

WATER AND QUALITY OF LIFE IN INDIANA

Modernizing the State's Approach
to a Critical Resource

Presented by
The Project Steering Committee

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NINA MASON PULLIAM
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*Front Cover Photos:
Sugar Creek (John Schanlaub),
Clubshell Mussels (Stihler Craig),
Canoeing on St. Mary's River (Momoneymoproblemz)*

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The Case For Action

Fresh Water Indiana

There is no resource more essential than water. The quality and quantity of water affects Indiana's economic development, its public health, and quality of life. The Indiana Chamber of Commerce addressed water's economic development importance in a ground-breaking 2014 report. The Chamber Report notes that many states with which Indiana competes for business and intellectual talent are investing in their water resources. Indiana has not yet made a comparable commitment. Our report complements the Chamber's good work by making a case for protecting Indiana waters for public health, ecological values and quality of life.

It is well documented now that Indiana faces major challenges associated with updating an aging water infrastructure. Indiana water is more than the pipes. Our vital "built" infrastructure depends on a much more expansive natural infrastructure: the landscape that services surface and ground water. Investment in that natural infrastructure is just as vital—and just as seriously deferred—as the investment coming due on our built water system.

This Report endorses many of the recommendations made in the 2014 Chamber report, but we also consider many issues that are beyond the scope of the Chamber's project. The billion dollar water recreation economy of the state is a solid indicator of the economic and ecological potential of our waters, as well as a vital element of the state's quality of life. Our waters, however, are at risk. Indiana's environmental monitors report that most of the state's streams, rivers, and lakes are polluted. At least nine thousand miles of streams and rivers are contaminated by pollutants that wash directly into them from streamside lands. Seven thousand miles of streams and rivers are impaired because we are still piping sewage directly into them. During times of reduced rainfall, Indiana waters are at risk for both quantity and quality, compromising public health as well as economic and ecological values. We need to address these issues.

"Our waters are at risk."

A diverse steering committee composed of Indiana civic, corporate, environmental, scientific, and academic leaders studied, developed, and stands behind this Report. Over the past year the committee volunteered many hours in and between a series of meetings to provide direction and guidance as the Report was being researched and drafted. The result points the way toward a twenty-first century water policy for Indiana.

The Steering Committee

- Dr. Indra Frank, MD, MPH, Director of Environmental Health and Water Policy, Hoosier Environmental Council
- Dr. Jane Frankenberger, Professor, Agricultural and Biological Engineering, Purdue University
- Sen. Beverly Gard, Chair, Indiana Environmental Rules Board; Former State Senator
- Cassie Hauswald, Freshwater Ecologist, The Nature Conservancy
- Cloyce Hedge, Ecologist; Retired Director of Indiana Natural Heritage Program
- Julianne Lis-Milam, Partner and General Counsel, Hammond, Kennedy, Whitney & Company, Inc.
- Brett McKamey, CFA, President and Chief Operating Officer, Goelzer Investment Management
- James Moseley, Farmer; Former Deputy Secretary of Agriculture
- Natalie Stucky, Assistant General Counsel, Real Estate, Environmental & Corporate Responsibility, Cummins. Inc.
- Joseph Sutherland, Director, Government & External Affairs, Citizens Energy Group
- Dr. Jeffrey White, Professor and Director, Integrated Program in the Environment, Indiana University

Affiliations of Steering Committee members are provided for identification purposes and generally do not imply endorsement of this report by the indicated affiliates.

The Report was made possible with major funding from the



PRINCIPLES and RECOMMENDATIONS

Principle I. Active Stewardship of Our Water Resources is Essential for This and Future Generations

- There is increasing pressure on freshwater resources in Indiana and the world.
- For our economy and our quality of life, it is essential that we plan ahead to preserve our freshwater resources. New demands and uncertain precipitation patterns create new stresses that need to be addressed before, not after potential crises.
- Other Midwest states are investing in fresh water data and management and will be at a competitive advantage to Indiana if our state does not commit to active water stewardship.
- Active stewardship means good information, sound plans, and attentive water management. The alternative is that water issues will be resolved ad hoc and at great expense in courts rather than through representative processes.
- We can reduce pressure on freshwater systems by making use more efficient, repairing leaks in water distribution systems, and planning ahead for sensible conservation during periods of low flow.
- Indiana must develop system-wide plans to address drought and flooding, both of which are likely to occur more frequently in the coming years.

Principle II. We All Care About Clean Water

- No one defends water pollution. And yet, more than 60% of Indiana's assessed stream miles and an even higher percentage of our lake waters are classified as impaired. We can and must do better.
- Water pollution affects us more than we know: 80% of Indiana water utilities recently surveyed report that water quality sometimes affects the amount of water that they can use from their sources of supply (Indiana Finance Authority, 2015).

Principle III. Water Is Life

- Indiana businesses and communities are competing to attract and retain talented, entrepreneurial people. To prevail, we have to build, maintain, and feature a high quality of life. Clean freshwater systems are essential to the quality of life Indiana can offer. Indiana is naturally endowed with great rivers, streams and lakes. These freshwater systems are essential for drinking, for industry, for agriculture and for economic development. They can be a jewel of our environment, as well. Indiana fresh waters sustain recreational fishing, boating, canoeing, and aquatic wildlife. Freshwater recreation contributes well over \$1 billion annually to our economy.
- The health of our unique complement of aquatic wildlife—including several nationally endangered species of shellfish—is a vital indicator of the health of our fresh waters. Those waters sustain us, physically and spiritually.

Our Recommendations Are:

1. **Invest in Department of Natural Resources (DNR) and United States Geological Survey programs for monitoring groundwater levels and stream flows** to better understand the connection between aquifers and surface waters. Add at least 60 monitoring wells to the state's groundwater network. *See Report, pages 11-13.*
2. Fund the Indiana Geological Survey and others to **perform systematic assessments of water resource and water supply availability** in major river basins in the state. *See Report, pages 14-15.*
3. **Commit to managing Indiana water resources for their ecological and social values as well as their economic value. Use collaborative processes, supported by data on** resource availability, water use, and future demand, to better determine priorities, identify key ecological limits, and define management triggers. *See Report pages 16-19.*
4. **Create the Indiana Water Authority (IWA) to coordinate Indiana's water management, catalyze needed investment,** and "roll-up" regional plans into a comprehensive state plan that reflects state, regional, and local priorities. *See Report pages 19-22.*
5. Once regional plans are approved by the IWA for incorporation in the state's comprehensive water plan, **Regional Water Management Groups must own and help implement the Regional Water Plans, including employing and adapting Plan priorities for managing water in periods of water shortage.** *See Report pages 22-26.*
6. Using Regional Water Management Group data when available, as well as other available data, **the IWA should develop and maintain a forecast of water demand** for all water use sectors to help guide analysis and priorities. Regions with stable use and abundant water resources will address water planning and management differently than regions with increases in use and limited water. *See report pages 26-27.*
7. Amend **Ind. Code §14-25-7-14 to require DNR to prepare flow duration curves for third order and larger Indiana streams and rivers. These will help regional planners understand how to plan for minimum stream flow** that will support water quality, public water supply needs, and healthy communities of aquatic life. (A third order stream is fed by a stream or streams that already have two smaller tributaries. Third order and higher streams comprise generally about a quarter of total stream miles.) Previous studies commissioned by DNR indicate that preserving

the flows needed to sustain aquatic life will enable us to meet water supply objectives we have for our fresh waters. *See Report page 28.*

8. Plan for water conservation. Financial incentives can help. In addition, one common sense measure that we recommend be considered in every regional plan is identifying drought indicators that would trigger mandatory curtailment of lawn and ornamental watering in regional drought warning and emergency conditions. *See Report pages 29-30.*

9. Research, develop, test, and if justified, **implement new water storage** that is carefully planned to be off-stream, flood-water supplied, and otherwise consistent with environmental stewardship. *See Report pages 30-31.*

10. The legislature should **empanel a study committee to consider requiring livestock producers to maintain vegetated buffers** to attenuate the most frequently cited source of impairment of Indiana streams and rivers: runoff from livestock grazing and feeding. If vegetative buffers are shown to be impracticable for watercourses affected by these sources, we need to develop a viable alternative strategy for reducing the *E. coli* (fecal) pollution of Indiana rivers, streams, and lakes. *See Report pages 33-37.*

11. **Eliminate** the second most important cited source of stream and river impairment: **direct piping of untreated or inadequately treated waste into Indiana waterways.** This is in addition to continuing to invest in reducing combined sewer overflow. Another essential investment is **funding for local health departments to regularly inspect septic systems** and to enforce the septic system rules. The IWA should catalyze the repairs or replacements needed to address each of these issues. This may include an evaluation of the feasibility of creation or expansion of rural sewer or septic management districts and other advanced sewage management technologies. *See Report page 37.*

12. **County Surveyors and drainage boards should be empowered to take the environment into account** when assessing the system, maintaining drains, and planning new or replacement drainage projects. Very minor statutory amendments could accomplish this, and suggested amendments are included in an Appendix to this Report. *See Report page 37-38.*

13. **Indiana needs to re-commit to improving water quality.** This will include re-examining Indiana Department of Environmental Management's (IDEM) staffing, which has been significantly reduced in recent years. Reduced funding for staff has affected monitoring and enforcement of existing permits. We also recommend that Indiana invest more in recognition of new pollutants, and regularly commission a team of experts to consider

new state standards for toxic and damaging substances in waste water.
See Report pages 38-39.

14. IDEM's first priorities for cleaning up polluted streams should be **vigorously protecting streams that are recognized as outstanding, and addressing key issues of streams and rivers in and near in large population centers.** *See Report pages 41-42.*

INTRODUCTION

There is an epic journey to be taken from the southern shore of Lake Michigan and east across northern Indiana to the Maumee River, and then south and down the Tippecanoe River and the Sugar Creek to the Wabash, down the White and the Patoka to the Wabash, and finally, on the southern border of the state, to the north shore of the great Ohio River. Indiana has an extraordinary system of fresh waters that are the arteries of life in the state. Our water represents a comparative advantage in a water-constrained world. Indiana water has amply supplied Indiana people, and permitted the state to compete effectively for industrial investment. Indiana's fresh waters sustain a billion-dollar recreational economy.

National security agencies and corporate planners alike have identified fresh water as a likely flashpoint for conflict in world affairs in this century. In the West, "water's for fighting" has been the rule for more than one hundred years. Forward looking leaders in the relatively well-watered eastern half of the United States have, however, begun to understand that water in our region is no longer to be taken for granted. Indiana is a signatory of The Great Lakes Compact, for example. The Compact is a preemptive agreement by the Great Lakes states to collectively exercise the greatest care in protecting the waters of the Lakes from demand for water export.

"Forward looking leaders understand that water is no longer to be taken for granted."

Within their own borders, Michigan, Wisconsin, and Minnesota have significantly increased their investment in understanding, protecting and governing their surface and ground waters. We in Indiana have not made comparable investments in understanding and protecting our state's water resource. New interest has been generated by a study sponsored by the state's Chamber of Commerce that took a careful first look at water uses and trends. Among the legislative responses to the study was to start building and re-building the state's water monitoring capability. And as described later in this Report, Indiana law now enables our biggest water suppliers to begin to close the hundred-year capital investment gap in their infrastructure.

