Guidance for Developing Watershed Action Plans in Illinois

Chicago Metropolitan Agency for Planning

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Foreword

Illinoisans, much like other Americans, face many challenging social problems that typically have environmental consequences. Today's problems are often subtle, chronic, and inter-related. This is particularly evident in the area of water resources. Nonpoint-source pollution, for example, is the most vexing water-quality problem that faces America today. In Illinois, as elsewhere, agricultural and urban land uses are the largest nonpoint-source contributors to water-resource impairment.

While a more regulatory or "top-down" approach has worked well in dealing with point-source pollution, a more flexible and collaborative or "bottom-up" approach is necessary for addressing the ongoing nonpoint-source threat. A watershed approach features those attributes and offers a coordinating framework for practicing collaborative governance and sustainable management of water resources. Other 21st century issues of growing importance including availability of safe drinking water, ground water overdraft and depletion, and maintenance of abundant water supplies, demand a more comprehensive approach to environmental protection, as well as an approach grounded in sound science, innovative solutions, and broad public involvement. These attributes describe the watershed approach too.

Embracing these ideas, this manual presents an approach to watershed-based planning designed to ensure that local stakeholders play a central role in the development of comprehensive, multi-issue watershed plans. A watershed approach to planning for and managing land and water resources is not a new idea. Explorer and civil-war veteran, John Wesley Powell, called for a water and watershed approach to organizing settlements in the arid West during the latter part of the 19th century. Only now has the wisdom of Powell's vision become fully appreciated. More recently, the United States Environmental Protection Agency (USEPA) reaffirmed their commitment to supporting a watershed approach to environmental-resource protection (i.e., Memo from G. Tracy Mehan, 2002). The USEPA argues that groups working within the watershed-based approach can identify and implement successful strategies to maintain and restore the chemical, physical and biological integrity of our nation's waters.

Closer to home, the Illinois Environmental Protection Agency is committed to a similar watershed approach to protecting, enhancing, and restoring state water resources. By focusing on multi-stakeholder efforts within hydrologically defined boundaries to protect and restore our aquatic resources, watershed planning offers a promising approach to manage today's challenges.

Watershed planning efforts have evolved considerably over the last couple decades. Previously, such efforts were often top-down processes that focused primarily on single issues. More recently, local groups variously described as "place-based" or "community-led" planning initiatives have assumed a larger role in watershed planning and management. At the same time, the importance of comprehensive planning, rather than a single-issue focus, has also been recognized. This manual embraces this evolution in watershed planning and seeks to provide an up-to-date approach to guide locally-driven, comprehensive watershed planning efforts in Illinois.

The USEPA has incorporated the watershed-based approach into many of its major programs—most importantly, for our purposes, are regulations regarding eligibility for certain types of Clean Water Act, Section 319 funding. The Section 319 program represents the USEPA's primary nonpoint-source water-pollution-control program. The USEPA requires nine components of a watershed-based plan. This manual addresses each component and explains how you can ensure that your planning efforts meet these requirements. Meeting these requirements will help ensure that when work towards plan implementation begins, funding support can be found under the Section 319 program.

This Guidance for Developing Watershed Action Plans in Illinois (referred to as The Illinois Guide hereafter) aims to help the reader create and develop an effective watershed-planning initiative that will produce a locally driven *watershed action plan*. The Illinois Guide features seven chapters. Each chapter represents a step in the strategy for conducting a watershed planning process. The Illinois Guide is written so as to be accessible by anyone interested in the watershed planning process. It is meant to be a companion to other useful reports that provide water-quality data and cover a variety of related concepts that collectively represent important information for those wishing to become more knowledgeable about our water resources. Terms that are printed in bold typeface and found throughout the Illinois Guide are defined for the reader in a Glossary located at the end of the document.

The reader is encouraged to review the entire document in order to get an overview of the entire process. However, groups that are seeking to update previously existing plans to meet the new requirements may find it more expedient to seek out the specific chapters and passages that apply to their needs. As the following table illustrates, each of the nine Section 319 components has been addressed by a planning stage. Note that some chapters do not address any of the nine components. This manual, while seeking to address these components, also strives to present a general approach to comprehensive watershed planning, whether you elect to work within the guidelines of the Section 319 program or not.

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Organizing a Watershed Planning Initiative

Chapter 1

Typical First Steps:

- Identify potential stakeholders and conduct an initial planning meeting
- Discuss known watershed characteristics, resource aspirations, and concerns
- Establish a planning-group structure to help facilitate meetings and engage stakeholders, resource experts, and other interested individuals in the planning process

How do you begin?

If you are interested in creating a watershed planning/management initiative to protect your local water resources and pursue other natural-resource goals, there are a number of initial steps that you will need to take. The first step will be to identify your concerns about the watershed and consider who else might have similar concerns. Contact the people and organizations that you know and have some informal discussions to help frame your ideas and develop a sense of local interest beyond yourself. Your acquaintances may well have similar or related interests in local water resource issues and could be important partners who will help you begin a locally-led watershed-planning process.

Once you have contacted the people you know, consider other groups who may be interested in discussing water resource concerns. Anyone who has a potential stake in the watershed action plan that will be an outcome of the planning process should be encouraged to share their ideas, concerns, and suggestions for possible solutions. By involving these stakeholders in the initial stages of the planning process, you will be helping to ensure the long-term success of both the planning initiative and resultant watershed action plan. Consider contacting the potential stakeholders listed below to determine if they share your water-resource concerns.

Many watershed planning initiatives are focused on protecting or restoring water quality. The stakeholders that become involved will vary, therefore, depending on the pollutants of concern within the watershed and the suspected causes and sources of pollution. Other factors such as predominant land uses, landownership, and ability to implement watershed-plan recommendations may also influence who participates in the process. Be sure to include stakeholders even if their perspective differs from yours on certain issues. Bringing in everyone whose interests would be affected by your watershed project is especially important when implementation of the watershed plan requires their cooperation and support. Working together and negotiating conflict will help build broad support for recommended solutions and ultimately increase the likelihood of a successful implementation of the plan.

Your initial stakeholder meeting

Once you have identified the stakeholders in your watershed, a good way to get started is to bring everyone interested in the project together in a public meeting. At the meeting, stakeholders can discuss known watershed characteristics and problems, leading to the creation of a (preliminary) list of watershed concerns and issues. The initial stakeholder meeting can also be used to establish the structure of your watershed project group.

A bit of preparation goes a long way toward ensuring the success of your stakeholder meeting. The following steps are a useful guide to a productive session:

- Provide advance notice to stakeholders
- Develop a strong agenda
- Manage the process during the meeting

Providing stakeholders with plenty of advance notice not only demonstrates your commitment and professionalism, but also increases the chances of a well-attended meeting. Moreover, if any materials have been prepared for the meeting, they should be distributed as soon as possible in order to give stakeholders the opportunity for review.

A strong agenda can help provide the structure necessary to ensure a productive meeting. Take the time to understand what you hope to accomplish at the meeting and what will have to happen to reach those goals. During the initial stakeholder meeting, the agenda may be focused on discussion of the watershed's problems as well as the stakeholders' views on the project's organizational structure. Identifying a preliminary list of watershed issues can help

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Stakeholder meetings should include a wide variety of participants.

Potential Stakeholder Groups

Local Government

Municipalities
Parks Department
Highway Department
Public Works Department
Townships
Wastewater Authorities
County Stormwater Management Committee
County Health Department
County and City Planners
County Forest Preserve or Conservation District
County Department of Transportation
County Soil and Water Conservation District (SWCD)
Regional Planning Agencies
Drainage Districts

State and Federal Agencies (local representatives)

Illinois Environmental Protection Agency (IEPA)
Illinois Department of Natural Resources (IDNR)
Illinois Department of Transportation (IDOT)
Illinois State Geological Survey
Illinois State Water Survey
University of Illinois Extension
USDA Natural Resources Conservation Service (NRCS)
US Fish and Wildlife Service (USFWS)
US Geological Survey (USGS)
US Environmental Protection Agency, Region 5 (USEPA)
US Army Corps of Engineers
US Forest Service

Business Representatives

Local Agribusiness
Developers/Home Builder's/Realtor's Association
Industries, Corporations, and other Businesses

Citizen Groups

Civic Organizations
Homeowner/Neighborhood/Lake Associations
Religious Organizations
Recreational Groups
Youth Groups

Universities and Schools

Environmental and Conservation Groups

Watershed Councils
Local Conservation/Environmental Groups
Local Chapters of National Conservation/ Environmental Groups

Landowners

(especially riparian (i.e., streamside) and floodplain property)

raise awareness within the group and provide stakeholders with a general framework to organize their efforts as they move forward.

It might be useful to have a facilitator, someone who is impartial and skilled at helping attendees achieve their meeting objectives, as well as manage the meeting to ensure that participants remain focused on the topics at hand. Sticking to pre-established ground rules—on speaking time, voting, the agenda, etc.—helps prevent unnecessary digressions and conflict, thereby helping to ensure a productive meeting.

Establishing a Framework for Stakeholder Involvement

After (or even during) your initial meeting with stakeholders, some form of organizational structure is usually established. While the level of formality varies, it is helpful to assign roles and responsibilities to key stakeholders. Doing so keeps stakeholders involved in the planning process and helps to ensure that work is well coordinated.

Textbook watershed planning projects have two key organizational components: the planning and technical committees. The planning committee is often made up of the individuals and authorities who are necessary to implement change in the watershed—as well as other interested parties. The technical committee, as its name implies, is concerned with the technical problems of the watershed and often leads the effort to identify and provide solutions to these problems.

The Planning Committee

Planning committee membership, roles and responsibilities will vary depending on water quality conditions and the interests of the individuals. Invite the members of the stakeholder group to serve on the planning committee. Usually, one representative per stakeholder organization or agency will be included. The planning committee should at a minimum include the individuals in the watershed who have some authority to implement change, since their participation and commitment will likely be critical to the successful implementation of the watershed plan.

There is no pre-determined size for the planning committee. You might begin the planning process with 20-30 stakeholders, and end up with an active planning committee of 7-10 people. Alternatively, your initial stakeholder group may be very small, and increase in size as key groups and individuals are encouraged to participate and serve as committee members.

Projects often begin with a large number of interested people in the early stages of the watershed planning process. The larger interest at the onset increases the chances that the individuals and agencies necessary to complete the project are already present. The initial public interest will also be useful for future information and education activities.

At the first planning committee meeting, review the list of concerns developed during the stakeholders' meeting and add any additional concerns. Once the list is complete, use it to evaluate the membership on the planning committee. Given the existing and perceived concerns in the watershed, are the planning committee members those who can make decisions and influence change? If not, contact the missing stakeholders and invite them to participate. Keep in mind that as concerns are identified and the plan is developed, the membership of the committee may evolve.

A planning committee provides overall direction for a watershed project. Members are decision makers and usually have some authority to make change, such as a municipal official with the authority to change site plan requirements to better protect water quality, or an agency representative who can provide leadership for a watershed restoration project.

Who should lead the planning committee?

Once the planning committee is in place, the next step is to identify a lead organization or individual who, in effect, becomes the watershed coordinator. This may be you or your organization/agency, or, if that is not appropriate, another organization that is represented on the committee. The leader's role is to ensure that the watershed planning and implementation process continues to move forward. The most appropriate organization to lead the effort is the one that can represent the entire project area, and has the staff and resources necessary to provide leadership.

The most appropriate lead organization also depends on the priority concerns within the watershed. For example, if the land use in the project area is predominantly agricultural, it may be appropriate for the local soil and water conservation district to provide leadership. If the primary concern is urban storm water, a county- or municipal-based group might be an appropriate lead organization.

How should the planning committee operate?

To ensure that meetings run smoothly, it is important to identify some basic rules and responsibilities for the planning committee. The same techniques outlined above for the initial stakeholder meeting would likely apply for planning committee meetings as well. Additionally, given the planning committee's (usual) lead role in decision-making—and the consequent possibility of conflict—rules for decision-making should be clearly established. The textbook decision-making process for watershed planning is decision by consensus. That is, the planning committee will only adopt a proposal if it is something that the entire body can live with. Unanimity created by consensus can help in the implementation phase of the watershed project, as all stakeholders—and therefore hopefully all community interests—will have agreed to the plan. Additionally, if the plan is to be formally adopted by local units of government, this process will be facilitated by early support for and/or commitment from each.

The Technical Committee

Since your planning committee will include decision makers who can bring about change in the watershed, it is helpful if they are supported by people who can provide them with technical information. The information might include water quality data or knowledge, such as the impact of increased storm water runoff volume on aquatic wildlife. A technical committee can play a valuable role if it includes professionals who are trained in various water-related disciplines. In addition to their professional expertise, technical committee members may have access to resources such as maps, data and other materials that can assist in the planning process.

Using the list of watershed concerns from the planning committee's initial brainstorming session, identify people who may be able to provide missing information. For example, you might require an IDNR fisheries biologist to provide data on the fishery, an IDNR hydrologist to provide the hydrologic information, and an engineer to provide expertise in Best Management Practices (BMP) design.

Depending on your situation, the technical committee may be a sub-group of individuals who also serve on the planning committee, or it may be a separate group that serves solely in an advisory capacity. Like the planning committee, the membership of this group may change over time as the planning process evolves. And as we saw in the example above, many watershed planning groups have found it expedient to hire a consultant group to fill the expert role of the technical committee.

Committee Structure

Indian Creek, Lake County

The Indian Creek Watershed Committee (ICWC) developed out of a partnership between Lake County Stormwater Management Commission (LCSMC) and several Indian Creek residents in the winter of 1999. The ICWC is a group of concerned watershed residents and stakeholders dedicated to the preservation, protection, and improvement of the Indian Creek Watershed. The ICWC acted as the planning committee for the Indian Creek watershed, and contained stakeholder representatives from municipal governments, watershed landowners and the LCSMC. The ICWC played an important role in the development of goals and objectives for the watershed plan, which in fact began with input generated during monthly ICWC meetings.

A consultant was hired to provide an inventory and analysis of the watershed, essentially filling the role of technical committee. During subsequent meetings, the consultant and ICWC members developed watershed goals, objectives, and management solutions for the plan. ICWC members were kept informed and involved throughout the entire process, helping to ensure that interest in and support for the plan was maintained.

Indian Creek stakeholders also created a third body—separate from both the planning and technical committees—in order to address watershed education. In July of 2000, several members of the ICWC formed the Indian Creek Watershed Project, Ltd. (ICWP), a non-profit organization established to promote water-quality education and to oversee IEPA Section 319 Clean Water Act grants received in 2001. The first Section 319 grant project included a four-part education and restoration effort designed to reduce non-point sources of pollution in the watershed.

Visit http://www.indiancreekwatershed.com for more information.

Watershed Project Scope

Nippersink Creek, McHenry County & Fish Lake Drain, Lake County

The Nippersink Creek Watershed Planning Committee produced a watershed plan for the largest tributary in the Fox River system in 1998, but an update of the plan will be completed in 2007. This watershed is approximately 87,632 acres. With this relatively large scope came increased complexity for the project. Their plan focused on many impairment concerns, including sediment, stream bank erosion and nutrient run-off from agriculture as well as concerns about future land use changes from development. Moreover, the project involved the coordination of more than a dozen local and state agencies. While the Nippersink Creek plan did include some recommendations targeted at specific sites and problems, the scope and complexity of the watershed project meant that the planning committee was unable to target all watershed problems. Instead, the committee called for further study and subsequent development of additional, more concrete recommendations as the process progressed—both important considerations for any watershed plan, to be sure.

Visit http://www.nippersink.org for more information.

The Fish Lake Drain Watershed management project focused on a much smaller area —only 4,480 acres. As in the Nippersink Creek plan, several watershed impairments were identified. This project also involved over a dozen governmental agencies and citizens' groups. However, given the project's less extensive geographic scope, the Fish Lake Drain plan was able to identify specific sites and management practices that are often beyond the scope of projects for larger watersheds. Indeed, the planning committee was able to produce detailed recommendations for each subwatershed within the Fish Lake Drain system.

An updated watershed plan will be completed in 2007.

While we have just laid out an ideal arrangement of having two distinct committees participating in a watershed planning process, it is important to know that having a single steering committee, a hybrid of both the planning and technical committees just described, is acceptable and not uncommon. Not all planning initiatives will have the luxury of enough people present, willing, or able to participate such that two types of committees composed of different people can be formed. What's most important is that some form of "watershed governance" is formed to lead the planning initiative forward. As your planning initiative matures and attracts greater participation, your system of governance can evolve to best reflect the issues, objectives, and people involved.

How do you determine the geographic scope of your watershed?

One of the first tasks of the planning committee will be to define the geographic scope (i.e., scale or size) of the watershed for planning. It will be immediately useful to produce a map that illustrates the watershed boundary, surface water features (e.g., drainage network, lakes, etc.), and other important characteristics of the landscape. The size of the watershed will depend on many factors, including the concerns that were identified at the stakeholder and planning committee meetings, and other watershed characteristics, such as land use and hydrology. The USEPA has found that watershed planning projects are often more successful on smaller scales (i.e., up to 40,000 acres or approximately 63 square miles), although planning initiatives do target watersheds of a wide range in geographic size. A crucial point to consider is practicality: is it within your group's resources and ability to plan for and implement projects over the spatial extent of your proposed watershed? Also, the sense of "local" or familiarity with the landscape and social ties that form within and between adjacent communities tends to break down or becomes lost altogether when attempting to plan for too large an area.

Your watershed might be:

- A river tributary from its headwaters to its confluence with the main branch of the river
- A segment of river from its headwaters to a dam, or confluence with a tributary
- A lake watershed, including all contributing tributaries

Remember that larger watershed boundaries will require the involvement of more individuals and agencies, and will likely create more challenges in designing a coordinated effort. Also, while planning can successfully occur at larger scales, the implementation will ultimately need to occur at a smaller scale. The practicality of all plans should be thoroughly investigated before planning begins in earnest. Large scale plans are usually only realistic in rural or undeveloped watersheds where land use is either fairly homogenous or there are few pollutants of concern. As a rule-of-thumb, watersheds of 50 square miles (32,000 acres) or less will be more tractable for planning purposes. Such a geographic extent will approximate a subwatershed, including smaller drainages, numbered with 12-digit USGS hydrologic unit codes (HUC), but could also include the smallest 10-digit HUC watersheds that represent larger watersheds within the USGS map of hydrologic units. More information on hydrologic units can be found at http://water.usgs.gov/GIS/huc.html.

Once the geographic area of your watershed has been determined, review the membership of your planning committee. Be sure to check that the stakeholder group includes representatives from all areas of the watershed and for all land uses.

