developed procedures to implement the antidegradation policy for all substances discharged to waters in the Great Lakes system. These revisions adopted by the Indiana Water Pollution Control Board became effective in February 1997 and were subsequently submitted to U.S. EPA for approval.

U.S. EPA formally approved the revisions based on the 1995 Great Lakes Water Quality Guidance in august of 2000 with the exception of the sections on reasonable potential for whole effluent toxicity and variances. For these parts of the rule, U.S. EPA promulgated the federal guidance language for Indiana. More information concerning the whole effluent toxicity guidance can be found at: http://www.epa.gov/waterscience/methods/wet/. Information concerning the variances is also available online at: http://www.epa.gov/safewater/standard/ve-fs.html.

In 2004, the Water Pollution Control Board adopted additional changes to Indiana's WQS. The revised standards:

- Changed the way metals criteria are expressed in waters outside the Great Lakes system from total metals (acid soluble) to dissolved metals;
- Changed the way cyanide is expressed from total cyanide to free cyanide in these same waters;
- Changed the point of application of the dissolved solids criterion from "all waters" to the "point of water intake" for drinking or industrial water supplies in waters outside the Great Lakes system;
- Changed the sulfate criterion for waters outside the Great Lakes system from 250 mg/L to 1000 mg/L, applicable outside a mixing zone;
- Added provisions to allow site specific modifications to aquatic life criteria using the recalculation procedure and the water effects ratio without having to go through a

rulemaking, and listed several water reaches where site specific criteria had been developed;
- Made changes to the list of bio-concentrating chemicals of concern in waters outside the Great Lakes system so as to be consistent with the list applicable to the Great Lakes system;
- Made changes in definitions and narrative criteria in order to achieve more consistency between waters within and outside the Great Lakes system; and,
- Made a number of other minor technical and grammatical changes.

These changes to the WQS were approved by U.S. EPA in 2005 with two exceptions. U.S. EPA disapproved one site-specific criterion that was proposed. With regard to the sulfate criterion, the U.S. EPA took no action on the revised sulfate criterion submitted for approval. U.S. EPA determined that Indiana's revised sulfate criterion was not protective of aquatic life in waters with an ambient hardness value of less than 109 mg/L based on toxicity studies carried out by the Illinois Natural History Survey. Therefore, U.S. EPA required IDEM to revise and readopt a sulfate criterion that is protective of aquatic life in waters with an ambient hardness value of less than 109 mg/L. The revised criteria based on hardness and chloride concentrations became effective in Indiana on June 21, 2008, and received U.S. EPA approval on November 6, 2008.

Ground water quality standards became effective in March 2002. Public water supply definitions have been formalized to be consistent with federal Safe Drinking Water Act definitions. IDEM has established minimum requirements for content of consumer confidence reports which public water suppliers deliver to their customers annually.

WQS development is an ongoing process. On March 14, 2012, Indiana formally adopted antidegradation standards and implementation procedures applicable to all waters of the state. These rules, when effective, will supersede the aforementioned1997 antidegradation rules that only applied to the Great Lakes Basin. IDEM is currently in the midst of rulemaking to amend aquatic life water quality criteria for chloride to an equation -based criteria that will allow chloride concentrations to vary depending on the hardness and sulfate concentrations in a water body.

U.S. EPA has required all states to develop numeric water quality criteria for nutrients by 2003. U.S. EPA guidance appears to give states flexibility in the development of nutrient criteria if the state and U.S. EPA have agreed on a plan to accomplish this goal. Indiana is actively participating in this effort and has submitted its nutrient criteria development plan to U.S. EPA which includes a schedule for the development of nutrient criteria. This plan, which has been approved by U.S. EPA, is updated annually.

IDEM is currently working with U.S. EPA Region 5, and the United States Geological Survey (USGS) to develop nutrient criteria for different water body types throughout the state.
To develop nutrient criteria for rivers and streams, IDEM has worked collaboratively with the USGS in Indianapolis over the last 10 years to collect the necessary stream data from waters throughout the state. USGS is currently in the process of analyzing these data. IDEM anticipates

final adoption of nutrient criteria for rivers and streams by the end of December 2014 if no further data analysis is required. For lakes and reservoirs, data analysis was completed in 2008 by LimnoTech, Inc. IDEM then performed additional analyses on the data set to refine the nutrient benchmarks developed by LimnoTech. On June 30, 2010, IDEM issued a first notice in the Indiana Register announcing a rulemaking to formally incorporate numeric water quality criteria for lakes and reservoirs into Indiana's water quality standards.

IDEM is currently considering other revisions to Indiana's WQS standards. For example, IDEM believes that the criteria and methodology to calculate water quality criteria for aquatic life use for the Great Lakes system represent the most current scientific thinking on how to incorporate existing toxicity data into aquatic life criteria and that these criteria and the methodology for calculating them should replace those currently used for downstate waters. With regard to human health-based criteria, IDEM also believes that U.S. EPA's 2000 guidance on deriving these criteria are appropriate for use in all waters of the state when the WQS are next revised.

IDEM has also collected considerable data on the macroinvertebrate and fish communities for many Indiana waters. Although Indiana is not at the stage in the evaluation of these data to propose numeric biocriteria, narrative biocriteria language that would allow the state to better utilize the available data to assess the biological integrity of aquatic communities may be proposed in the future.

Point Source Program

Point source pollution in Indiana is controlled primarily through permits issued by IDEM for discharges to surface water under the NPDES Permit Program/Permits Branch. Regulated facilities which discharge to waters of the state must apply for and receive a NPDES permit. Limitations in each permit protect all designated and existing uses of the receiving water body.

The Permits Branch issues individual (municipal, semi-public and industrial) NPDES permits as well as industrial wastewater pretreatment permits to industries that discharge to municipal wastewater treatment plants in some communities. In addition, the Permits Branch issues general permits for: hydrostatic testing; non-contact cooling; sand and gravel operations; petroleum product terminals; groundwater petroleum remediation systems; and coal mines.

The Permits Branch is also responsible for the review and approval of long term control plans (LTCPs) submitted by communities to reduce discharges from combined sewers. All of the combined sewer overflow communities for which IDEM is the lead regulating agency are currently under one of three enforceable mechanisms (permit, agreed order or state judicial agreement). These mechanisms are in place to help implement the approved LTCP and/or to develop and implement an approvable LTCP. There are a few remaining communities where U.S. EPA is the lead regulating agency that have not yet entered into an enforceable mechanism for development and implementation of an approved LTCP. The communities are still in negotiations with U.S. EPA.

The Compliance Branch in OWQ conducts wastewater treatment plant inspections, provides operator assistance and training, tracks and reviews compliance data, and assists in the enforcement process. Compliance Branch staff also oversees and audits municipal pretreatment programs in 47 municipalities with U.S. EPA delegated pre-treatment programs. Unpermitted dischargers as well as permittees that are out of compliance with their permit conditions may be referred to OWQ's enforcement staff for corrective actions.

The Compliance Branch works closely with the Permits Branch and enforcement staff to ensure that permit limits are adequate for protection of designated uses and dischargers remain in compliance with their permit requirements. For example, IDEM inspectors conduct onsite wastewater treatment plant inspections throughout the state. In addition, IDEM is increasing its focus on laboratory proficiency and proper certification of wastewater treatment plant operators. Inspectors review operation and maintenance of wastewater treatment plants permitted under the NPDES Permit Program and provide referrals for operator assistance and training. Inspectors issue violation letters action as needed and may refer permittees directly to OWQ's enforcement section for corrective action.

Nonpoint Source (NPS) Pollution Program

NPS pollution in Indiana is addressed in many ways through a number of agencies and organizations in the state. IDEM's Watershed Planning and Restoration Section (formerly the NPS/TMDL Section) leads the Agency's efforts to reduce nonpoint source pollution in Indiana waters in partnership with other agencies and organizations including the Natural Resources Conservation Service (NRCS), Indiana Association of Soil and Water Conservation Districts (IASWCD), Indiana State Department of Agriculture (ISDA), Indiana Department of Natural Resources (IDNR) and the ISFA/State Revolving Fund (SRF) Loan Program. The Watershed Planning and Restoration Section also leads efforts to restore waters of the state that are identified on the 303(d) List of Impaired Waters. In addition to working with other state and federal agencies, IDEM employs four watershed specialists who work with local watershed groups to promote the watershed approach and assist them in their watershed planning and restoration activities.

NPS Grant Programs

The Watershed Planning and Restoration Section manages two federal pass-through grant programs aimed at improving water quality in the state: Section 205(j) and Section 319(h); each named after the authorizing section of the Clean Water Act.

The Section 205(j) Grant Program is dedicated to water quality management planning. Funds are used to determine the nature, extent, and causes of point and nonpoint source pollution problems and to develop plans to solve these problems. In federal fiscal year (FFY) 2011, U.S. EPA allocated Indiana $359,000 in 205(j) funds. In addition, 205(j) funds left over from allocations in previous years have been rolled into the FFY 2011 grant, so the total available funds for FFY 2011 are $699,775. Four projects will be funded with this money, including a watershed management planning project, another project that will conduct water quality

monitoring in the Wabash River, a project to provide training to Indiana Conservation Partnership staff, and another to maintain and enhance IDEM's Assessment Information Management System (AIMS) water quality database.

The Section 319(h) Program is one of the primary resources for reducing NPS pollution in Indiana and receives a significantly larger allocation than that under Section 205(j) of the CWA. In FFY 2011, U.S. EPA allocated $3,763,000 in Section 319(h) funds to Indiana, which will fund a total of eight projects. Two other projects that submitted proposals for FFY 2011 funding will be supported with funds left over from the FFY 2009 allocation. Each year proposals are submitted, reviewed by a committee and selected for funding based on the NPS Program's priorities and the quality of the proposal. Much of this funding goes to groups working to develop and/or implement a comprehensive watershed management plan which will lead to implementation of on-the-ground best management practices (BMPs) in critical areas of the watershed.

Additional information about IDEM's 205(j) and 319(h) grant programs and their different requirements is available online at: http://www.in.gov/idem/nps/.

Nonpoint Source Program Focus

Each year, IDEM identifies priority projects for Section 319(h) funds in order to more efficiently meet NPS Program goals, coordinate with TMDL Program efforts to identify and reduce NPS pollution, and focus more funding on impaired waters. For FFY 2011, the NPS Program focused funding on:

- Watershed management planning in areas with waterbodies on the State 303(d) List of Impaired Waterbodies: http://www.in.gov/idem/files/section_303d_list_of_waterbodies.xls
- Implementing watershed management plans that meet IDEM's Watershed Management Plan Checklist: http://www.in.gov/idem/6135.htm.
- Watershed management planning and implementation in areas with approved TMDLs: http://www.in.gov/idem/nps/2347.htm.
- Projects that support the mission of the sponsor and which will either facilitate water quality improvements statewide or help to build capacity at the local level.

Developing and implementing a comprehensive watershed management plan is an effective way to focus efforts and resources on a watershed and its particular problems and to implement solutions to those problems. All watershed management plans currently under development and those developed in the future with NPS grant funds must meet the required elements of IDEM's 2009 Watershed Management Plan Checklist before they can be implemented. The checklist incorporates EPA's nine required components of a watershed-based plan and also comes with comprehensive guidance on IDEM's Nonpoint Source Program expectations, as well as examples and direction on how to meet those expectations. In the planning process the watershed group identifies the problems, causes, sources, and critical or target areas in the

watershed, then sets goals and chooses measures or BMPs to be implemented to achieve those goals.

One important indicator of program and project success is the quantity of pollutants, such as sediment, phosphorus, nitrogen, and *E. coli*, that has been prevented from entering waterbodies as a result of BMPs implemented. Most projects use the Region 5 Load Estimation Model to estimate their pollutant load reductions for each BMP they implement and submit their data to IDEM. The total reported estimated pollutant load reductions in Indiana for FFY 2011 are: sediment; 23,580 tons/year, phosphorus; 27,978 pounds/year, and nitrogen; 59,530 pounds/year.

Many of the projects funded with NPS Program grants also include the collection of water quality data for watershed planning and other purposes. In accordance with their grant agreements, these projects submit these data to the NPS Program. The NPS Program recently sponsored a project to upgrade IDEM's AIMS database in order to improve its ability to manage these data and make them more readily available for review and potential use in other agency programs. In addition to housing data collected by NPS projects, the AIMS database project will provide storage and facilitate review of datasets submitted by external parties to IDEM for potential use in the Agency's 305(b)/303(d) assessment and listing processes, development of the Integrated Report and TMDLs, and possibly other program areas.

Total Maximum Daily Load Program (TMDL)
Early TMDLs were developed primarily through the use of third party contractors. The TMDL Program now develops most of its TMDLs in-house, which is more cost effective and provides the opportunity for more effective coordination with IDEM's NPS Program and other relevant water quality programs.

U.S. EPA has awarded IDEM's TMDL Program considerable funding through contractor support grants to develop additional TMDLs. including a collaborative project between IDEM and the State of Michigan to complete and interstate TMDL for the Pigeon River.