Yet that is only a beginning. Indiana's own Comprehensive Outdoor Recreation Plans (2006-2011 and 2011-2015) as well as reports from the Great Lakes Commission, the 2006 National Survey of Fishing, Hunting and Wildlife Associated Recreation, and the 2013 Report of the American Sportfishing Association all point to water as a driver of quality of life and the economy that follows it: in Indiana, fishing, boating, and other aquatic recreation alone generate well over a billion dollars annually. Our policies for the protection of that economic value-driving asset don't recognize the urgency of preserving it. We are not even prepared to maintain our place

in the world as an exceptional center of biological diversity in mussels and other aquatic life. Indiana streams and rivers are home to nine mussel species now listed as nationally endangered: this is both a mark of distinction and a warning sign.

Decades ago, Indiana adopted comprehensive legislation that promised fishable, swimmable, and drinkable waters. We are still working at meeting the vision of that legislation, and we have made progress. But by many measures we have stalled. Almost seven thousand miles of our streams and rivers, for example, are still impaired because untreated sewage is piped into them!

The time is now to make the appropriate investments in planning and action to preserve and protect Indiana's freshwater resources. If we make those investments, not only will we benefit, we will fulfill the responsibility we have to future generations. The health of our streams, rivers, and lakes is one critical measure of our wisdom and foresight as a state and society. This Report is intended to re-focus our policy-makers, our public voices, and our institutions on fulfilling the promise of our laws to restore and protect the natural values of Indiana waters.

There is a lot to do. The most important thing we can do is get started.

PRINCIPLE I: Active Stewardship of Our Water Resources is Essential for This and Future Generations

A. Good Policy-Making Requires Good Data

Indiana does not have one fresh water system; it has many. Northeast and northwest Indiana send water to glacial lakes and ponds and the Great Lakes. Just south of the Great Lakes Watershed boundary are the headwaters of Indiana's big rivers. The Wabash and the White flow south and west through glacially influenced soils. These river systems characterize much of Indiana. Further south, the limestone country in south central Indiana isn't covered by glacial till, and holds little groundwater. Water availability can be an issue in southern Indiana until, moving south, the aquifers of the Ohio River again represent an abundant water source.

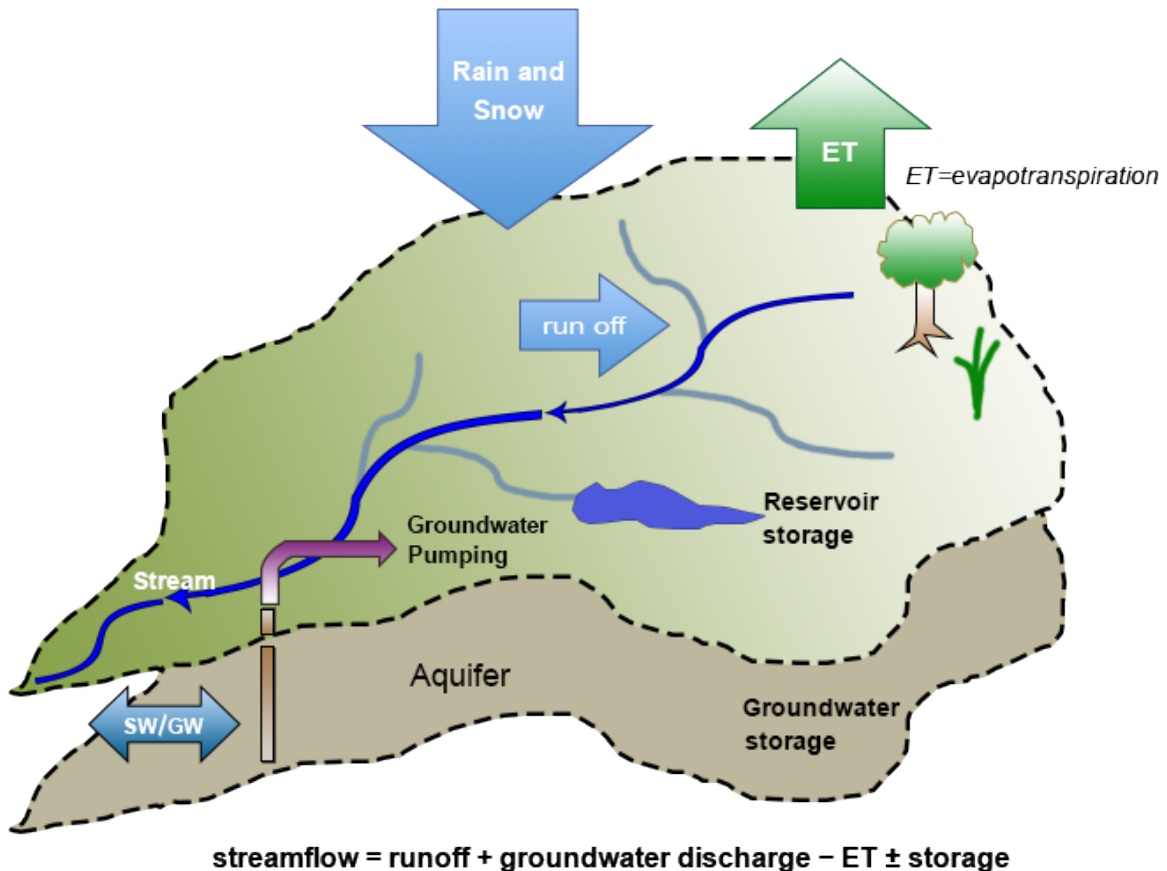


Figure 1. Schematic of the Hydrologic cycle.

Indiana’s groundwater affects its surface water (Figure 1). Stream flow during the driest periods—“base flow”—comes from two sources: groundwater aquifers discharging into the stream beds, and upstream discharges of waste water. But base flow derived from groundwater is not secure. Many sources report a consistent trend in Indiana of increases in groundwater use.

The connection between groundwater and stream flow is most visible and biologically most critical during water-constrained times, but our public

In a recent report, the GAO found that... “40 of 50 state water managers expect shortages in some portion of their states under average conditions in the next 10 years.” (Emphasis added)

General Accounting Office-14-430, May 2014

policies do not fully acknowledge that relationship. The Indiana Water Shortage Plan, for example, was written to help water users in the state respond to changing conditions during droughts and declared water shortages. The plan anticipates that water users will shift from stream diversions to groundwater withdrawal (wells) during a drought. While this is practical enough, the consequences for other groundwater users and base flow to the stream during the next drought may be significant.

One impact related to increases in the use of groundwater is the effect of the combined aquifer withdrawals on the length of ephemeral and perennial streams within a basin. Many forms of aquatic life can only survive in perennial streams. In any watershed that includes a perennial stream (i.e., the stream flows all year), as one moves upstream the perennial flow diminishes until a point where the stream becomes

ephemeral, that is, it only flows during the wet season. The location of this shift from perennial to ephemeral is usually a reflection of the intersection of the groundwater table with the land surface. As water levels in the aquifer change, the location of this shift from perennial to ephemeral also moves to reflect the new condition. Thus, when groundwater aquifers are depleted, the state loses perennial surface water and the aquatic life it supports.

Recommendation 1. Invest in ongoing research by the Indiana Department of Natural Resources and the United States Geological Survey designed to increase our understanding of streamflow and document the effect of groundwater upon stream flow. Add at least 65 monitoring wells to the groundwater network.

We need data to make good decisions. A direct measurement of water levels in monitoring wells in the aquifers used during shortage can determine the degree of impact and the duration of reductions in base flow to the stream as well as the reliability and the recovery rates of the aquifers themselves. However, because the state of Indiana has so few water level measurements in the aquifers around the state, it is currently not possible

to determine the effect of any shifts that have occurred (or to discern the general trends in use over longer time periods) for the aquifers around the state (Figure 2). Until 2004, Indiana maintained 100 monitoring wells. Today, there are only 35. We need to re-commit to at least the hundred wells we had a decade ago, with a special focus on areas that are experiencing the most growth in use. Based on the areas with increasing groundwater use and the number of monitoring wells currently in place, we should, over the next ten years, add at least 65 new monitoring wells to the 35 now maintained. With 100 total wells, we will approach the monitoring density of our neighboring states. Figure 2 illustrates priority locations for the additional wells, based on coverage and projected demand.

Existing and Proposed USGS Monitoring Wells

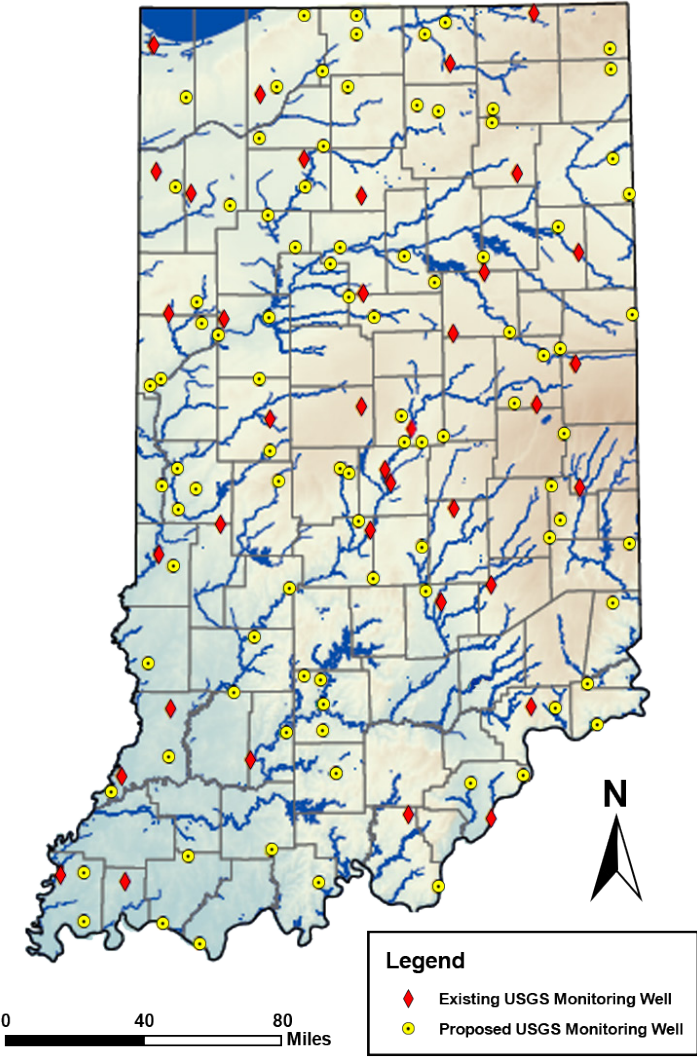
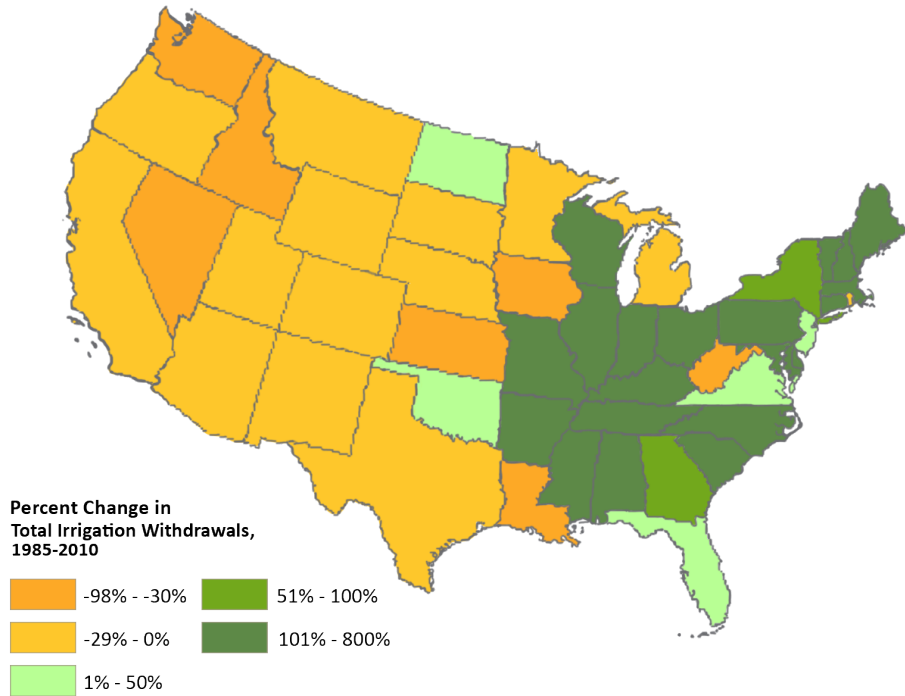


Figure 2. Potential locations for future USGS Monitoring Wells.