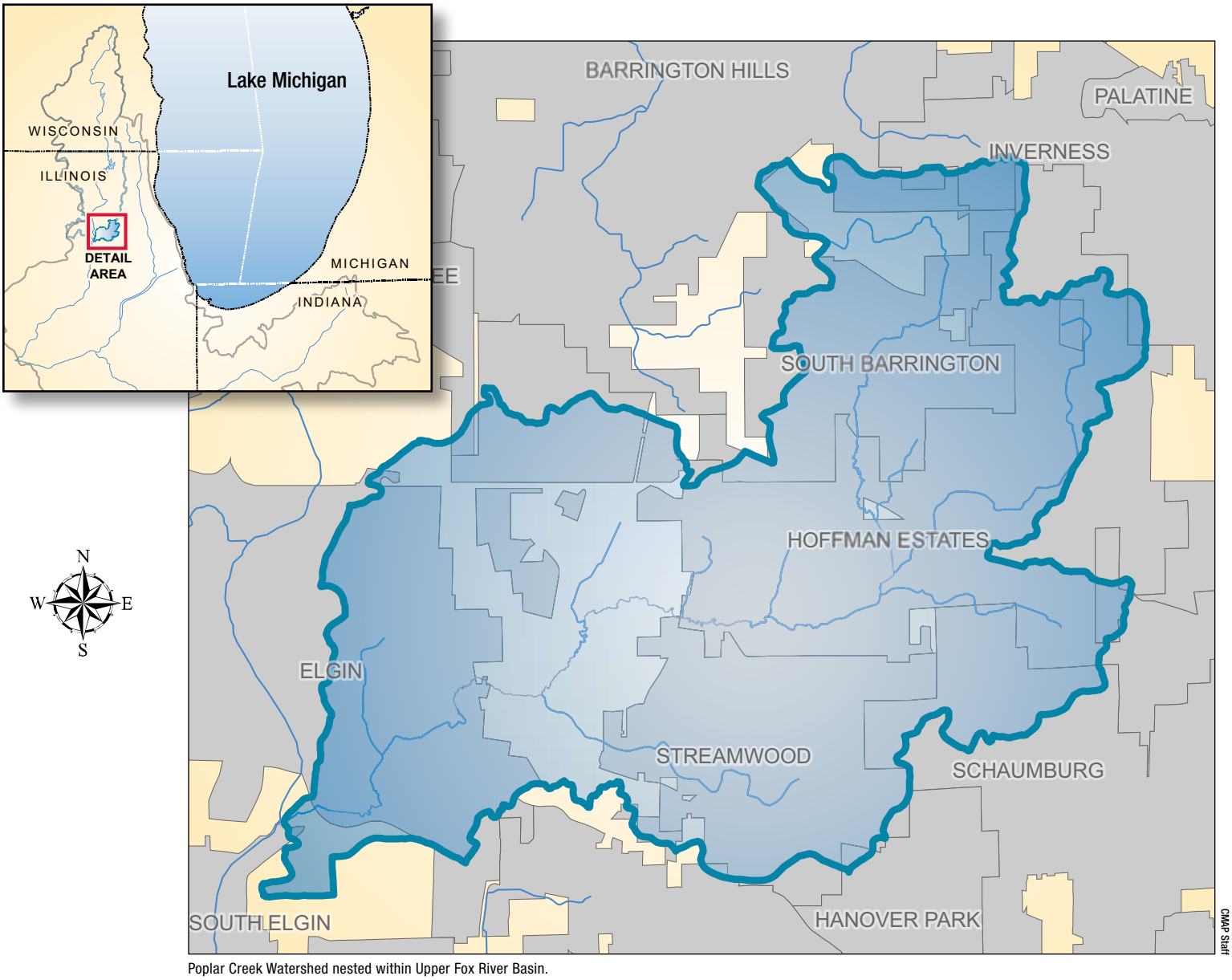
You will need to determine whether your project area is actually a sub-watershed of a larger watershed, and make sure that your planned activities complement those broader-scale efforts. Contact your local IEPA field office for more information about watershed planning in your area. For contact information, visit http://www.epa.state.il.us/about/locations.html.

At this stage of the planning process, a rough sketch of your watershed's boundaries is probably sufficient. Later, you will formally inventory the watershed and its characteristics. See Chapter 3 for more on watershed inventories and a more complete listing of information resources and contacts.

it's a fact...

Public drinking-water systems using groundwater serve approximately 4.1 million people in Illinois.

Illinois Integrated Water Quality Report and Section 303(d) List - 2006



Poplar Creek Watershed nested within Upper Fox River Basin.

Establish Goals

Chapter 2

Typical Steps:

- Identify Potential Watershed Goals
- Identify Impartial Facilitator
- Prioritize Key Goals

Goals to Guide the Process

Thus far, we have focused on the stakeholders for the watershed project and their organizational structure. In this chapter, you will begin work on the actual plan that will lead to the protection and restoration of your watershed. Before any detailed analysis of the watershed is conducted, it is important that the watershed stakeholders identify a preliminary set of goals. These preliminary goals are meant to provide the basic direction for the watershed analysis and planning that follows. It is important to note that, as more information becomes available over the course of the planning process, these initial goals may be modified or expanded.

Why bother establishing goals now, if they may change as more information is obtained during later planning steps? There are several benefits to setting goals early in the process. Most basically, there can be an overwhelming amount of information to process about a watershed. By setting goals before watershed analysis begins, the project can focus on data related to problems identified in the goals. This, of course, is not to say that information pointing to a problem unrelated to your goals should be ignored. Instead, these goals are an attempt to provide a framework or context for understanding all the watershed data that you will collect when you inventory your watershed (see Chapter 3).

Moreover, these goals do more than provide an analytical framework. Publicizing these goals—in a pamphlet, local newspaper, etc.—can help build public awareness of the watershed and its problems and attract community involvement.

Who sets the goals?

The goals should reflect stakeholder and local concerns and be representative of desired outcomes of the watershed planning process. Community input, therefore, is vitally important and necessary. Stakeholders are more likely to take ownership of a planning process and resultant plan—and thereby give it their support and effort—when watershed goals reflect their concerns and interests.

Similarly, stakeholder-driven goals prevent claims that governmental agencies or special interests are "forcing" their will on the watershed community.

When goals are set by stakeholders—who ideally represent all key community groups and interests within the watershed—then questions from the public (or the stakeholders themselves) like "why is the project doing this?" can be answered by simply referring to the "will of the community," as expressed by the stakeholders. That said, it is wise to develop watershed goals and plans with an eye towards village, regional, and state goals (e.g., water quality) and plans as none of these exist in isolation from the others.

What is a goal?

Everyone knows what a "goal" is, but in practice the term is used to refer to many different concepts. For our purposes, a goal reflects a desired outcome for the watershed. These outcomes can represent remedial action against current watershed problems, preemptive action against potential problems, improvement to current watershed infrastructure, etc. In general, goals can be divided into two broad categories: remediation and restoration goals, and protection and prevention goals. The former deal with existing watershed problems, while the latter focus on protecting current high quality areas or preventing changes within the watershed (e.g., land use change brought about by development) from degrading water and related natural resources.

In either case, goals reflect outcomes. For example, improved water quality, fishing, or recreational access are all appropriate outcome-based goals. Goal achievement is enabled by developing and meeting objectives.

Goal	Objective
Improve Recreational Opportunities	a. Control nutrient loadings that lead to algal blooms in lakes
	b. Organize beach cleanup days
	c. Increase open space and public access to lakes and waterways

Goals

Upper Des Plaines River, Cook and Lake Counties

The Upper Des Plaines River Ecosystem Partnership (UDPREP) formed in 1996 under the guidance of the Illinois Department of Natural Resources' Conservation 2000 Program, an award-winning initiative to preserve and restore Illinois ecosystems. The project, involving stakeholders from both the Wisconsin and Illinois portions of the watershed, was designed as a test case to demonstrate the feasibility of interstate and public/private partnerships in watershed planning. This has led to more focused and detailed planning in the Indian Creek Watershed as well as the Bull Creek/Bull's Brook Watershed.

Even in this project—unusual for its size, complexity and interstate nature—watershed stakeholders were still involved in the project's goal-setting agenda. On April 7, 2000, a group of thirty-five people representing diverse constituencies in the Upper Des Plaines watershed met to identify concerns regarding management and restoration of the watershed. The concerns of these stakeholders formed the basis of the project's goals.

Based on the success of the project, UDPREP participants continued to work together over the years to expand the partnership's mission and services and to secure 501(c)(3) nonprofit status for the organization in 2005.

The Partnership included non-profit organizations, businesses, local landowners, planning agencies and government representatives, such as:

- Applied Ecological Services
- Cook County Forest Preserve District
- Des Plaines River Alliance
- Des Plaines Watershed Team
- Eyring and Associates
- Home Builders Association of Lake County
- Integrated Lakes Management
- Kenosha-Racine Land Trust
- Lake County Soil and Water Conservation District
- Lake County Forest Preserve District
- Lake County Stormwater Management Commission
- Liberty Prairie Conservancy
- Liberty Prairie Foundation
- Loch Lomond Property Owners Association
- North Cook County Soil and Water Conservation District
- Northeastern Illinois Planning Commission
- Openlands Project
- Rivershire Property Owners Association
- Southeastern Wisconsin Regional Planning Commission
- U.S. Army Corps of Engineers
- U.S. Fish & Wildlife Service

Visit http://www.upperdesplainesriver.org for more information.

However you use the terminology, the main point is that—at this stage in the planning process—the focus should be on broad outcomes rather than detailed problems and potential solutions. Of course, some detailed discussion and talk of solutions may be inevitable. Focusing on goals/outcomes is preferable at this stage, since: (1) our main purpose in this step is to provide a framework for analyzing the watershed; and (2) it is likely too early (i.e., not enough information has been collected) for objective analysis of detailed watershed problems. Talk of solutions this early in the project may be little more than uninformed finger-pointing, a complication that every watershed planning process can do without.

Impartial Facilitators

In order to avoid the finger-pointing pitfall identified above, many watershed planning groups have found the services of an impartial facilitator useful. While there are trained, commercially available facilitators, any neutral individual (i.e., without a vested interest in a particular outcome) with the respect, or at least acceptance, of the watershed stakeholders can act in this role. Such an individual, as mentioned in Chapter 1, will maintain order and focus at the meeting; a particularly useful attribute following discussion of potentially sensitive issues or during times of conflict. In the case of goal-setting, a facilitator can help the group remain focused on goals, rather than finger-pointing. Facilitators may help stakeholders with conflicting perspectives find common ground. They can also help stakeholders get to the root of their concerns.

Designated Uses and Goals

As noted above, the goals of a watershed plan should be largely driven by stakeholders or, more broadly speaking, the watershed community of interests. Thus, while watershed planning often focuses on water quality, this stage of the planning process should also incorporate other watershed-related concerns and goals. For example, a goal focused on recreation may include establishing more open space and public trails in addition to objectives related to achieving the water quality necessary for safe swimming.

Even though this goal-setting planning stage is meant to allow for any watershed-related concerns to be expressed, it is important to recognize and incorporate IEPA designated uses for your watershed in these goals. Water pollution control programs are designed to protect the beneficial uses of the water resources of the state—these protected uses are commonly referred to as designated uses. In Illinois, the IEPA is responsible for developing water quality standards designed to protect the designated uses; IEPA then proposes these standards to the Illinois Pollution Control Board, which is ultimately responsible for setting the water quality standards necessary to ensure that waterbodies attain their designated uses.

CMAP Staff

Fishing at Maple Lake (DuPage County, Illinois).

Illinois waters are designated for various uses, including: aquatic life, wildlife, agricultural use, primary contact (e.g., swimming), secondary contact (e.g., boating), industrial use, drinking water and food-processing water supply.

The IEPA is required by statute to release a biennial report describing Illinois water quality in terms of the degree to which they attain their applicable designated uses. This document is prepared to satisfy reporting requirements in Section 305(b) of the federal Clean Water Act (CWA) and is available on-line from the IEPA at http://www.epa.state.il.us/water/water-quality/index.html.

Another relevant document prepared by IEPA is the Section 303(d) List. This document, updated every two years, fulfills the requirements of Section 303(d) of the CWA. The 303(d) list is also the means for informing the public about the Total Maximum Daily Load (TMDL) program and state process for implementation. This document is available on-line from the IEPA at http://www.epa.state.il.us/water/tmdl/303d-list.html. If your watershed contains a waterbody on the 303(d) listing, check to see if a TMDL has been developed by the IEPA. A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards (therefore attaining its designated uses) and allocates pollutant loadings among point and nonpoint pollutant sources. If your waterbody is impaired for any designated use, then your goals should, in most cases, reflect this problem in your plan. Moreover, if a TMDL has been designed and approved for your waterbody, your plan must incorporate the TMDL standards in order to be eligible for IEPA funding under CWA section 319.

Finally, states can now integrate these two reporting requirements into one biennial report. Illinois has created an integrated report is available from the IEPA at http://www.epa.state.il.us/water/water-quality/report-2006/2006-report.pdf.

Prioritizing Goals

Finally, all of the plan goals proposed by your watershed stakeholders should be discussed and prioritized. Prioritizing goals can further refine the focus of a plan by demonstrating which problems the group believes to be most significant.

Stakeholders should again play the lead role in prioritizing goals. A stakeholder (or steering committee) meeting can be held to determine priorities. By having stakeholders set priorities—usually through a real-time decision-making process, like dot voting—stakeholder ownership in the plan is further increased.

CMAP Staff

Dot voting exercises are often used to establish group priorities.

it's a fact...

For 2006, 15,424 stream miles, or 21.6% of the total 71,394 stream miles in Illinois have been assessed for at least one designated use.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

Your Watershed Goals

While the goals of your plan should be tailored to the conditions and resources of your particular watershed, there is no gain in reinventing the wheel. Watershed planning initiatives exist throughout Illinois and the rest of the country. These other planning efforts can be a valuable resource to your watershed planning process. The material produced by other planning groups, for instance, can be a good place to start when stakeholders begin to discuss the goals for your plan. Moreover, you can see how their efforts have progressed and attempt to learn from other's successes and mistakes. Remember, however, to tailor your watershed-plan goals after your particular watershed concerns and interests.

The following table presents some example goals from previous watershed plans in Illinois, as well as some key considerations for applying each to your watershed.

Example Goal…	Keep in mind…
… improve stream, lake and wetland habitat.	… type and conditions of habitat, along with sources of degradation, vary.
… identify and mitigate flooding problems.	… the level of development of your watershed's floodplain and previous flood prevention efforts.
… improve recreational opportunities.	… the stakeholders in your project may desire assorted recreational opportunities.
… preserve and enhance watershed greenways.	… ownership (private, public) of targeted open space.
… improve environmental education.	… target audience and harmful practices vary.
… improve management of upland portions of the watershed.	… level of development (and impervious cover) is key and variable.
… develop conservation ordinances and other watershed policy tools.	… the language of existing ordinances that may inhibit adoption of conservation design.

Taking Inventory of Watershed Resources and Conditions

Chapter 3

Typical Steps:

- Assemble any and all readily-available data, such as that available in the Illinois Integrated Water Quality Report and Section 303(d) List–2006 and any river basin assessment reports developed by IEPA
- Assemble relevant spatial data, generated in a geographic information system (GIS), for mapmaking as appropriate
- Visually evaluate key waterbodies and natural resources, documenting physical characteristics and problems

The Watershed Resource Inventory

Before a watershed-based plan and its recommendations can be developed, an inventory of the natural and human resources in the watershed must be completed. In general, the inventory should be directed at factors related to your goals and objectives. This is not to say, however, that information indicating a watershed resource problem should be ignored if it is unrelated to your initial goals. The inventory is essential for the steering and technical committees as they determine the sources and causes of impairments in the watershed. The inventory also guides their recommendations for watershed protection and restoration. It is imperative, then, that the Watershed Resource Inventory (WRI) is as complete as possible.

A comprehensive WRI will also be valuable as a "working" document for use in analyzing proposed future activities and what effect they may have on the watershed. By addressing future issues in a proactive manner, potential problems may be avoided.

Much of the information needed for a WRI already exists. Finding this information and incorporating it into a single document is essential. Moreover, inventories are sometimes done on an iterative basis. Depending on the quality of and breadth of readily available information, you may determine that more data collection is necessary. Some information not readily available may need to be obtained through methods such as mail surveys, aerial photographs, a physical survey of the watershed, watershed monitoring or other studies, and/or by conducting public meetings.

Components of a Watershed Resource Inventory

In some cases, certain information suggested in this chapter may not exist, or be relevant to your watershed. In such cases, a notation should be made within the text of the WRI stating that the resource information is either unavailable, or that the resource, activity, or situation does not exist in your watershed. This allows anyone reviewing the plan to be certain that the steering and technical committees did consider those issues.

The information listed in this chapter is provided to help the steering and technical committees gather as much information about the watershed as possible—but it is not necessarily a comprehensive list. For each inventory component listed, agencies and organizations likely to be useful are noted. At the end of the chapter, there is a table of online resources that should help to get you started.

Waterbodies

In a narrative format, provide as much information as possible about the following items. Use tables, graphs and maps to illustrate significant information and to summarize important facts.

IDNR

The Great Blue Heron, *Ardea herodias*, is protected by the U.S. Migratory Bird Act.

Issues or topics to consider:

lake(s) (name(s), location, surface area, volume); trophic status; pond(s) (number, acres, life expectancy); river(s) (miles, conditions, level fluctuation, uses, levees); stream(s) (miles, type—i.e., perennial, intermittent, modified); and trends

Source(s) for obtaining above information:

maps; IEPA, Illinois Integrated Water Quality Report and Section 303(d) List–2006; and County Soil and Water Conservation District (SWCD)

Getting Started: The IEPA Illinois Integrated Water Quality Report and Section 303(d) List

As you probably noticed reading through the first few sections of this chapter, the Illinois Water Quality Report–also known as the 305(b) report, for the section of the Clean Water Act that mandates its publication–is a very useful resource. The same is true for the Illinois Integrated Water Quality Report and Section 303(d) List that combines the two formerly separate 305(b) and 303(d) reports beginning in 2006. As we saw in Chapter Two, the 305(b) report includes detailed discussion of the designated uses and levels of attainment and use impairment (if applicable) for Illinois waterbodies. Moreover, this report also contains IEPA estimates for the potential causes and sources of use impairment. In addition to the above information, the document also includes discussion of the IEPA-approved methodologies for determining the level of use support for each of the designated uses.

As you may have surmised, the Integrated Water Quality Report is a lengthy document. However, it is important that your steering and technical committees familiarize themselves with the report. The document consists of two general parts. The main body of the report describes the assessment process and criteria for both surface and groundwater in detail. The appendices present IEPA assessments for specific waterbodies and are arranged by watershed; it is thus in the appendices that you will find information about use support and impairments specific to your watershed as well as others throughout the state. The 305(b) report is available online from the IEPA at http://www.epa.state.il.us/water/water-quality/index.html and it can also be obtained from the IEPA Bureau of Water, Surface Water Section.

Designated Use(s)

Assessment of waterbodies by the IEPA falls under a set of five designated use categories: public water supply, primary contact (swimming), secondary contact (recreation), aquatic life, and fish consumption. A waterbody should be capable of fully supporting the designated use(s) for which it has been assigned. The ability of a waterbody to attain a designated use is influenced by the land-use activities within the watershed. Watershed planning and implementation must take designated uses into account and develop strategies to meet the water quality standards associated with designated use attainment.

Identify the designated use(s) of the waterbody(ies):
aquatic life; primary contact; secondary contact; public water supply; fish consumption; indigenous aquatic life; and overall use (inland lakes only)

Source(s) for obtaining above information:
IEPA, Illinois Integrated Water Quality Report and Section 303(d) List–2006

Designated Use Support and Impaired Waterbodies

For the designated uses applicable to each waterbody, IEPA's assessment concludes one of two possible use-support levels: Fully Supporting (good) and Not Supporting (fair or poor). A waterbody must achieve a "Fully Supporting" use-attainment score in order to attain its designated use. Waters in which at least one applicable use is not fully supported are identified as "impaired." With this information, determinations can be made as to whether the planning efforts and implementation strategies should be directed toward protection and preventive measures or restoration of the impaired water resource.