The TMDL Program takes into account potential sources of impairment, including point and nonpoint sources/ As of April 1, 2012, the TMDL program has developed 947 TMDLs (individually counting each waterbody impairment evaluated), all of which have been approved by U.S. EPA. More than 201 TMDLs are either in progress or planned for the 2014 cycle. To date, most TMDLs have focused on *E. coli* impairments. More recently, however, the TMDL program has worked to develop TMDLs to address other issues related to NPS pollution such as impaired biotic communities and nutrient impairments.

When developing TMDLs, the TMDL Program coordinates with local government agencies and stakeholders within the watershed. This coordination provides numerous opportunities for local participation in the TMDL process, which leads to positive changes in the watershed. The coordinated efforts of the Watershed Planning and Restoration Section and IDEM's watershed specialists have resulted in the formation of numerous new watershed groups and new grant funded projects for planning and restoration activities in impaired watersheds.

Recently, the TMDL Program developed a new template that will include EPA's required nine elements for funding that are used in the NPS Program. The template builds on common needs – it includes information that both external partners involved in watershed planning and implementation need for their watershed and the TMDL program needs to develop the TMDL. It is anticipated that the new template will not only enhance internal collaboration between the TMDL and NPS programs but will also result in TMDL reports that can be more effectively used by local watershed groups and stakeholders to facilitate the restoration of impaired waters.

IDEM's Watershed Specialists

IDEM's four watershed specialists provide an important link between watershed groups and other interested stakeholders and OWQ programs. In 2010-2011, the watershed specialists assisted more than 80 watershed groups on many levels including: meeting facilitation, reviewing draft and final watershed management plans, reviewing grant proposals, providing water quality data and watershed maps, connecting them with other local organizations and agencies to complement planning efforts, and assisting watershed coordinators with the overall watershed planning and implementation processes. The watershed specialists also work with the TMDL Program by attending TMDL public meetings to provide information on watershed planning and to build local partnerships to address water quality. In 2010-2011, the watershed specialists assisted with the formation of new watershed groups in areas with completed TMDLs (the Iroquois River, Plummer Creek, and Maumee River watersheds). These groups are currently developing and implementing watershed management plans to restore the impaired waters in their watersheds.

Coordination with Other Agencies

NPS pollution ranges from urban sources to construction and agricultural run-off which makes cooperation essential across political boundaries and disciplines. Many local, regional, state, and federal agencies play an essential part in addressing NPS pollution, especially at the watershed level. Various agencies in Indiana provide data, technical resources and grants to local watershed groups to assist with planning, infrastructure design review and BMP implementation to reduce and prevent NPS pollution. Through coordination and collaboration, IDEM and the other agencies can more effectively focus water quality protection efforts.

IDEM works closely with other state and federal agencies engaged in improving water quality and the agency strives to integrate the results of projects completed by local and regional units of government, universities and not for profit organizations.

IDEM serves as a member of the Indiana Conservation Partnership (ICP), which is comprised of the Natural Resources Conservation Service (NRCS), the Farm Services Agency (FSA), Indiana State Department of Agriculture (ISDA), the Indiana Department of Natural Resources (IDNR), the Indiana Association of Soil and Water Conservation Districts (IASWCD) and the Purdue University Cooperative Extension Service.

The ICP meets bimonthly for partner updates, to coordinate and collaborate where possible to optimize their resources, particularly the various cost-share and grant programs, and technical training they can provide, for achieving water quality objectives. The ICP also prepares an annual work plan that defines objectives for up to four conservation focus areas and includes the actions, responsible entities and deadlines for achieving them.

IDEM's watershed specialists serve as Section 319(h) project managers and help with coordination and advising and assisting locally led watershed management activities within assigned watersheds. They assist in a technical, managerial and financial advisory role for local watershed groups and act as liaisons for working with local, state and federal entities to integrate watershed planning into local level planning.

IDEM staff in the Wetlands and Storm Water Programs work cooperatively with the U.S. Army Corps of Engineers, the Indiana Department of Natural Resources, the U.S. Fish and Wildlife Service and other agencies to issue water quality certifications and permits that are protective of water quality, regulating activities in wetlands and other waters in accordance with CWA Section 401.

Coordination with Indiana Department of Natural Resources (IDNR)

Hoosier Riverwatch Program

From 1999-2002, IDEM and IDNR worked cooperatively to develop and implement the Hoosier Riverwatch Program, a statewide volunteer stream water quality monitoring program. The Hoosier Riverwatch program mission is to involve the citizens of Indiana in becoming active stewards of Indiana's water resources through watershed education, water monitoring, and clean-up activities. The program accomplishes this goal by educating citizen volunteer in water quality monitoring methods and by electronically storing their monitoring results to make them available to other interested parties such as watershed groups, schools and to IDEM technical staff for potential use in various OWQ programs.

IDNR's Division of Fish and Wildlife staff have taken the lead in developing the Hoosier Riverwatch program, which has trained more than 7,000 volunteer stream monitors to date. Since 2001, volunteers have registered results for nearly 1,500 sites into the Hoosier Riverwatch database. The Hoosier Riverwatch database is web-based and interactive, allowing volunteers to enter their own data and view data collected by other volunteers. In 2007, the program completed a three-year regional research project in cooperation with cooperative extension programs in Iowa, Ohio, Michigan, Wisconsin and Minnesota to test the accuracy of bacteriological monitoring methods used by volunteers and the usability of their results. More details on this project can be found at: http://www.usawaterquality.org/volunteer/EColi.

Division of Reclamation, Abandoned Mine Lands (AML) Program

IDEM's TMDL Program works with IDNR's Abandoned Mine Lands Program on any TMDL development in watersheds where abandoned coal mines exist. The AML Program contributes to TMDL development by sharing water quality data and information regarding the costs and techniques involved in their reclamation projects. The AML Program has also helped to educate TMDL staff about areas impacted by acid mine drainage by touring reclamation projects with them that are at different points in the reclamation process.

Division of Fish and Wildlife, Lake and River Enhancement Program (LARE)

The goal of this division is to protect and enhance aquatic habitat for fish and wildlife to ensure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. To accomplish this goal, the LARE program awards grants for technical and financial assistance to qualifying projects. Projects range from lakescaping and strategic planning workshops to scientific studies and design and construction of engineered structures. In accordance with state law, a portion of LARE funds is dedicated specifically to the remedial control of invasive exotic aquatic species and sediment removal from publicly accessible lakes.

Indiana Lake Michigan Coastal Program (LMCP)
The purpose of the Indiana Lake Michigan Coastal Program (LMCP) is to enhance the state's role in planning for and managing natural and cultural resources in the coastal region and to support partnerships between federal, state and local agencies and organizations.

The LMCP annually awards grants through its Coastal Grants Program for projects to protect and restore natural, cultural and historic resources in Indiana's Lake Michigan coastal region. Examples of how these funds might be used include:

- Protection and restoration of significant natural and cultural resources;
- Programs to prevent the loss of life and property in coastal hazard areas;
- Improved public access for recreational purposes;
- Revitalized urban waterfronts and ports;
- Improved coordination among government agencies in policy and decision-making processes, and;
- Pollution prevention initiatives, including non-point source pollution into coastal water.

Coordination with the United States Geological Survey (USGS)
IDEM's TMDL program occasionally works with the USGS to develop TMDLs, usually with contract support from U.S. EPA Region V. Under these arrangements, the USGS has provided data and sampling assistance as well as other types of support for the development of TMDLs. On the last TMDL with which USGS collaborated with IDEM, the USGS prepared a presentation and brought in specialists to discuss data collected in the watershed to assist in determining biological impacts. More recently, USGS provided training to NPS/TMDL staff on

the new StreamStats software for Indiana. As a result, IDEM staff can now assist watershed groups in the use of this valuable new tool.

The USGS has also been very involved in IDEM's ongoing development of nutrient criteria for rivers and streams. USGS has assisted in collecting the water quality data needed and is currently assisting IDEM's Water Quality Standards Program in analyzing the data to determine potential relationships between nutrients and biological communities These efforts are considered critical steps in Indiana's nutrient criteria development plan.

In addition to direct collaboration through specific projects, the USGS is doing other work that will be valuable in the development of nutrient criteria. For example, water quality data collected by the USGS at its National Water Quality Assessment Program study sites in Indiana will provide information regarding seasonal and annual trends of nutrient and algal concentrations and their potential effects on the biotic community, which are important for the development of nutrient criteria. The USGS is also currently analyzing fate and transport data in the White River, West Fork and Sugar Creek watersheds, which will provide information about the fate and transport of nutrients in these waters. These studies have also been incorporated into IDEM's nutrient criteria development plan.

Coordination with the Indiana State Department of Agriculture (ISDA), Division of Soil Conservation (DSC)

The ISDA Division of Soil Conservation (DSC) focuses on enhancing the stewardship of natural resources on agricultural land and strengthening the capacity of local soil and water conservation districts (SWCDs) to ensure that constituents have a local resource for conservation assistance. In addition, ISDA-DSC resource specialists and district support specialists provide conservation technical assistance to implement federal, state and local conservation projects. Currently, IDEM's NPS program is providing funding for three ISDA-DSC positions, which provide technical support for the implementation of watershed plans in the Tippecanoe River, Upper Wabash River, and Eel River, North watersheds. ISDA-DSC also provides 319 projects in other watersheds with technical assistance in getting BMPs on the ground.

IDEM's Watershed Specialists routinely coordinate with ISDA-DSC staff when working on watershed-wide issues and collaborate on outreach efforts such as networking sessions and other meetings, including the IASWCD annual conference, the Indiana Conservation Partnership's Training and Certification Program.

ISDA-DSC also works with the Farm Services Agency (FSA) to provide additional incentives to landowners who install BMPs adjacent to eligible surface waters through the Conservation Reserve Enhancement Program and through the State Soil Conservation Board, which awards state grants to local SWCDs through the Clean Water Indiana Grants Program. This program complements the 319 program in both outreach and cost-share components and can be used as match for 319 grant projects.

Coordination with the Natural Resources Conservation Service (NRCS)
The NRCS mission statement is "helping people help the land," which is accomplished through financial and technical assistance to agricultural producers, its primary customers, who are those that make decisions about natural resource use and management on non-federal land.

The NRCS assists landowners to develop conservation plans, provides technical assistance and advice about natural resource management, and helps install practices and systems that meet the agency's technical standards and specifications. IDEM's NPS Program approves the use of NRCS standards and specifications for many of the cost-share practices implemented through Section 319(h) grants. The program also encourages the use of NRCS Farm Bill conservation programs as a funding source for implementing local watershed management plans where appropriate.

Coordination with Indiana's State Revolving Fund (SRF) Loan Program
The SRF Loan Program administers two different loan programs that provide low-interest loans to Indiana communities, one for projects that improve drinking water and the other for wastewater infrastructure projects. The Indiana Finance Authority administers these programs to protect public health and the environment. Cities, towns, counties, regional sewer/water districts, conservancy districts and water authorities are eligible for both programs. Private and not-for-profit public water systems are eligible for drinking water SRF loans.

Eligible projects include those that abate water pollution problems, provide greater protection for public health or ensure compliance with either the CWA or the Safe Water Drinking Act. Wastewater projects may include wastewater treatment plant construction or improvements, sewer line extensions to existing unsewered areas, decentralized treatment systems, combined sewer overflow elimination and infiltration/inflow corrections. Drinking water projects may include treatment plant construction and improvements, water storage facilities, water distribution systems and water supply. The program provides additional financial incentives to projects to include green technology, a brownfields program project or a sustainable infrastructure component.

Both SRF Loan Programs offer a 20-year, fixed rate loan term. Interest rates on loans through the SRF Programs use a base interest rate, which is reset on the first business day of each January, April, July and October. The base rate is calculated by using 90 percent of the average 20-year AAA-rated, general obligation bond Municipal Market Data composite index for the most recent calendar month. The base rate is then discounted further based upon a borrower's median household income from 2000 census data and projected user rates. As an incentive to communities to address nonpoint source water pollution, for projects with a NPS component or green/sustainable infrastructure components, the interest rate on their loan may be reduced by up to 0.5%.

The SRF Loan Programs coordinate with state and federal programs, including IDEM's OWQ, to identify ways the SRF Loan Programs might provide assistance to Indiana communities that

will ultimately help to achieve common goals. For example, the Clean Water SRF ranking and scoring gives additional points for projects that remove a pollutant source from an impaired stream. This way of scoring increases the likelihood that projects with a water quality benefit will be high on the SRF project priority list. The funds loaned for these removal projects can be documented as a match, when applicable, for the projects submitting grant proposals to the NPS Program. Projects eligible for match must provide water quality benefits to their respective communities and may include one or more of the following:

- wetland restoration/protection;
- erosion control measures;
- groundwater remediation;
- repair or replacement of failing septic systems or connection to sewer;
- storm water BMPs;
- source water and wellhead protection;
- conservation easements, and;
- agricultural and waste management BMPs.

The SRF Loan Program also serves on the Rural Wastewater Task Force and the Environmental Infrastructure Working Group, which gives the program the opportunity to provide input and offer financing options to communities for their drinking water and/or wastewater infrastructure needs. The SRF Loan Programs work with communities addressing combined sewer overflows, enforcement issues or those with or nearing a sewer ban.