Figure 2. Changes in irrigation withdrawals: 1985-2010



Source: USGS historical irrigation water withdrawals for the U.S.

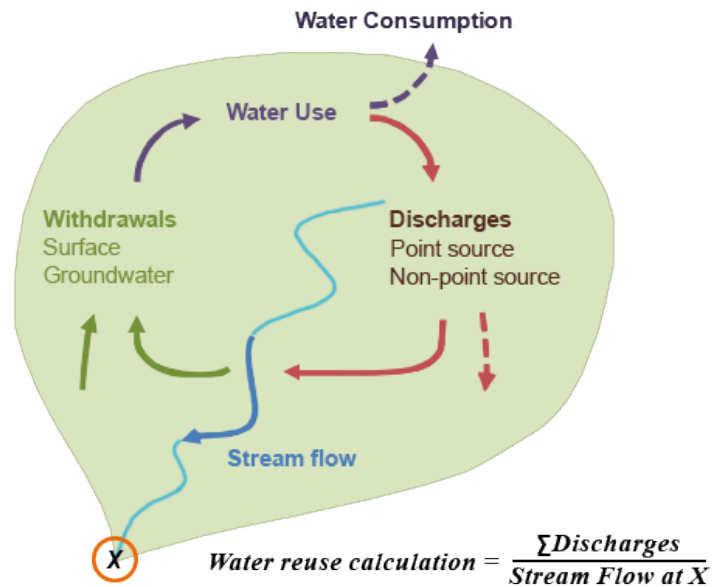
Figure 3. Percent change in total irrigation withdrawals, 1985-2010.

As indicated above, understanding groundwater is essential for understanding low flow in streams. One of the reasons that groundwater use is a critical indicator of sustainability is that water use is more sensitive than ever before to climate shifts. In the past, Indiana farmers rarely relied on irrigation. However, in the last 20 years there has been a large increase in the use of irrigation in Indiana agriculture (Figure 3). This increase in installed irrigation pumping capacity means that a relatively small shift in drought occurrence can result in much larger shifts in water use. It is essential that we understand the implications of the increase in irrigated acres in Indiana, and that we manage the impacts to minimize loss of surface water values.

Recommendation 2. Fund the Indiana Geological Survey and others to initiate and sustain basin studies to determine the amount of groundwater and surface water availability in each watershed.

We join the Chamber of Commerce in recommending that Indiana invest in understanding stream flow. A vital first step is establishing baseline data over the next ten years on the point at which streams change from perennial to ephemeral flow.

We Are Using All of the Wabash River – and we didn't even know it.



In 2016 a group of researchers at Purdue evaluated the water budget of the Wabash River. Their work was done to determine the sustainability of existing withdrawals in the basin given increasing diversions from the river and the aquifers in the Wabash basin. A number of databases were combined to assess how indirect reuse plays a role in meeting freshwater demands. The analysis showed that during the summer months the ratio of water withdrawal to return flow discharge back into the River is effectively 1:1. The authors argue that this is an important sustainability and yield metric of any basin.

The paper suggests that it is not possible to make informed water policy in any basin without evaluating the water budget. We need to consider what it means that during low flow months the water in the Wabash River amounts to no more than the upstream discharges. [Weiner, Jafvert, and Nies, 2016. The Assessment of Water Use and Reuse through reported Data: A U. S. Case Study, *Science of the Total Environment*, 539:70-77.] More generally, In order to know if water availability is being affected by use, we need reliable stream flow measurements, properly distributed groundwater monitoring wells, and an agency to organize and curate the data.

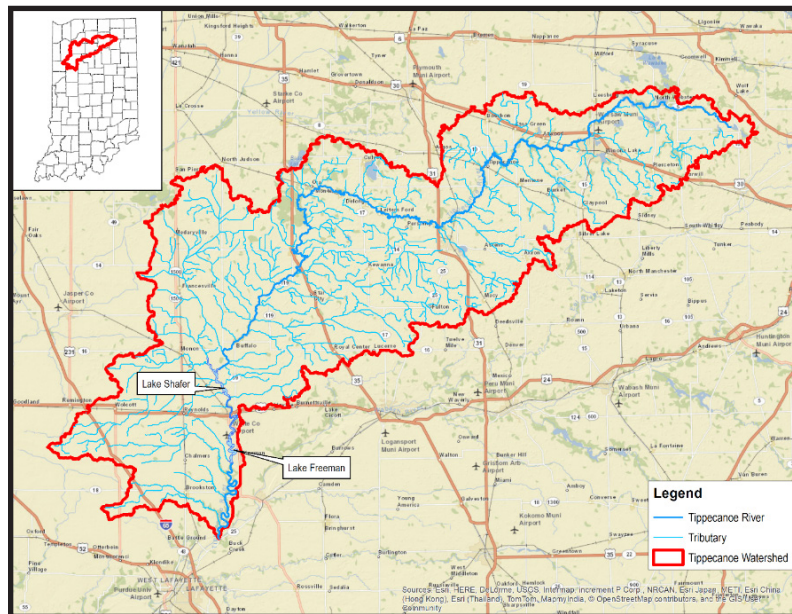
B. Active Stewardship: A Plan for Water Resource Management

If we commit now to a water management process in which the voices of all of the state's water stakeholders can be heard, we can avoid making rushed and poorly considered decisions in the face of future water shortages and floods. Indeed, if we do not plan in advance, such predictable water events will become crises. For instance, the Tippecanoe Watershed (see Insert below) can either become an example of a crisis or an example of informed collaboration that optimizes the achievement of diverse objectives for a water resource.

Attempting to manage without understanding is a recipe for failure.

NIPSCO's two hydroelectric dams on the Tippecanoe River have created Lakes Shafer and Freeman (see map insert). Both dams are licensed by Federal Energy Regulatory Commission (FERC) as "run-of-river", meaning that they are required to operate so that the outflow from the dams approximates the sum of the inflows to the lakes (NIPSCO, 2015).

Downstream of those NIPSCO dams is a diverse freshwater mussel community, including several mussel species that are listed under the Endangered Species Act (USFWS, 2015). During drought conditions in 2012 and again in 2013, the Indiana Department of Natural Resources (DNR) and U.S. Fish and Wildlife Service (USFWS) documented mortality of mussels in this critical stretch of the Tippecanoe River. The mortality was attributed to low flows.



RESPONSE: The USFWS diagnosed the problem as one of dam operation. They recommended to NIPSCO a series of changes in releases to mimic natural flows and sustain downstream mussel populations during drought. However, implementation of the recommendations lowered lake levels in Lake Freeman. The lower lake levels reduced the recreational opportunities on the lake and caused property owners to be concerned about the long-term effects of the policy.

The Tippecanoe watershed must serve at least four masters: (1) upstream users, including agriculture; (2) NIPSCO; (3) our legal commitment to aquatic wildlife, including endangered mussels; and (4) the lakeside property owners. A full analysis of the effects of various ways of operating the dam is not possible because essential data has not been gathered.

Analysis of the historic water levels, current water use, and trends in the basin could support decisions and mitigate this conflict. From the Indiana Finance Authority's current work, we know that:

The lakes cannot be managed to satisfy all needs of the system during low water flows– Lake Freeman cannot provide substantial, long-term releases during dry periods without facing periods of low lake levels. Some compromise and optimization will be essential.

Increasing groundwater use in the basin may limit future options – The increasing use of groundwater in the basin is currently registered in the IDNR significant water withdrawal facilities database but there is no management of this use when stream flows are low.

High aquifer storage masks impacts of increasing groundwater withdrawal – Although aquifer storage is high now, the effect of releases on lake levels could be much more dramatic if drought conditions return and additional releases are needed.

Method to predict low flow needs to be improved – Naturalized flow analysis presented in the report suggests that the USFWS's linear scaling method may be biased toward overcorrecting for potential low flows, and may result in recommending releases that actually exceed natural flows.

If the Tippecanoe River region had water-resource plans and regional water management groups, not only could this analysis have been done before the low-flow rule implementation, but all of the stakeholders would have the information needed to negotiate an optimal solution for providing for upstream irrigation, maintaining lake levels so far as possible, and providing, as federal law requires, for the survival of Indiana's endangered aquatic wildlife.

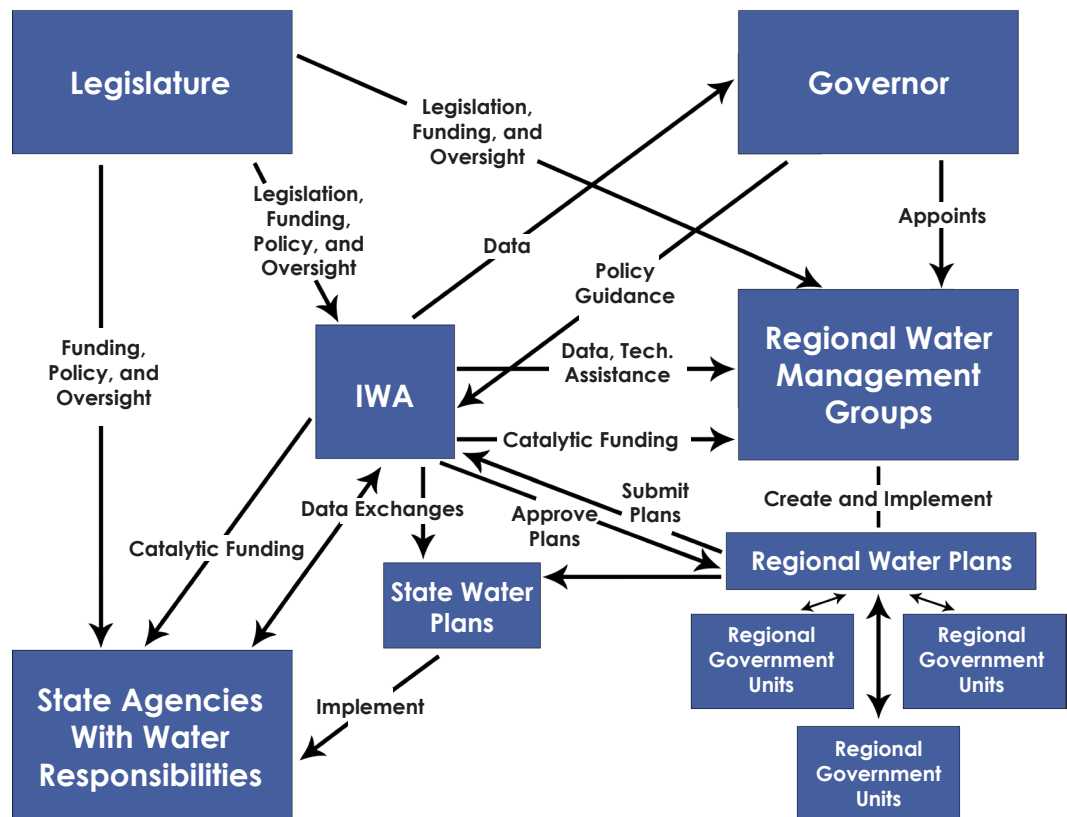
Recommendation 3. Commit to managing Indiana's water resources in an environmentally, socially and economically conscious way. Managing water can be an active, resource-driven effort that benefits the users while protecting streams and aquifers.