For waterbodies that are deemed impaired by an IEPA assessment, they will be accounted for on the Section 303(d) List and targeted for total maximum daily load (TMDL) development. Among other information, the Section 303(d) List provides both the potential causes of impairment and potential sources of impairment. A potential cause can be thought of as an obstacle, typically a pollutant, to designated use attainment. A potential source, much as the term suggests, refers to the activity or condition that is responsible for creating or generating the cause.

For example, agricultural land use (e.g., row-cropping, livestock operations and manure management) can be the source of causes of impairment that include sedimentation, high nutrient levels (e.g., nitrate-nitrogen, total phosphorus, etc.), or low dissolved oxygen. Urban stormwater runoff as a source of impairment can create causes of impairment that include high chloride levels, high total dissolved solids (TDS), and oil and grease to name but a few. An understanding of causes and sources of impairment will help lead watershed planning partners to a suite of strategies designed to address the water quality problems at issue.

Source(s) for obtaining above information:
IEPA, Illinois Integrated Water Quality Report and Section 303(d) List–2006

Groundwater/Surface water

Your watershed plan needs to address both ground and surface water issues. Even if surface-water quality is the central issue of the plan, it is important to gain as much knowledge as possible about the groundwater resource(s). Understanding the interaction between ground and surface water will be beneficial in making decisions for the applicability of certain practices during the implementation stages of the project. Protection of public water supply wells and their recharge areas should be a component of all watershed plans where appropriate.

Issues or topics to consider:
confined aquifer; unconfined aquifer; capture zone; re-charge area; Wellhead Protection Area; Priority Groundwater Protection Panning Region; water wells (abandoned, active, condition); susceptibility to nitrogen leaching; and susceptibility to pesticide leaching

Source(s) for obtaining above information:
IEPA; Illinois State Water Survey (ISWS), Groundwater Section; and Illinois State Geological Survey (ISGS)

Irrigation
Management practices involved in irrigation may have an effect on water quality for both ground and surface water. It is important to know if nutrients and chemicals are applied through the irrigation system and what affect that may have on the aquifer, and nearby streams. Irrigation return flow, water that enters a stream or other waterbody via overland flow after application to a target crop, is often of concern due to the nutrients and pesticides that are often applied to the crops that are grown with irrigation water. Issues regarding irrigation-water withdrawals from either surface or groundwater sources may also need to be addressed in the planning and implementation process.

Issues or topics to consider:
location of irrigation; acres served; source of irrigation water; number of wells (groundwater/surface water); backflow prevention; and pumpage (gallons per minute)

Source(s) for obtaining above information:
ISWS; and field reconnaissance

Drainage
Drainage ditches and drainage tile are potential sources for various pollutants. The influence that various drainage systems have on a watershed should be evaluated and factored into the planning and implementation effort.

Issues or topics to consider:
effects of surface drainage; effects of subsurface drainage; and extent of drainage tile

Source(s) for obtaining above information:
local drainage district; County Soil and Water Conservation District; field reconnaissance; and USDA NRCS

Floodplain Boundaries
Flooding can create many problems when a natural floodplain has been appropriated from the river for other uses. Not only can flooding damage urban property and existing crops in rural areas, delay planting and threaten life, it may also be a contributor to water quality degradation. When addressing flooding issues, consideration should be given during design of BMPs so that they address not only flooding, but water quality issues as well. All flood control facility designs should be reviewed for their potential to achieve multiple (e.g., flood and water quality) objectives.

Issues or topics to consider:
flooding (frequency, history); flood structures; flood plain boundaries; 100 year flood zone; and flood damage estimates

Source(s) for obtaining above information:
SWCD land use opinion reports; Army Corps of Engineers, Federal Emergency Management Agency (FEMA)

Indian Creek
Lake County
In the Indian Creek Watershed, the project's technical staff surveyed the watershed for all point-source discharges. During visual inventories of the watershed, surveyors found 485 discharge points (defined here as open channels and outfall pipes greater than 4 inches in diameter that drain into a stream channel). Only one point source, a municipal wastewater-treatment plant, was permitted under the National Pollution Discharge Elimination System and would therefore have been identified from a desktop inventory. However, an additional 58 of the 485 discharge points were considered problematic. The visual inventory found erosion at pipe outfalls on open channels, polluted and/or suspicious discharges, and failing outfall structures.

Visit http://www.indiancreekwp.org for more information.

Fish Lake Drain
Lake County
The Fish Lake Drain Watershed Planning Committee (FLDWPC) and the Lake County Stormwater Management Commission (LCSMC) hired a consultant to inventory their watershed. While not required, this action gave the FLDWPC and LCSMC access to technical expertise that may not have been otherwise available. Depending upon the financial and technical resources of your project, your steering committee may decide to do the same.

For Fish Lake Drain, the consultant performed the legwork of the inventory and assembled the results into a unified document. Included in this document were several maps developed using a GIS. Such maps are useful tools for representing information about your watershed collected during the inventory, especially as a tool for public education.

Visit http://www.co.lake.il.us/smc/planning/fishlake/ for more information.

Municipal/Industrial Point Sources

A comprehensive watershed plan should address point-source issues as well as nonpoint sources. Identify the point-source discharges in the watershed. Other point-source issues may exist such as wildcat sewers and malfunctioning home-septic systems.

Issues or topics to consider:

NPDES permitted sites; stormwater outfalls; and illicit discharges

Source(s) for obtaining above information:

USEPA; IEPA; County Health Department; and field reconnaissance

Riparian Corridors

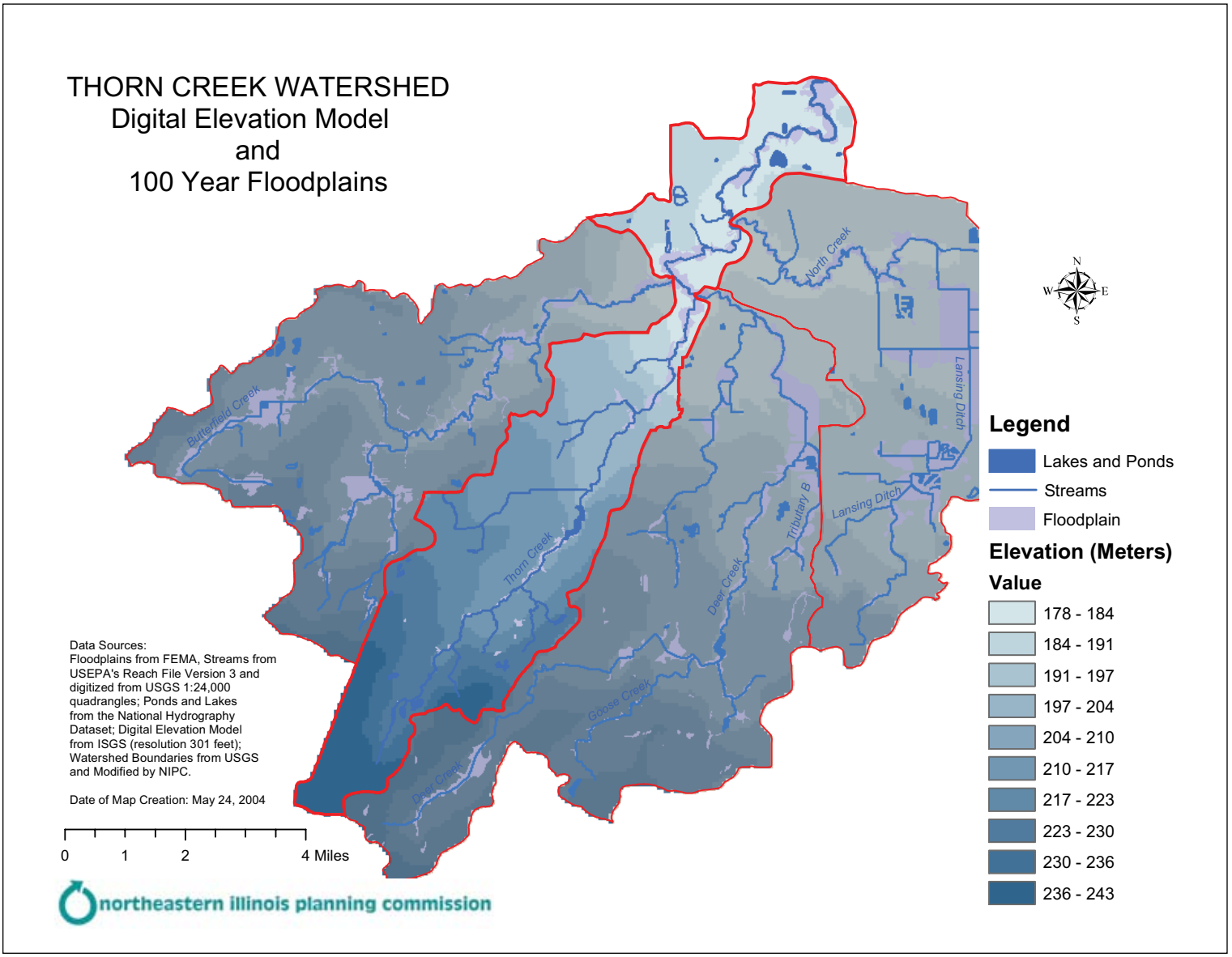
The physical characteristics of the riparian corridor have a direct influence on stream biology and habitat. Survey and generate a database for the following information.

Issues or topics to consider:

streambank erosion; existing vegetation (kind, quality, width); and presence of streamside BMPs (e.g., Filter Strips)

Source(s) for obtaining above information:

aerial photographs; and field reconnaissance



Hydrologic Modifications

Identify all areas in the stream system where hydrologic modifications (aka, hydromodification) have occurred. This may include the entire waterway if the watershed is highly urbanized. Localized modifications include online detention basins or impounded lakes. This information can be obtained at the same time the stream system is being assessed for streambank erosion problems. Hydromodification not only increases streambed down-cutting (channel incision) and streambank erosion, but is detrimental to the biological characteristics of the stream system too.

Issues or topics to consider:

location; length; width; down cutting; and effects

Source(s) for obtaining above information:

streamside landowners; aerial photographs; field reconnaissance; local drainage district(s); and Army Corps of Engineers

Stormwater Management

Urban-stormwater runoff, the result of precipitation falling on impervious surfaces (e.g., parking lots, rooftops, streets), typically carries dirt particles, grease, oil, metals and many other pollutants from paved surfaces. Uninformed individuals have been known to pour or wash solvents, paints, and chemicals down storm drains that very often lead directly to a stream. Dealing with these issues and understanding the effects that stormwater discharges have on water quality and the aquatic resources of a watershed are important elements for a watershed plan to address; particularly for any watershed with an urban influence. Identify known problems and existing controls or regulation to treat stormwater runoff and prevent illicit dumping.

Issues or topics to consider:

discharge location; combined sewer systems and overflows; stormwater ordinance; and stormwater control practices existent (do they address water quality, or just runoff/flood control)

Source(s) for obtaining above information:

local government; and IEPA

Wetland(s)

Wetlands are now understood to be valuable resources that provide many benefits to society when they are fully functional and able to yield ecosystem services. Wetland functions, such as floodwater storage, are valued by society for providing the service of flood damage reduction. Floodwater storage allows wetlands to remove or transform a variety of pollutants. Thus, wetlands provide another highly valued service: water purification. Wetlands provide habitat to numerous aquatic and terrestrial species. Society benefits again for the wildlife and recreational services that are provided by wetlands. These services, known as ecosystem or nature's services are free, but worth a great deal when one considers the cost of replacing them with artificial (i.e., man-made) means.

The degree to which wetlands are present and protected, at risk of loss, or available for restoration, should all be accounted for in the watershed plan. Wetlands, as functional elements of the landscape, will be valuable allies in any watershed plan that aims to protect or restore water quality, protect against flood damage, or provide aquatic and terrestrial habitat.

Issues or topics to consider:

type; condition; and acres

Source(s) for obtaining above information:

USDA NRCS, IDNR, Army Corps of Engineers

Butterfield Creek

Cook and Will Counties

In 1992, the Northeastern Illinois Planning Commission (NIPC) assessed the aquatic life use of Butterfield Creek—and was able to do so entirely on pre-existing available data. NIPC used the Biological Stream Characterization (BSC) classification system to assess the level of stream support for aquatic life. The BSC is a five-tiered system designed to evaluate the quality of streams and rivers based on the values of ecological indices for aquatic organisms.

The BSC places priority consideration on the type and condition of the existing fishery resource, which can be quantified with a multi-metric index, the index of biotic integrity (IBI). The IBI compares fish communities in a waterbody with those in undisturbed areas—a higher IBI implies a higher quality water resource.
For Butterfield Creek, NIPC used an available Illinois Natural History Survey IBI and two similar Metropolitan Water Reclamation District of Greater Chicago (MWRD) IBIs to determine that Butterfield Creek, at that time, was a "limited" aquatic resource.

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Parking lot runoff. Inset: oil and grease, a component of runoff.

Getting Started: Mapping Resources

As previously mentioned, the first stage in any WRI occurs at the desktop. Several mapping resources are now available online and can be very helpful. The Resource Management Mapping Service (RMMS)–an Illinois Department of Natural Resources project–allows the public to map geological, topographical, environmental and economic information. It is currently available at http://agec31.agecon.uiuc.edu/website/rmms. Another useful site is the USGS-IEPA water quality mapping tool, available at http://il.water.usgs.gov/proj/wqinfo/index.html. This mapping tool focuses specifically on water resources and designated use assessments.

Biological Indicators

Aquatic biota, fish, macroinvertebrates and other organisms that live in water are key indicators of water quality. Some species of fish and macro-invertebrates are more pollutant tolerant than others. Conducting a fish or macro-invertebrate survey, or obtaining existing information from previous surveys, can provide the steering and technical committees with very useful information about one component of a stream's overall ecological health.

Issues or topics to consider:

species; fish size; fish kills; habitat; population; stocking; biotic indicators (Fish IBI and MBI); and Biological Stream Characterization (BSC)

Source(s) for obtaining above information:

USEPA; IEPA; and IDNR regional watershed assessments

Chemical Parameters

The ecological health of a waterbody can be partially evaluated via a variety of water chemistry parameters that characterize overall water quality. Illinois standards are set by the Illinois Pollution Control Board. Illinois standards evolve over time. The most recent standards can be found in the Illinois Integrated Water Quality Report and Section 303(d) List prepared by the Illinois EPA, Bureau of Water.

Source(s) for obtaining above information:

IEPA

Priority Waterbody

Watersheds, much like the people and resources they frame, are dynamic units of our living space. Various organizations including those that are grant giving, have established priority areas based on a particular program's requirements. Look at all the resources, and understand their interrelationships. Understanding and then listing program priorities regarding selected watershed plan components will assist the steering committee in identifying and seeking technical assistance and possibly obtaining financial support for plan implementation.

Source(s) for obtaining above information:

IEPA; USDA NRCS; IDNR; and Illinois Department of Agriculture

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Signage raises awareness and is useful for outreach and education (Wolf Road Prairie in Westchester, Illinois).

Soil Classification

Identifying soils, geology, and land use activities within a watershed and their relationship to the quality of the water resource is essential in the planning and implementation of a watershed protection and/or restoration effort. Understanding soil characteristics and the underlying geologic formations is necessary for making determinations between ground and surface water issues and the development of implementation strategies. The identification of current and forecasted land use activities within the watershed is vital in the development of an implementation strategy.

Soils information is used to determine soil loss and sedimentation rates, and is valuable in making determinations that involve ground or surface water issues based on a soil's leachability and other factors. Selection of best management practices may be influenced by the soils in the watershed; in addition, soils information may be utilized when prioritizing areas within the watershed where implementation of BMPs will occur.

Provide a narrative of the soil types and soil associations in the watershed. The narrative should include information on soil composition (i.e., sand, silt, clay, clay loam, silty clay loam), slope (i.e., gently sloping, steep), water table, permeability, land use capability classification, erodibility index, and hydric soils. Use table(s) and when possible maps developed in a geographic information system (GIS) to show such things as acres/percentage of Highly Erodible Land (HEL), prime farmland, and land use capability.

Issues or topics to consider:

soil types (names and soil associations); land use capability classes; Highly Erodible Land (HEL); prime farmland; hydric soils; and Erodibility Indexes (EI)

Source(s) for obtaining above information:

USDA NRCS soil surveys; SWCD; and University of Illinois Cooperative Extension Service (UICES)

Soil Erosion

Identification and assessment of the types of erosion occurring and the sources and causes within the watershed are essential information to obtain. Available information (i.e., soils, climate, land use, etc.) that is gathered for this inventory will be needed to make this assessment. In many cases it may be necessary to physically walk or drive the watershed to gather accurate information, especially for gully and streambank erosion. Provide a narrative and utilize tables discussing erosion conditions in the watershed. Discuss agricultural and urban issues separately. List erosion rates by soil type, and provide information on sedimentation rates to waterbodies if possible. Provide a figure for total soil erosion and estimated sedimentation in the watershed. Rates of soil loss are not typically the same as rates of sedimentation.

When discussing soil loss, planners often refer to it in relation to "T", or "Tolerable" soil loss levels. "T" is a defined annual rate of soil loss that does not exceed the rate of natural soil formation. One long-term effect of soil loss that exceeds the "T" rate is reduced soil productivity. Soil loss equal to or less than "T", however, may still be eroding at a level which is detrimental to water quality. To address water quality, the total amount of soil loss needs to be taken into consideration regardless of "T".

Issues or topics to consider:

agricultural: sheet and rill; ephemeral; gully; streambank; sedimentation rates
construction: sheet and rill; ephemeral; gully; streambank; sedimentation rates

Source(s) for obtaining above information:

USDA NRCS, County Soil and Water Conservation District

Poplar Creek

Cook and Kane Counties

The Poplar Creek Watershed Coalition inventoried the soil types present within its watershed by *k-factor*, a soil erodibility factor that represents both susceptibility of soil to erosion and the rate of runoff. (The k-factor is one of several right-hand-side variables in the **Revised Universal Soil Loss Equation**.) By determining the soil types present in the watershed, along with each type's k-factor, the project's technical staff was able to determine not only which parts of the watershed were most susceptible to erosion but also candidate areas for different types of BMPs. For example, infiltration BMPs—such as infiltration basins and trenches—are most suited for permeable soils (i.e., soils with low run-off rates).

it's a fact...

One person consumes on average about 150 gallons of water each day from public water supplies.

CMAP pamphlet: State and Regional Water-Supply Planning in Illinois, 2006

Geology

Knowledge of the geological history of a watershed provides useful information for developing a comprehensive understanding of the dynamics of the watershed. Formation and age of the stream system, underlying materials, depth to the aquifer, and type of aquifer (confined, unconfined) are all determined by the geological characteristics. Geological information in conjunction with soils information can be used for determining sources and causes, potential problems, and BMP selection.