In State Fiscal Years (SFYs) 2010 and 2011, seven projects had a NPS component and saved an additional $8,975,879 over the 20-year term of their loans. While these savings are realized over the longer term, these projects are typically completed within two years and the water quality benefits are achieved much sooner than 20 years.

Cost/Benefit Assessment

Water is a vital component of the economic health of Indiana, which is diverse in agriculture, industry, population, and environmental resources. Finding the right balance between these often competing needs creates the benefits associated with a robust economy, high quality of life, and healthy ecosystems. However, the finances available to restore, enhance, and protect our water resources is limited in comparison to the work needed to ensure that balance. The following is a discussion of some of the revenue sources available to state, regional, and local entities to achieve the objectives of the Clean Water Act and case studies that illustrate improvements in water quality and their resulting benefits.

Since 1992, the SRF Programs have provided more than $2.8 billion dollars for more than 556 wastewater (Appendix C, Figure 2) and drinking water (Appendix C, Figure 3) infrastructure improvement projects. Water quality benefits to many Indiana rivers and streams are expected as a result of the assistance to communities from the SRF Programs.

In SFYs 2010 and 2011, the Wastewater SRF Program closed 83 loans totaling approximately $504,263,018. This provided an estimated savings (compared to open market interest rates) of $296,282,558. The Drinking Water SRF Program closed on 48 loans for approximately $119,226,546 and provided an estimated savings $75,475,205 to communities (Appendix A, Table 3).

In addition to the SRF Loan Program, IDEM's NPS Program awarded 205(j) grants totaling almost $1 million to six projects and awarded more than $6.1 million in Section 319(h) grants to 19 projects for the 2010 and 2011 FFYs. These federally funded grant projects include watershed management planning, water quality management, and nonpoint source pollution assessment, prevention, education, and restoration. It is estimated that these investments in local level watershed management planning and implementation, have resulted in significant reductions in the amount of sediment, phosphorus and nitrogen reaching Indiana waterways in the form of nonpoint source polluted runoff (Appendix A, Table 4).

303(d) Impaired Waters List Case Study – Bull Run Creek/West Creek Watershed
In 2002, IDEM placed a reach of Bull Run in the Bull Run Creek/West Creek watershed on its 303(d) list for impaired biotic communities (IBC) based on biological sampling results and other information suggesting that the impairment was caused by nonpoint sources of pollution. Using CWA Section 319(h) grant funds, project partners educated stakeholders about sound agricultural management and installed BMPs throughout the watershed. Recent biological monitoring has shown that the reach of Bull Run that was previously impaired is now supporting a healthy biotic community. As a result, IDEM has proposed removing this reach from the state's 2012 CWA section 303(d) list of impaired waters. The following provides a more thorough discussion of the Bull Run watershed, how the problem was identified, and how it was resolved at the local level with a combination of NPS Program grant funding and effective partnerships.

The Bull Run watershed headwaters lay within an agricultural area and the confluence with St. John Ditch lies within an urban area in northwest Lake County, just south of St. John and west of Crown Point (Appendix C, Figure 4). Bull Run (6.04 miles in length) is the headwaters of West Creek before it joins St. John ditch to form West Creek. Bull Run was first added to the state's 303(d) list for impaired biotic communities in 2002. West Creek was also added to the list for impaired biotic communities in 2008.

The narrative criteria in Indiana's water quality standards state that all waters must support healthy aquatic communities. IDEM has developed indices of biotic integrity for both fish communities and macroinvertebrates, which provide a means of scoring waters based on biological monitoring results to determine whether they meet this criterion. For either biotic community (fish or macroinvertebrates) any score 36 or above is considered supporting a healthy biotic community and any score below 36 is considered impaired and requires either a TMDL or other improvement activities. Fish Community monitoring was conducted in Bull Run in 1999 and 2005 and 2011. Fish community monitoring was conducted in West Creek in 2004, 2005 and 2011. Results from both streams indicated IBC impairments (Appendix 1, Table 5).

IDEM determined that these impairments were the result of nonpoint source runoff. Based on the land uses in the watershed, Bull Run and West Creek receive runoff from a variety of sources including, row crop agriculture, improper manure spreading, and livestock with direct access to streams, pasturing of livestock, leaking and failing septic systems, stream bank erosion, and urban stormwater runoff. The only potential point source of pollution in the watershed is a Municipal Storm Sewer System (MS4). IDEM verified that this MS4 facility did not have a history of permit violations, and that it had been actively working to install BMPs and identifying outfall locations to address stormwater runoff within the MS4 community boundaries.

In 2011, IDEM sampled the fish community in both Bull Run and West Creek again and found that they had improved significantly due to several projects in the greater Lake County area funded by IDEM's NPS Program grants to improve water quality. Since 1990, IDEM has funded nine projects in the greater Lake County area totaling almost $600,000 with an additional cash and in-kind match provided by project sponsors of more than $121,000. These projects included a locally-led development of a comprehensive watershed management plan, identification of critical areas and needed actions, and targeting of resources to the installation of BMPs designed to improve water quality. The projects also funded positions to provide technical expertise for the development of agricultural BMP placement and access to federal funding. These positions later went to NRCS and are still funded by the USDA to continue providing local technical assistance. Funding also included work in BMP development for urban runoff sources and erosion control.

Although NPS funding played an important role in achieving the needed water quality improvements in the Bull Run/West Creek watershed, these improvements would not have been possible without partnerships at multiple levels, which were developed as a result of the projects funded with those dollars.

In the greater Lake County area, the Northwest Indiana Regional Planning Commission works closely with the Lake County Soil and Water Conservation District, NRCS regional conservation staff and a number of local and state partners including: IDNR; ISDA; and the Lake County Health Department. These agencies and organizations have partnered together to contribute their combined resources to support watershed education and outreach to stakeholders in the watershed, identify sources of pollutants and critical areas in need of restoration, and possible solutions to water quality problems.

Since 1996, the NRCS and FSA have spent on average $120,000 per year in the Bull Run/West Creek watershed. This watershed has a significant number of farmers participating in no-till cropping, which means that the ground is only minimally disturbed when planting. With 80% of the agricultural community participating in no till, this watershed has been positively impacted by the significant reductions in nutrients and soil run off that these practices provide.

The Town of St. John MS4 community, which is the only potential point source in the watershed, has also been actively working to make improvements in water quality. The town has

completed a number of projects aimed at reducing the amount of sediment that reaches the streams and ditches in the watershed, clearing several ditches of silt build-up, reseeding the areas around their banks to prevent further erosion and replanting native vegetation along some streams. The town also provides outreach to home owners associations in the watershed about how to enhance the storm water management within their respective subdivisions.

The cumulative effects of these projects and the partnerships they facilitated have resulted in water quality improvements in the watershed that in turn facilitated a rebound in the fish community in Bull Run and West Creek. As a result, the fish community impairments previously identified for these waters will be removed from IDEM's 2012 303(d) list of impaired waters in 2012.

SPECIAL STATE CONCERNS AND RECOMMENDATIONS

IDEM has special state concerns regarding two significant issues that affect IDEM's water quality programs and its ability to achieve specific CWA objectives. The first concern involves mercury and polychlorinated biphenyls (PCBs) in fish tissue as impairments to Indiana's waters. The second concern involves monitoring needs within the state. IDEM's probabilistic monitoring allows for statistical analysis, but does not provide information on specific location of the impaired waterbody.

Developing TMDLs for Waters Impaired by Mercury and/or PCBs in Fish Tissue
Mercury and polychlorinated biphenyls (PCBs) in fish tissue are among the top four causes of impairment to Indiana's waters. IDEM has placed all fish tissue impairments in a separate category (5B) of the consolidated and 303(d) Impaired Waters List because it does not believe that a conventional TMDL is the appropriate approach for addressing these impairments. IDEM considers it more prudent to focus its limited resources on developing TMDLs for other impairments.

Additionally, funding has been cut for the analysis of fish tissue. These data are important because they indicate that the concentrations of PCBs, dieldrin, DDT (dichlorodiphenyltrichloroethane), and chlordane are decreasing in fish tissue. Continued collection of fish tissue data is important in determining whether mercury concentrations in fish tissue are changing over time.

Conflicting Monitoring Needs
U.S. EPA emphasizes a probabilistic monitoring approach in order to help states meet the CWA Section 305(b) goal of comprehensively monitoring all waters of the state. IDEM's probabilistic monitoring program provides IDEM with the ability to make statistical inferences regarding the extent to which waters of the state, as a whole, support or do not support designated uses based on data collected randomly throughout the state. However, these statistical results do not indicate where each specific impaired stream is located.

While the data collected through probabilistic monitoring can be used to make site specific assessments, the randomness built into the probabilistic study design does not allow for continued monitoring of those streams where impairments have been identified. Follow-up monitoring is needed for these waters in order to determine the full extent of these impairments and the stressors and/or pollutants driving them. In the past, IDEM was unable to direct a larger proportion of its monitoring funds to meet the targeted monitoring needs because the minimum number of samples required to maintain the statistical rigor required by IDEM's probabilistic sampling design consumed most of OWQ's monitoring resources each year, leaving comparatively little funding for targeted monitoring.

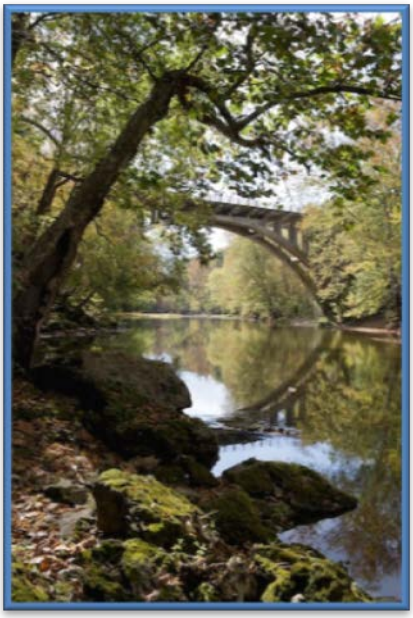
As a result, OWQ programs continue to struggle with conflicting monitoring needs. The resources available to conduct the targeted monitoring necessary to meet other CWA mandates and U.S. EPA performance measures are not keeping pace.

IDEM has reported this issue as a special state concern for the past three Integrated Reporting cycles. With no significant increases in federal funding for maintaining current monitoring and the possibility of future cuts in funding, IDEM has necessarily had to make some significant changes in its monitoring strategy to address the problem.

In 2011, IDEM revised its Water Quality Monitoring Strategy (WQMS) to focus existing and limited resources on primary monitoring objectives (Appendix 1, Table 6) and to address significant data gaps. The most notable changes specifically intended to address the issue of conflicting monitoring needs was the change in the basin-rotation strategy employed by the Probabilistic Monitoring Program. Probabilistic monitoring is now conducted on a nine-year rotating basin schedule rather than a five-year rotating basin, monitoring in one basin each year instead of two. This longer rotation allows IDEM to still meet the primary monitoring objective of assessing all waters of the state and provides for reallocation of approximately 50% of existing staff and financial resources to conduct targeted monitoring that is needed to meet other primary objectives, which IDEM has struggled to meet or has not met in the past including:

- Baseline monitoring to support watershed planning;
- Monitoring for performance measures; to show changes in watersheds where Section 319(h) Watershed Management Plans have been implemented as well as where other ICP investments have been made;
- Increased monitoring for TMDL development;
- Monitoring to support development of NPDES permits; sampling data from locations where new permits are being developed;
- Monitoring fish tissue contaminants for the development of public health advisories, and;
- Monitoring cyanobacteria and algal toxins.

Although the reallocation of resources from probabilistic monitoring to targeted monitoring allows IDEM to meet more of its primary monitoring objectives, most of which are driven by federal CWA requirements, it is not an ideal solution because comprehensive assessments of the entire state will now take nine years instead of five to produce. States remain in need of additional monitoring resources to meet CWA goals and U.S. EPA objectives.



SURFACE WATER MONITORING AND ASSESSMENT

IDEM conducts most of its surface water monitoring through various programs in the Watershed Assessment and Planning Branch (WAPB). This section includes a discussion of IDEM's surface water monitoring strategy, a description of the assessment methodology for classifying all surface waters according to the degree to which they meet their designated uses, and the most current assessment results available. This section also provides a description of Indiana's Wetlands Program, an analysis of surface water quality trends and information on public health issues.

IDEM'S SURFACE WATER MONITORING STRATEGY

The United States Environmental Protection Agency (U.S. EPA) recommends that states develop a comprehensive monitoring program strategy for collecting the data and information needed to address its water quality management needs. IDEM developed its first water quality monitoring strategy in 1995, which has undergone a number of revisions, most recently in 2011.

IDEM's Water Quality Monitoring Strategy (WQMS) uses a watershed approach to prioritize water quality management needs and the monitoring activities intended to meet them. Most of IDEM's surface water monitoring is conducted by the WAPB within IDEM's Office of Water Quality (OWQ). The WAPB includes several Clean Water Act (CWA) programs and conducts a wide range of monitoring activities in order to meet the needs of CWA programs that reside within the branch and in other branches and programs within IDEM's OWQ.