State and Regional Water Planning, Management, and Implementation

Our vision for active management of Indiana’s water resources involves enhanced commitments at regional and statewide levels.

Proper stewardship of Indiana’s freshwater resources requires gathering information, analyzing demand and trends, making infrastructure investments, and setting priorities that will guide us in times of water scarcity. Statewide, Indiana should facilitate the transformation of current work now being done in the Indiana Finance Authority into a focused effort that we call the Indiana Water Authority. The IWA will lead, coordinate and catalyze state-level water planning, management and investment. At the same time, much of the information that will be used by a statewide agency ought to be generated regionally. Active water stewardship should include the establishment of Regional Water Management Groups. These RWMGs will develop authoritative regional water plans.

Figure 4. Conceptual Organization Chart for Water Management.



The RWPGs will be supported and their plans harmonized and ultimately approved by the Indiana Water Authority. The combined statewide and regional efforts will embody a new state focus on protecting and developing Indiana's water resources as public capital.

C. Indiana's Water Governance

At least eight Indiana government agencies currently gather data and manage aspects of Indiana's water policy: The Department of Environmental Management, the Department of Natural Resources, the Indiana Geological Survey, the Utilities Regulatory Commission, the Department of Agriculture, the Department of Homeland Security, the Department of Health, and the State Chemist. There is also a state network of soil and water conservation districts. Each of these governmental units is tasked with accomplishing its own essential purposes. There is no agency with comprehensive responsibility or vision. For a resource as vital as Indiana's water, it is essential that Indiana's governing structure include one entity that is charged with developing and maintaining a state-wide perspective on water. We think the right way to do that will be to establish an Indiana Water Authority.

On the other hand, as we have established, Indiana's natural waters are profoundly different in different parts of the state. One size will not fit all in water management. Thus, the detailed planning and management of water is best done regionally. We need to establish new regional structures that will be suited to meet the planning and management need. Our vision for regional management is set forth later in this Report.

Recommendation 4. Consolidate and expand existing water stewardship efforts within the state by creating a new organization, the Indiana Water Authority (IWA).

D. The Indiana Water Authority

Water is unquestionably one of the Indiana's most important assets. It is vital natural capital, and we are not managing that capital as if we recognize its true value. We need a public recognition of and a consistent commitment to water as natural capital.

SUSTAINABLE WATER SYSTEMS:
STEP ONE - REDEFINING THE NATION'S
INFRASTRUCTURE CHALLENGE



THE ASPEN INSTITUTE
ENERGY AND ENVIRONMENT PROGRAM

Infrastructure Includes Watersheds and Aquifers

Long-term sustainable development depends upon investment in social and human capital and the accumulation and careful management of a portfolio of manufactured and natural capital. Freshwater streams, high quality aquifers, and reservoirs are

among the natural resources that sustain our manufacturing and agricultural economy. They are part of the infrastructure of our water supply system. Funding for the maintenance and restoration of this natural infrastructure is as critical as funding for built infrastructure.

In 2006 the Aspen Institute brought together distinguished leaders in the water utility industry, state and federal regulators, and non-profit groups to develop policy recommendations that address water infrastructure planning and management challenges over the coming decades. The report published from this effort, entitled, "Sustainable Water Systems: Step One – Redefining the Nation's Infrastructure Challenge," describes the fiscal and social challenges posed by the unmet water utility infrastructure needs. The panel of experts assembled by the Institute identified three key principles:

1. **The traditional definition of water infrastructure must evolve to embrace a broader, more holistic definition of sustainable water infrastructure that includes both traditional man-made water and wastewater infrastructure and natural watershed systems.** This new definition of infrastructure includes both the natural watersheds and aquifers that affect the yield of the landscape as well as the value of these assets to achieving clean water for the utility.
2. **The definition of sustainable water infrastructure should be embraced by all public and private entities involved in water management, and these same entities have a shared role in ensuring their decisions consider and integrate a set of criteria that include environmental, economic and social considerations.** Water utilities should take the primary responsibility for setting the full cost for

water service to not only include a sufficient level of expenditure to replace pipes and other capital assets for reliable service, but to fund remediation and/or avoidance of any associated adverse hydrological or environmental impacts on the natural watershed system of fulfilling domestic and industrial demand for water.

3. **Watershed-based management is required for drinking water, wastewater and stormwater services to ensure integrated, sustainable management of water resources.** Water utilities can lead the way by fostering more regional approaches to managing the resource that include partnerships to integrate planning and management and reconsider the questions of supply, demand and alternative methods of meeting unmet future demand and social and economic and environmental challenges.

What is needed is a sustainable approach to funding long-term built and natural water infrastructure.

The Indiana public body we now depend on to analyze and make other long term investments in the state's capital infrastructure is the Indiana Finance Authority. One small unit within the IFA deals with water-related issues. A much more robust commitment is needed: the Indiana Water Authority.

The Indiana Finance Authority is a quasi-public organization specifically charged by the legislature with facilitating improvement of the state's economy and infrastructure, including work associated with "preventing and remediating...water pollution" and "promoting the provision of safe and adequate drinking water." The IFA is also required by Ind. Code §14-25-7-18 to do quality assurance reviews of the data provided by significant water withdrawal facilities. It has of course already made investments toward those purposes. We think more work needs to be done. We think water is such a critical resource that an IFA-type organization ought to focus on it. Indiana's legislature should empower a new, dedicated entity to address Indiana's freshwater resource as a critical part of the state's infrastructure.

We recommend that Indiana assign the existing IFA water responsibilities and add additional capacity to create a new Indiana Water Authority. We

envision the IWA as a relatively small, focused entity. Its duties would include collecting water related information from all of the current sources, analyzing that data, and sharing the results with the legislature, the governor, relevant agencies, and the RWMGs. It would also identify gaps in information and make provisions for filling those gaps. Existing data collection efforts managed by other state agencies can and must continue but the IWA has to know what is being produced, review early drafts, and receive final drafts as they are completed.

The IWA would also provide a technical staff person and other assistance to the regional management groups described below, and IWA would receive, analyze, harmonize, and ultimately adopt each regional plan toward the creation of a state-wide water strategy. Its vital role in this ongoing planning process will also prepare it for one more duty: identifying and investing in key water infrastructure projects.

E. The Regional Water Management Process

The right place to identify needs, sort out conflicts, and implement plans is at the regional level. This process begins with collaborative planning through the creation of Regional Water Management Groups (RWMGs). They will identify and resolve issues with the participation and support of state IWA staff and of additional technical staff people from DNR and IDEM, and as needed, other state agencies involved in collecting and affecting water management. RWMGs will determine whether the water resource is generally adequate to satisfy identified needs, and if not, agree to adjust and explore options for supplementing the available resources. Finally, RWMGs will develop drought plans with all stakeholders present and participating, forging agreements for the compromises that will be necessary in shortage conditions. Upon IWA's approval of a regional plan, that plan will be incorporated into the state water plan, and the RWMG will qualify for state implementation funding. The RWMG will use the plan and the funding to help the units of government in the region carry out the plan.

Our recommendation for regional water management adds specifics to the general recommendations made in the 2014 Chamber of Commerce report. The Indiana Code already includes many analogous authorizations for development and economic planning entities that operate at regional scales. A simple legislative directive incorporating the features described in this Report will establish a template for the RWMGs. A draft statute is provided in the appendix of this Report.

Recommendation 5. Create Regional Water Planning and Management Groups. The advance negotiation regarding priorities and trade-offs that we believe is essential for water planning must take place in the RWMGs and, in the case of extra-regional issues, with the involvement of the IWA.

Regional Planning and Management

The RWMG planning process should feature regular public meetings, and should be consistently staffed by an IWA staff person, as well as technical representatives from DNR and IDEM, with the US Fish and Wildlife Service and the US Army Corps of Engineers invited to have representatives present at all meetings. In addition, other state agencies that collect relevant data, or manage programs that affect water quality or quantity should be given notice of RWMG meetings and should participate as requested by the RWMG. The Group members could be appointed to three year terms by the Governor with input from regional officials, and the Groups will elect their own Chairs. Of the ten members of each Group, we recommend that no more than six be affiliated with any one political party. Terms will be staggered to preserve continuity. Each Group should have members representing the following water interests:

- drinking water and domestic use
- local government
- natural values, fish and wildlife, and ecology
- recreational use
- industrial use
- electric power production
- agriculture
- public health
- drainage and stormwater management

Once approved by the IWA for incorporation in the state's comprehensive water plan, the regional water plan will be implemented by the units of government within the regions, with the key marginal funding available through the Regional Water Management Groups. The RWMGs will then carry out the ongoing process of adaptive management, adjustments to changing conditions, and follow-up to ensure that planned projects are completed. The RWMGs will amend plans when appropriate. RWMGs will also have authority to declare regional drought emergencies, and, through the sponsoring units of local government, should implement the voluntary and mandatory responses set forth in their planning documents. All RWMG meetings are to be public, and time must be allotted on every meeting agenda to take public comment.

Good regional plans and management will lead to good questions about statewide water governance. For example, Regional water managers may ask their legislators about certain state-mandated priorities. At present, domestic water users owning land adjacent to a watercourse have legal priority over "all other uses" for satisfying "domestic" needs. (Ind. Code §14-25-1-3.) "Domestic," however, is defined to include water for livestock and poultry and domestic animals. That surprising definition of "domestic" may be appropriate for some regions, but not others. No one wants livestock to suffer from inadequate water, and we must plan carefully to avoid that catastrophe. But the needs of commercial livestock operations as a water priority ought to be considered independently from domestic uses of water.

The Regions

One of the first steps to be taken in any regional planning process is the delineation of planning regions. Several alternatives have been considered and proposed based on methods used in other states. In Texas, the water supply planning regions are delineated along county boundaries that fit either the watersheds (East Texas) or the aquifer boundaries (West Texas). In each case in Texas, the regional water users are extracting supplies from the same set of water resources. Georgia follows the same principles; it has established 11 regions based on watershed boundaries. Like Texas, Georgia has used the county boundaries as the delineation perimeter for the regions. Doing so makes the best use of the established local governance mechanisms.