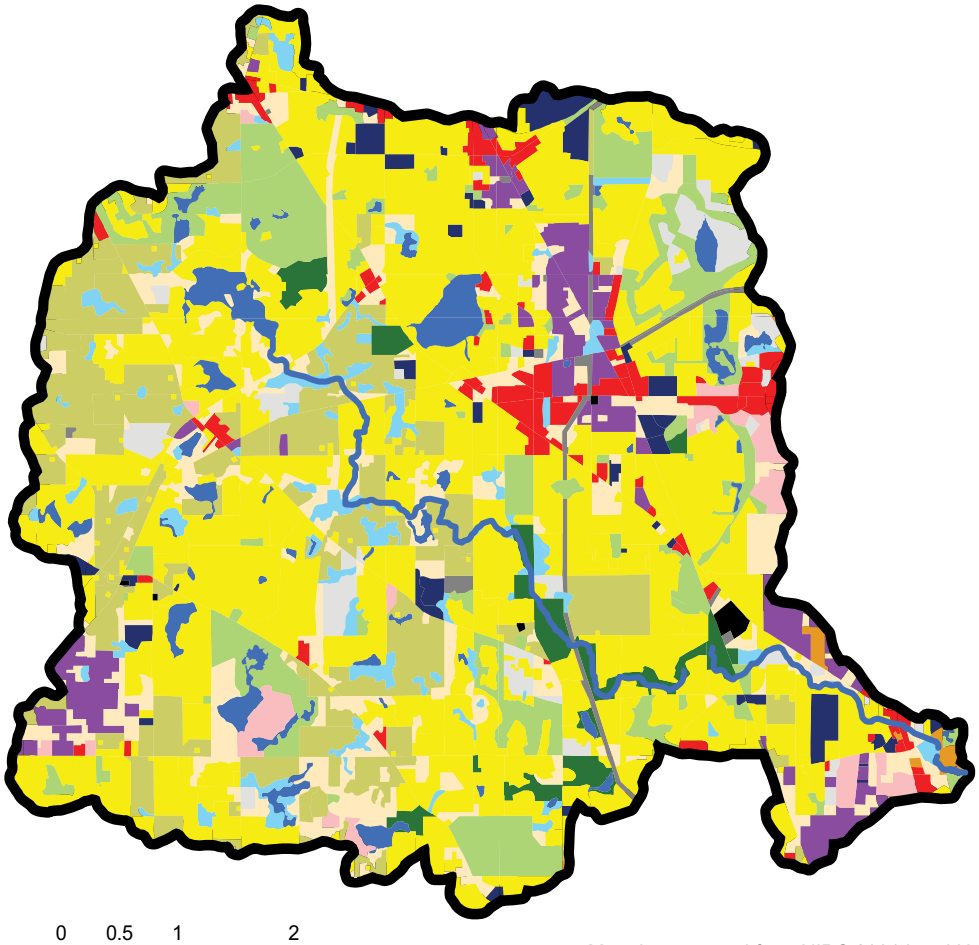
Describe the glacial history and structural characteristics of the region/watershed:

glacial influence; sand deposits; gravel deposits; limestone formations; and Karst Topography

Source(s) for obtaining above information:

ISGS

Indian Creek Watershed Land Use



Map data sourced from NIPC 2001 Land Use Inventory.

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Topography

Topography, a geographic term, is a description of the physical features of a place or region. Topographic maps, for example, illustrate such land features as elevation, slope, orientation and more. The topography of a watershed will directly influence drainage system characteristics, water movement, and thus, water quality. Provide a narrative describing the following characteristics. Use tables and charts where applicable to highlight key facts and information. Always give reference to documents used as sources of information.

Issues or topics to consider:

relief; elevation; watershed size and shape; drainage pattern; and drainage density

Source(s) for obtaining above information:

USGS topographic maps; and aerial photos

Land Use/Cover

Activities in a watershed influence water quality, quantity, wildlife, and human health. The problems affecting a watershed are directly related to the natural and human activities that alter the natural ecosystem. These activities are inherent to our way of life. To determine the problems a watershed is experiencing, and to determine the sources and causes of impairments, a complete inventory of the land uses must be conducted. Because land use activities and land use change will continue, a comprehensive watershed plan that properly addresses these issues is essential. If land coverage data is out of date, or if the watershed is rapidly developing, then aerial photographs can be used to update and augment earlier land use maps.

Issues or topics to consider:

cropland (acres); livestock operations (size, location, waste management system, species, NPDES Permitted CAFO); woodland resources (species, condition, value, logging, human use); roads (types, miles, acres); municipalities (with populations past, present, projected); zoning; industry (number, type, size, NPDES permit number, density); commercial (business types, density, potential for growth); development (current, potential, growth projections, local attitudes); Conservation Reserve Program (CRP) (acres enrolled); natural areas (forest or prairies); public lands (city parks, county conservation areas, state parks, national forests, national wildlife refuges); and impervious cover(%)

Source(s) for obtaining above information:

aerial photos, IDNR, field reconnaissance, IEPA, municipal/county land development departments

Pollutant Loadings

A pollutant load refers to the amount of a pollutant contributed to a waterbody by its watershed, expressed in terms of pollutant concentration X flow (volume/time). One common way to estimate (potential) loads focuses on the runoff from various land uses or land covers. Different land uses have specific pollutant loading characteristics due to differences in imperviousness and the types of activities associated with those land uses. Watershed imperviousness is an important indicator of watershed and water quality impairment. High quality resources are generally supportable in watersheds with up to approximately 10 percent impervious area. As imperviousness increases beyond 10 percent, watershed quality decreases significantly.

Pollutant loadings can be estimated for your watershed with land use data collected during your WRI in conjunction with pollutant loading spreadsheets available from the IEPA's Nonpoint Source Unit. As we will see in later chapters, identifying pollutant loadings can help planners focus their efforts on critical areas within the watershed, thereby allowing planners to target

Thorn Creek

Will and Cook Counties

For Thorn Creek's Watershed Resource Inventory, the technical staff compiled data on the land cover present in the watershed. These data, along with regional planning commission population and development forecasts, can help a project focus on land uses and land use trends that could contribute to water quality impairments. It can also help planners focus on resources present in the watershed, like a large quantity of wetlands or natural communities.

Thorn Creek Watershed Land Cover*

Land Cover	% of subbasin
Agricultural Land	29.9
Forest and Woodland	17.1
Urban and Built-Up	47.1
Wetland	3.6
Other Land	2.3
Lake & Streams	1.5

* rounding may yield percentage total >100

The project also assessed whether particular subwatersheds may be more responsible for specific pollutants than others, potentially leading to recommend different suites of best management practices for each subwatershed. The analysis directed planners to two relatively small but urbanized areas that appeared to contribute more pollutants than their area would suggest.

For more information visit:
http://www.nipc.org/environment/thorncreek/

Getting Started: Visual Inventories and Field Reconnaissance

In the above listing, you probably noticed that several components of a WRI may require that members of your watershed project get out and visually catalogue certain characteristics of your watershed. Visually evaluating key waterbodies and natural resources—especially the stream corridor—can uncover a wealth of information.

A visual inventory provides many benefits. It can provide a clearer understanding of what is currently occurring in the watershed and it familiarizes local stakeholders, decision makers, citizens, and agency personnel with their local watershed resources. It also presents a great opportunity to introduce the watershed project to riparian landowners who own key parcels along the stream network.

In most watersheds, the primary focus of the visual inventory is the stream corridor. When investigating the corridor, most watershed groups have used an inventory sheet that includes information such as the following:

- Land use (for example, is the land being used for agricultural row crops or is it an urban area developed adjacent to the stream bank?)
- The condition of stream bank vegetation
- The slope of the bank
- The stability of the stream bank (e.g., signs of gully erosion, bank sloughing)
- In-stream water quality indicators such as nuisance algal growth
- The condition of road-stream crossings
- Storm water or other pipes (e.g., drainage tile) discharging into the stream

The Center for Watershed Protection (CWP) has developed detailed guidance for field reconnaissance and assessment in the upland areas of a watershed. This manual—*Unified Subwatershed and Site Reconnaissance: A User's Manual*—is the eleventh in an on-going series by the CWP.

Visit http://www.cwp.org for more information.

their recommendations at those portions of the watershed most in need of attention. Loadings can also act as baseline data on the conditions of your watershed; this baseline can be used to evaluate the success of your plan after it has been implemented.

Source for obtaining the above information:
USEPA at http://www.epa.gov/waterscience/models

Existing Best Management Practices

There may already be areas within your watershed where BMPs have been implemented. These efforts—and their effectiveness—should be catalogued as part of the inventory. They can be identified by field reconnaissance and/or aerial photographs.

Issues or topics to consider:
Existing Best Management Practices - Cultural and mechanical (grade stabilization structures, contour farming, conservation tillage, terraces, filter strips, grass waterways, stormwater runoff control, detention/retention basins, sedimentation basins, nutrient management, pest management, livestock waste management, etc.)

Source(s) for obtaining above information:
aerial photos; field reconnaissance; municipal/county land development departments; USDA NRCS; SWCD; Municipal department of Public Works; RMMS

Air Quality

Air quality should not be overlooked in your planning efforts. Addressing air quality is three-fold; 1) identify activities which pollute the air, or have the potential to pollute the air and address them in the strategies developed for implementation, 2) identify the sources of, or the potential for, pollutants from atmospheric deposition contributing to the degradation of water and/or land resources, and 3) understanding of the potential health affects caused by air borne pollutants on humans and wildlife.

Not only does the planning committee need to know what the sources and causes of air pollution are, but they need to identify potential sources, and be aware of what effect future activities (i.e., industry, transportation, mega-livestock facilities) may have on the watershed.

Issues or topics to consider:
atmospheric deposition; wind direction (predominant); wind speed; (daily average); pollution sources and types; and climate (rainfall, temperature)

Source(s) for obtaining above information:
IEPA Bureau of Air, Illinois State Climatologist's Office, ISWS

IDNR

Southern Redbelly Dace Fish, *Phoxinus erythrogaster*

it's a fact...

Wetlands provide valuable habitat for 40% of the state's threatened and endangered species as well as benefits such as flood storage, water quality improvement and groundwater recharge.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

Wildlife

Wildlife are property of the State of Illinois no matter where a species might make its home. Wildlife present in the watershed should be taken into consideration in the planning process. An inventory should be conducted as part of this comprehensive WRI. Strategies which reduce point and/or nonpoint pollution should be developed that will protect and/or enhance wildlife habitat/population. Some restoration activities could be detrimental to wildlife and should be avoided if possible. When detrimental activities cannot be avoided, the planning and technical committee should consider remediation efforts to replace the habitat that has been destroyed. Endangered and threatened species should be identified and factored into the design of the implementation strategies. Any activity which may cause a detriment to endangered or threatened species should be avoided.

Many things can be done to restore water quality while protecting, or enhancing wildlife habitat.

Issues or topics to consider:

endangered/threatened species (macro-invertebrates, fish, animals, birds); and wildlife (game species, non-game species, populations)

Source(s) for obtaining above information:

IDNR at http://dnr.state.il.us/espb/

Available Resources:

Data Category	Components	Source
Hydrology and Hydraulics	Streams	USGS, http://waterdata.usgs.gov/nwis
	Lakes	USGS, http://water.usgs.gov/data.html
	Flooding	USGS, http://il.water.usgs.gov
		FEMA Floodplain Mapping Tool, http://www.eris.com/hazards/makeup.html
	Stormwater Management	NPDES Permits, http://www.epa.gov/enviro/html/pcs/pcs_query_java.html
	Drainage	SWCD, contact info, http://www.agr.state.il.us/news/directories/swcd.html; Local Drainage District
	Hydraulic Structures	National Inventory of Dams, http://crunch.tec.army.mil/nid/webpages/NIDsearch.html
	Hydrologic Modifications	Illinois State Water Survey, http://www.sws.uiuc.edu/data.asp; Streamflow Model
Water Quality	Raw Data	USGS, http://waterdata.usgs.gov/nwis; IEPA
	Impairments	IEPA, 305(b) Water Quality Report, http://www.epa.state.il.us/water/water-quality/index.html
	Groundwater	Illinois State Water Survey, Groundwater Section, http://www.sws.uiuc.edu/sws; IEPA
	Mapping	USGS/IEPA Water Quality Mapping tool, http://il.water.usgs.gov/proj/wqinfo/index.html
Biological	Fish and Biotic Indicators	Illinois DNR, CTAP, http://dnr.state.il.us/orep/ctap/index.htm
		USEPA, STORET, http://epa.gov/storet; IEPA
Physical Traits	Geology	IDNR, CTAP, http://dnr.state.il.us/orep/ctap/index.htm
	Soils	NRCS, STATSGO database, http://www.il.nrcs.usda.gov/technical/soils/statsgo_inf.html
	Topography	USDA, IDA, & IDNR, statewide landcover, http://www.agr.state.il.us/gis/landcover99-00.html
	Aquifer	ISGS & IDNR, Geospatial Data Clearinghouse, http://www.isgs.uiuc.edu/isgishome/groundw.html
	Natural Resource	Illinois State Climatologist's Office, http://www.sws.uiuc.edu/atmos/statecli
	Natural Communities	Illinois Natural Heritage Database, endangered/threatened species listing, info available at http://dnr.state.il.us/conservation/naturalheritage/inhd.htm
	Wetlands	
	Wildlife	EPA, STORET, http://epa.gov/storet
	Habitat	http://dnr.state.il.us/orep/c2000/guide/habitats/
	Riparian Conditions	http://www.epa.gov/nps/MMGI/Chapter6/ch6-2b.html
	Climate	NOAA, http://www.ncdc.noaa.gov/oa/climate/climatedata.html

Data Category	Components	Source
Human Impacts	Socio-Economic	http://www.census.gov/census2000/states/il.html
	Current Watershed Activities	USGS, http://nationalatlas.gov/atlasftp.html
	Land Use and Development	Aerial Photos, http://www.isgs.uiuc.edu/nsdihome/ISGSindex.html
		INHS, IL-GAP, landuse data (public lands), http://www.inhs.uiuc.edu/cwe/gap
		NASS, National Ag Stats, http://www.nass.usda.gov/research/Cropland/SARS1a.htm
		IDNR, CTAP, http://dnr.state.il.us/orep/ctap/index.htm
	Municipal/Industrial PS	NPDES Permits, http://www.epa.gov/enviro/html/pcs/pcs_query_java.html
	Population Forecasts	SEIRPC, http://www.sirpdc.org/
		TCRPC, http://www.tricountyrpc.org/
		SFRPC, http://www.southernfive.org/
		NIPC, http://nipc.org/2030_forecast_endorsed_093003.htm
	Agricultural Practices	Irrigation: ISWS Reports; Drainage: Drainage District; SWCD
	Stormwater Management	IEPA
	Air Quality	IEPA, Illinois State Climatologists Office
General Resources	Catch-All Websites	Illinois Watershed Management Clearinghouse, http://www.watershed.uiuc.edu
		University of Illinois Extension, http://www.extension.uiuc.edu
		American Heritage Rivers, EPA list of available sources, http://www.epa.gov/rivers/
	Watershed Education	UCONN NEMO, http://nemo.uconn.edu/index.htm
		Illinois Green Door, Illinois specific education materials, http://www.isbe.net/ilgreendoor/
		Social Dimensions of Planning, University of Illinois, http://www.watershedplanning.uiuc.edu

Socio-Economic/Human Resources

The socioeconomic and demographic makeup of a watershed may influence participation in the planning process and ability to implement plan recommendations. For this reason, an inventory of human resources should be conducted and considered as part of the overall evaluation process. This information can then be used as appropriate when evaluating watershed concerns and potential problems that will be identified in the planning process.

Issues or topics to consider:

average annual income; economy (major employers—i.e., business, industry, agriculture); jobs; infrastructure; outreach programs; agriculture organizations; conservation organizations; conservancy districts; drainage districts; federal agencies; state agencies; local government; environmental organizations; and media/education outlets

Land user problems; attitudes toward watershed/waterbody/current projects; number of farm operating units; Number of owner/operator vs. owner/tenants; major off-farm employment; Real estate average values/average taxes; land user average age; loss/retention on people in area; family farm/corporate farm trends; recreational, educational opportunities in area; community support; and volunteers (groups, organizations)

Source(s) for obtaining above information:

US Census Bureau data, regional planning commission, local government, public surveys

Other Resources

Other inventory components may be included that were not presented here. This list of resources is not inclusive and the steering and technical committees may be able to identify additional components which should be included in their watershed inventory. At the end of the chapter, a table of resources is available to help get you started.

What's Next?

Once a comprehensive WRI has been completed for the watershed, the steering committee, with assistance from the technical committee, can begin the process of evaluation. The WRI will allow the planning committee to see the inter-relationships between watershed problems, thereby allowing for the development of multi-purpose implementation strategies and the design of BMPs which address multiple objectives.

Very often, a watershed-planning committee forms because of a single issue. What may ultimately emerge, however, is a more comprehensive planning process that takes a more complete accounting of all the issues of interest to stakeholders in the watershed. A comprehensive WRI enables the planning committee to consider the multitude of issues and their inter-relationships rather than a single issue.

it's a fact...

The top 3 of the 41 potential sources of all use impairments in streams are crop production, channelization and municipal point source discharges. Combined they affect 6,380 or 43% of impaired stream miles. Crop production alone represents 3,040 miles or 21%.

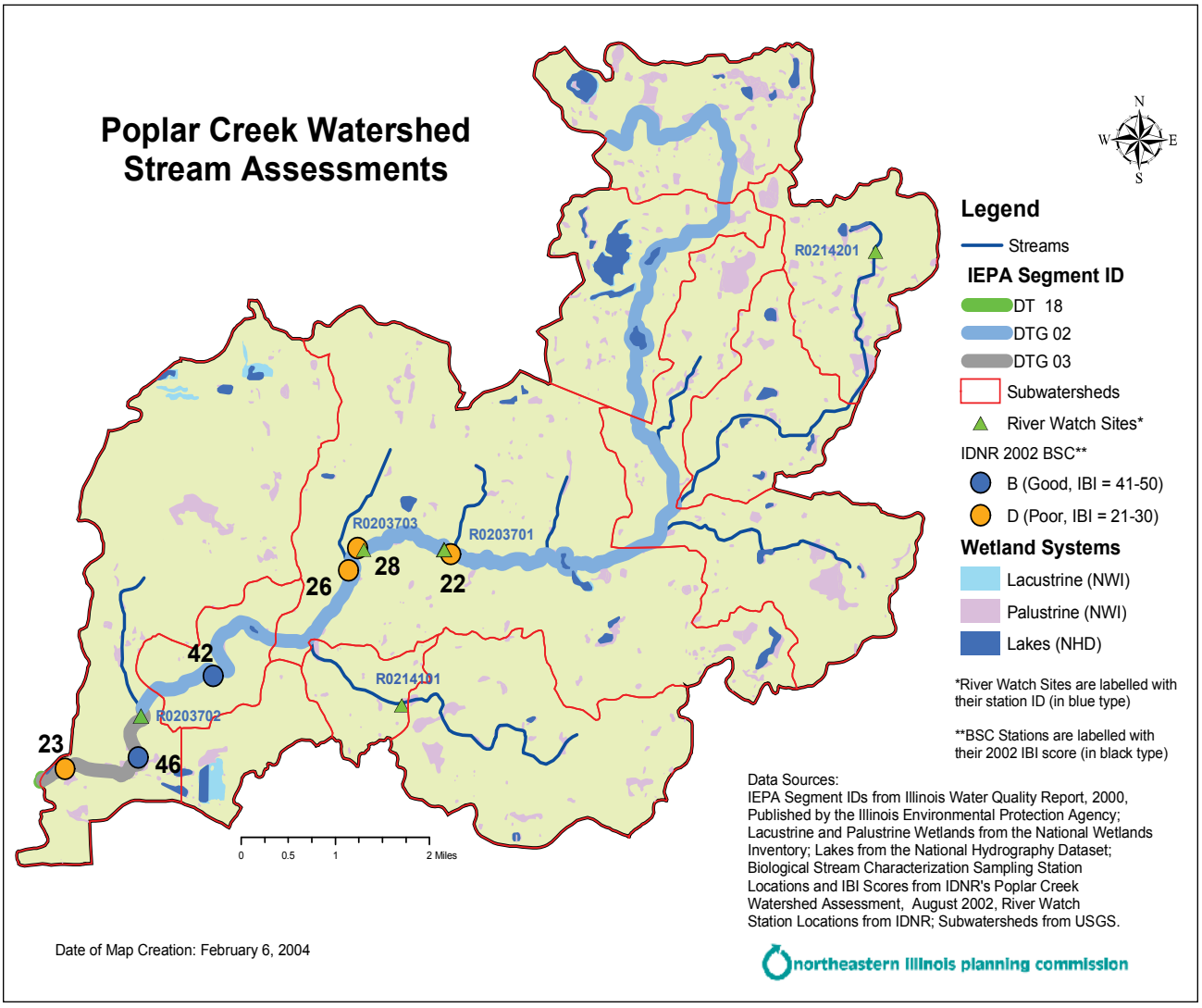
Illinois Integrated Water Quality Report and Section 303(d) List–2006

Typical First Steps:

- Assess potential uses and use impairments for your project's waterbodies
- Build on IEPA use assessments and update to level of detail needed for planning
- Identify and quantify the causes and sources that will need to be controlled in order to achieve the plan goals
- Begin to set project priorities and identify areas for remediation and protection
- Develop pollutant load reduction targets designed to attain water quality standards and guidelines

It can be easy to fall into a thought process during watershed planning that sees each individual planning step (e.g., stakeholder involvement, WRI, assessment, etc.) as an end in itself. While each component is valuable, it is important for planners and technical staff not to lose sight of the overall goals of the project as well as the relationships between each planning step in the achievement of these goals.