Although the 2011 revision to the WQMS resulted in a change in IDEM's rotating basin approach from a five-year to a nine-year rotation, this 2012 Integrated Report was developed with data collected under IDEM's previous strategy, which employed the five-year rotation. Following the five-year basin rotation, approximately one-fifth of the state (one to two basins) was scheduled for monitoring each year over a period of five years (Figure 5; Appendix C). IDEM's nine-year rotation (Appendix C, Figure 6) began with the 2011 monitoring season.

In accordance with the WQMS, regardless of rotation, monitoring is conducted within a given basin(s) and the results are reviewed for quality assurance and quality control in year one. In year two, the quality assured data are used to make water quality assessments for the basin(s). These assessments and any waterbody impairments identified through these assessments are reported in the next reporting cycle. Appendix D provides a detailed schedule of IDEM's 305(b) assessment and reporting, and 303(d) listing activities before and after the change made to the rotating basin approach.

IDEM's Probabilistic Monitoring Program samples at least 38 randomly selected sites in a given basin and is the primary source of data used in IDEM's CWA assessments. This program, which focuses specifically on rivers and streams, is designed to characterize the overall environmental quality of each major river basin and to identify those monitored waterbodies within each basin that are not fully supporting their beneficial designated uses.

Lakes monitoring is conducted by the Clean Lakes Program (CLP), which is discussed in later sections of this report. IDEM's Contaminants Monitoring Program, which is also discussed in later sections, collects fish tissue samples from Indiana's flowing waters as well as the state's lakes and reservoirs.

IDEM uses the data collected by the Probabilistic Monitoring Program to make water quality assessments of rivers and streams at two spatial scales, reach-specific assessments and basin-wide assessments.

Reach-specific Use Support Assessments
IDEM uses the data collected by the Watershed Monitoring Program to make use support assessments of the stream or stream reach from which they were collected and any other reaches for which the results are representative. For these assessments, the water quality data are compared to applicable water quality criteria to determine whether or not the reach or reaches represented by the data are supporting one or more of their designated uses. Results from IDEM's reach specific assessments are summarized in the "Rivers and Streams Water Quality Assessment" section of this report. In addition to data collected through the Watershed Monitoring program, IDEM also uses data collected by the agency's other water monitoring programs to make reach specific assessments and may use data from external sources if they meet the necessary data quality requirements.

Comprehensive Use Support Assessments
Comprehensive assessments are statistical calculations that allow IDEM to predict with reasonable certainty the percentage of Indiana's rivers and streams within a given area that are either impaired or supporting their designated uses. Comprehensive use support assessments are based solely on the reach specific assessment results from data collected by the Probabilistic Monitoring Program because, unlike data collected through other IDEM monitoring programs and most external organizations, these data are collected using a probability based sampling design, which is necessary to make statistically valid calculations.

IDEM's comprehensive use support assessments and its reach specific assessments of designated use support provide water quality information in two very different ways and IDEM uses both types of assessments to meet CWA requirements. The agency's comprehensive assessments, which rely on probabilistic data, provide statistically valid statements about the overall water quality throughout Indiana on a basin level, which allows IDEM to meet the CWA requirement to assess all the waters of the state. These results are stated as the percentage of the total stream miles in each basin meeting their designated uses and the percentage that are impaired. These percentages are statistically derived and cannot be applied to specific streams or stream reaches. Given this, they do not identify where specific impairments exist or the sources of impairment. This specific information, which is required by Section 303(d) of the CWA, is provided by IDEM's reach specific results based on data collected from a variety of sources including IDEM's Probabilistic Monitoring Program.

This report provides comprehensive assessments for watersheds in all of Indiana's major basins (Appendix E) in addition to summaries of results from IDEM stream-specific assessments (Appendix F). This report also includes the 2012 draft 303(d) List of Impaired Waters (Appendix H), which identifies waters impaired for one or more designated uses.
This report builds on the water quality assessment results reported in the 2010 Integrated Report and includes revised assessments for the Upper Wabash basin monitored in 2008 and the Lower Wabash River and Kankakee River basins monitored in 2009. In addition to these basins which were monitored and assessed for the 2012 cycle, this report contains assessment information revised as a result of total maximum daily load (TMDL) development in other basins throughout Indiana.

DATA QUALITY ASSURANCE AND QUALITY CONTROL

To ensure the quality of the data used in IDEM's CWA Section 305(b) assessments, all surface water monitoring is conducted in accordance with IDEM's quality assurance project plan (QAPP) for Indiana Surface Water Quality Assessment Monitoring and Nonpoint Source (NPS)/Total Maximum Daily Load (TMDL) Programs, which are part of IDEM's overall quality management plan approved by U.S. Environmental Protection Agency (EPA). IDEM's QAPP for surface water monitoring was most recently revised in October 2004 and complies with the 2002 U.S. EPA guidance for QAPPs (U.S. EPA, 2002).

The QAPP outlines specific data quality objectives for environmental data and serves as a tool and provides a plan for environmental data collection for several surface water quality monitoring and TMDL Programs. Additionally, the QAPP describes a well-defined data quality assessment process for reviewing analytical data and categorizing analytical results in one of four levels of data quality. These data quality levels are used to determine the usability of the data for water quality assessments and other decisions.

IDEM'S WATER QUALITY AND ASSESSMENT DATA MANAGEMENT

Management of Water Quality Monitoring Data
The IDEM WAPB maintains its surface water quality data in the Assessment Information Management System (AIMS) database. The AIMS houses surface water chemistry, fish community, macroinvertebrate community, habitat quality, fish tissue contaminant and sediment contaminant data. This application will be further modified to accept algae data and allow for more efficient datasheet upload and retrieval and by adding more search functions for faster query building.

Results from the Fixed Station Monitoring Program that were collected prior to 1995 are also stored in U.S. EPA's Storage and Retrieval system (STORET) for samples collected through 1995. Since the old STORET is not taking batch uploads any longer, the AIMS data since 1995 will be uploaded into the new U.S. EPA EnviroFacts Data Warehouse through the new Water

Quality Exchange (WQX). IDEM has completed modifications to the AIMS database that will allow updates through the WQX.

The initial AIMS update provided for a more user-friendly interface for staff members, and also allowed for storage of additional water quality data from nonpoint source (NPS) projects (including estimated load reductions) and third party datasets for potential use in assessing waters for the integrated report. The load reduction estimates provided by the NPS project sponsors have been included in this report (Table 7; Appendix A). The NPS water quality data is estimated using models and is used to assist in the evaluation of water quality sampling data collected by the project sponsors and IDEM WAPB staff.

Management of Water Quality Assessment Information

IDEM's WAPB maintains IDEM's assessment database. The assessment database houses the CWA Section 305(b) assessment decisions that have been made on the basis of the results stored in the AIMS database. Waterbody Assessment Units (AU) in the assessment database are assigned a unique identifier which is matched to the National Hydrography Dataset (NHD) for the purposes of mapping. This geographic information system spatial data set is called the Indiana Reach Index. When Indiana created its first Reach Index in 2002, most waterbodies in the state were assigned an assessment unit ID (AUID) based on the 14-digit watershed in which they were located. In most cases, each 14-digit watershed was assigned a single AUID regardless of how many individual streams were in the watershed. Therefore, an assessment of any stream would be applied to all the streams in the watershed regardless of where the sample was located or its relative representativeness to each stream. This problem was not preventable at the time because, while the reach indexing tool used to create Indiana's Reach Index had the capability to split watershed segments into smaller AUs, the software had no built-in means for tracking changes in segmentation.

For the 2006 integrated reporting cycle, IDEM developed an administrative process for splitting stream segments into smaller AUs allowing for more accurate application of assessment data. This process had been refined somewhat for the 2008 cycle. However, the basic process for splitting AUs is the same. Changes in segmentation are considered on a case by case basis and are generally made either to accommodate a more accurate assessment or to correct an earlier assessment in which the data were inappropriately applied.

Segmentation changes are based on a combination of factors including hydrology, similarities in land use and potential sources of impairment. Splitting AUs in this way allows IDEM to associate an identified impairment more accurately to the waterbody from which the sample was collected and to any others for which results are representative. When AUs are split, IDEM reevaluates any assessments made on the original AU along with any recent data that is available. This reassessment process ensures that the original assessment information is properly applied to the resulting new AUs. In most cases, the original assessment applies to only one or two of the resulting AUs while the remaining units are unassessed.

It is important to note that while changes in segmentation – usually from one large AU to several smaller AUs – increased the number of impairments on the 303(d) Impaired Waters List, they provide a more accurate representation of the number of stream miles impaired. IDEM recognizes the importance of accurate tracking in this regard, particularly when resegmentation results in changes to the total number of AUs and stream miles listed as impaired.

In addition to splitting segments, the Indiana Reach Index is currently being revised to include many streams that were not previously mapped in the National Hydrography Dataset. The 1:100,000 scale NHD that IDEM used to develop its first index did not include many of the state's first and second order streams and smaller lakes. Today the NHD is available in high resolution (1:24,000 scale) for all of Indiana. In order to facilitate more accurate mapping of Indiana waters, IDEM has begun the ambitious process of revising the Reach Index to include all waters that appear in the high resolution NHD. Due to the complexity of this work and the enormous number of additional waterbodies that appear when mapping at high resolution, this is no small task. To date, IDEM has completed approximately 80% of the indexing work. However, once IDEM completes its revision of the Indiana Reach Index, all new AUs identified must then be incorporated into IDEM's assessment database for assessment purposes, which will require significant time and staff resources. With regard to streams, in order to index new streams that appear at high resolution, the indexing for the entire watershed must be revisited. Those AUs that were originally comprised of all streams in a given watershed will necessarily have to be split into more representative reaches for assessment purposes. Once this process is complete for the entire state, the need to split AUs on an assessment-by-assessment basis will be eliminated along with the difficulties associated with tracking such changes.

Segmentation of previously indexed streams and addition of high resolution streams to the Indiana Reach Index is conducted using the catchment basin approach. The indexing process is guided in large part by the hydrology of a system. This is because the mechanisms of large streams and rivers are very different from those of small streams and tributary systems, making it logical to segment these into separate AUs. Varying land uses within a watershed are also considered because rural development is expected to have different impacts on a stream than urban areas, which in turn, have different impacts to a stream segment than forested areas. The presence of a NPDES facility also has the potential to impact water quality depending on the type of facility and whether the facility is operating efficiently. While confined feeding operations are not allowed by their permits to discharge, the presence of such a facility within five miles of a stream located in a heavily row-cropped area indicates the potential for impacts resulting from land application of animal wastes. Aerial photography is particularly important in determining appropriate segmentation within a watershed because it provides very recent and accurate information about the presence and thickness of riparian buffers, the presence and spatial extent of rural development, and the types of land use practices in the watershed. All of these factors help to determine where differences in water quality throughout the entire stream within a given watershed might reasonably be expected and where the appropriate endpoints might be located to achieve a representative reach for the purposes of assessment.

Achieving representativeness for the purpose of making water quality assessments is the primary goal of the segmentation process. In practice, this process leads to grouping tributary streams into smaller catchment basins of similar hydrology, land use and other characteristics such that all tributaries within the catchment basin can be expected to have similar potential impacts. Catchment basins, as defined by the aforementioned factors, are typically very small which significantly reduces the variability in the water quality we might expect from one stream or stream reach to another. Given this, all tributaries within a catchment basin are assigned a single AUID. Grouping tributary systems into smaller catchment basins also allows for better characterization of the larger watershed. Variability within the larger watershed will be accounted for by the differing AUIDs assigned to the different catchment basins.

IDEM has also converted its AUID naming convention to follow the U.S. Geological Survey (USGS) 12-digit hydrologic unit areas (HUAs) in order to achieve more consistency across its water programs, most of which have now moved away from the use of 14-digit HUAs. This revision is ongoing and has been incorporated into the indexing process. As each watershed is reindexed, every waterbody within it is assigned a new AUID based on the 12-digit HUA, which will then be incorporated into IDEM's assessment database. All of these new AUIDs and any associated assessment information must then be entered into the assessment database. U.S. EPA has requested that all previously used AUIDs be retired (i.e. not reapplied to new reaches) in order to facilitate tracking of water quality impairments in federal databases.

At this time, it is IDEM's goal to complete the revisions to the Indiana Reach Index and get all new AUIDs entered into the assessment database prior to the 2014 integrated report cycle. In the meantime, IDEM has prioritized its high resolution indexing work to stay ahead of planned TMDLs. IDEM's monitoring and assessment schedule is another consideration. However, indexing efforts have been completed in those basins in line for the 2014 assessments.

SUMMARY DATA AND ASSESSMENT METHODOLOGY

Summary Data

Indiana's Consolidated Assessment and Listing Methodology (CALM) is a document that guides IDEM's CWA Section 305(b) assessment and Section 303(d) listing processes. The CALM is provided in its entirety in Appendix H along with Indiana's 303(d) List of Impaired Waters. This section provides a summary of the data that IDEM uses to make its 305(b)/303(d) decisions.