Indiana has other already established regions that could be used to define regional units of the water planning process. For example, the existing

Indiana Water Shortage Plan uses climactic regions. These do not track the water resource but they are already used for reporting on drought (Figure 5a). Another approach would be to use a set of boundaries that exist in the water supply industry – the districts of the American Water Works Association (Figure 5b). The advantage of using this way of defining

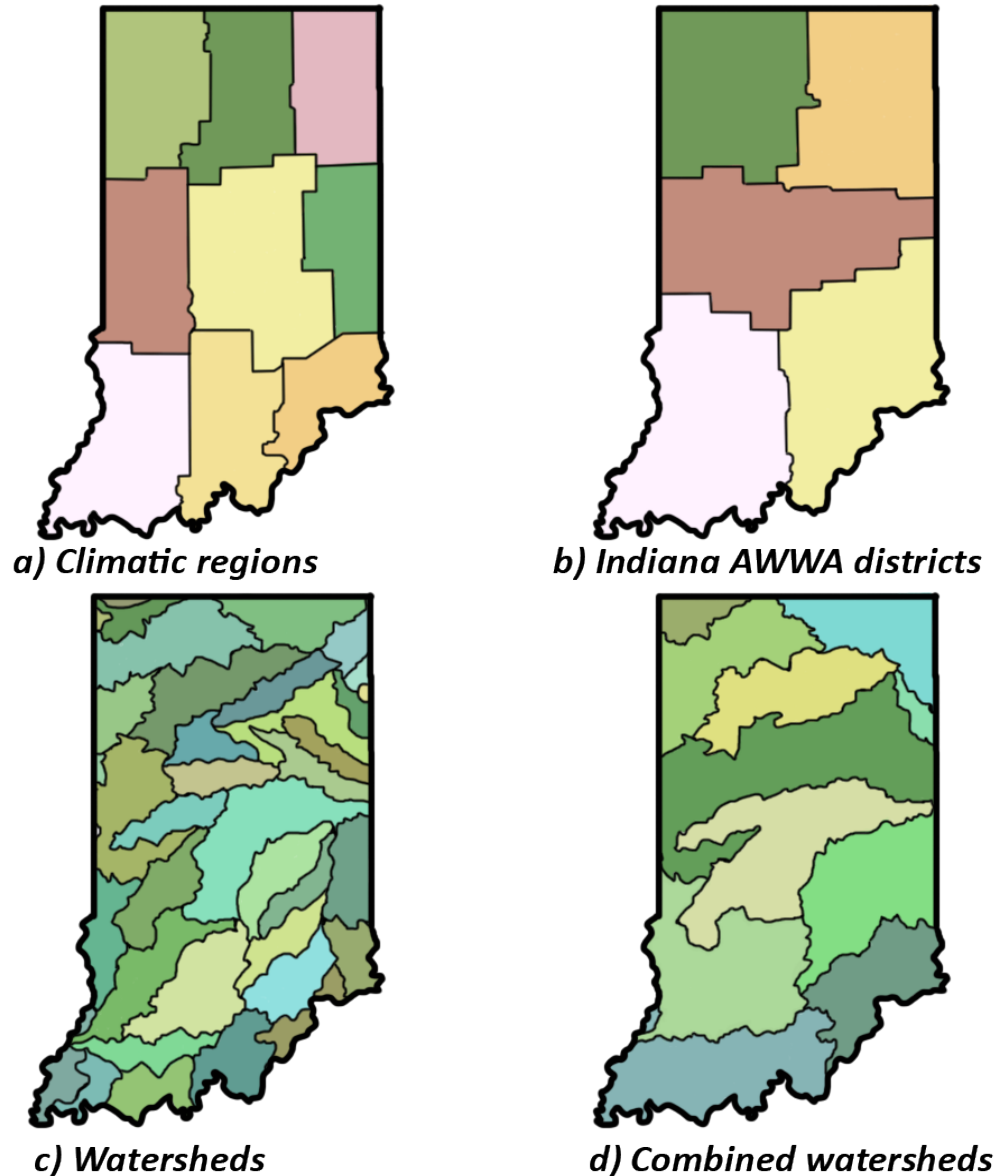


Figure 5. Examples of potential water planning and management regions in Indiana.

regions is that most of the water utilities in these areas already know their neighbors and meet with them in these district meetings. The disadvantage is that the AWWA regions do not follow watershed boundaries and they are slightly larger than optimal for regional planning. A third alternative is to define a region as a subset of watersheds that are naturally connected (Figure 5d). The watersheds can be combined and divided in various ways to result in seven to ten planning and management regions. This third approach appeals to many members of this Report's Steering Committee.

In any case, the planning regions should share a set of water resources, face common growth and development issues, and share a natural landscape and relatively similar ecological advantages and limitations.

F. Statewide Policies to Minimize Impact of Drought and Flood

Water Shortage

Across the country water shortage issues are linked to an increased (and increasingly concentrated) population, and changing climate patterns. These changes demand new public policies. The droughts that have occasionally reminded us that even Indiana cannot take water for granted may well occur more regularly. Indeed, they may be particularly troublesome as they are predicted to occur during the agricultural growing season. The development of new irrigation wells for that use may have significant impact during the droughts of the future (Figure 6). Plans for avoiding and managing those impacts should be made in advance of likely conflicts.

If we fail to plan in advance for water shortages, we are simply planning to allocate surface water to users who live beside lakes, rivers and streams, and (so long as their use does not unreasonably compromise the uses of other riparian owners) we are planning to allow them to use as much of the waters adjacent to their property as they can reasonably use. In times of water shortage, other users, including downstream owners, will argue that riparian owners' water use does in fact compromise downstream rights. They will look to the courts for help. The result of failing to plan for a different outcome will be the development of critically important state water policy in the courts through a patchwork of lawsuits and legal precedents.

Recommendation 6. IWA should develop forecasts of future water demand for all water use sectors.

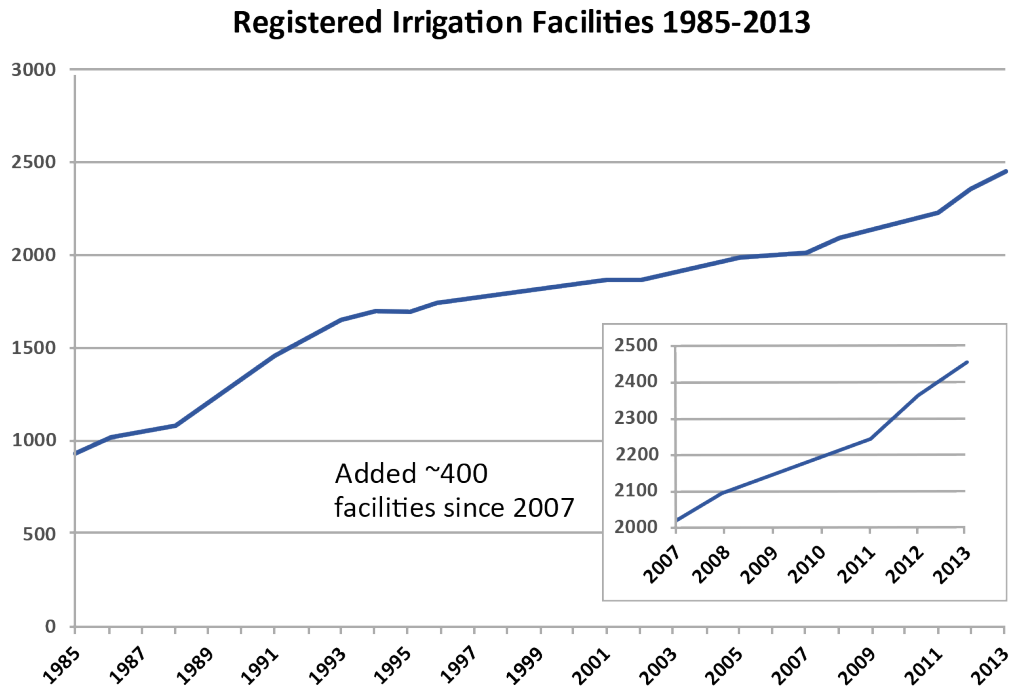


Figure 6. Registered irrigation facilities, 1985-2013.

We are failing to act upon what we know: that groundwater and stream flow are linked. Our groundwater rules do prohibit waste, but otherwise, we are still governed by the law of capture: if you can find groundwater under property that you own or lease, you can have it. We do require the registration of water withdrawal facilities big enough to supply a population of about 500 households. And our law prescribes that if such wells dry up smaller wells, or significantly affect groundwater recharge, the DNR may take action. Nothing in Indiana law, however, would prevent a well user from drying up a nearby stream. The integral nature of surface and groundwater leads us to recommend that we gather the information we will need to make sound water policy.

The entire suite of things we value about our waters will be better protected if we assess demand on our freshwater systems and plan in advance to protect as many values as we can. Ultimately, we have to plan for trade-

offs in water use. The forecast we advocate in our sixth recommendation (see previous page) should help the state avoid water crises. It will also help to identify the instream flows. Maintaining appropriate instream flows will help protect the ecology of Indiana fresh waters and keep pollution loads at safe levels.

As we have mentioned in a previous section of this Report, Indiana updated its Water Shortage Plan almost a decade ago. The plan includes a good deal of useful information, and it is reasonably likely to help Indiana agencies that will be called on to lead drought response. We applaud the planners for stating that agencies “should attempt to preserve minimum stream flow.” Agencies, as well as RMMGs, would be significantly more likely to meet that goal if the DNR can help both of them by providing stream flow data associated with a minor adjustment in a long- existing legislative invitation to do so. Specifically:

Recommendation 7. Ind. Code §14-25-7-14 should be amended to require DNR to establish for information and reference purposes, flow duration curves for Indiana’s third order and greater streams and

Certain Indiana reservoirs are operated by the U.S. Army Corps of Engineers for statutorily defined purposes. Upon agreement with the Indiana Department of Natural Resources, reservoirs such as Mississinewa and Salamonie could be operated to supplement stream flows when needed to benefit aquatic wildlife, so long as the primary purposes were not compromised.

rivers. The flow duration curves will inform the RWMGs decision-making regarding the minimum stream flows needed to support water quality, public water supply needs, and healthy communities of aquatic life. Previous studies commissioned by DNR indicate that if we preserve the flow needed to sustain aquatic life, we will meet the other volume-related objectives we have for our fresh waters.

Third order and greater streams comprise roughly twenty percent of stream and river miles. A third order stream is one that is fed by a stream or streams that already have two smaller tributaries.

The state Water Shortage Plan avoids one essential task for managing water in a time of shortage. It merely says that “the state can determine” what priorities ought to be in the event of drought. Setting priorities is an essential task that we believe ought to be taken up by the RWMGs. In fact, the current state Water Shortage Plan generally endorses regional water planning, but provides no specifics.

Employing the RWMG process will provide a locally customized way for Indiana to get beyond the tentative steps that the Water Shortage Plan

currently calls for in drought: our current plan relies solely on voluntary water conservation measures in water “watch”, “warning” and almost all water “emergency” conditions. Absent legislative action at local or state levels, only our Governor can respond to a specific water shortage with immediate and mandatory emergency water conservation measures. The Governor can only do so during a declared emergency. With Regional Water Plans as a foundation, the RWMGs will be able to make well-informed judgments in advance of a crisis with regard to the need to implement mandatory conservation measures, and the governing jurisdictions can use the RWMGs recommendation to develop, in advance of a water crisis, water conservation laws for use in a time of water shortage.