In terms of the assessment, it is important to recognize that you've already collected most, if not all, of the data necessary to complete it in the WRI. The challenge is in recognizing the connections between impairments and the causes and sources of these impairments that you identified in the WRI. Given the potentially large quantity of watershed data gathered during the WRI, a logical, efficient assessment procedure is crucial.



Analyzing the Waterbody: Uses

If your technical committee and/or staff completed a watershed resources inventory, then your project should already have most of the information necessary to assess your watershed. This section outlines the major components of the analytical method used by the IEPA to assess the condition of a water resource. It also (briefly) identifies the work necessary to produce a watershed assessment. Again, a complete WRI will have compiled this information already; now is the time to apply that data to your watershed problems.

The goal of this assessment is to link watershed resource problems to the causes and sources of those problems. As was covered in Chapter 3, the IEPA analyzes waterbodies in terms of their designated uses and use-support levels. Recall that designated uses refer to the beneficial uses of state water resources protected by water pollution control programs. In the 2004 Illinois 305(b) report, for example, waterbodies are designated for:

- aquatic life
- fish consumption
- primary contact (swimming, water skiing)
- secondary contact (boating, fishing)
- indigenous aquatic life
- public water supply
- overall use (lakes only)

When applying this analytical framework to a watershed project, a planning committee need not limit itself to the designated uses identified in the Illinois Integrated Water Quality Report. While starting with the Integrated Report assessments is usually a good idea, a watershed plan may address additional issues. Any desired use–that is, a goal identified by project stakeholders and/or the public unrelated to a designated use—can be assessed. Thus, the process can, and often should, include investigation of both existing and potential future waterbody impairments and problems. Whether or not your project will address potentially impaired desired uses in addition to IEPA-identified impaired designated uses depends on your watershed project goals (see Chapter 2).

11.5%

or 920,000 acres of wetlands remain in the state. Illinois once contained more than 8 million acres of wetlands.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

Analyzing the Watershed: Causes of Impairment

Once all of the uses, both designated and desired, and corresponding use-support levels have been identified, your technical committee and/or staff should analyze the impairments preventing full-use support. An impairment, first discussed in Chapter 3, refers to a broad category of related adverse impacts that can prevent designated- or desired-use attainment. For example, degraded water quality is perhaps the most common and wide-ranging impairment—it has the potential to impair most, if not all, designated uses. As you proceed, keep in mind that you may find that each use has a number of impairments, which in turn have a number of causes, and so on.

The first step in understanding impairments is to determine the causes of impairment. A cause of impairment is a condition (e.g., a pollutant, hydrologic modification, habitat alteration, etc.) that contributes to an impairment and is thus an obstacle to use attainment. To continue our example, poor water quality (an impairment) can result from various causes, such as heavy metals, nutrients, and suspended solids.

The Integrated Report includes an IEPA hypothesis on the cause of impairment for partial support and non-support waterbodies. When such a hypothesis is not available—either because the IEPA did not produce a hypothesis or because your target watershed is too small to have been assessed—your project's technical committee will need to formulate one. This can be accomplished through desktop analysis and field reconnaissance—including, in some cases, water quality testing—to determine the cause(s) of use impairment (see Chapter 3 for more on watershed data collection). Moreover, even when causes are identified in the Integrated Report, your

project's technical committee may still need to refine and verify the IEPA assessment using these techniques.

Analyzing the Watershed: Sources of Impairment

The next step in the assessment involves identification of the sources of impairment. A source of impairment refers to the activity or condition that leads to the cause of impairment. To continue with the poor water quality (an impairment) example, one cause of this impairment may have been suspended solids; the sources of these solids may have been construction-site activity, urban-stormwater runoff, and row-crop agricultural production.

Causes	Sources	Related Impacts
Solids and Sediment	Construction Bank Destabilization & Erosion Row-crop Agriculture Forestry Highway Runoff Mining Pasture Grazing Livestock Operations Atmospheric Deposition	Solids can increase turbidity and reduce penetration of light in the water column, limiting the growth of desirable aquatic plants. It can impair fish habitat as bottom deposits form, blanketing spawning and feeding areas. Recreation can also be affected, as sport fish habitat is degraded and navigation is impaired. Solids indirectly affect water resources as nutrients and toxic substances can attach to solids; these bound pollutants may enter aquatic food chains, cause fish toxicity problems, impair recreation and degrade water quality.
Nutrients	Row-crop Agriculture Urban Runoff, Landscape and Fertilizer Runoff Wastewater Treatment Plant Discharges Industrial Discharges Home Septic Systems Livestock Operations Erosion Atmospheric Deposition	The two most common nutrients of concern are nitrogen and phosphorous. Nutrient enrichment tends to produce excessive algae growth, leading to nuisance algal blooms and eutrophication of the water resource. Eutrophic conditions may cause some native plant species to be chocked out. Nuisance algal blooms also interfere with recreation and degrade aquatic habitat. As this excess plant growth decomposes, dissolved oxygen concentrations are depleted in the respiration process, adversely affecting fish and other aquatic organisms. Additionally, high nitrate-nitrogen concentrations in drinking water (i.e., > 10mg/L) can cause health problems for infants (methoglobinemia).
Pathogens	Human and Animal Wastes Livestock Operations Cropland or Pasture where manure is spread Wastewater Treatment Plant Discharges Home Septic Systems Urban Runoff Wildlife Wildcat Sewers	The main concern regarding pathogens and water resources is one of public health. Waterborne diseases may be transmitted to humans through drinking or contact with pathogen-laden waters. For both surface and ground water, the potential for degradation of the public water supply exists. More often, the presence of pathogens limits or prevents shellfish consumption and primary contact recreation, such as swimming, especially after storm events in urban areas.
Synthetic Organic Compounds	All land where pesticides and herbicides are used (e.g., cropland, pastures, residential lawns, golf courses) Urban Runoff Irrigation Return Flows	Synthetic organic compounds (SOCs), such as pesticides, herbicides, solvents and other residential-industrial chemicals, can enter surface waters dissolved in runoff or attached to sediment. SOCs can also enter groundwater through soil infiltration. SOCs have the potential to pose toxic health risks to humans and aquatic life through direct ingestion or bioaccumulation through the food chain.
Metals	Urban Runoff Wastewater Treatment Plant Discharges Industrial Discharges Automobiles Erosion Atmospheric Deposition	Dissolved metals (especially heavy metals like copper, lead and zinc) were found to be the most prevalent priority pollutant found in urban stormwater runoff, according to the EPA Nationwide Urban Runoff Program (NURP). Metals have the potential to degrade water supplies and cause acute or chronic toxic impacts for aquatic life.
Petroleum Hydrocarbons	Highway Runoff Urban Runoff, especially Parking Lots and Gas Stations Illicit Dumping	The principal petroleum hydrocarbons of concern in the context of water resources are oil and grease. Petroleum hydrocarbons are known for acute toxicity at low levels and have the potential to affect human and (more often) aquatic life health. They are usually concentrated in and around transportation corridors.

it's a fact...

For 2006, 146,732 lake acres, or 46.1% of the total 319,477 lake acres were assessed for at least one designated use.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

5,534

The number of groundwater dependent public water supplies in the state, of which 1,779 are community water supplies.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

Causes	Sources	Related Impacts
Organic Materials	Human and Animal Wastes Decaying Plant and Animal Matter Discarded Litter & Food Residential/Commercial Landscaping	Organic materials may enter a waterbody dissolved or suspended in runoff. Decomposition of these materials can deplete oxygen supplies within the water resource. This may reduce dissolved oxygen concentrations below the threshold necessary to maintain aquatic life.
Temperature	Removal of Riparian Vegetation Bank destruction Urban Runoff Hydromodification Industrial discharges	Temperature increases in a waterbody—due to increased exposure to sunlight or warm urban runoff—can alter some important physical characteristics of water, such as salinity and the solubility of dissolved gasses. Warm water holds less oxygen, while at the same time, elevated water temperatures increase the metabolism and therefore oxygen demand of fish. Certain species, such as salmon, trout and other cold water fish, are rather sensitive and require low temperatures, especially for spawning and egg hatching. Elevated water temperature can also promote excessive algal growth.
pH	Mine Drainage Mine Tailings runoff Atmospheric Deposition (acid precipitation) Industrial Point Sources	Most aquatic organisms show sensitivity to pH variations; fish kills can result from a pH outside of a species tolerance levels. Acidic conditions (low pH) can adversely affect the reproduction and development of aquatic organisms, especially fish and amphibians. Alkaline conditions (high pH) can cause ammonia toxicity in aquatic organisms.
Salinity	Highway De-icing Resource Extraction	High concentrations of salts in a water resource—usually the result of winter de-icing of roads—can inhibit aquatic plant growth. Deicers can also potentially be toxic to all types of aquatic life.
Hydrologic Modifications	Channelization Dams Dredging Streambank Modification Land Development (i.e., increase in impervious surfaces) Stream Burial Construction	During storms, urban watersheds, compared to rural ones, quickly deliver a large volume of runoff to streams; these large flows can contribute to flooding and erosion of the streambank. Additionally, flow alterations—either from structures like dams or other activities like dredging—may be the source of stressors (e.g., habitat modification) or exacerbate other stressors (e.g., temperature). Dams and other structures may also create fish barriers, interfering with spawning and general movement.
Habitat Modifications	Channelization Construction Land Development Stream Burial Dredging Removal of Riparian Vegetation Hydromodification	Removal of riparian vegetation can destabilize the streambank and contribute to erosion; streamside vegetation also is needed to provide shade and lower water temperatures. In urban streams, the increased runoff flow can contribute to streambed sedimentation, thereby degrading the habitat necessary for many types of fish spawning. Channelization destroys the pools, riffles and meanders that are key to aquatic habitat.
Trash and Debris	Litter Spills Illegal Dumping of Solid Wastes	Trash and debris can: impair designated uses like swimming and boating, diminish the scenic quality of the water resource and waterfronts, stress aquatic organisms; reduce water clarity, and interfere with water treatment plant operations.

Keep in mind that each use may ultimately have a number of sources that led to its impairment. This is indicative of the relationships between the numerous processes at work in a watershed. Therefore, it may often be difficult to assign responsibility to a single "source of impairment."

Sources of impairment include both point and nonpoint-source pollution. An impairment may also result from a combination of the effects of both types of pollution. Moreover, an impairment may be due to various forms of each type of pollution. A point source of water pollution refers to the release of an effluent from a pipe or discrete conveyance into a waterbody. Typical examples of point sources include municipal wastewater-treatment plants and industrial dischargers. Nonpoint-source (NPS) pollution refers to pollution caused when rain, snowmelt or wind carry pollutants off the land and into a waterbody. Urban-stormwater runoff is a typical example of NPS water pollution.

Potential sources are generally included in the Integrated Report for each IEPA identified impaired use. These sources, along with others that your technical committee and/or staff identify, should be verified and focused on specific sites (when applicable).

Linking Causes and Sources

In the context of a watershed plan—which culminates in action designed to restore and protect water resources—determining the link between causes and sources of use impairments is a crucial step. A planning committee can only propose actions once it knows what to target. This section reviews major causes of impairment and links them to the typical corresponding sources. It also describes the adverse impacts typically related to each group of causes and sources.

Note that this arrangement (cause-source-impact) differs from the order of analysis (use-impairment-cause-source) suggested above. However, our focus in this section is on the single analytical step that brings together causes and sources; in other words, it is an aid to help you begin to piece together causes of impairment with the data on potential sources gathered in your WRI. The "related impacts" information is meant to help direct your thinking to include all the effects to which the combination of cause and sources that you identify could contribute.

The following owes much to IEPA Illinois Water Quality Report, Ohio EPA's A Guide to Developing Local Watershed Plans in Ohio, US EPA's Preliminary Data Summary of Urban Storm Water BMPs and CWP's Urban Subwatershed Restoration Manual 1.

While this section provides a review of many of the major causes and sources of impairment, there may be others that are important to consider in your watershed project. Moreover, you should always tailor your assessment to your particular watershed and verify which causes and sources are contributing to use impairment(s).

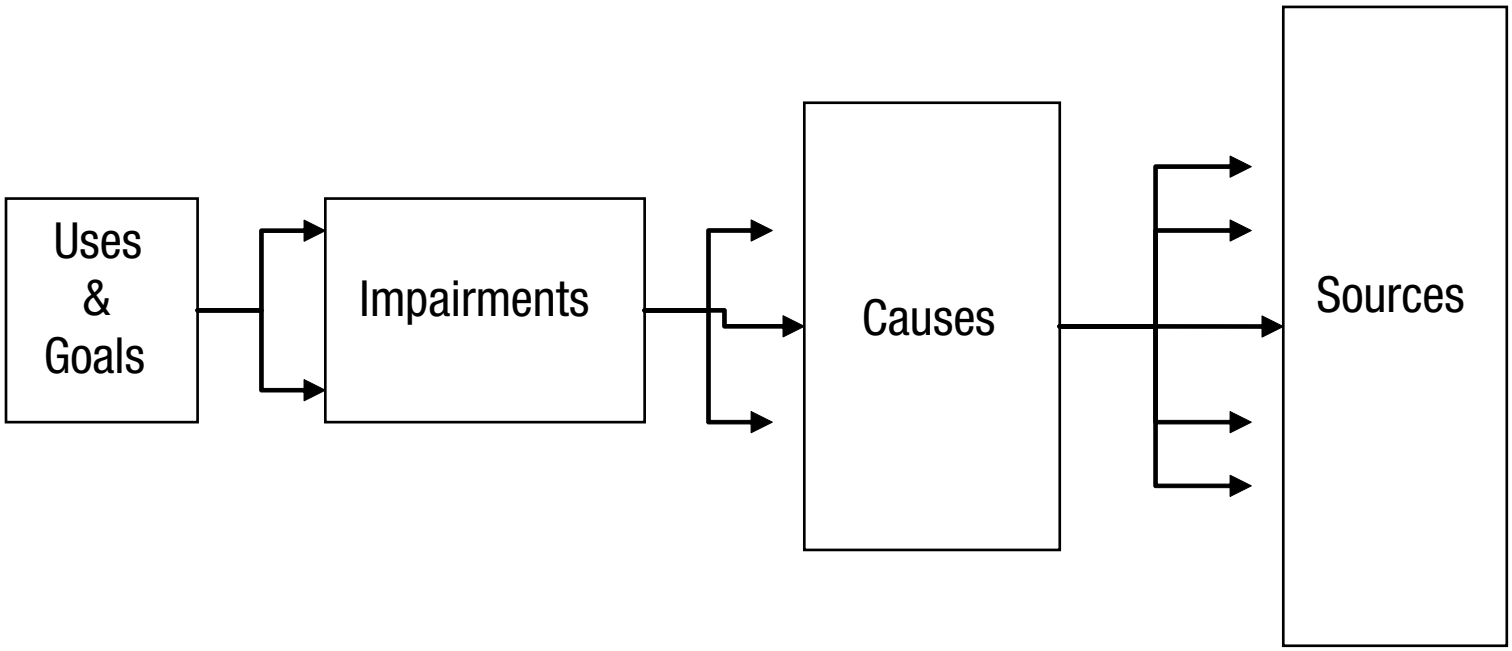
Putting it all together

A completed watershed assessment will link each (impaired) designated and desired use through to the corresponding sources of impairment.

it's a fact...

Aquatic life is the most common designated use for Illinois stream miles assessed.

Illinois Integrated Water Quality Report and Section 303(d) List–2006



Upper Des Plaines River

Lake and Cook Counties

One of the major goals of the Upper Des Plaines River Ecosystem Partnership is improved water quality. The aquatic life use was assessed by IEPA to have attained only partial support for most of the target sections of the river, while the primary contact recreation (swimming) use was rated nonsupport throughout the project area. The project technical staff broke the river into three sub-sections, and identified the causes of impairment for each, based on IEPA assessments and their best professional judgment. They also assessed the magnitude to which each cause contributed to use impairment. The technical staff, again based on IEPA assessments and their best professional judgment, then identified the major sources of impairment, along with the magnitude of each.

The project focused on nutrients as the primary cause of impairment across the entire watershed, citing municipal-point sources (e.g., wastewater-treatment plants), urban-stormwater runoff and agriculture has the principal sources of pollution. Later, the planning committee used this assessment to produce recommendations for management measures designed to address these sources. These measures included local-stormwater ordinances, natural drainage and infiltration BMPs, stormwater detention BMPs, erosion and sediment controls, and improvements to land/roadway management.

Visit http://www.upperdesplainesriver.org for more information.

Preliminary Priorities: Key Causes and Sources of Impairment

Once the technical committee and staff have assessed the watershed, the planning and/or technical committees can refine the plan's priorities. Recall that in Chapter 2 we prioritized goals based on the concerns of stakeholders and other watershed residents. Now that these goals have been assessed—through our analytic framework of designated and desired uses, causes and sources of impairment—the planning and technical committees can build off their early work on prioritizing goals to develop selection criteria designed to guide their focus toward the most important causes and sources of impairment identified in the assessment.

The following list briefly outlines a few of the most common selection criteria:

- Importance (based on goal prioritization) of the use or uses impaired by a cause or source: a cause or source may contribute to the impairment of highly ranked uses/goals, and may therefore be of higher concern than others.
- Number of designated/desired uses impacted or impaired by each cause and source: if a source (cause) is found to be related to multiple causes (impairments), it may be of higher concern than a source (cause) responsible for a single cause (impairment).
- Ability of the plan to address each cause and source: some causes and sources may be more easily addressed than others, but provide equivalent benefits. Prioritizing causes and sources in this way is, in a sense, identifying the so-called "low-hanging fruit."
- Relative impact of each cause and source on each use/goal: identified causes and sources contribute relatively more or less than others to impairments. Using stakeholders knowledge and the information collected in the WRI, you may target the worst offenders.

Regardless of how your planning and technical committees decide to set your project's priorities, the process should incorporate several general ideas. First, it is important to select and document prioritization criteria that are acceptable to both committees and stakeholders generally. Second, stakeholders should use their knowledge about the concerns and desires of watershed residents when setting priorities. Otherwise, residents may come to believe that the project is unresponsive to their concerns and thus reduce their level of support and enthusiasm for project implementation.