Internally, IDEM draws from the following monitoring programs for data to use in making the use support determinations required under CWA Section 305(b) assessments and subsequent CWA Section 303(d) listing decisions:

- Probabilistic Monitoring Program, which provides fish and benthic aquatic macroinvertebrate community data, habitat evaluations and water chemistry data including information on nutrients, Chlorophyll *a* data and *E. coli* data;
- Fixed Station Monitoring Program, which provides chemistry data;
- Contaminants Monitoring Program, which provides fish tissue data;

- Clean Lakes Program (CLP), which provides chemistry data and information on nutrients, algae and secchi depth; and,
- Special Studies Program, which provides a variety of information for selected locations.

In addition to the water quality data IDEM collects, the agency reviews data from other sources for potential use in its CWA assessments, including data collected through partnerships with other state and federal agencies and by nonpoint source grant projects. IDEM is committed to making greater use of external data not only in its CWA Section 305(b) assessments but wherever possible in all OWQ programs.

The OWQ has been working since 2006 to develop the External Data Framework to provide a systematic and streamlined process for the solicitation and review of external data for potential use in OWQ programs. Several organizations and individuals have submitted data to IDEM in response to preliminary solicitations issued early in the development of the External Data Framework, in 2007 and 2009 (Appendix A; Table 8). These solicitations were conducted by letter, individual email and through email listservs targeted to organizations that might reasonably be expected to have water quality data. IDEM also placed links on various agency Web pages to help reach the broadest audience possible.
The types of organizations directly solicited include:

- Biology, chemistry, general and environmental science programs at every college and
- university in the state;
- Environmental groups and interested citizens identified through various sources;
- Hoosier Riverwatch, Indiana's statewide volunteer monitoring program;
- IDEM's CLP, administered through a grant agreement with Indiana University School of Public and Environmental Affairs (IU/SPEA);
- Drinking water utilities;
- County health departments and the Indiana State Department of Health (ISDH);
- County soil and water conservation districts (via the Indiana Association of Soil and Water Conservation Districts);
- Municipal separate storm sewer system (MS4) entities and combined sewer overflow communities;
- Federal agencies (USGS, U.S. Forest Service, etc.), and;
- State professional organizations (Indiana Water Resources Association, Indiana Association of Cities and Towns, etc.).

IDEM has completed its review of the data sets submitted by external organizations in response to these solicitations to determine their usability in 305(b) assessments and 303(d) listing decisions. The external data sets shown in Table 9 (Appendix A) meet the necessary data quality requirements as outlined in IDEM's Assessment Branch QAPP for 305(b) assessment purposes and are currently being used to make designated use assessments. It was IDEM's original goal to incorporate these assessment results into the 2010 Integrated Report and 303(d) listing. However, once the data quality review was complete and usable data sets identified, organizing the data in order to facilitate the assessment process proved to be much more time consuming than

anticipated. It should be noted that IDEM's solicitation processes were (and still are) under development at the time these preliminary solicitations were made.

While IDEM has made some progress in the development of the External Data Framework, it is still not fully developed, which has made its implementation in the meantime more difficult. This fact, coupled with and exacerbated by staff resource constraints has resulted in the delay of these assessments.

IDEM continues to receive and review data from external organizations. The Agency's goal is to complete the development of the External Data Framework and begin its implementation by early 2013. More information concerning the solicitation and IDEM's use of external data sets can be found in Appendix H.

Assessment Methodology

Waterbodies in this report are identified based on HUAs, which are watershed areas that have been defined by the USGS. For the 2010 cycle, IDEM began moving from the 14-digit HUA to the 12-digit HUA. The average 14-digit HUA is 20 square miles, while the average 12-digit HUA is 22 square miles. As IDEM converts to the 12-digit HUA, stream segments will be split based on many factors including hydrology and land use. As discussed earlier, this splitting will minimize the need to split segments for assessment purposes.

Indiana's lakes and reservoirs are tracked as individual waterbodies and are reported in terms of their acreage with the hydrologic unit area in which they are located. Lake Michigan is tracked both as Great Lake shoreline miles and as a lake in acres with its own USGS cataloging unit (eight-digit hydrologic unit code). Due to its large size and unique characteristics as compared to other freshwater lakes in Indiana, Lake Michigan and its shoreline are each discussed in their own sections of this report.

The assessment process described in Indiana's consolidated assessment and listing methodology (Appendix H) is summarized in Table 10 (Appendix A) and was applied to data from various programs in IDEM's WAPB and to other external data meeting IDEM's quality assurance/quality control requirements. Results from the assessment process are entered into IDEM's assessment database. Reach specific assessments that are entered into the assessment database are presented in Appendix F, which includes all assessments completed to date for each waterbody by their beneficial uses: aquatic life support, fish consumption, recreational use and drinking water supply for those waterbodies designated for this use. Each unique waterbody AU for which data was collected was individually assessed.

Physical/chemical data for toxicants (total recoverable or dissolved metals, polynuclear aromatic hydrocarbons (PAHs), pesticides, ammonia and cyanide), conventional water chemistry parameters (dissolved oxygen, pH, temperature and anions), and bacteria (*E. coli*) were evaluated for exceedance of the Indiana water quality standards (327 Indiana Administrative Code 2-1-6 and 2-1.5-8). U.S. EPA 305(b) guidelines (U.S. EPA 1997b) were applied to sample results as indicated in Table 10 (Appendix A).

For the Ohio River, IDEM collaborates with the Ohio River Valley Water Sanitation Commission (ORSANCO) to conduct water quality assessments. IDEM has completed a thorough review of ORSANCO's methodology for the assessment of aquatic life use support, recreational use support and support of fishable uses. This review included a comparison of the relative stringencies of applicable criteria in ORSANCO's Pollution Control Standards and Indiana's WQS and the different ways in which these criteria are used to make each type of use support assessment. More detailed information concerning ORSANCO assessments are in the CALM (Appendix H).

List of Impaired Waters

OWQ began using the integrated reporting format in 2002. Indiana's consolidated list (Appendix F) contains assessment information for all waters of the state, which is developed to fulfill CWA Section 305(b) requirements. The 303(d) Impaired Waters List is a subset of the consolidated list and identifies only those waters that are impaired and for which a TMDL is required per CWA Section 303(d).

IDEM submitted its 2010 Integrated Report, including a finalized 303(d) List of Impaired Waters to U.S. EPA on November 16, 2010. In a letter to IDEM dated June 30, 2011, U.S. EPA identified concerns regarding changes in IDEM's Consolidated Assessment and Listing Methodology that resulted in the removal from Indiana's 303(d) list five water bodies for total metals and IDEM's decision not to add to the list another 139 water bodies that were proposed for listing when the draft 303(d) list was published. The original assessments for the 139 water bodies proposed for listing were based on total metals data and/or the use of derived criteria. Based on public comments received, IDEM re-evaluated its CALM and decided that total metals results cannot be compared to dissolved metals criteria and that derived criteria should not be used to make 305(b) assessments and develop the 303(d) list until they have been codified. These decisions are the basis for U.S EPA's concerns regarding Indiana's 2010 303(d) list.

Given these concerns, U.S. EPA has not yet approved Indiana's 2010 303(d) List of Impaired Waters. IDEM is working with U.S. EPA to resolve these issues. More detail about U.S. EPA's concerns regarding IDEM's 2010 303(d) list and IDEM's response are provided in Appendix H. In the meantime, IDEM has developed its 2012 303(d) list in accordance with its revised CALM. IDEM's finalized 2012 Section 303(d) Impaired Waters List, which addresses the water bodies still in question, is included in Appendix H of this report.

The draft 2012 Section 303(d) Impaired Waters List is included in Appendix H of this report and reflects the most current information IDEM can provide regarding the status of impairment of Indiana's surface waters.

For the development of the draft 2012 303(d) List of Impaired Waters, IDEM has followed to the degree possible the 305(b) and 303(d) reporting methods outlined by the U.S. EPA (U.S. EPA, 2005) and the additional guidance provided in the U.S. EPA memorandums (U.S. EPA, 2009). The 303(d) Impaired Waters List was developed using IDEM's 305(b) assessment database.

Current issues notwithstanding, interpretation of the data and listing decisions take into account U.S. EPA guidance, and IDEM's current CALM. The 2006 guidance from U.S. EPA provides states with the option of using a multi-category approach in which each waterbody is placed into one of five categories (or subcategories) for each designated use depending on the degree to which it supports that designated use. Waters in Category 5 require TMDLs and comprise the Section 303(d) Impaired Waters List. A more detailed discussion of the consolidated listing methodology and the different categories illustrated in Figure 7 (Appendix C) can be found in Appendix H of this report.

RIVERS AND STREAMS WATER QUALITY ASSESSMENT

Designated Use Support

Rivers and streams in all watersheds were assessed for support of beneficial uses designated in Indiana's water quality standards (Indiana Legislative Services Agency, 1997), which contain both narrative and numeric requirements to ensure that the beneficial uses of Indiana waters are protected. Indiana's water quality standards provide the basis for IDEM's CWA Section 305(b) water quality assessments. Of the beneficial uses designated in the state's water quality standards, IDEM assesses aquatic life use support, recreational use support and the support of "fishable" uses. IDEM also assesses drinking water use support on surface waters that serve as a public water supply. Although there are additional uses designated in Indiana's water quality standards, IDEM limits its assessments to these four because the criteria in place to protect them are more stringent than those necessary to protect other uses. Thus, by protecting these uses the other uses such as agricultural and industrial uses are also supported.

A summary of IDEM's methods for determining support of designated uses is provided in the "Assessment Methodology and Summary Data" section of this report, and IDEM's CALM is provided in its entirety in Appendix H of this report. Assessed waters are those waterbodies for which the available data were sufficient to allow determination of designated use support.

In 2011, IDEM made significant revisions to its water quality monitoring strategy to guide its monitoring efforts from 2011 to 2019. The data collected by IDEM and evaluated for the 2012 Integrated Report was collected in accordance with IDEM's previous water monitoring strategy, which provided for monitoring all the state's major basins within a five-year period. Therefore, the data used in the development of this report are five years old or less. The results of IDEM's comprehensive use support assessments are provided in Appendix E.

Waterbodies are classified for designated use support as described in the "Assessment Methodology" section of this report. The number of stream miles in Indiana assessed and the number of miles fully supporting and impaired are shown for each individual use in Table 11 (Appendix A).

Causes/Stressors and Sources of Impairment of Designated Uses

Causes/stressors are those pollutants or other stressors that contribute to the actual or threatened impairment of designated uses in a waterbody. Toxic substances listed in the state's numeric water quality standards and conditions such as habitat alterations, presence of exotic species, etc. are all examples of causes or stressors. The stressor inhibits the waterbody from providing a habitat that can support aquatic life or creates a situation that is hazardous to human health or animal life.

Table 12 (Appendix A) represents the total miles of streams affected by each cause/stressor in Indiana. A waterbody may be impaired by several different causes/stressors so that the total stream miles affected may actually be less than the total number of miles listed in the table.

Impaired biotic community status represents streams where the cause of impairment is not identified. The fish and/or benthic macroinvertebrate community at sampling sites in the watershed have responded to as yet unidentified stressors.

Sources are the activities that contribute pollutants or stressors to surface water resulting in impairment of designated uses in a waterbody. The structure of IDEM's assessment database, which was designed by U.S. EPA for states to use in their CWA Section 305(b) reporting, requires that a source be identified for each assessment made whether or not specific sources are precisely known. For most assessments, the sources identified in the assessment database for a given impairment are not proven. Rather they represent those sources determined by IDEM staff to be the most likely sources given a variety of factors, including but not limited to:

- Land uses (as indicated by field observations and land use data from published sources such as the USGS Gap Analysis Program, aerial photography, etc.);
- Field observations of potential sources such as illegal straight pipes, tillage to the stream's edge, livestock in the stream, etc.;
- The presence of permitted facilities within close proximity of the impaired stream in cases where the impairment is something that could reasonably be expected to be associated with the discharge of those facilities; and,
- Naturally occurring conditions that could contribute to impairment.

IDEM believes that by using best professional judgment, scientists can distinguish the most likely sources of impairment in the watershed and provide a starting point for a TMDL, watershed planning or other activities aimed at restoring the stream. Within this context, the sources identified in the assessment database do not identify any entities or practices known to contribute to a specific impairment.

Accurately attributing a given impairment to specific sources is difficult at best without more detailed and resource intensive sampling and analyses and is in many cases impossible to do with a high degree of certainty.

IDEM continues to explore different approaches to determine sources of impairments. One approach involves gathering a variety of information from sources within and outside IDEM to determine the extent of problem area and potential sources/stressors contributing to the impairment. When sufficient information is gathered to characterize the impairment, all the data are analyzed to narrow down the list of potential sources and identify those contributing to the impairment.

The potential of these sources to contribute to the identified impairment is then verified and a sampling plan is developed to collect any additional biological and/or chemical water quality data needed to confirm or eliminate the potential sources identified. It is anticipated that the changes in IDEM's water quality monitoring strategy, which focuses more of the Agency's limited monitoring resources to targeted monitoring efforts, including those for TMDL development and baseline monitoring, will provide additional data to help in more accurately identifying sources of impairment.