All of the choices we need to make regarding Indiana waters will be made easier if we pay attention to water conservation. Among the most important conservation measures that could be implemented to alleviate pressure on the streams and rivers of Indiana during water shortages, as well as minimize the need to build infrastructure to ensure peak water supply in drought years, is minimizing the leaks from water distribution systems. Municipal water suppliers, and some industrial sources report significant amounts of water lost in system leaks. Leak remediation as part of a resource management strategy can result in significant savings. A small leak on the order of one gallon per minute equates to more than 500,000 gallons of water use per year. The capital investment required to fix those leaks is essential conservation. Indiana law described below has enabled some utilities to address infrastructure without financial penalties. We need to find ways to address the same issue for smaller water utilities, and industry.

The new utility law referred to above provides for “system integrity adjustments” that basically allow a regulated water utility (under the jurisdiction of the Indiana Utility Regulatory Commission) to achieve their approved revenue over the course of the year. Prior to passage of this bill, utilities were dependent on the summer peak sales to meet their revenue targets. Given the high fixed cost of service, this perverse incentive discouraged water utility conservation programs. Since passage of this law, however, eligible utilities can provide water to their customers knowing that if they do not sell enough water in a wet year, they will be able to make up the difference in the subsequent year with a budget billing system that adds a surcharge to the water bill. This law also works in reverse. That is, in a dry year in which the utility sells more water than expected, resulting in windfall profits, it will return that money to its customers as a rebate.

While the effect of this bill has not yet been felt in the state, it should change the way that water utilities engage in water management. Going forward, water utilities can be enthusiastic conservationists and managers

of customer demand as they manage necessary growth in raw water supply.

Of nearly equal priority to planning for water supply use in dry years would be the ability to plan on sensible restrictions on water use. One Indiana water utility, for example, has produced graphics that help policy-makers understand that it could plan for significantly lower investment in sourcing water for peak daily demand if it did not need to plan on supplying water used to keep lawns bright and green in the driest years. During the 2012 drought, for example, peak demand for the water it supplies spiked from around 125 million gallons per day (a level that characterizes most of its year) to 225 million gallons per day in mid-summer, primarily due to lawn watering.

Recommendation 8. Plan for water conservation, and create financial incentives for efficiency. One common sense measure that we recommend for every regional plan is identifying drought indicators that should trigger mandatory curtailment of lawn, landscape, and ornamental watering in regional drought warning and emergency conditions.

Lawn and landscape watering may seem like an unusually specific issue to highlight in this Report, but as the above statistics show, it is in fact an important one. In addition, we recommend that the managers of athletic fields, golf courses, commercial properties, and other outdoor water-using facilities be incentivized to develop and implement strategies to meet their water needs with re-used water.

Water Planning for Flood

On the other side of the water management spectrum is flooding. Past approaches to flood control emphasized the imposition of engineered structures on rivers at great expense both to our treasury and to the environment. We have an opportunity and the need to design a new generation of flood control projects that are designed to work with nature. For example, we don't store the water we could in Indiana's soil because of the extensive installation of drainage tiles. That technology, necessary as it has been to agriculture in many areas of the state, can now be more finely tuned to preserve or even enhance agricultural production while, when appropriate, storing water in the soil or in small reservoirs. See <http://engineering.purdue.edu/watersheds/conservationdrainage>; <http://transformingdrainage.org>.

In addition, some frequently flooded Indiana lands now employed as our

least productive farmland want to be wetland. There may be a win-win possibility of putting that land to a better use.

As climate change-related variations in precipitation patterns continue to result in fewer and larger storms with increased periods of drought during the middle to later stages of growing seasons, we recommend that IWA fund research, environmental planning, development and testing of relatively small, off-stream reservoirs. The reservoirs would be built on and partially restore former wetland areas. They would be filled primarily with flood or near-flood waters. They would be designed to fluctuate in level. If testing proves the concept, they could be built by a new utility with flood control, wetland restoration and water storage as its public purposes.

Recommendation 9. Research, develop, test, and if justified, implement new water storage that is carefully planned to be off-stream, flood-water supplied, and otherwise consistent with environmental stewardship.

The potential benefits of such a network of reservoirs suggests possible investors and customers:

- Flood reduction: USDA crop insurance, private insurers
- Wetland restoration: wetland mitigation credit purchasers
- Low flow supplementation: DNR fisheries/Dingell-Johnson funds, municipal water systems
- Supplemental water for agriculture: farmers
- Water quality improvement, including nutrient reduction: Great Lakes (and Gulf) water quality interests, EPA

The alternative to building such a system is to expect that as the problems it could solve become acute over the next forty years, environmentally harmful solutions will be implemented in crisis mode.

PRINCIPLE II: We All Care about Clean Water

Indiana law explicitly recognizes “the right of all persons to an environment sufficiently uncontaminated as not to be injurious to (a) human, plant, animal, and aquatic life.”

As we established in the introduction to this Report, pollution of Indiana waters is still a pressing issue. We made important progress when—decades ago—our legislature decided in spite of strong opposition that no one should be able to pipe polluted waste water directly into our state waters without a permit—and that you could get a permit only if you used appropriate technology to reduce the level of pollution of your waste. The water pollution laws have helped. We have made progress. We have made progress. Yet today, 80% of Indiana water utilities in a recent survey still responded that water pollution sometimes affects their ability to deliver the quality and quantity of water they need. Incredibly, Indiana’s most recent assessment of its waters shows nearly seven thousand miles of streams and rivers impaired because untreated or insufficiently treated sewage is being piped from buildings directly into our waters. Of the nine watersheds tracked in IDEM’s 2016 water assessment, an average of 81% of stream miles was adjudged not suitable for recreational use because of bacteriological contamination. **We should not allow ourselves to become complacent about the fact that our lakes and streams are still seriously polluted.**

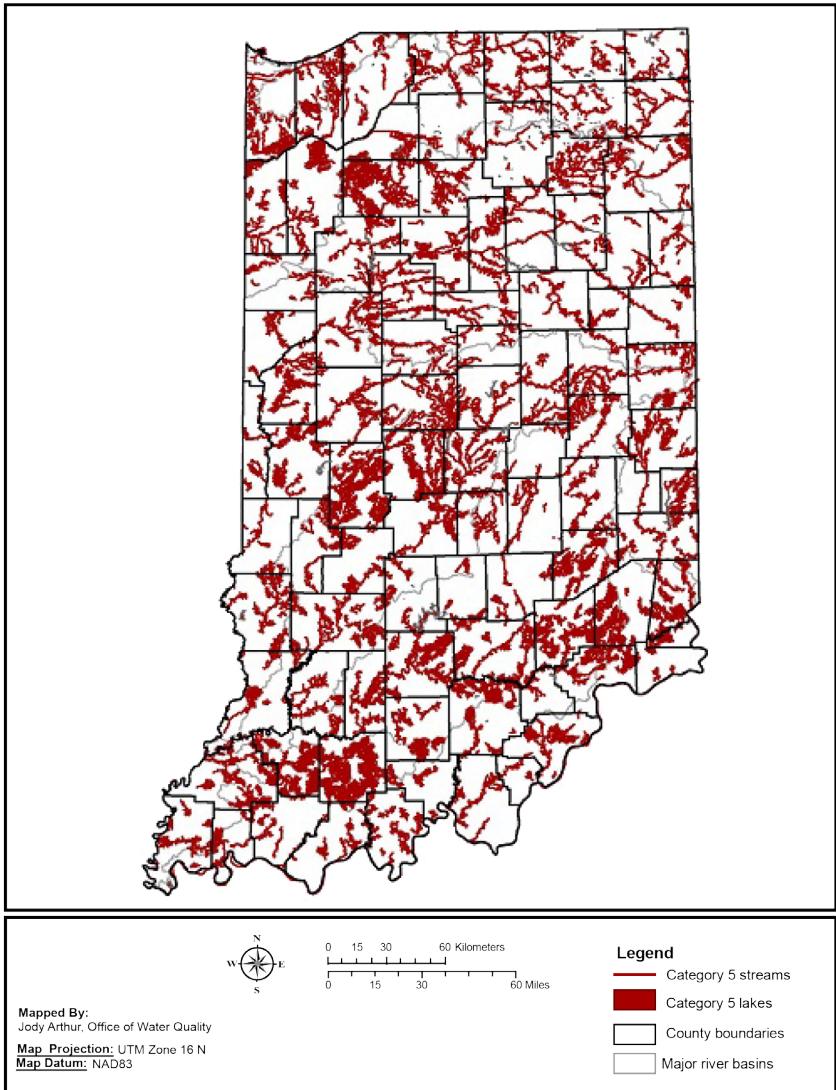


Figure 7. Category 5 impaired streams and lakes in Indiana (IDEM, 2016).

A. Sources of Water Pollution

Perhaps the most important new commitment we recommend that the state make now is to recognize what the General Accounting Office said in a 2014 report to Congress (*Clean Water Act: Changes Needed If Key EPA Program is to Help Fulfill the Nation's Water Quality Goals*): “More than 40 years after the Congress passed the Clean Water Act...the nation's waters are still impaired...without changes to the Act's approach to non-point source pollution, the Act's goals are likely to remain unfulfilled.”

Non-point pollution is water pollution that doesn't require a permit under state and federal water pollution laws. Non-point pollution is what washes into our streams, rivers and lakes without being collected and treated in factories or sewer districts. Most of Indiana's stream impairment is attributable to non-point sources. The most significant sources of non-point source pollution are certain agricultural activities. For decades we have funded programs designed to address non-point water pollution with incentives and voluntary programs. These well-intended programs, though not without effect, have not done the job.

More specifically, the Indiana Department of Environmental Management, in its 2016 report says that two of the top three known sources of impairment of Indiana waters are non-point pollution associated with animal feeding and grazing (Table 1). Sewage discharge in areas without sewers (as distinct from combined sewer overflows or failed septic systems) are cited as the second most important known cause of impairment. (These sewage discharges are an important unresolved point source of pollution.) Agricultural sub-surface drainage (currently a source of what is considered non-point source pollution) is the seventh most important challenge.

As to groundwater, Indiana's Nutrient Reduction Strategy states: “nitrate [primarily from fertilizer] is one of the most common groundwater contaminants found in the state. It represents a threat to drinking water primarily because excess levels can cause methemoglobinemia, or 'blue baby' syndrome.” Soil health improvements and continued improvement in fertilizer application technology are vital elements of a solution to that problem. While only 36% of groundwater samples revealed detectable levels of nitrogen contamination and only 2% exceed EPA established maximum allowable levels, groundwater contamination is an issue that will bear careful attention in areas of the state that have high hydrogeologic sensitivity (that is, soils classified as moderately to excessively well-drained).

Nutrient pollution has other effects in surface water. It isn't the most frequently cited cause of impairment in streams and rivers, but it stimulates unnatural growth of algae when those streams and rivers get to lakes or (eventually) the Gulf of Mexico. Indiana contributes a significant share of the nutrient pollution that causes the dead zone in the Gulf of Mexico and is a source of some of the phosphorus pollution that feeds the algae blooms in Lake Erie. Over several chaotic days in 2014, those toxic blooms made the public water supply of the city of Toledo unusable. Nutrient pollution is also an important nuisance that results in a reduction of the recreational value of Indiana lakes.