You can organize your prioritized assessment in a table such as the (partial) example given below (note: you should repeat this step for every use-impairment-cause-source).

Use/Goal	Impairment(s)	Causes	Sources
Primary-Contact Recreation	Water Quality Degradation	1. E.coli bacteria	1a. Failing Septic Systems
			1b. Urban Runoff
		2. Nutrients	2a. Failing Septic Systems
			2b. Urban Runoff
			2c. Erosion

Another point to keep in mind is that the prioritization process, like much of the watershed planning process, is not necessarily linear. At this time, you may not have all the information necessary to complete a prioritization exercise like the one outlined above. As you move forward, however, remember to revisit this step—especially after you have completed the next three: identifying critical areas, pollutant load reduction targets and priority protection areas.

Finding Critical Areas

A critical area refers to a particular place or area of the watershed where any source and/or cause of impairment is present in a concentration relatively higher than that found in the watershed in general. For example, a subwatershed with high pollutant loading could represent one critical area; a stream segment with a severely degraded riparian buffer could be another. In either case, the main idea is that conservation/resource planners have identified a sub-region within their target watershed that is by some measure significantly "worse off" than the rest.

Focusing on critical areas can help planners focus their restoration, remediation and/or protection activities on sites where their efforts will make their greatest impact. Indeed, this is the key point in identifying critical areas; they are, by definition, areas in need of remediation or protection measures. Moreover, they contribute to a disproportionate share of the watershed's problems. By focusing on critical areas, then, planners can target the segments of their watershed that often will give them the most "bang for their buck" (both literally in dollars spent and figuratively in terms of effort).

There are many ways to develop information about critical areas in your watershed. Computer modeling of the watershed, while data intensive, technical, and sometimes costly, can often provide the greatest level of detail if the required resources are available. There are other indicators, however, that can also help project members identify critical areas.

One way to identify critical areas begins by developing pollutant load estimates by subwatershed within your project area (recall from Chapter 3 that your WRI should already contain load estimates). By comparing the relative loading estimates of each subwatershed, as well as their position within the tributary system of your principal target waterbody, you can form preliminary estimates of your critical areas. Areas that potentially contribute large loadings but are tributary to only a short reach of your target waterbody, for example, may paradoxically be less important to your resource management efforts than other areas contributing smaller loads further upstream. Planners will need to consider the value of targeting areas contributing high loads (e.g., urban subwatersheds) versus the relative position of such areas within the entire watershed.

Pollutant-loading analysis is not possible and/or appropriate for all causes and sources of impairment. Additionally, in some instances, subwatersheds will be relatively homogenous and undifferentiated in land use; thus, the pollutant loading analysis outlined above will not identify any overt critical areas. In these types of situations, other indicators can be used to find critical areas in your watershed, including:

- Inventory of stormwater-management facilities and major storm-sewer outfalls: These point sources can deliver large volumes of (treated) waste and stormwater runoff to the stream and can therefore be responsible for pollutant loadings.
- Characterization of existing development area in terms of sewer service and existing stormwater-management controls: Sewer service allows for denser development. Additionally, sewer pipes often parallel the stream network and can leak into it. Existing stormwater management controls that date from the 1970's and 1980's may be less effective (esp. in terms of pollutant filtration) than current BMPs.
- Identification of historical flooding problems: Development in a flood-plain, and the resultant modifications to it, can reduce the capacity of the floodplain and exacerbate downstream flooding problems.
- Status of ongoing NPDES Phase II programs: Areas that have not completed Phase II-related projects may lack stormwater runoff controls that exist in other areas; therefore, these areas may be contributing greater pollutant loadings.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for CWA Section 319 Incremental funding, a watershed-based plan must identify the causes and sources responsible for use impairment at the significant subcategory level with estimates of the extent to which they are present in the watershed. These estimates are meant to act as a baseline against which the success of your watershed plan recommendations can be compared after plan implementation. The data that you have developed in this chapter—the watershed assessment, baseline pollutant load estimates and identification of critical areas—can be used to meet this Section 319 funding requirement.

Swimming is an example of primary contact use.

Indian Creek

Lake County

For the Indian Creek Watershed, the technical staff conducted nonpoint-source pollutant-loading estimates in order to identify "hotspots" (i.e., critical areas) within the watershed. The staff produced annual-load estimates by the land use for carbon, solids, nitrogen, phosphorous, and heavy metals (cadmium, lead, copper, and zinc) for each of the watershed's stormwater management units (SMUs). Two key "hotspots" were identified with this analysis.

Additionally, the project's technical staff recognized that most land use-based loading estimates do not account for pollutants removed from the watershed through the use of stormwater detention/treatment facilities. The technical staff refined their pollutant load estimates by modeling the effects of existing stormwater management practices; perhaps most importantly, this analysis provided data on the relative effectiveness of various stormwater BMPs that helped planners make recommendations later in the process.

Beyond pollutant loading analysis, the Indian Creek watershed staff also employed the Center for Watershed Protection's Impervious Cover Model to help set their project priorities. The model was used to classify streams within the SMUs into three categories: Sensitive, Impacted, and Non-Supporting. Based on these classifications, land use projections and other supplemental field data, the project staff ranked priority SMUs for immediate planning and BMP implementation.

For more information visit http://www.indiancreekwp.org.

- Amount of impervious land cover by subwatershed: Conversion of land to impervious cover fundamentally alters the hydrology of a subwatershed by generating increased stormwater runoff and reducing infiltration. A widely-accepted connection exists between percent impervious cover and water resource degradation.
- Management of pervious areas: Most pervious areas in developed and developing watershed have been disturbed in the past. Soil and vegetation in these areas have reduced ability to infiltrate and/or filter runoff as compared to more natural areas.
- Interruption of stream corridor: Most streams in developed areas have been "improved" (e.g., channelized, ditched, enclosed, etc.) Stream interruption is an important factor in determining fish passage, channel erosion and aquatic habitat stability.
- Population density: Higher population density generally is related to a higher incidence of water resource stressors, such as development, runoff, etc.

Pollutant Load Reduction Targets

Once you have identified and quantified the baseline severity of the causes and sources of use impairment present in your watershed, it may be possible for your technical committee or participating agency staff to develop pollutant-load-reduction targets for these causes and sources. Your planning and technical committees may consider hiring a consultant or partnering with a municipal engineer to produce the desired results. The IEPA has acknowledged that the development of reduction targets presents an additional cost to planning groups, but it is prepared to help with technical assistance, data sources and, in some cases, Section 319 funding.

Groups that intend to apply for Clean Water Act Section 319 funds are expected to develop such targets. The IEPA will use these targets to assess your watershed plan and as a guideline to measure the success of your plan once it has been implemented. Groups that do not intend to seek Section 319 funds may also choose to establish pollutant load reduction targets as a means to measure plan implementation progress and subsequent successes.

The development of pollutant load reduction targets builds upon your technical committee's earlier work quantifying the causes and sources of use impairment. Pollutant load reduction targets are often complex, however, to arrive at. The basic idea behind this step is to analyze the baseline pollutant loads present in your watershed in terms of the Illinois water quality standards or IEPA designated use water quality guidelines (available in the Integrated Report). This presumes that either sufficient data are available to determine baseline loads or modeling efforts can be applied to estimate such loads based largely on land use and other data. The reduction target that your technical committee develops, therefore, should represent the reduction necessary to bring your waterbody into compliance with these standards and/or guidelines. Here again, this assumes such standards/guidelines exist for the pollutant of concern.

Ideally, a Total Maximum Daily Load (TMDL) will have been developed for water-quality-limited segments within an impaired watershed. Pollutant loads and load reductions targets will have been calculated as part of a TMDL. If your watershed is impaired and has not yet had a TMDL developed for the water-quality-limited segment(s), if applicable, your planning group can use estimated loads developed from land use and monitoring data and found in the scientific literature. Relatively straightforward calculations and/or spreadsheet formulas can be applied to estimate loads. As suggested above, computer models can be applied to generate loading estimates (see http://www.epa.gov/waterscience/wqm/). Using available data and applying techniques that make sense are all that can be expected when resources for this task are typically limited.

Be prepared to defend your approach, resultant load estimates, and be clear as to the limitations of any technique applied and values generated. Understanding the relative magnitude of sources is an important outcome of any load estimation exercise.

If insufficient data is available to adequately quantify your baseline conditions, your technical committee and/or consultant staff may not be able to develop reduction targets at this time. In such cases, the technical committee should identify the causes and sources of use impairment, and quantify the baseline severity of each to the fullest extent possible, indicating what additional information needs to be collected. Additionally, interim reduction targets should be developed based on the information available. Your planning committee may then apply to the IEPA for Section 319 funds that will be used to complete your technical committee's assessment of the baseline conditions of the watershed and finalize your reduction targets.

Identifying Priority Protection Areas

In addition to critical areas and pollutant loads, project members may also want to identify key resources for protection. In these situations, priority protection areas can be identified. These areas represent subsections of your watershed that have valuable characteristics; valuable either in the sense that (1) they contain resources and characteristics that you may want to protect and/or (2) property ownership or land use characteristics make the subsection a strong candidate for action.

Some subwatershed characteristics to consider when setting priorities include:

Natural Resources

1) Subwatershed contains more than 10% wetland area.

2) Subwatershed contains more than 40% open space.

3) Subwatershed contains documented threatened or endangered plants and animals.

4) Subwatershed contains stream segment with fair or good MBI score and/or Class A, B, or C stream based on the Index of Biotic Integrity (IBI) score.

Stream and Water Quality

1) Stream corridor is vegetated and at least 30' wide on both sides of stream and/or lake is less than 33% developed along shoreline.

2) Majority of stream channel in subwatershed shows little alteration.

3) Water quality monitoring (if available) shows no violations of state standards.

Property Ownership and Land Use

1) Municipal or local government ownership of land (e.g., school board)

2) County, state or federal ownership (e.g., parks)

In most cases, if a subsection of your watershed has only one of these characteristics, it may not be enough to justify a priority ranking (although this depends on your project goals). Generally, the highest priority protection areas will have some combination of valuable resources and public land ownership.

In the next chapter, the planning and technical committees will apply this watershed assessment in order to develop a comprehensive system of management measures designed to address your pollutant load reduction targets and ultimately your plan's overall goals.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for CWA Section 319 Incremental funding, a watershed-based plan must include an estimate of the load reductions necessary to work towards attainment of water quality standards and/or guidelines—and ultimately through this process, to your plan's goals.

Recommending Watershed Objectives and Management Practices

Chapter 5

Typical First Steps:

- Identify specific objectives necessary to address the causes and sources of impairment identified in the watershed assessment
- Identify and describe the nonpoint-source and point-source management measures (e.g., BMPs) that will need to be implemented to achieve the load reductions (Section 319, component b) and identify the critical areas in which those measures will be needed to implement the plan (Section 319, component c)
- Identify practices (with specific sites, where applicable) needed to prevent/minimize future problems as well as measures needed to maintain existing high quality conditions
- Estimate the cost of all recommended management practices (Section 319, component d)

Chapters 3 and 4 presented an approach that is designed to help you learn about your watershed's characteristics, its water-quality problems and the causes and sources of these problems. In this chapter, you will connect that information to your project goals (see Chapter 2) in order to produce objectives. An objective outlines a method by which you will address your watershed's problems and achieve a goal.

Determining your Objectives

As part of the watershed assessment discussed in Chapter 4, the planning/technical/steering committee(s) identified and prioritized the causes and sources of use impairments present in your watershed. Now, you will address the causes and sources of impairment identified in that assessment by determining what needs to be done to reduce the impact of these causes and sources. At this step, we are merely identifying the general action or actions necessary to mitigate these impacts; these general actions are your objectives. Later, we will select specific management measures and practices that are needed to reach each objective.

Restore aquatic habitat	A. Reduce nutrient loadings by: 1) Encouraging a reduction in fertilizer use on lawns 2) Identify and encourage replacement of failing septic systems
	B. Reduce hydrological impacts from development by: 1) Retrofitting existing stormwater runoff infrastructure 2) Promoting onsite infiltration

Since your objectives are based on your project goals as well as the causes and sources of impairment identified in your watershed assessment, prioritizing objectives is a relatively easy task. When completing a chart like the one above, your planning and technical committees should complete this prioritization exercise. Since objectives typically address specific causes and sources of impairment, in most cases objectives will share a similar priority level as the causes and sources to which they correspond.

Introduction to Management Measures and Practices

After you have identified your objectives, you will need to determine what types of management measures and practices are necessary to achieve them. A wide array of management measures and practices exist that can contribute to attainment of your plan's objectives, and thereby your goals. While structural Best Management Practices (BMPs) are not uncommon, management measures go beyond these "hard-engineering" approaches to include measures related to public outreach and education, municipal ordinances, planning and project coordination, and other non-structural BMPs.

Various forms of all of these management measures have been identified, employed and refined over time. While there will always be innovation, most of the currently accepted measures and BMPs have been in use for ten to twenty years. The effectiveness and validity of these approaches has thus been borne out by experience, and there is no need to reinvent the wheel. At the same time, be sure to tailor the management measures you select to your watershed conditions and needs.

In the following sections, we will explore each of the five broad classes of management measures identified above. Then, we will turn to a discussion of the selection of the right management measures for your watershed.

CMAP Staff

Naturalized detention area (Mill Creek Subdivision, Geneva, Illinois).

CMAP Staff

Porous Pavement Example 1: Porous pavement (background) parking lot, adjacent to conventional street during rain storm at Ryerson Woods Welcome Center. Porous pavement allows infiltration and reduces runoff (Lake County, Illinois).

CMAP Staff

Porous Pavement Example 2: Another type of porous pavement features pavers to allow for immediate infiltration (Morton Arboretum, Lisle, Illinois).

CMAP Staff

Rain gardens utilize rooftop and other surface runoff and provide attractive native landscaping opportunities (Brookfield Zoo, Brookfield, Illinois).

CMAP Staff

Drainage swales, planted with native vegetation can reduce both the volume and rate of stormwater runoff (Tellabs Company, Naperville, Illinois).

Structural Best Management Practices

There are a wide variety of structural BMPs available for use in watershed resource management. Structural BMPs are generally engineered, constructed systems that can be designed to provide water quality and/or water quantity control benefits. Structural BMPs are used to address both existing watershed impairments as well as the impacts of new development. For our purposes, we will divide structural BMPs into seven categories. The following is based on the USEPA's Preliminary Data Summary of Urban Storm Water Best Management Practices and the Northeastern Illinois Planning Commission's Best Management Practice Guidebook for Urban Development. For further information on structural BMPs, refer to:

1) Infiltration systems are designed to capture a volume of stormwater runoff, retain it and infiltrate that volume into the ground. Examples of infiltration systems include infiltration basins, porous pavement, rain gardens and infiltration wells or trenches. Infiltration systems can provide both water quantity and water quality control. Water quantity control results from the infiltration of surface runoff into underlying soils which in turn reduces the surface-runoff water volume reaching streams. Moreover, infiltration systems can recharge groundwater supplies, thereby helping to maintain dry weather base flow. Infiltration BMPs also provide water quality treatment; as infiltrated water percolates through various soil layers, particles (i.e., pollutants) are filtered out.

2) Detention systems temporarily store runoff and release it at a gradual and controlled rate. Detention systems are primarily beneficial in terms of water quantity control, but some designs remove some pollutants through limited settling of particulate matter. Detention systems should be considered mainly as a management measure to reduce the peak discharge of stormwater to receiving streams, thereby reducing downstream flooding. Detention basins are the most common example of this management system.

3) Retention systems are designed to capture a volume of runoff and retain that volume until it is displaced in part or whole by the next runoff event. Unlike detention systems, retention systems retain a permanent pool of water. During runoff events, additional storage capacity beyond that filled by the permanent pool captures the runoff. Retention basins provide water quality control in addition to quantity control. Water quality benefits result from sedimentation and biofiltration (made possible by aquatic plants and microorganisms present in the system). Wet ponds or retention basins are the most typical form of retention system.

4) Constructed wetland systems provide both water quality and water quantity control. For the former, this system incorporates the natural processes present in wetlands in order to remove pollutants from storm water. Water quantity control is provided since a significant volume of ponded water can be retained in the system. Some constructed wetland systems have a permanent pool of water but differ from retention systems in that a significant portion of this pool is covered by wetland vegetation.

5) Filtration systems are devices that use a media such as sand, gravel or peat in order to remove particulate pollutants found in stormwater runoff. Filters are thus primarily a water quality control device. Filters should generally be placed "off-line"—that is, a portion of the runoff volume is diverted to the BMP system for treatment while any runoff above this volume bypasses the system. Filters can be placed under parking lots and other structures, thereby reducing costly land requirements. Filter systems are thus often used in highly urbanized areas.

6) Vegetated systems and biofilters such as grass filter strips and vegetated swales are used for conveying, intercepting, and treating stormwater runoff. Water quality control is provided by infiltration and filtration of runoff by vegetation. Water quantity control is also provided, as these systems can temporarily store runoff as well as infiltrate it into the soils. Thus, some degree of treatment, storage and infiltration can occur before discharge from vegetated systems into the storm-sewer system or waterbody, thereby reducing the overall volume and pollutant concentration of runoff. (Grass filter strips, commonly implemented on farm fields that are adjacent to rivers and streams, are not structural BMPs per se, but rather a specific type of land use/land cover.)

7) Natural resource restoration covers a wide range of structural practices designed to restore stream channels, streambeds, shorelines and important habitat areas. Some example practices include steambank stabilization bioengineering techniques like A-Jacks and lunkers; removal of barriers to wildlife movement like dams and weirs; restoration of unique ecosystems like prairie, wetlands and riparian buffers; and restoration of instream habitat like meanders and pool-riffles.

Non-Structural Best Management Practices

Non-structural BMPs are a broad group of practices that prevent pollution through maintenance and management measures. They are typically related to the betterment of operational techniques or the performance of necessary stewardship tasks that are of an ongoing nature. These include institutional and pollution-prevention practices designed to control pollutants at their source and to prevent pollutants from entering stormwater runoff. Non-structural measures can be very effective at controlling pollution generation at the source, thereby reducing the need for costly "end-of-pipe" treatment by structural BMPs.

Often, the BMPs and management measures discussed in this section would be combined with those in the following three sections under one heading, but in this manual they have been separated to highlight the importance of each. This section is based on the USEPA's Preliminary Data Summary of Urban Storm Water Best Management Practices and the Center for Watershed Protection's Manual #8, Pollution Source Control Practices. For further information, refer to:

1) Maintenance Practices can help reduce the pollutant contribution from various land uses and human operations. Examples include street and parking lot sweeping; road and ditch maintenance; proper use of road de-icers; avoidance of fertilizer and pesticide overuse and appropriate maintenance of vehicles, outdoor storage spaces and physical structures. Some existing maintenance practices in your watershed may also be identified for reform—some businesses or residents may currently use techniques harmful to water resources even though alternatives exist. Additionally, BMP maintenance is necessary to ensure that these systems are operating effectively. BMP maintenance includes tasks like inspections, vegetation management, sediment clean-out and structural repairs.

2) Recycling and Waste Disposal Practices refers to a set of management measures designed to reduce waste streams entering runoff. Various forms of these practices apply to residential, commercial, industrial and municipal activities. Examples include proper storage and disposal of hazardous materials; lawn debris composting; pet waste cleanup; maintenance of septic systems; and dumpster management.