The activities listed in Table 13 (Appendix A) represent the total stream miles impaired due to each potential source. Several potential sources may contribute to impairment of a single stream or stream reach, so the total miles in the table may be greater than the actual stream miles impaired reported elsewhere in this document.

Table 13 (Appendix A) includes 46 potential sources for the use impairments, including agricultural categories and additional sources resulting from urban activities and land development. Illicit connections identify "straight pipes" from buildings in unsewered areas that flow into state waters with no or insufficient treatment. Contaminated sediments are largely due to PCBs that correlate with elevated PCB levels in fish tissue.

OHIO RIVER

IDEM collaborates with ORSANCO to conduct water quality assessments of the Ohio River reaches that border Indiana. ORSANCO is an interstate water pollution control agency for the Ohio River established through a compact agreement between member states and approved by Congress. Under the terms of the compact, member states cooperate in the control of water pollution in the Ohio River Basin.

ORSANCO monitors the Ohio River on behalf of the compact states. Under CWA Section 305(b), ORSANCO produces a water quality assessment report of the Ohio River water quality condition every two years. Although this report identifies water quality issues on the Ohio River, unlike its compact states, ORSANCO is not required to develop a 303(d) List of Impaired Waters. Identifying Ohio River impairments on a 303(d) list for the purposes of TMDL development is the responsibility of each compact state. A more detailed discussion of the Ohio River assessments is located in Appendix A.

GREAT LAKES SHORELINE WATER QUALITY ASSESSMENT

Indiana's entire portion of the Lake Michigan shoreline was last assessed in 2001 and was found to be fully supporting of aquatic life use and fully supporting of drinking water uses for the 33 designated miles. All 59 miles of the shoreline in Indiana were assessed as impaired for recreational and fishable uses. IDEM's assessment results are summarized in Table 14 (Appendix A). The specific causes of impairment to Indiana's Lake Michigan shoreline are reported in Table 15 (Appendix A) and the potential sources are summarized in Table 16 (Appendix A).

GREAT LAKE WATER QUALITY ASSESSMENT – LAKE MICHIGAN

The Indiana waters of Lake Michigan have been assessed for mercury and PCBs in fish tissue in accordance with IDEM's CALM. Tables 17 through 19 (Appendix A) reflect the results of these assessments. Because Lake Michigan is assessed as a single unit, any impairment identified in any part of the lake is applied to all 154,176 acres of Lake Michigan.

LAKE WATER QUALITY ASSESSMENT

Because of the differences in the scope and nature of the data collected on Indiana's lakes as opposed to the state's rivers and streams, there is generally less information available with which to make assessments. The criteria for use support assessments for lakes and reservoirs is presented in Table 10 (Appendix A) and discussed in more detail here and in the section on the Indiana CLP. Summaries of 305(b) assessment information for Indiana lakes are provided in Tables 20 through 22 (Appendix A).

Designated Use Support

Monitoring for CWA Section 305(b) designated use support assessments of Indiana lakes has been limited in the past because the majority of state resources allocated for lakes have gone toward assessing the trophic status of lakes in the state as required by CWA Section 314. IDEM uses the Indiana Trophic State Index (TSI) to make its CWA Section 314 assessments. Although TSI calculations take into account results for water quality indicators such as nutrients, dissolved oxygen, water clarity and plankton, the TSI score alone is considered insufficient for judging the condition of biological communities such as fish, macroinvertebrates and plant life for the purposes of Section 305(b) assessments of aquatic life use support.

IDEM has used biological indicators to determine aquatic life use support in rivers and streams for many years. However, IDEM has comparatively little biological community data for Indiana lakes. Given this, Section 305(b) lake assessments for aquatic life use support have relied on information primarily from the Indiana Department of Natural Resources (IDNR):

- IDNR's surveys of sport fish communities, which provide information regarding the presence or absence of the native cold water Cisco (*Coregonus artedi*) were used to determine whether a given lake is fully supporting aquatic life use or impaired, respectively; and,

- In keeping with Indiana's narrative water quality standards, those waters stocked for the purposes of put-and-take trout fishing as indicated by IDNR's trout stocking plans were assessed as fully supporting.

In cases where temperature and pH information are available and indicate an adverse affect on the aquatic life, the lake was assessed as impaired.

Between 1999 and 2004, IDEM commissioned two studies aimed at developing indices of biological integrity for Indiana lakes. The first study focused on northern Indiana lakes and reservoirs and the second focused on lakes in the southern part of the state. Both studies were funded under CWA Section 319(h) grants to the Indiana Lakes Management Society. These studies resulted in the development, calibration and subsequent validation of an index of biotic integrity for northern lakes and reservoirs and an index of biological sustainability for southern lakes and oxbows. More work remains to determine whether these indices can be used to assess aquatic life use in the waterbodies sampled and the extent to which they can be incorporated into IDEM's CALM.

The degree to which a given lake supports its "fishable" uses as described in Indiana's narrative water quality standards is determined by reviewing data that indicate the concentrations of contaminants in the edible portion of fish captured from the lake. IDEM's fishable use assessments include both mercury and PCBs in fish tissue. Details regarding IDEM's fish tissue assessment methodology can be found in IDEM's CALM in Appendix H of this report.

IDEM conducts two types of recreational use support assessments on lakes:

- Recreational uses within the context of human health; and,
- Recreational uses within the context of aesthetics.

Recreational use support assessments within the context of human health are made in the same manner as for rivers and streams. These assessments are based on *E. coli* data, collected primarily from boat docks and/or swimming beaches. Each lake for which IDEM has sufficient data was assessed by comparing the results to the criteria in Indiana's water quality standards which describe acceptable levels of *E. coli* in order to determine whether or not the lake supports recreational uses. The recreational uses of concern in these assessments are any that might involve full body contact with the water or the possibility of ingestion or where excessive pathogens pose a potential health risk.

IDEM's method for determining recreational use support within the context of aesthetics was developed in 2008. Because excessive algae can deter the use of the resource for recreational purposes for aesthetic reasons, these criteria are used to make recreational use support determinations within the context of aesthetics as opposed to health risk. These assessments are based on total phosphorus concentrations for both natural lakes and reservoirs that have been found to result in significant increases in algal levels in addition to TSI results. Details regarding the development of this methodology and how it was applied are provided in IDEM's CALM document (Appendix H).

Drinking water use support for lakes and reservoirs is limited to those that are used directly or indirectly as drinking water supplies. Lakes and reservoirs for which water utilities have applied for pesticide application permits from IDEM's Drinking Water Branch were assessed as not supporting of their drinking water use. Conditions that require the application of pesticides to a drinking water supply to control excessive algal levels are considered an impairment of the Indiana's narrative water quality standards for taste and odor producing substances.

Blue-green algae (cyanobacteria) continue to be a concern in Indiana lakes and reservoirs both with respect to recreational uses and drinking water uses. Blue-green algae are common constituents of algal communities in lakes and many are known to produce potent toxins, which are now recognized as a potentially serious threat to human health. Microcystin is the cyanotoxin most commonly monitored. In 2010, IDEM piloted a targeted monitoring effort to support the development of an interagency process for the development of public health advisories for algal toxins. Monitoring is conducted statewide at 10 public lakes on a monthly basis from June through September. Sampling frequency is increased to biweekly for lakes where cyanobacteria densities are found to be greater than 100,000 cells per milliliter, as recommended by the World Health Organization. Lakes and reservoirs are selected for monitoring based on having public recreation and swimming beaches and known or suspected blue-green algae production.

The public is kept informed of the status of the sampled reservoirs by the www.algae.IN.gov website, which also incorporates public health information related to blue-green algae from the ISDH as well as other relevant information from government agencies and educational institutions. Once the two-year grant period is over, IDEM intends to incorporate a blue-green algae monitoring program as a part of its overall water monitoring strategy.

In 2010, IDEM also contracted with IU/SPEA to conduct a different, but related, pilot project to monitor Microcystin at all of the same lakes to be monitored for the CLP. Like the Microcystin monitoring conducted by IDEM, it is anticipated that the results from this monitoring will help IDEM to better understand the environmental variables associated with blue-green algal blooms and MMicrocystin production. However, results from the CLP Microcystin monitoring are not used to support the development of public health advisories because they are collected for a different purpose and use different methods than those used by IDEM to conduct its sampling.

IDEM does not use information collected through these monitoring programs to make 305(b) assessments because the environmental factors that influence the occurrence and production of algal toxins are not well understood, and there are no federal drinking water standards for blue-green algae. However, algal toxins now appear on U.S. EPA's federal drinking water contaminant candidate list (CCL 3), which is used to prioritize federal research and data collection efforts to help determine whether a specific contaminant ought to be regulated. Details regarding U.S. EPA's CCL are available online at: http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm#microbial. It is anticipated that as more scientific information becomes available, including the development of a federal water

quality criteria for algal toxins, it may be possible to develop water quality assessment methods that will allow IDEM to determine the impact that algal toxins may be having on designated uses of Indiana waters.

CWA Section 314 Assessments of Lake Trends and Trophic Status
IDEM bases its Section 314 assessments of trend and trophic state of Indiana's lakes on data collected by staff and students at IU/SPEA through the Indiana CLP. Indiana's CLP is funded through a CWA Section 319 grant. Lake assessments are included in this report (Appendix I).

Indiana CLP monitoring and IDEM's Section 314 assessments follow a five-year basin rotation strategy. This strategy differs somewhat from that which is used for river and stream sampling because lakes are not as equally distributed across the Indiana landscape as rivers. While some basins contain very few lakes, others contain more than can feasibly be sampled in a given year. In addition, new lakes created in reclaimed coal mine areas have added another year, at least, to the previous sampling cycle rotation. As a result, it now takes nearly six years instead of five to complete a sampling rotation of the lakes and reservoirs in all the major basins of the state.

The Indiana TSI is used to assign points for each of ten common water quality parameters. The total of these points for a particular lake is that lake's trophic or TSI score. Scores range from 0 to 75 points, with lower numbers indicating waters with the least amount of nutrient enrichment. Details on the water quality parameters used to calculate Indiana's TSI can be found in IDEM's CALM document, located in Appendix H of this report.

For the purposes of CWA Section 314 assessments, Indiana lakes were placed in one of five classes per U.S. EPA guidelines (U.S. EPA, 1997b) based on their trophic state as measured by the Indiana TSI score. The lake classes used in this report are shown in Table 23 (Appendix A). A summary of the trophic status information for lakes assessed between 2005 and 2012 is presented in Table 245.

Indiana now has enough data collected to begin conducting some cursory trend analyses on the trophic status of lakes in the state (Table 25; Appendix A). Of the lakes assessed from 2005-2012, approximately eleven percent of the lakes (fifteen percent of the acres assessed) show some water quality improvement as measured by a reduction in their trophic scores. Twenty-three percent of the lakes (30 percent of the acres assessed) appear to have relatively stable trophic conditions. . Five percent of the lakes sampled during this time (two percent of the acres assessed) show an increase in their trophic scores indicating that the trophic conditions are degrading. The water quality trend is fluctuating for 61 percent of the lakes (54 percent of the acres assessed). A lack of detectable trend may be due to abnormal seasonal effects or changing activities in the surrounding watershed. An unknown trend as used in this report reflects having insufficient data points to determine a trend, as in the case of newly created or never before sampled lake.

WETLANDS ASSESSMENT

IDEM administers the CWA Section 401 Water Quality Certification (WQC) Program and also administers Indiana's State Isolated Wetlands law for those wetlands that are not under federal jurisdiction.

IDEM regulates the placement of fill materials, excavation (in certain cases) and mechanical clearing of wetlands and other waterbodies. IDEM draws its authority from the federal CWA, state law and rules for state regulated wetlands, and from Indiana's water quality standards. IDEM regulates some activities in waterbodies in conjunction with the U.S. Army Corps of Engineers (ACOE).

Any person who wishes to place fill materials, excavate or dredge, or mechanically clear (use heavy equipment) within a jurisdictional wetland, lake, river or stream must first apply to the ACOE for a CWA Section 404 permit. If the ACOE decides a permit is needed, then the person must also obtain a CWA Section 401 WQC from IDEM. Placement of fill into non-jurisdictional wetlands is regulated by Indiana law (Indiana Code 13-18-22; 327 IAC 17).

Under CWA Section 401, IDEM reviews the proposed activity to determine if it will comply with Indiana's water quality standards. The applicant may be required to avoid impacts, minimize impacts or mitigate for impacts to wetlands and other waters. IDEM will deny water quality certification if the activity will cause adverse impacts to water quality the application is deficient, the wetland activities are not necessary or compensatory mitigation does not offset impacts. A regulated project may not proceed until it has received a certification from IDEM. A key goal of the program is to ensure that all activities regulated by IDEM meet the national no-net-loss of wetlands policy. Table 26 (Appendix A) provides some basis statistics regarding wetlands in Indiana. Table 27 (Appendix A) provides information regarding historical and present estimates of wetland resources in Indiana.

Development of Wetland Water Quality Standards
Draft wetland water quality standards were preliminarily adopted by the Indiana Water Pollution Control Board on February 13, 2002. However, with the passage of isolated wetland legislation, IDEM has decided not to pursue final adoption of these standards.