Table 1. Dirty Dozen: The top twelve manageable sources of known pollution in Indiana waters (IDEM 2016 Site Assessment).

Source	Stream or river miles
Non-point animal feeding operations	9,746
Direct Piped Sewage discharge	6,976
Livestock grazing/feeding operations	6,207
Municipal Treatment plants	3,139
Permitted Small discharge/package plants	2,858
Crop Production- sub-surface drainage	2,702
Animal Agriculture-unspecified	2,049
Concentrated Animal Feeding Operations	1,942
Combined Sewer Overflows	1,570
Loss of Riparian habitat	1,368
Failing septic systems	1,228
Unspecified Urban Stormwater	1,053

*Note: Waterfowl (3,836 miles) and other wildlife (3,815 miles) are also cited. There are management strategies that might help for sources such as resident Canada geese, but in this report, because detailed information about wildlife as a source of water pollution is unavailable, wildlife sources are treated as unmanageable.

IDEM's 2016 report concludes that over 60% of the assessed lake and river waters are unfit for human health and wildlife. There are both point source and non-point source issues, but the point source issues are simply a matter of will. The non-point sources both known and unidentified are now the most difficult problem we have to solve.

Current efforts to reduce non-point source pollution haven't been sufficient, but they are worthy of support. Indiana farmers have been among the nation's leaders in planting winter cover crops to manage nutrients, soil health and erosion. Over 1.2 million Indiana farm acres, or roughly 8% of Indiana cropland, was planted in cover crops in 2015. Also noteworthy are the state's nutrient reduction strategy and the Lake Erie Domestic Action plan. They reflect renewed urgency toward the goal of reducing nitrogen and phosphorus pollution. A component of both is a nutrient applicator certification effort, the "4R Nutrient Certification" program, which is designed to promote observance of best practices in fertilizer application. Nonetheless, Indiana and other states have tried for decades to address the non-point source pollution issues with education, and incentives and local watershed planning and talk. Current programs share many characteristics with past efforts. New approaches are needed.

Indiana has started to establish "pollution budgets" for impaired streams as a first step toward addressing the impairment. These budgets, called TMDLs, are designed to identify problem pollutants and sources, and enable IDEM to focus enforcement attention on the sources of those pollutants. They can only make a difference in water quality with an accurate assessment of the sources of the pollution problem and a sustained commitment to follow-up.

As the GAO said in its 2014 report (p 36) effective TMDLs must "accurately identify and address causes of impairment, be implemented, and ... be revised if found to be ineffective in helping water bodies attain water quality standards." Because, as GAO says, EPA guidance is lacking specificity regarding those key elements of a worthwhile TMDL program, states need to take the lead in making good on the investment we are required by law to make in establishing TMDLs. One or two states, having not made progress with less assertive efforts, have balanced the scales by making non-point source polluters legally accountable just as point source polluters are. We have three specific recommendations for achieving the clean water that is our statutory right as Indiana citizens:

Recommendation 10. We recommend that the legislature empanel a study committee to consider two new programs to mitigate non-point source pollution. First, we should consider requiring livestock producers to maintain well-vegetated buffers that separate grazing and feeding livestock from Indiana streams and rivers. Second, we should consider upgrading current rules by requiring animal feeding operations that border Indiana waters to maintain well-vegetated buffers in fields upon which manure from those operations is spread.

Indiana reports some success in improving nutrient and bacteriological loads in state waters through implementation of best practices. The case reported in IDEM's 2016 report, however shows relatively small investment from the sources of contamination, and large public investment. With state supplementation to USDA and EPA-funded programs, and an appropriate private sector commitment, the challenge of funding best practices implementation can be met. Forty years of trying, however, teaches us that the challenge will not be met solely with voluntary efforts. The stream buffers called for in recommendation 10 need not be non-productive lands; in many situations, they could, for example be managed for hay. And if buffers are shown to be impracticable, we need an alternative strategy for reducing livestock-sourced *E. coli* (fecal) pollution of our rivers, streams, and lakes.

The second largest collection of related known sources of pollution of the rivers and streams of Indiana is untreated or improperly treated sewage from: (in descending order of stream miles affected) direct pipes, municipal treatment systems, permitted package treatment plants, combined sewer overflow, and failed septic systems. We must resolve to end that pollution.

Recommendation 11. The state of Indiana should commit immediately to resolving every case of direct piping of insufficiently treated sewage into Indiana waters. Within four years, we should cut by 90% the number of stream miles impaired by untreated sewage, and we should have a plan to bring that number to zero within 10 years. In addition, we should continue to invest in reducing combined sewer overflow and address rural sewage management with appropriate funding for public health department inspection and enforcement.

In 2015 (according to the United Health Foundation) Indiana ranked 48th in the nation for funding public health departments. We certainly need to fund local health departments to support regular inspections of septic systems and enforce regulations. We believe there will be a role for the IWA in catalyzing the repair or replacement of failing septic systems and investigating the feasibility of investment in rural sewer districts, rural septic management districts, and other new sewage management technologies.

The next most important manageable source of non-point source surface water pollution in Indiana is agricultural drainage. Important efforts led by soil and water conservation districts and others have resulted in a new emphasis on building soil health with cover crops and other methods. These efforts deserve praise because improved soil health will increase the capacity of soil to hold water, improve yields in variable weather conditions, and reduce nutrient run-off and leaching.

There is an additional way to reduce the deposition of nutrient pollution in to our waters, and that is to empower drainage boards to invest toward that goal. Very minor statutory amendments could accomplish this. Only two basic changes are needed. First, a definition of “undesirable environmental effects.” Second, authorization for drainage boards and county surveyors to consider reducing undesirable environmental effects in constructing and maintaining public drains. Suggested amendments are included in the Appendix to this Report.

Recommendation 12. Allow surveyors and drainage boards to take the environment into account when assessing the system, maintaining drains, and planning new or replacement drainage projects.

B. Water Pollution Regulation

The central feature of Indiana’s Clean Water Act was to prohibit pollution of Indiana waters unless the polluter had obtained a permit. Some forty years later, it is important to recognize the improvement in Indiana waters that has been made, and the change in our culture that the law has stimulated. Almost all Hoosiers recognize that each person and company that generates pollution has the responsibility to clean it up before returning liquid waste to public waters.

And yet the Environmental Protection Agency reported in 2009 that of 196 major point sources of water pollution in Indiana, 147 were not in compliance with their water pollution permits. Of those, 12 were in “significant” non-compliance. This resulted in informal enforcement actions in 53 cases. There were 5 cases of formal enforcement. There have been no comparable EPA reports since 2009, but non-compliance continues to be an issue. For example, two utilities that discharge into the White River have been in non-compliance every quarter for the past three years.

A significant reason for the issues Indiana has with compliance is that according to IDEM’s “IDEM 101” PowerPoint presentation, the staff of the agency has been reduced by more than 14% since 2010. Along the same lines, a Hoosier Environmental Council analysis showed that the General Fund allocation for the agency’s budget has been reduced by 39% since its recent high mark in 2001-2002 and 2002-2003: from over \$37 million per year to over \$22 million. Using the same years as a comparison, IDEM’s overall budget, which includes funds from fees and fines as well as federal support, has dropped by 21%. There are not comparably fewer permits to monitor, fewer streams to assess or even fewer violations to deal with than there were a decade ago. Formal enforcement is, of course, not always

the right action for a permittee in non-compliance. But when enforcement becomes rare, permittees who are under financial pressure—and that means all permittees—are inevitably more likely to fund other priorities and try to get by without fixing their systems.

In addition to enforcing the permits we have issued, we need to address pollution caused by unpermitted polluters, including particularly the sources of the sewage being piped directly into Indiana waters as mentioned above.

Finally, we need to consider the safety of new substances. The Indiana legislature showed the will to do this when it recently banned the use of microscopic plastic beads in personal care products. As new research identifies other new hazards to our waters, from hormone mimics to other nano-particles, we need to be prepared as a state to require the promulgation of standards that protect people and wildlife from the effects of those substance on our state waters. We need not and should not bind ourselves to federal action or lack thereof on these pollutants.

We need an appraisal of IDEM's capacity, and a commitment to appropriate staffing. In addition, there is a constant flow of new substances that may threaten our waters: certain nano-particles and hormone mimics are examples. IDEM should regularly convene a team of experts to consider setting new state standards for toxic and damaging substances in waste water.

Recommendation 13. We recommend that Indiana re-invest in its capacity to monitor and enforce its water pollution laws, recognize new pollutants, and set appropriate state standards for toxic and damaging substances in waste water.

Indiana needs to re-commit to resolving the issues of water quality. The state committed to clean water forty years ago, but we haven't yet achieved the clean water we hoped for. We need to monitor and be willing to enforce the water pollution permits we have issued.

Our legal system in Indiana recognizes a right to an environment that is safe for humans and wildlife. That right is yet to be redeemed in many of our surface waters. We have the resources to do it. We cannot afford not to do it. It is time to re-commit ourselves to the task.

PRINCIPLE III: Water is Life.

Many of our great cities were built where they were because of the water resources that nature provided. As those cities grew, those water sources were uniformly ruined, as greater and greater amounts of more and more exotic and dangerous filth were channeled into them. The cities turned their backs on the rivers that once attracted them.

And yet, humankind's affinity for water kept us from forgetting. When we began to improve those waters, we started turning back toward them, and in many cities, it is now those waters that attract the most valuable new development. The City of Chattanooga is one of the best known examples, and some Indiana cities have been paying attention.

When we leave our homes, fresh waters are central among the attractions we seek out: we go to the lake, we canoe on the stream, and we fish in the rivers and lakes at a rate of a billion dollars per year. We still marvel at Cataract Falls, the great rivers, the glacial lakes, and the reservoirs. The availability of spiritual refreshment at our waters is part of what makes for the quality of life we seek.

"The natural value of our waters is part of what makes for the quality of life we seek."

And there is something special about waters that still testify to the health of the ecosystems that bound and sustain them. Indiana has designated 251 miles of stream as "outstanding" and 160 miles as "salmonid" (Figure 8). As fine as these waters are, many are classified as impaired, and many are fed by impaired waters.

Like all government agencies, the Indiana Department of Environmental Management is operating in a resource-constrained environment. That makes it critical that it establish priorities for the use of the resources it has. Indeed, the 2014 GAO report affirms (pp17-18) that by 2016, "States are to systematically set priorities for, and in their biennial integrated reports identify waters for restoration and protection." Indiana has set some priorities, but we recommend adoption of two factors not currently being used to set priorities.

Recommendation 14. We recommend two high priorities for taking action to resolve impaired waters. IDEM should focus first on (1) waters that are recognized as outstanding, and (2) waters in large population centers.

There is every reason to make the resolution of the impairment of most important water bodies in the state the subject of exemplary programs to

resolve the issue of persistent water quality impairment. The programs must go beyond establishing TMDLs. IDEM must carefully, credibly, and specifically identify and address the reasons the waters remain impaired in the priority streams and rivers and their tributaries. All plans and findings should be shared with the RWMGs.