3) Illicit Discharges and Storm Sewer Connections can be a significant source of pollutants in urban runoff. Management measures should target connections of sanitary sewer piping to the storm drain system; seepage from sanitary sewers into storm drains; downspout connections from rooftops to storm sewers; and illicit discharges and spills from residential, commercial and industrial activities.

Lake Zurich

Lake County

Most of the development in the Lake Zurich Watershed is older and virtually none was constructed with stormwater detention or water quality BMPs. Many areas of the watershed were well developed and therefore space was relatively limited. When the municipality of Lake Zurich implemented a BMP retrofit demonstration project, space limitations largely drove the BMP selection process at several sites. Sand filters were installed at these sites, since this system fit into the smallish space available. In other sites with more space, on the other hand, different BMPs were selected that could provide both water quantity and quality control.

Pet waste ordinance awareness sign. Pet waste can contaminate watersheds with bacteria and pathogens.

Mill Creek

Kane County

A 1500-acre Mill Creek watershed subdivision has incorporated several non-structural BMPs into its site design and maintenance. The creek itself is protected by a natural riparian buffer that averages 200 feet wide. An additional 650-plus acres of open space has also been preserved. Wastewater from homes and businesses is disposed of by an innovative land application system that uses 650,000 gallons of treated wastewater to irrigate a local golf course.

Visit http://www.millcreekwatershed.org for more information.

Village of Barrington

Flint Creek, Cook and Lake Counties

The village of Barrington produced a three-pronged public education and outreach program in order to address the problems present in the Flint Creek watershed. One portion of the program dealt with general watershed stewardship practices and the dissemination of these practices to the general public. The second prong of the program involved the development of a biological monitoring program in tandem with local biology teachers and their students. The final part of the program sought to demonstrate bioengineering technology to riparian landowners, in order to encourage the adoption of these techniques. For more information on public education and public outreach campaigns, refer to the USEPA's *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns*. This manual is available online at http://www.epa.gov/owow/watershed/outreach/documents.

4) Open Space and Riparian Buffer Preservation can help maintain terrestrial and aquatic habitats in your watershed. Additionally, natural vegetation buffers along waterways help to filter out pollutants, allow natural stream flow and protect streambanks from erosion. Development within buffer areas and other open space preservations should be strictly limited. These natural areas may also need to be actively managed in order to control non-native plant species as well as to ensure that native vegetation becomes established as desired. Land or conservation easements for buffers and open space may need to be purchased to ensure adequate protection.

Public Education and Outreach

Public education and outreach can be an effective means of nonpoint-source pollution prevention. The public is often unaware of the environmental impacts of numerous day-to-day activities and education regarding these impacts can help bring about behavioral change. Additionally, public outreach can help build support for your watershed project; such support makes implementation of your plan's other recommendations simpler and more feasible.

Public education can cover a wide range of topics, from the basics of environmental science to the necessity of action in your watershed. Common topics include proper waste management and disposal, pesticide and fertilizer use, commercial and industrial good housekeeping practices for small businesses and many more. Remember, however, that simply informing and educating the public on the issues is often not enough to build support for a project and produce the behavioral changes necessary for plan implementation. Your education and outreach efforts should be proactive and include public events and demonstrations of BMPs to encourage participation in the plan. Be sure to relate the issues to your public audience, explaining how the issues affect them.

There are several ways to approach public education within the context of your watershed plan. You may decide to develop a detailed component within your watershed plan that describes your overall approach to public education. In other cases, you may decide to attach a plan education module to each management measure that you recommend; such an approach would be designed to explain the necessity of the management measures to the public at large and build their support for each. At the very least, your plan should acknowledge the importance of public education and outreach to the success of watershed planning and lay out the process by which your planning committee intends to address this key step in the process.

CMAP Staff

Field trips and outings increase community awareness of watershed resources.

Policy, Regulations and Ordinances

There are a number of local government policies, regulations and ordinances that can help prevent non-point source pollution and reduce stormwater runoff volumes. Thus, implementing these policies, especially prior to extensive development of an area, can help reduce the need for structural BMPs and other forms of restoration and remediation.

One key policy area deals with new development practices; ordinances can be designed that require environmentally-friendly stormwater control and minimization of impervious surface cover. Ordinances can also be used to direct development and growth away from parts of the watershed that contain crucial resources or are sensitive. Indeed, if you identified Critical Areas and Priority Protection Areas in your watershed assessment, you may consider a recommendation directing development away from those portions of your watershed.

Other pertinent policy areas include floodplain management, natural resource protection, erosion control and stormwater management. Many local level governmental mechanisms exist to address these issues, such as zoning regulations, subdivision regulations, conservation development, natural buffer requirements and land acquisition programs.

For additional resources regarding municipal ordinances, refer to the Northeastern Illinois Planning Commission's Model Floodplain Ordinance, Model Soil Erosion and Sediment Control Ordinance: A Guide for Local Officials, Model Stormwater Drainage and Detention Ordinance: A Guide for Local Officials, Model Stream and Wetland Protection Ordinance and Suggested Water Conservation Ordinance: A Guide for Local Officials. For more information, see http://www.nipc.org/pubs-services/.

Planning and Project Coordination

Another series of management measures that can greatly increase the effectiveness of your watershed planning process focuses on coordination and cooperation between your watershed planning group, other citizens' and business groups, municipalities, counties and other local units of government, and state and federal agencies. While all of these entities will ideally be represented in your stakeholder group and your committees, it may still be necessary to identify additional measures to ensure cooperation and coordination of efforts during plan implementation.

Moreover, taking time to focus on the current activities (e.g., projects, programs, maintenance, etc.) of all these organizations can help identify areas of overlap as well as areas in need of more attention. When reviewing these activities, be sure to consider how they relate to your planning process; whether these activities could be incorporated into your watershed plan or conversely, if they need to be addressed and reformed; and whether any opportunities exist to expand or build upon existing programs and projects.

Comprehensive Planning

In the previous sections, individual BMPs and other management measures were introduced. As we saw, different measures are effective for different objectives. In order to comprehensively address watershed impairments (both existing and potential), it is often necessary to use several management measures and BMPs in tandem.

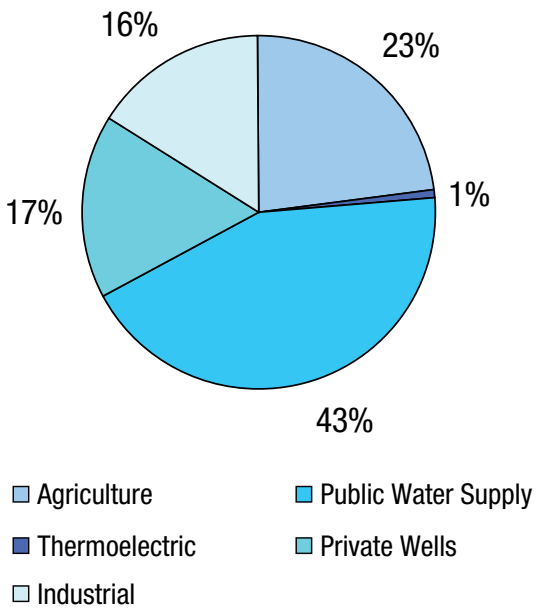
For example, in order to address nutrient loadings to a stream, a project may recommend several structural BMPs in an identified critical area, a public education campaign addressing fertilizer use and a municipal ordinance calling for vegetated streamside buffer strips in new develop ments bordering the stream.

it's a fact...

Public water supply accounts for the largest percentage of groundwater withdrawal in Illinois.

USGS Circular 1268 March 2004 as sited in IEPA Integrated Water Quality Report and Section 303(d) List–2006

Groundwater Supply Withdrawals in Illinois



Village of Streamwood

Cook County

In order to go beyond the USEPA's National Pollutant Discharge Elimination System (NPDES) Phase 2 minimum measures, the Village of Streamwood began to require commercial, industrial and residential developments to install permanent stormwater filtering devices. The filtering devices are selected based on their ability to remove suspended solids, floating objects and oil and grease, and keep these items from being resuspended in high flows. The unit must be easily cleaned using a vactor-type truck, must not require personnel to enter a confined space, must be designed for a long life span, and have good support from the manufacturer. There are several products now marketed and most are available for inspection at the annual American Public Works Association Conference or the Water Environment Federation annual conference.

All the stormwater storage ponds are constructed using a 10:1 slope under the water to a depth of one foot to allow installation of emergent plants to help filter excess nutrients from the stormwater before release into the South Branch of Poplar Creek.

The requirements to install the filtering structures and pond grading are included in the planned unit development (PUD) agreement adopted by ordinance by the Village Board. In some communities a subdivision improvement agreement could be used or the subdivision control ordinance revised to include these requirements. The PUD agreement also includes a provision where the developer agrees to the creation of a special service area. The Village Board must approve the tax levy for the special service areas each year. The special service area, a funding mechanism authorized by Illinois State Statute in 1973 and since amended, includes the maintenance of the wetland/pond and any special features in the subdivision such as wooded areas or other open space not owned by the park district. The existence of the special service area is explained to people before they purchase property in the subdivision and is adopted by the Village Board before the developer has closed on any lots.

Visit http://www.streamwood.org for more information.

Moreover, if your technical committee developed pollutant load reduction targets in Chapter 4, you will need to consider how the set of management measures you recommend in this planning stage address those reduction targets. As will be discussed in greater detail in subsequent sections, you do not need to design your management measure recommendations to achieve the complete pollutant load reduction target at this time. Watershed planning is an iterative process; the pollutant load reduction target represents a long term goal which may be beyond your planning group's ability at this stage.

At the same time, the various measures in your plan should address your watershed problems as comprehensively as possible. As we move forward, keep in mind that no single management measure (or category of management measure, for that matter) can completely address all watershed resource problems. Consequently, try not to place undue focus on one type of management measure at the price of ignoring others. Instead, remember that your goal when identifying these measures is to comprehensively address your watershed problems.

Selecting Your Management Measures

To identify appropriate management measures, review your list of objectives as well as your lists of causes and sources of impairment that you created as part of your watershed assessment. Start with your critical areas and identify the class or classes of management measures that are most appropriate to the conditions present in those areas. Recall that critical areas represent the sections of your watershed most in need of attention. By beginning with these areas, you should be able to identify management measures that will provide many benefits to your watershed. Once you have identified potential management measures for critical areas, check to see if any other causes and sources of impairment remain to be addressed. If so, begin to develop a list of potential management measures that could be used address these remaining problems.

When you identify appropriate management measures for your watershed, keep the notion of diminishing returns in mind. You will likely find many management measures which could potentially improve your watershed, but at the same time would not be a feasible recommendation. The expenditure of resources—monetary, public support, etc.—necessary to implement certain measures may not be justifiable, especially if you have identified other management measures that can also contribute toward your plan goals at a more reasonable cost. For groups planning to apply for CWA Section 319 funds, remember that your plan does not have to be designed to completely address your pollutant load reduction targets at this time. Instead, the goal for you—as it is with all groups—is to identify appropriate management measures that will build toward your ultimate goals.

You can use the brief descriptions of management measures provided above to narrow your focus to certain classes, but you should use the additional references provided—along with the information collected in your watershed inventory and assessment—in order to refine your recommendations and tailor them to your watershed. Be sure to take advantage of the expertise and local knowledge of your technical committee in this process.

For structural BMPs, you must identify potential implementation sites for your measures. Indeed, the selection of an appropriate BMP can be contingent on the characteristics of your site. In general, you can use your lists of causes and sources along with your assessment of critical and priority protection areas to identify potential sites. Other considerations include:

- drainage area
- land use
- average rainfall frequency, duration and intensity
- runoff volumes and flow rates
- soil type
- site slopes
- geology/topography
- availability of land
- future development/land use in watershed
- depth to groundwater table
- availability of supplemental water to support vegetative BMPs
- susceptibility to freezing
- safety and community acceptance
- maintenance accessibility
- periodic and long-term maintenance/rehabilitation needs

The level of development of a potential site can be a very important consideration when selecting among structural BMP options. When retrofitting BMPs on existing sites or adding new systems to such sites, land may be limited and acquisition expensive. In such situations, you may need to focus on BMPs that require relatively little space. In sites of new development, however, land availability may not be a key concern. In these cases, other factors like the relative cost or effectiveness of various BMPs may be the driving force behind your recommendation.

When evaluating non-structural BMPs and the other management measures identified previously, you may need to consider the cost and effectiveness as well as stakeholder and public support for the various options you identify. Unlike structural BMPs, specific sites do not need to be identified for most non-structural management measures. For some, you may apply them to the entire watershed (e.g., public education) while others may be targeted at certain subsections of the watershed, like critical areas (e.g., easement requirements).

Determining Management Measure Effectiveness

When selecting management measures, planning and technical committees should consider the ability of various measures to address the impairment of their watershed. That is, the effectiveness of each management measure should be identified.

Measuring the relative effectiveness of potential management measures can help your project committees determine which measures to recommend as part of the watershed plan. Estimates of relative effectiveness can be obtained from the management measure and BMP manuals identified in the previous sections above. You can also contact local organizations and governmental agencies with experience implementing BMPs and other measures in your area in order to obtain information of relative effectiveness. The experts on your technical committee may also prove to be a valuable resource.

You may also want to develop estimates for the expected pollutant loading reduction that each management measure under consideration by your committees can be expected to provide. Quantification of pollutant loading reductions is required for projects seeking Clean Water Act Section 319 funds. Remember, while your recommended management measures do not necessarily have to be designed to meet the load reduction target in full, you should strive to identify as comprehensive a package of management measures as possible. Additionally, this step can be a useful measure if you attempt to identify the most cost-effective management measures (i.e., which measures give you the greatest reduction per dollar spent).

Northbrook Central Business District River Corridor Restoration

Chicago River, Cook County

In this river corridor restoration project—partially funded by Clean Water Act Section 319 dollars—several structural BMPs were used to address waterbody impairments in a highly urbanized section of the North Chicago River. The project addressed pollution, floodplain and stormwater management, ecosystem restoration and water quality. Specific project elements included erosion control and river restoration, installation of water pollution control filters, pool-riffle construction and streambank stabilization measure.

Village of Schaumburg

Cook County

In order to protect remaining wetlands within its boundaries, the Village of Schaumburg enacted a Wetlands, Streams, and Aquatic Resources Protection Overlay District as part of its zoning ordinance. This ordinance requires a special use permit for construction within the district. The ordinance also establishes development standards for such construction and requires a detailed set of reports dealing with the environmental characteristics of the site.

Visit http://www.villageofschaumburg.com for more information.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a description of the nonpoint-source pollution management measures that will need to be implemented to achieve your pollutant load reduction targets developed in Chapter 4. While your management measure recommendations do not need to be designed to completely achieve these reduction targets, you should show that substantial work has been done to develop a comprehensive system of management measures that will work towards your targets and other plan goals. Remember that watershed planning is an iterative process. Your reduction targets represent long-term goals that will be addressed over time by both current and subsequent watershed planning efforts.

CMAP Staff

Stormdrain stenciling; an educational BMP.

The pollutant load reductions resulting from management measures can be assessed in various ways. Non-structural BMPs, public education, policy and project coordination all mainly deal with pollution prevention. Their effectiveness is best measured in terms of the degree to which people, businesses and other organizations in your community change their behavior following implementation or by the degree of reduction in the number and severity of various pollutant sources. It is often very difficult to estimate the benefits of these types of measures in terms of pollutant load reductions. Instead, the effectiveness of these measures is often analyzed through public surveys designed to assess behavioral changes (for more on measuring success, see Chapter 7).

Structural BMPs (and some case-specific non-structural management measures), on the other hand, can be assessed in terms of reduced pollutant loads discharged into the watershed as well as by the degree of decrease in stormwater runoff volume and flow. Various studies and BMP manuals provide estimates of effectiveness of many structural measures. Computation may be needed for BMPs that address runoff volume and flow as well. Additionally, the IEPA has spreadsheets available that can help you estimate potential pollutant loading reductions following implementation of various BMPs. These are available from the IEPA Bureau of Water Nonpoint Source Unit. You can use these estimates in order to indicate a range of potential pollutant load reductions; keep in mind, however, that the actual load reductions that you can achieve are dependant upon your watershed characteristics and the design of your BMPs.

Estimating Costs

To estimate costs of BMPs and other management measures, your planning and technical committees will likely have to contact or meet with other agencies in your area with experience in implementing these or similar measures. For management measures for which you have identified sites or target areas, try to tailor your cost estimates to these specific areas. Make the cost estimates as precise as possible. Try to express your estimate as in terms of a per-unit cost and include the number of units recommended by the plan. Ask contractors or consultants for estimates on structural and non-structural BMPs; call municipal governments to obtain information on staffing costs (their time will be needed to change any policies or ordinances); contact public relations agencies to put together an estimate on an outreach campaign, if you plan on having yours professionally managed.

Some BMP manuals provide cost estimates for many of the management measures discussed in this chapter. These estimates can be a useful reference, but you should still contact local governmental agencies and other organizations with experience implementing various management measures in your area in order to refine these estimates.

Be sure to include all the costs needed to implement measures. For structural and many non-structural BMPs, these costs may include engineering designs, materials, labor, maintenance and the purchase of land, where needed. For other management measures—like public education, government policy initiatives and agency project coordination—the primary cost will likely be municipal or other governmental unit staff time (along with volunteer time from project members).

When selecting management measures, you may want to take the relative cost of the various options available into consideration. While your primary focus should be on selecting the management measures that will most effectively address your watershed impairments, taking costs into consideration can help you identify a comprehensive system of measures that will provide the highest return on your project investment.

Moreover, as discussed above, try to identify management measures that fall into the category of "diminishing returns"—that is, measures for which the costs (in terms of money, public support, political capital, etc) prevent a recommendation for such measures from being viable. When more "cost-effective" alternatives to such management measures exist, these alternatives should be favored in your recommendations. When no alternatives exist, you may decide to include the measure in your recommendations, but your planning committee should also note the poor chance of implementation for that measure. In the next chapter, when your planning committee develops its Action Plan to guide plan implementation, it will likely give these potentially impractical or unviable measures a low priority.

Putting Together your Comprehensive Program

Once you have identified your recommended set of management measures to address your planning objectives, you can put them together into your project's Comprehensive Program. The Program should contain all of the management measures that your planning and technical committees would ideally implement—above the level of unfeasible management measures discussed in "Selecting Your Management Measures" and "Estimating Costs"—in order to address all watershed impairments and problems, regardless of cost and your project's resources.

The idea behind outlining the Program is that the planning and technical committees will identify everything that can feasibly be done to address your watershed problems. This Program can then help guide not only this current planning phase, but also act as a guide for subsequent watershed projects in your area. At this stage, you should also prioritize your management measures for each objective and goal. Again, this should be a relatively easy task, since the corresponding objectives have already been prioritized. For objectives that require two or more management measures, the planning committee should develop criteria to prioritize these as well; this can be based on effectiveness, cost, public support, etc.

In the following chapter, we will develop your comprehensive management measures program into the Action Plan that will guide the implementation of your management measures recommendations.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a public education component as well as early and continued encouragement of public involvement in the design and implementation of the watershed-based plan. The latter portion of this requirement–public participation–should be intrinsic to your project if you have followed the planning process outline in this guidance (see Chapter 1). The public education component should address whatever combination of issues are identified in the Public Education and Outreach section above and are applicable to your watershed project (e.g., general watershed environmental topics, watershed problems and possible solutions, "how-to" for various management measures, etc.).