Integrity and Extent of Wetland Resources
Wetlands occur in and provide benefits to every county in Indiana. The lack of quantitative information on some aspects of Indiana's wetland resources is a major obstacle to improving wetland conservation efforts. The most extensive database of wetland resources in Indiana is the National Wetlands Inventory (NWI) developed by the U.S. FWS. The original NWI maps were produced primarily from interpretation of high-altitude color infrared aerial photographs taken of Indiana during spring and fall 1980-87. These maps were updated at a much higher resolution during 2008-2009 through a grant to Ducks Unlimited. The updated maps indicate wetlands

type, using the Coward in, *et al*. classification scheme. IDEM uses the updated, higher resolution NWI inventory primarily in the Section 401/Wetlands program as a screening tool when evaluating applications for impacts to wetlands and streams and also to help identify wetland compensatory mitigation or restoration sites. It has benefited IDEM wetland staff in setting priorities for complaint investigations.

IDNR conducted the most recent and complete analysis of the NWI database in 1991. According to the analysis, Indiana had approximately 813,000 acres of wetland habitat in the mid-1980s when the data were collected (Table 26; Appendix A). Wetland loss or gain since then is not known at this time (Rolled 1991).

Wetland Protection Activities
In addition to the review of applications for Section 401 WQC and state regulated wetland permits, the program works on additional projects devoted to wetland assessment and wetland protection:

- IDEM staff work closely with the ACOE, U.S. FWS, and IDNR to evaluate proposed projects to coordinate requirements for various state and federal permits related to wetlands;
- IDEM maintains a web page devoted to wetlands and water quality issues: http://www.in.gov/idem/4138.htm. This page includes information on the status of Indiana's wetlands, current laws and rules, conservation programs and links to other regulatory and non-regulatory wetland programs.
- IDEM maintains a web-based mapping tool for potential wetland restoration sites, including opportunities for compensatory mitigation and non-regulatory purposes: http://idemmaps.idem.in.gov/apps/MitigationVolunteer/;
- Section 401 WQC Program staff conduct outreach events at various locations to promote the importance of wetlands and to educate the public on regulations protecting wetlands; and,
- IDEM continues to work closely with all partners in the Indiana wetland conservation plan.

The wetlands section merged with the storm water section in 2008. The storm water programs are comprised of construction site run-off (327 IAC15-5, Rule 5), industrial storm water run-off (327 IAC 15-6, Rule 6), and municipal separate storm sewer systems (327 IAC 15-13, Rule 13). Additional information is available for the Storm Water Program at: http://www.in.gov/idem/4896.htm.

PUBLIC HEALTH/AQUATIC LIFE CONCERNS

The release of toxic materials into the aquatic environment can produce harmful impacts:

- Contaminants present in acutely toxic amounts may kill fish or other aquatic organisms directly;

- Substances present in lesser, chronically toxic amounts can reduce densities and growth rates of aquatic organisms and/or become concentrated in their body tissues. These substances can be further passed to humans through consumption of the organism; and,
- Toxic materials in the water could potentially affect human health by contaminating public water supplies.

In the last several years, advances in analytical capabilities and techniques and the generation of more frequent and higher quality toxicity information on chemicals have led to an increased concern about their presence in the aquatic environment and the associated effects on human health and other organisms. Because many pollutants are likely to be found in fish tissue and bottom sediments at levels higher than in the water column, much of the data on toxic substances used for fishable use assessments in this report were obtained through the Fish Tissue Contamination and Sediment Contaminants Monitoring Programs.

While not all species of fish found in Indiana lakes and streams have been tested, carp are commonly found to be contaminated with both polychlorinated biphenyls (PCBs) and mercury at levels exceeding the state's benchmark criteria for these contaminants in fish tissue.

Data collected from September 1983 through October 2008 indicate that concentrations of PCBs in fish tissue are decreasing (Figure 8; Appendix C). Data collected from common carp (Figure 9; Appendix C) and from Channel Catfish (Figure 10; Appendix C) indicate that the PCB concentrations in both of these species are declining over time.

Data collected from August 1983 through October 2008 indicate no apparent trend in mercury concentrations in fish tissue (Figure 11; Appendix C). Data collected from Largemouth Bass (Figure 12; Appendix C), from Channel Catfish (Figure 13; Appendix C), and from Walleye (Figure 14; Appendix C) indicate that the mercury concentrations in these species are remaining fairly constant over time. While there are slight variations in the concentrations of mercury in fish tissue within a species, these variations are likely due to the size of the individuals collected during a sampling year. Smaller fish tend to have lower levels of mercury compared to larger fish.

Fishable use assessments are reported separately from aquatic life use in order to provide more information about each individual designated use. Concerns related to fish consumption can be evaluated independently by referring to the Indiana State Department of Health and fish consumption advisories online at: http://www.in.gov/isdh/23650.htm.
A diverse and healthy fish community is considered an indication of good water quality. Serious public concern is generated when dead and dying fish are noted in the aquatic environment since this is sometimes evidence of a severe water quality problem and may indicate the long term loss of use. A fish kill can result from:

- The accidental or intentional spill of a toxic compound or oxygen depleting substance into the aquatic environment;
- A continuous industrial or municipal discharge due to a system upset which may release an atypical effluent containing high concentrations of pollutants, and;

- Natural causes such as disease, extreme draught or depletion of dissolved oxygen from extreme weather conditions.

IDEM's Office of Land Quality tracks spills and fish kills that are reported to IDEM or discovered by agency staff. The total number of calls, spills, and kills recorded from 1998 to 2011 are listed in Table 28 (Appendix A).

GROUND WATER ASSESSMENT

In order to be eligible for section 106 grant funds, Indiana is required to have the means to monitor water quality (including "navigable waters and to the extent practicable, ground waters") and annually update water quality data and include them in the section 305(b) submittal. This section provides a summary of Indiana's ground water monitoring and protection programs, ground water/surface water interactions within Indiana, and ground water quality and ground water contamination sources from 2008-2010.

INTRODUCTION TO INDIANA GROUND WATER

Ground water is an important resource for Indiana citizens, agriculture and industry. The majority of the population uses ground water for drinking water and other household uses. IDEM's 2010 Annual Compliance Report for Indiana public water supply (PWS) systems is online at: http://www.in.gov/idem/files/annual_compliance_report_2010.pdf.

Major Sources of Ground Water Contamination

The major contaminant sources impacting Indiana ground water as of 1998 are listed by general activity types in Table 29 (Appendix A). All sources listed are a potential threat to ground water. However, the degree to which the source is a threat to ground water depends on several factors with the most significant being hydrogeologic sensitivity. Other major risk factors include location of the contaminant source relative to drinking water sources, toxicity of the contaminant and the size of the population at risk. All risk factors listed in 290 (Appendix A) were considered in selection of the ten priority contaminant sources and those risk factors relevant to the highest priorities are identified. Classes of contaminants commonly associated with each high priority contaminant source are also given. Due to resource constraints, the information in Table 29 (Appendix A) has not been significantly updated since the 2000 305(b) report. However, anecdotal evidence indicates the same major contaminant sources are impacting Indiana ground water now as they were in 1997 and 1998.

Nitrate is a potential contaminant from the following high priority sources listed in Table 29 (Appendix A): commercial fertilizer and animal manure applications to farm land, and septic systems. Nitrate, a highly mobile and soluble contaminant, is the most frequently detected ground water contaminant in rural areas. However, determining the source of nitrates detected in ground water can be difficult and costly.

When applied at the proper rate and time, commercial fertilizer poses little threat of contamination to ground water. Purdue University Cooperative Extension Service staff, Natural Resource Conservation Service staff, and private consultants assist crop producers in developing nutrient management plans that focus on meeting crop nutrient needs.

On July 28, 2010, the Indiana rule requiring *Certification for Distributors and Users of Fertilizer Materials* of the Indiana Administrative Code (355 IAC 7-1-1) became effective and is administered through the Office of the Indiana State Chemist (OISC). The date for full

compliance with the requirements of this rule was January 1, 2012. The processes resulting in this new rule were supported by a variety of agricultural groups and other stakeholders who envisioned this as an opportunity for fertilizer material applicators and distributors to demonstrate their competency to handle and apply these materials safely and effectively. In addition, this provides a state-wide standard for applicator certification and training. For purposes of this rule, "fertilizer material" is defined to mean both commercial fertilizer and manure from a confined feeding operation (CFO). Any person using (applying, handling, or transporting) fertilizer material for hire for purposes of producing an agricultural crop must be certified and licensed by OISC in Category 14 or be trained and supervised by a Category 14 applicator, and be working for a licensed Category 14 fertilizer business. Any person applying manure from a CFO (in excess of 10 cubic yards or 4,000 gallons per year) to his/her own property must be certified by OISC as a private fertilizer applicator. Certified and licensed applicators may supervise up to ten employees provided that those employees have received training and are working within the business or farming operation. Any person (individual, partnership, corporation, business, etc.) that only distributes, but does not use fertilizer material must obtain a fertilizer distributor business license.

Livestock and poultry confined feeding operations exist throughout Indiana as an integral component of Indiana's agricultural economy. The primary concerns associated with CFOs are the proper storage and land application of the large volumes of manure produced by these operations. The manure is applied to farmland to recycle the nutrients to fertilize crops. The manure contains ammonia-nitrogen which is converted to nitrate through biological processes in the soil. Consequently, the rate of manure application to farmland is a major concern when the application provides more nitrogen than a crop will use. The excess nitrogen can move beyond the crop root zone and potentially into underlying aquifers. The Water Pollution Control Board adopted revised regulations for confined feeding operations on November 9, 2011. The revised regulations continue to require the proper design and construction of manure storage structures and the application of manure to land in a manner that protects ground and surface water quality. Crop nutrients within manure are available at a slower rate than commercial fertilizer nutrients due to the rate of decomposition of the manure. When applied at the proper agronomic rate, manure poses little threat of contamination to ground water.

Properly constructed and maintained septic systems provide satisfactory on-site treatment of domestic wastewater in rural and unsewered suburban areas of Indiana. However, improperly constructed or poorly maintained septic systems, as well as systems operating in areas of high seasonal water tables or other ground water sensitive areas, are also of concern as a source of nitrate contamination to ground water.

Landfills and underground storage tanks are a high priority ground water contamination concern largely due to practices or activities that occurred prior to construction standards and legislation established for the protection of ground water. Landfills constructed after 1988 have been required to adhere to stringent construction standards. Since 1988, underground storage tank registration, upgrading, closure activity and site assessment have been closely reviewed by the IDEM Underground Storage Tank (UST) Section.

Since 1988, IDEM has ensured that all regulated UST system owners and operators properly registered, upgraded and/or closed existing UST systems in accordance with state requirements. Currently, IDEM inspects all USTs systems at least once every three years to ensure that systems are properly designed and operated for corrosion protection, spill and overfill protection, leak detection in order to prevent releases or ensure early detection of releases. UST systems that are no longer in use are inspected to ensure they are properly closed. In addition, IDEM ensures that all confirmed releases to the environment of petroleum and hazardous substances are cleaned up as necessary to protect human health, including ground water consumption.

Class V underground injection wells are widespread throughout the state and occur in high concentration in several areas, including some areas where ground water is highly sensitive to contamination. Most Class V wells are shallow wells that are used by business and individuals to dispose of a wide variety of non-hazardous fluids into the ground. These wells are regulated by the U.S. Environmental Protection Agency (EPA) and can release a wide variety of contaminants into or above aquifers supplying drinking water. The large number and diversity of Class V wells combined with lack of information regarding the effects of these wells on ground water pose a potential threat to ground water. U.S. EPA's Class V Underground Injection Control Program targets the wells that pose the greatest environmental risk. In 2000, the U.S. EPA implemented more intensive regulations and enforcement for large capacity cesspools and motor vehicle waste disposal wells.

Several cases of ground water contamination due to industrial facilities or their ancillary operations have been documented in Indiana. Although many contamination events occurred prior to the development of regulations for the storage and handling of industrial materials, ground water contamination still occurs as a result of either accidents or intentional dumping of waste. In 1998, Indiana's Secondary Containment of Above-Ground Storage Tanks Containing Hazardous Materials Rule (327 IAC 2-10) was adopted. This rule requires that new facilities provide secondary containment for storage of 660 gallons or more of hazardous wastes if the facility is located outside an approved delineated wellhead protection area. However, if the facility is located within an approved delineated wellhead protection area, the tank requires secondary containment if 275 gallons or more of hazardous materials are stored there. The secondary containment rule, along with outreach and education programs, has alleviated a number of problems. However, these activities continue to be a potential source of contamination to ground water in Indiana.

The storage and extensive use of salt as a deicing agent during the winter months has an impact on ground water. Ground water contamination from road salt has been documented in Indiana. Efforts are being made by the Indiana Department of Transportation (INDOT) to build salt storage facilities in areas where ground water is not sensitive to contamination and to upgrade existing facilities to protect ground water. Currently all INDOT salt storage facilities are covered by domes or canopies, and several new facilities were built to contain all surface runoff on-site to reduce ground water contamination. In addition, road salt usage and application rates have been

significantly reduced from past years through computerized weather forecasting and roadway temperature sensors.