The map below illustrates some of the waters that should be a priority: it shows waters that support salmonid fisheries, as well as waters the Indiana Department of Natural Resources identified as qualifying for natural or scenic status.

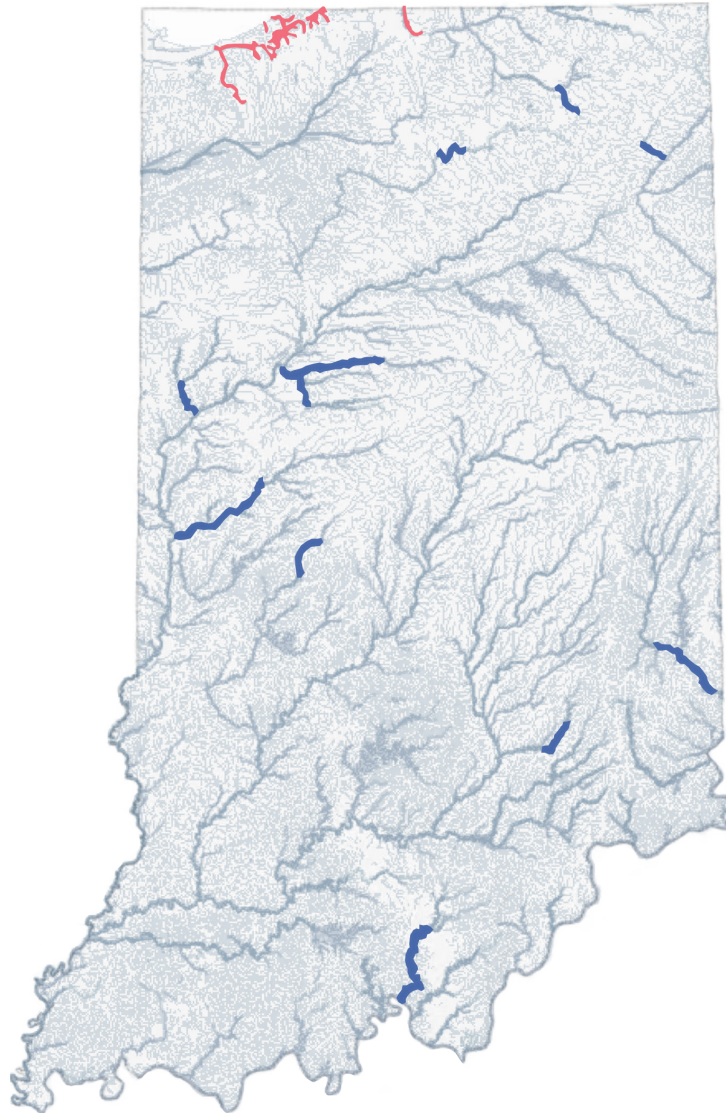


Figure 8. Salmonid streams and (INRC, 2003) waters qualifying for natural or scenic status.

Funding

It is going to take a sense of commitment and a sense of responsibility to do what needs to be done to modernize Indiana's approach to water as a critical economic, quality of life, and public health resource. That commitment must be expressed both in action and in funding. There is no more important nor vital resource than water, and Indiana has not been making the investment needed, nor even the investment that nearby states are making in their waters.

Making specific recommendations about a funding source for the needed investments is beyond the scope of this Report. But we can do two things. First, we can urge policy makers—despite the ever-present pressures of each legislative day—to invest in the state's future: to stop thinking about chipping in a few hundred thousand dollars here or there, and start thinking seriously about the millions of dollars per year that the job requires. (Our best information is that Minnesota, Georgia, North Carolina, and Virginia, among many others, are each devoting more than \$10 million per year to water management.)

Second, without specifically recommending any of these funding sources, we can emphasize that identifying the needed funding is not impossible by taking note of funding sources employed in other cities and states, and adding a couple of ideas unique to the cost or lack thereof of water used in our own state:

- Chicago employs a five-cent tax on bottles of water to fund its water management program.
- The state of Maine has added five cents to its gasoline tax for source water protection.
- Cook County, Illinois, Philadelphia, San Francisco, and Albany, New York impose a penny-per-fluid-ounce tax on sugary soda drinks.
- The Indiana legislature could impose a fee as low as \$0.005/thousand gallon charge for metered water to provide for the management of natural and built infrastructure used to deliver that water.
- Finally, Indiana could apply to all water users the kind of payment made by Hoosiers who rely on U.S. Army Corps of Engineers-built reservoirs for their

water. Many Indiana residents already pay a general charge of a fraction of a cent per metered gallon for their water. Expanding that charge of all users of the waters of the state [exempting private wells, while examining the possibility of including wells required to register under Indiana law] would adequately fund the data, research, forecasts, planning and some of the investment needed to accomplish the goals of this Report.

Conclusion

Indiana has the natural water infrastructure needed to meet our needs and more: our water resource can in many ways enable the state to compete effectively for the other resources we want. The resource is so good that it has masked our failure to care for and invest in it.

The Steering Committee that guided the preparation of this Report did not come to the task with pre-conceptions. After many hours of work, it concluded that the time has come for Indiana to make a new investment in the state's waters. We need good data, a focused state and regional effort at stewardship, a renewed commitment to address water pollution, and a fresh appreciation of the scope and quality of our state's fresh water.

The money it will take to do what we need to do is an investment in preserving valuable capital rather than an expense. It is an investment we recommend that the state make soon.

Now would be best.

Appendix 1

Ind. Code 36-7-XX-X Regional Water Management Planning Groups

Sec. 1. The legislature finds that appropriate stewardship of state waters requires among other things, active planning and management of water resources, and that regional planning and management of water resources is a vital part of Indiana's water stewardship effort.

Sec. 2. In order to gather and analyze information about water resources and their use, and to help establish sustainable, productive, and equitable management and use of water resources in Indiana, water planning regions are hereby established for each of the regions in Indiana defined in section 3 of this chapter.

Sec 3. [Definition of Water Planning Regions]

Sec 4. Establishment of Regional Water Management Groups

- a. In each water planning region, a Regional Water Management Group shall be established.
 1. The governor, in consultation with elected officials from each city, town, and county in each water planning region, shall appoint ten members to each Regional Water Management Group. No more than six members shall be affiliated with any one political party. Each member shall be a resident of the water planning region of which he or she is appointed a member of the Regional Water Management Group.
 2. The members shall serve three year terms, except that one third of the initially appointed members shall serve one year terms, and one third shall serve two year terms.
 3. Members representing each of the following water interests shall be included among those appointed.
 - i. Drinking water and domestic use.
 - ii. Local government.
 - iii. Natural values, fish and wildlife, and ecology.
 - iv. Recreational use.
 - v. Industrial use.
 - vi. Use in electric power production.
 - vii. Agriculture.
 - viii. Public health.
 - ix. Drainage and stormwater management.
 4. Members of the Regional Water Management Groups shall serve without salary but may be reimbursed for expenses incurred in the performance of their duties.

5. If a vacancy occurs by resignation or otherwise, the governor shall appoint a member for the unexpired term.

Sec. 5. Powers and Duties

- a. Each Regional Water Management Group shall fix the time and place for holding regular meetings, but it shall meet at least quarterly and at such other times as may be established by the commission or the executive board. It shall provide quarterly notice in advance of its meeting schedule to the public, the [Indiana Water Authority] and other appropriate state agencies, the appropriate regional office of the United States Fish and Wildlife Service, the appropriate regional office of the United States Army Corps of Engineers.
- b. Each Regional Water Management Group shall adopt rules for the transaction of business and shall keep a record of its resolutions, transactions, findings, and determinations, which is a public record.
- c. A majority of members constitutes a quorum.
- d. Working cooperatively with state, local, and national agencies, the Regional Water Management Group will:
 1. gather and analyze regional water resources and uses, develop regional water plans that to the greatest extent possible sustainably serve all of the water needs and interests of the region without compromising the needs of other regions or the future.
 2. Working with the units within its Region, the Regional Water Management Group will administer funds it is provided by local government, state appropriations, grants and gifts so as to help carry out the plans it has established, as well as to adapt and adjust the plan to changing conditions, complete water infrastructure improvements addressing both built and natural water infrastructure, reduce flood damage with ecologically sound projects, address adjustments in water use required in conditions of drought.
- e. The Regional Water Management Groups, in addition to the specific powers here established:
 - i. shall generally have all powers necessary and appropriate to the achievement of their purposes except those specifically withheld in this article or those exclusively granted to other governmental units.
 - ii. shall coordinate its activities with all units in the region and shall coordinate with other regions and the state.

- iii. may accept public and private grants-in-aid and may enter into agreements or contracts regarding the acceptance or use of those grants and appropriations for the purpose of carrying out any of its purposes and duties.
 - iv. may acquire by grant, gift, purchase, lease, devise, or otherwise and hold, use, improve, maintain, operate, own, manage, or lease (as lessor or lessee) such real or personal property as necessary for its purposes and duties.
 - v. may employ staff and delegate appropriate operating authority to employees, retaining fiduciary responsibility and policy-making authority.
 - vi. may provide administrative, management, or technical services to a unit that requests the services.
- shall

Sec. 6. [FUNDING]

Appendix 2

Amendments to Drainage Code

Proposed amendments underlined in italics

1. Amend Ind. Code §36-9-27-2 After definition of “Tiled drain” and before definition of “Urban land” as follows: “Undesirable environmental effects” includes but is not limited to transport of nutrients, agricultural chemicals, pesticides, or herbicides; soil erosion; failure to store water when storage might be useful; or facilitation of flood conditions downstream when not necessary to achieve drainage objectives.
2. Amend Ind. Code §36-9-27-34 (Classification of Drains by County Surveyor) as follows:
 - (b) A regulated drain is in need of reconstruction when:
 - (1) it will not perform the function for which it was designed and constructed; or it could be reconstructed to perform the function for which it was designed and constructed with significantly reduced undesirable environmental effects at reasonable cost.
 - (c) A regulated drain is in need of periodic maintenance when, with or without the use of mechanical equipment, it can be made to perform the function for which it was designed and constructed, and to properly drain all affected land under current conditions, or to properly drain affected land with fewer undesirable environmental effects at reasonable cost, by periodically:
 - (4) making minor repairs, additions, or alterations to it.
3. Amend Ind. Code §36-9-27-45 as follows:
 45. A maintenance fund established under Sec. 44 of this chapter is subject to the use of the board for the necessary or proper repair, maintenance, study, or evaluation of the particular drain or combination of drains, or to fund in whole or in part, work to reduce undesirable environmental effects, drainage control, or drainage water storage infrastructure or technology for private or mutual drainage systems that flow into a regulated drain, which may be done whenever the board, based upon the recommendation of the county surveyor, finds that it is necessary or appropriate. The payment for all such maintenance work shall be made out of the appropriate maintenance fund. However, if:

4. Amend Ind. Code §36-9-27-49 as follows:

(a) When the board refers a regulated drain to the county surveyor for a reconstruction report, the surveyor shall determine and set forth in his report the best and cheapest method of reconstructing the drain so that it will adequately drain all affected land. The "best" means the method that will result in a drain that performs drainage functions well while limiting undesirable environmental effects to the greatest degree reasonable and cost-effective.

5. Amend Ind. Code §36-9-27-61(5) as follows:

(5) Determine the best (*as defined in Sec. 49 of this chapter*) and cheapest method of drainage, which may be by... (A)-(H).