Ground water contamination as a result of spills can be avoided or minimized if spills are properly handled and cleaned up. Unreported spills may contribute to ground water contamination. Spill handling and clean up, when not properly executed, create a concern for ground water contamination. Indiana's Spills; Reporting, Containment and Response Rule (327 IAC 2-6.1) requires that spills are reported, properly handled and cleaned up.

Ground Water Protection Programs

Programs that conduct monitoring to evaluate and protect ground water resources in Indiana occur at all levels of government. At the state level, several ground water protection programs and activities have been implemented or are in the process of being implemented. Table 30 (Appendix A) lists the state's ground water protection programs and activities, developmental stage of the program or activity, and the agency or agencies responsible for the program's implementation and/or enforcement.

Indiana's ground water quality standards became effective in March 2002. The language of the rule, which includes numeric standards, provides ground water protection to wells and allows for the classification of ground water. The rule states that all ground water of the state shall be classified as drinking water class ground water unless it is classified as limited class ground water or impaired drinking water class ground water. IDEM may classify ground water as limited when ground water is shown to have a yield of less than 200 gallons per day or a total dissolved solids concentration of more than 10,000 parts per million (ppm). Additionally, ground water that is in the crop root zone, in a coal mined area, or in an injection zone of a permitted Class I, II or III injection well or gas storage well may be considered limited. IDEM may classify ground water as impaired when specific conditions are met. These conditions include, but are not limited to:

- The ground water is not in a state approved wellhead protection area established pursuant to 327 IAC 8-4.1;
- The ground water has one or more contaminant concentrations above the numeric criteria established in the rule; and,
- The commissioner has approved a ground water remediation, closure, cleanup or corrective action plan that describes the nature and extent of contaminants exceeding the criteria.

In addition, IDEM's commissioner may deny a request to classify ground water as impaired drinking water class if the exceedance of the contaminant was caused by an illegal action of the person seeking the change in classification.

In 2000, U.S. EPA approved Indiana's Source Water Assessment Program developed by Indiana stakeholders. IDEM made the decision to prepare source water protection plans (SWAPs) for public water systems with the exception of community water systems that utilize ground water as their primary source of water. Those community ground water systems are required by the

Indiana Wellhead Protection Rule (327 IAC 8.4.1) to prepare a wellhead protection plan for each well or well field that provides water to the public. IDEM contracted the majority of field work and the preparation of the SWAPs. Since 2000, the contractors have identified the source water areas for approximately 3,600 public water systems. In the delineated source water areas, IDEM contractors have inventoried the potential sources of contamination from regulated facilities and assessed water system susceptibility to contamination. As of the end of 2008, all SWAPs for the 3,614 public water systems were surveyed by IDEM's contractors and final reports were distributed by IDEM to the owners of the public water systems. As a result of this effort, IDEM's Source Water Assessment Program is completely implemented and satisfies the requirements of substantial implementation of the Source Water Assessment Program as defined by IDEM and accepted by U.S. EPA Region 5.

The Indiana Wellhead Protection Rule (327 IAC 8-4.1) became effective in March 1997. The Wellhead Protection Program is a proactive program that protects public water supplies from contamination. The Wellhead Protection Rule outlines the minimum requirements community public water supplies must meet to comply with the Wellhead Protection Program. The Wellhead Protection Program is a part of the Source Water Assessment Program. As of October 2009, approximately 98 percent of Indiana's community water systems utilizing ground water as their source of drinking water have an approved wellhead protection plan. This equates to 633 community water systems with an approved wellhead protection plan. Having an approved Wellhead Protection Plan indicates that a community has met the requirements of the Indiana Wellhead Protection Rule and has developed strategies to adequately protect their community water supplies from becoming contaminated.

In addition to regulatory programs and other structured ground water protection activities listed in Table 30 (Appendix A), there are several educational programs conducted in Indiana that place an emphasis on ground water protection. The Purdue University Extension Service's Safe Water for the Future Program is an umbrella for several programs that provide resources on drinking water protection for individuals and communities. The Farm*A*Syst and Home*A*Syst Programs are essentially wellhead protection programs for rural and domestic private wells. A series of publications and brochures on wellhead protection are also available to assist communities working on wellhead protection. "Watershed Connections" brings together local contacts to produce a community specific publication on water resources and their protection. The Indiana Department of Natural Resources' Project WET (Water Education for Teachers) and Purdue University Extension Service's "Water Riches" Program are two general water education programs that provide information about ground water protection. The Purdue University Cooperative Extension Service's Water Quality Program has made more than 70 publications addressing specific topics for the general public available through their website. For example, the Purdue Extension publication "Nitrate and Indiana's Ground Water" describes the occurrences of nitrate across the state, potential causes of contamination, health risks associated with nitrates and types of available treatment technology if nitrates are found in ground water.

Ground Water for Drinking Water Monitoring Data
The Compliance Section of the Drinking Water Branch at IDEM receives ground water compliance monitoring results reported by public water systems for volatile organic compounds (VOCs), synthetic organic compounds (SOCs), inorganic compounds (IOCs), nitrates (NO_3), and radionuclides.

Radionuclide monitoring consists of analysis for gross alpha particle activity. Samples collected by public water systems are from entry points, which occur after treatment and before the distribution system. Entry point data can be from a single well or blended from two or more wells.

The parameters monitored by public water systems depend on the type of system. There are three types of public water systems: community, non-transient non-community, and transient non-community. Compliance monitoring results reported by public water systems are considered "treated water" and may not represent "source" or "raw water" results. Information reported to IDEM from public water systems may be viewed through the Safe Drinking Water Information System at: https://myweb.in.gov/IDEM/DWW/.
The three types of public water systems are defined below:

- A community system is defined as a system that serves water to the public and has at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Examples of community water systems are municipal systems, mobile home parks, nursing homes and homeowners associations. Along with regular bacteria sampling, community systems are required to test for thirty regulated SOCs, 21 VOCs, 12 regulated IOCs, sodium, and radionuclides. Sampling for these parameters is required a minimum of once every three years, unless certain levels of contaminates are detected. There are currently 806 community systems in Indiana.
- A non-transient non-community water system is defined as a public water system that is not a community water system which regularly serves the same 25 or more persons at least six months per year. Examples of non-transient non-community water systems could include restaurants, factories, daycares and schools. Along with regular bacteria sampling, non-community non-transient systems are required to test for thirty regulated SOCs, 21 VOCs, 11 regulated IOCs (except sodium and fluoride), and radionuclides. Sampling for these parameters is required a minimum of once every three years, unless certain levels of contaminates are detected. There are currently 2,792 non-transient non-community systems in Indiana.
- A transient non-community is defined as a non-community water system that does not serve at least the same 25 people over six months per year. Examples of transient non-community water systems could include restaurants, rest stops and gas stations. Along with regular bacteria sampling, transient non-community systems are required to test for radionuclides. There are currently 566 transient non-community systems in Indiana.

Statewide Ground Water Monitoring Network

The Ground Water Section of the Drinking Water Branch manages a statewide ground water monitoring network (GWMN) which began in the spring of 2008. As of 2010, sampling locations consisted of 313 drinking water wells across Indiana (Appendix C, figure 15). The 313 GWMN sites include 153 private well sites, and 160 public water supply wells. The 153 private water well sites are residential wells predominately located in rural settings. The 160 public water supply well sites include non-community systems like schools, day cares, churches, businesses, etc. The number of sites sampled yearly is not static, and may vary based on sampling results, additional site selection, and availability of resources.

Field parameters collected include the following: temperature, specific conductivity, dissolved oxygen, pH, and oxidation reduction potential. Analytical parameters include: alkalinity, anions/cations, metals, nitrate-nitrite, volatile organic compounds, pesticides and their breakdown products.

Table 31 shows the analytical parameters that were detected during the 2008, 2009, and 2010 sampling rounds. In addition, a statistical summary is provided, and the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) or Secondary Maximum Contaminant Level is provided. The analytes that had the most occurrences above a MCL included Arsenic (7.78%), Nitrogen, Nitrate-Nitrite (3.42%) and Iron (66.28%). Nitrogen, Nitrate-Nitrite and Arsenic are addressed in greater detail below. Figures 16 and 17 display nitrogen, nitrate-nitrite and arsenic results, as well as the hydrogeological sensitivity across the state.

Additional data analysis will be conducted in GWMN annual reports; existing data was analyzed using geographic information system software. Table 32 (Appendix A) table was developed to show the relationship between hydrogeologic sensitivity and land cover and detections of nitrogen, nitrate-nitrite and arsenic above the EPA MCL. This analysis shows illustrates that 84% of the nitrogen, nitrate-nitrite detections above the MCL were in highly sensitive areas, and 68% of the detections above the MCL were in areas with cultivated crops. The arsenic detections were more spread out, as they are likely naturally occurring in the aquifers or surrounding material. Forty-six percent of the detections were found in highly sensitive areas and 33% were found in areas of low sensitivity. Only 38% of the detections above the MCL were found in areas with cultivated crops.

Sampling will continue through 2012 for the GWMN. The GWMN annual reports will soon be available. The focus of the GWMN will continue to be to determine the quality of the state's ambient ground water and to locate areas of concern due to the presence of contaminants.

REFERENCES

Cowardin, et al. (1979).Classification of Wetlands and Deepwater Habitats of the United States (1992 Reprint). U. S Department of the Interior Fish and Wildlife Service.

Horizon Systems Corporation. 1994. The U.S. EPA Reach File Version 3.0 Alpha Release (RF3-Alpha) Technical Reference, First Edition. Washington, DC: STORET User Assistance. Indiana Agricultural Statistics Service. (1999). Indiana Agricultural Statistics, 1998-1999. West Lafayette, IN: Purdue University.

Indiana Department of Environmental Management. (1995). Indiana 305(b) Report 1994-1995. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (1998). Indiana Water Quality Report 1998. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2000). Indiana Water Quality Report 2000. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2003). Indiana Nonpoint Source Pollution Management Program: FFY 2003 Annual Report to the U.S. EPA. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management (2004). Indiana Nonpoint Source Pollution Management Program: FFY 2004 Annual Report to the U.S. EPA. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2005a). Indiana Nonpoint Source Program: FFY 2005 Annual Report to the U.S. EPA. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2005b). Surface Water Quality Monitoring Strategy 2006-2010. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2006). Indiana Nonpoint Source Program: FFY 2006 Annual Report to the US EPA. Indianapolis: Indiana Department of Environmental Management. Indiana Department of Environmental Management. (2007a). 2006 Annual Compliance Report for Indiana Public Water Supply Systems. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2007b). Section 319(h) Nonpoint Source Grant Program: FFY 2007 Annual Report to the US EPA. Indianapolis: Indiana Department of Environmental Management.

Indiana Department of Environmental Management. (2007c). Office of Land Quality. Indianapolis, IN: Indiana Department of Environmental Management.

Indiana Legislative Services Agency, Office of Code Revision. (1997). Title 327 Water Pollution Control Board. Indiana Register 20: 1347-1480.

Office of Wetlands, Oceans and Watersheds, U. S. Environmental Protection Agency. (1993). Total Waters Estimates for United States Streams and Lakes. Washington, DC: U.S. EPA. Rolley, R.E. (1991). Indiana's Wetland Inventory. Wildlife Research Note (532). Indianapolis: Indiana Department of Natural Resources.

Spaeth, Ralph. (2000). Indiana Department of Natural Resources. (personal communication).

State Information Center. (2004). About Indiana. Indianapolis, IN. Retrieved from www.IN.gov/sic/about/general_facts.html .

U.S. Census Bureau. (2000). Census 2000 Summary File 1 Table GCT-PH1 Population, Housing Units, Area, and Density. Retrieved from: www.census.gov/population/www/censusdata/density.html .

U.S. Food and Drug Administration. (YEAR). Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed.

U. S. Environmental Protection Agency. (1997a). Guidelines for Preparation of the State Water Quality Assessments (305[b] Reports) and Electronic Updates: Report Contents. Washington, DC: U. S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (1997b). Guidelines for Preparation of the State Water Quality Assessments (305[b] Reports) and Electronic Updates: Supplement. Washington, DC: U. S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (2002). Guidance for Quality Assurance Project Plans. Washington, DC: U. S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (2005). Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act: Public Review Draft. Washington, DC: U. S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (2006a). Draft Regulatory Determinations Support Document for Selected Contaminants from the Second Drinking Water Contaminant Candidate List (CCL 2). Washington DC: U.S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (2006b). Memorandum to Regions 1-10 Water Division Directors Regarding Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. Washington, D.C.: U.S. Environmental Protection Agency.

U. S. Environmental Protection Agency. (2007). Fact Sheet: Preliminary Regulatory Determinations for the Second Drinking Waters Contaminant Candidate List (CCL 2). Washington, DC: U. S. Environmental Protection Agency.

U.S. Environmental Protection Agency. (2009). Information Concerning 2010 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions. Washington, DC: U. S. Environmental Protection Agency.

U.S. Food and Drug Administration (FDA). (2000). Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed Handbook.