Goal	Objectives	Management Measures	Site or Target Area	Cost Estimate
Restore aquatic habitat	A. Reduce nutrient loadings by:			
	1. Reducing fertilizer runoff from residential and commercial lawns	i. Install vegetated swales in all new developments	Development X between 2nd and 3rd Streets	$21 per linear foot for 10,000 feet: total cost $210,000[1]
		ii. Produce a public education flyer on appropriate fertilizer use practices	Entire Watershed	$700 per 1000 flyers: total cost $7,000[2]
	2. Identify and replace failing septic systems	i. Inspect septic systems in critical areas	Development Y along the Mack Creek	$200 per inspection for 100 sites: total cost $20,000[3]

[1]Source: Flint Creek Watershed Plan: Appendix D Model BMP Selection Methodology
[2]Source: CWP Manual 8
[3]Source: Ibid

it's a fact...

About three-fourths of Illinois inland lakes are man-made, including dammed stream and side-channel impoundments, strip mine lakes, borrow pits, and other excavated lakes.

Illinois Integrated Water Quality Report and Section 303(d) List–2006

Developing an Action Plan

Chapter 6

- Identify responsible parties to undertake recommended actions
- Identify existing and potential funding sources for plan implementation (Section 319, component d)
- Produce an implementation schedule recommending a prioritized implementation sequence for the various recommended actions (Section 319, component f)

Chapter 5 developed an approach for the selection of your watershed plan's management measures. Now, you should have a clear idea of the comprehensive management system that will be recommended in your plan. You should also have identified potential sites and target areas for each management measure as well as their expected costs. In this chapter, that information will be developed into an action plan that will guide the implementation of your management measure recommendations.

Action plans are, by their nature, a challenge to produce. Your planning and technical committees will likely have incomplete information regarding funding, technical assistance and implementation responsibility—together, these "informational blindspots" will make it difficult, if not impossible, to assemble an action plan with every task assigned, funded and dated in advance.

At the same time, your action plan should seek to address the questions of who, what and when to the fullest extent possible. This chapter presents an approach to action plans that focuses on three main ideas: (1) a schedule or prioritized sequence for your recommendations; (2) the identification of potential implementers and the assignment of responsibility to these implementers; and (3) the identification of possible funding sources for plan implementation. In the end, you will have produced an action plan that addresses the major requirements for successful implementation of a watershed project.

Developing your Action Plan Sequence

In Chapter 5, we developed proposed management measures and prioritized in terms of objectives and goals. Your objectives and goals, in turn, have also been prioritized. At this time, your planning committee will take all of these prioritized recommendations and develop an implementation schedule for your watershed project. Given the incomplete information that most watershed planning projects possess, this schedule is usually expressed in terms of a sequence of implementation, with target timeframes and other goals also described.

Watershed planning is an ongoing exercise. You may make major strides in your first watershed plan, but future efforts will be needed to adjust to new information and conditions that may only become evident after plan implementation begins. Your action plan sequence will act as a guide for this process, directing the priority given to the various projects which your planning and technical committees recommend. The action plan sequence will typically identify short-, medium- and long-term aims. You may also want to develop target dates or timeframes for implementation of management measures in each priority level. Planning for timeframes 5 years or more can be especially difficult. Acknowledge which problems will take longer than 5 years to address and briefly discuss how they will be handled in your action plan.

Developing prioritized goals, objectives and management measures into a concrete action sequence can involve some difficult decisions. How will your planning committee compare different management measures across goals? The goals have already been prioritized; will all the management measures of the highest ranked goal take precedent in your action sequence? Or will your planning committee decide to pick various high priority objectives and measures from each goal, selecting these for early action in the sequence. The planning and technical committees, along with other project stakeholders and implementers (for more, see below), should work together to develop your final prioritized action plan sequence. When developing this action plan sequence, consider similar criteria as those employed in Chapter 5 to develop your management measure recommendations: effectiveness and benefits, cost, public/stakeholder support, etc. Also try to consider how each part of the plan fits together, taking special care to identify management measures that address several objectives across more than one goal.

CMAP Staff

Maps are important and useful tools in watershed planning.

it's a fact...

Almost 16 billion gallons of water are used in Illinois each day and over 2 billion gallons withdrawn daily are not returned to their sources. Due to projected growth of the population and economy, Illinois could require 20 to 50 percent or 3.2 to 8 billion more gallons per day in the near future.

CMAP pamphlet: State and Regional Water-Supply Planning in Illinois, 2006

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a schedule for implementation of the management measures identified in the plan.

For example, suppose that your watershed plan has 2 goals, each with 3 objectives. Each objective, in turn, has 2 associated management measures.

Goals	Objectives	Management Measures
#1	A	BMP 1
		BMP 2
	B	BMP 3
		BMP 1
	C	BMP 4
		BMP 5
#2	A	BMP 6
		BMP 1
	B	BMP 7
		BMP 8
	C	BMP 9
		BMP 10

When producing an action plan sequence, a planning committee faced with these recommendations may decide to address goal #1 in its entirety first and then goal #2. Or, the planning committee may decide to address the primary objective of each goal first, and then the secondary objective, etc. Or, it may take notice that BMP 1 addresses several objectives, and prioritize this management measure.

Suppose our fictitious committee selects the second option and establishes an action plan sequence that addresses the primary objective of each goal first, the secondary objective next, and so on. The resultant action plan sequence may look something like the following table.

Action	Priority
BMP 1	High Target Timeframe: 1-2 years
BMP 2	
BMP 6	
BMP 3	Medium Target Timeframe: 3-5 years
BMP 7	
BMP 8	
BMP 4	Low Target Timeframe: > 5 years
BMP 5	
BMP 9	
BMP 10	

Remember, regardless of the criteria selected to develop an action plan sequence, the planning committee should involve a diverse group of stakeholders and implementers to ensure widespread support.

Assigning Responsibility

An action plan should also identify the parties responsible for implementation of the plan's various recommendations. Most of the common implementers will be represented in your stakeholder group from the very beginning of your planning process. Some typical implementers include municipal, county and other local level units of government, major riparian landowners, state and federal agencies, businesses and industry, homeowners associations, etc. If you identify any other potential implementers during the planning process, you should encourage these individuals and/or groups to participate.

In a typical successful planning process, there will be considerable interaction and feedback during this part of the process between potential implementers and the planning committee. Ideally, this approach will result in the mutual education of the participants and ultimately in an action plan that is both implementable (i.e., supported) and effective. The planning committee should attempt to foster an atmosphere in which implementers can discuss their concerns regarding any proposed management measures, while at the same time educating implementers on the why and how of watershed resource management.

Finding Funding

As you identify implementers, you should also try to discern the level of financial and technical resources available to those implementers and your project. Collect information from potential implementers and other project stakeholders regarding available funds as well as the technical expertise necessary to implement recommended management measures. Compare this information to the financial and technical requirements of the management measures recommended by your planning and technical committees in order to develop an estimate of the amount of assistance needed for successful plan implementation.

In most cases, financial and technical assistance will be required to implement a recommended BMP. Indeed, one of the biggest frustrations for a watershed group can be funding. Locating and securing funding from outside sources can be tedious and time consuming. Typically, funding for a watershed group will come from a variety of sources and will vary in both the amount awarded and length of contract (i.e., project period).

Two major sources of (non-local) funding and technical assistance in Illinois are the Clean Water Act Section 319 Program and the Illinois Department of Natural Resources' Conservation 2000 Ecosystems Program (C2000).

The Section 319 program includes a variety of components, such as: technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Section 319 funds are provided by the federal government but awarded to Illinois projects by the IEPA and can be used for project implementation and/or planning. More information on the Section 319 program is available at: http://www.epa.gov/owow/nps/319hfunds.html and http://www.epa.state.il.us/water/financial-assistance.

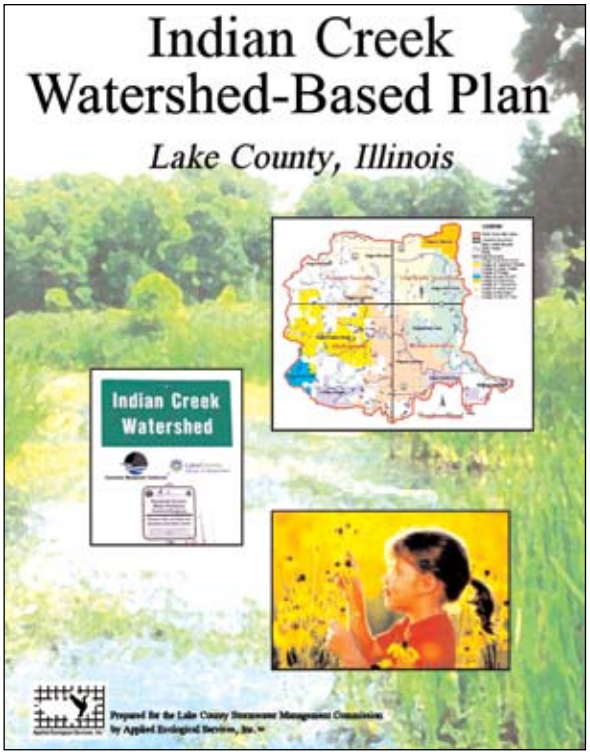
The C2000 Program brings together the interests and participation of local communities along watersheds—landowners, businesses, scientists, environmental organizations, recreational enthusiasts, and policy makers—in partnerships to enhance and protect watersheds through ecosystem-based management. More information on the C2000 program is available at http://www.dnr.state.il.us/orep/c2000.

Online, two sites provide a good overview of other funding options available to watershed resource planning groups. The USEPA provides a large set of funding information resources at http://www.epa.gov/owow/nps/funding.html. The Illinois Watershed Management Clearinghouse also presents a body of information on possible funding sources, including some additional Illinois-specific sources. Visit the website at http://www.watershed.uiuc.edu/index.cfm.

North Branch of the Chicago River

Lake County

The North Branch of the Chicago River Watershed Assessment and Management Plan, developed for the Lake County Stormwater Commission and the Lake County Board, sets out a "Programmatic Action Plan" which details the implementation of the documents recommendations. Each management measure is assigned to a lead agency or implementer as well as a supporting agency or implementer, where applicable. These responsible parties included municipalities, residents, corporate landowners, federal and state agencies, as well as less obvious groups, like a botanical garden and the county health board. Remember that any major landowner can potentially act as an implementer.



Lake County Stormwater Management Commission

Watershed Plan Cover

At this stage in the planning process, you may not have a detailed funding strategy for project implementation. When completing your action plan, list the funding source of management measures for which you have secured financial or technical assistance. If a measure will be funded locally, note this too. For management measures that have yet to secure funding (either local or state/federal grants), identify potential sources and programs to which either project staff or implementers will apply for funds and technical assistance.

Putting it all together

As noted at the beginning of the chapter, it will likely be a challenge for your planning committee to develop an action plan that strictly describes the complete implementation process of your watershed-based plan. Nevertheless, your planning committee should strive to produce the most complete action plan possible. The approach outlined in this chapter should help your planning committee develop a workable action plan. Perhaps most importantly, by working with local stakeholders, local government and state and federal agencies, your planning committee should identify to the fullest extent possible the sources of financial and technical assistance as well as the responsible party or parties available for implementation of each management measure.

Your planning committee may want to organize its action plan in a table similar to the example below. Your action plan should at least identify the management measures recommended; the sequence or schedule of implementation; the site or target area and cost of each; potential or secured sources of financial and/or technical assistance for each; and the party responsible for the implementation of each measure. Again, while you should strive for the most complete action plan possible, remember that watershed planning is an iterative process and that you may be able to address certain issues (like funding sources) more completely as time progresses.

In the next chapter, we will develop an approach to track the implementation and monitor the effectiveness of your watershed action plan.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include an estimate of the amounts of technical and financial assistance needed for plan implementation as well as identification of the sources of assistance that will be relied upon for implementation.

Management Measures	Site or Target Area	Estimated Cost	Financial/ Technical Assistance	Responsible Party	Priority
Public education on fertilizer use	Entire watershed	$700 per 1,000 flyers; 5,000 flyers total	Secured: 319 grant 60% Secured: Local match from watershed project volunteers 40%	Planning Committee	High
Identify and inspect failing septic systems	Country Club Hills subdivision	$200 per inspection for 150 sites		Country Club Hills Homeowners Association	Medium
Vegetated swale	Main St. between 1st and 4th Avenues	$25 per foot for 5,000 ft	Potential: City of Steubenville 40% Potential: 319 Grant 60%	Steubenville Department of Public Works	Low

Monitoring your Success

Chapter 7

- Develop interim, measurable milestones to track implementation of your watershed action plan
- Develop a monitoring component designed to assess the effectiveness of implemented management measures and the action plan
- Develop criteria designed to assess the success of implemented management measures to achieve pollutant load reduction targets
- Establish a planning mechanism to review the effectiveness of the watershed plan, and if necessary, reevaluate or modify the plan

Evaluation is an important part of watershed planning. It can tell you whether or not your efforts are successful and provide a feedback loop for improving project implementation. A well-planned evaluation process will provide measures of the effectiveness of the watershed action plan. If you are able to show results, you will gain more support from the community, and increase the likelihood of project sustainability.

Monitoring

Any comprehensive watershed plan should have a monitoring component of some kind in order to measure the success of the plan's recommendations and action plan. This is especially important because, once again, watershed planning is an iterative, dynamic process. If your monitoring component uncovers weaknesses in the implementation or effectiveness of your action plan, your planning and technical committees should seek to address these deficiencies in follow up planning efforts. For more on the evaluation of plan success, see the section "Evaluating Success," page 50.

There are several monitoring methods to draw upon, each with its pros and cons. Some methods are more complex or costly to use, while others require special expertise to be effectively implemented. Monitoring methods include, see table below:

Your plan should describe the monitoring strategies that you intend to employ. For water quality sampling, you should describe the sampling sites, method and frequency of collection, method of analysis, and of course the constituent(s) being monitored.

For indicators other than water quality, describe the measuring methods you plan to utilize and what you hope to measure/understand.

CMAP Staff

Multi-parameter meter measures dissolved oxygen, temperature, pH and conductivity.

Quality Assurance Project Plans (QAPP)

If you intend to fund any water quality monitoring through the Section 319 program, your planning committee will need to complete a Quality Assurance Project Plan (QAPP). A QAPP describes your intended monitoring component in detail and explains the reasoning behind it. By developing and then following the carefully designed monitoring procedures of your QAPP, the IEPA can be assured that the data you collect will be credible. Even if your planning committee does not intend to apply for Section 319 funds to implement its monitoring component, the QAPP process is a valuable aid in the development of a sound water quality monitoring program.

Method	Description
Tracking action plan effectiveness	The effectiveness of your plan can be measured by monitoring progress toward your watershed planning goals. This could take the form of water quality, environmental indicators and/or pollutant loading monitoring as well as other less rigorous forms of monitoring that will reveal progress toward your goals. For Section 319 funded projects, USEPA does not require that you to track the effectiveness of each individual BMP or management measure; instead you should measure the effectiveness of your overall action plan through watershed-scale monitoring.
Tracking action plan implementation	One important measure of success is the level of implementation of your action plan. Tracking implementation is therefore an important part of most monitoring components; for example, if you can show that X number of management measures have been implemented, you can qualitatively assess the success of your action plan and show progress toward your planning goals and improved water quality.
Social and behavioral indicators	Surveys and/or focus groups can be used to measure the changes in watershed residents and businesses behavior toward and understanding of their watershed. These strategies can also be used to determine whether local residents assess the action plan to be successful or not. You could develop surveys both before and after (or during) implementation of the action plan in order to ascertain baseline data against which behavioral and attitudinal changes can be assessed.

For detailed guidance on the QAPP process, visit the EPA website at: http://www.epa.gov/quality/qapps.html or contact the IEPA, Bureau of Water, http://www.epa.state.il.us/water.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a monitoring component to evaluate the effectiveness of your implementation efforts over time, measured against evaluation criteria established by your watershed planning group. Any combination of the monitoring strategies identified above can satisfy this requirement, although you should take care to tailor your monitoring strategy to the needs and goals of your watershed. For more on evaluation criteria, see the section "Evaluating Success."

Evaluating Success

Monitoring can turn into an academic exercise if it is not connected to (pre-established) criteria designed to evaluate the success of the implementation of your action plan. Ultimately, your planning and technical committees will analyze monitoring data in terms of these evaluation criteria in order to determine the effectiveness of your action plan, and if necessary, modify the action plan. In the next section, planning mechanisms for modification of the action plan will be discussed. Here, we will identify the thought process underlying evaluation criteria as well as some typical examples of criteria.

Your evaluation criteria should be designed to take the data assembled from your monitoring component and analyze the success of your plan in terms of your goals and/or the success of your plan to improve water quality. Thus, evaluation criteria should be both measurable and quantifiable. Stakeholder involvement is key in the development of evaluation criteria. Just as in the case of goals and recommendations, evaluation criteria will need the support of a diverse group of stakeholders in order to have validity. This validity is especially important here, since the evaluation criteria form the basis of the mechanism by which your planning committee will decide if it is necessary to modify the plan in the future (see "Modifying your Action Plan", page 52).

Evaluation criteria can include both quantitative measures of plan implementation progress and more qualitative measures of overall plan success. Regardless of the type employed, your criteria should establish an endpoint or target against which the actual results of action plan implementation can be compared. For instance, you may (and for Section 319 funded planning projects, you must) evaluate the success of your action plan in terms of the attainment of the pollutant load reduction targets developed in chapter 4. Your criteria may define success for this planning stage as the attainment of X% of this target reduction, with the appropriate percentage dependant upon your watershed conditions and goals.

For goals for which load reduction targets were not appropriate, other evaluation criteria should be developed. For example, threshold levels of success can be developed in terms of project implementation. You project may recommend X number of filter strips installed. You may then design criteria to assess the success of your implementation in terms of the actual number of filter strips installed (e.g., acres or linear feet). Similarly, you could measure success in terms of expected versus actual physical, chemical or biological water quality conditions achieved after plan implementation. This is where the concept of adaptive management comes into play.

In simplest terms, adaptive management features a flexible approach, encourages public input, and monitors the outcomes of management actions for purposes of adjusting plans and then trying new and/or revised approaches. Adaptive management, therefore, can include threshold criteria that serve to signal when it's time to make adjustments.

OMAP Staff

Lakes and rivers can be both educational and recreational.

The following table outlines some potential evaluation criteria:

Category	Sub-Category	Indicator Name
Environmental Indicators	Water Quality (i.e., water chemistry)	Dissolved oxygen
		Toxicity testing (e.g., metals, pesticides, etc.)
		Pollutant Loadings (e.g., sediment)
		Exceedance frequencies of water quality standards
		Light and temperature
		Human health criteria
	Physical and Hydrological	Stream widening/downcutting
		Habitat structure
		Flow regime
		Energy source
		Sedimentation
	Biological	Fish assemblage
		Macroinvertebrate assemblage
		Single species indicator
		Composite indicator
		Other biological indicators
Social Indicators		Public attitude surveys
		Industrial/commercial pollution prevention
		Public involvement
		Local government and community cooperation
Programmatic Indicators		Number of management measures installed, inspected and maintained
		Number of sources and total amount of funding secured
		Completion of baseline monitoring component, if applicable
		Local government upgrades of ordinances

Interim Milestones

Interim, measurable milestones will allow you to quantify the progress of plan implementation and the performance of your management measures. These interim milestones should be developed together with the evaluation criteria discussed above. The main idea behind these interim milestones is that you will measure ongoing improvement, rather than wait five or ten years to assess whether any improvement has occurred. Moreover, evaluating the rate of change can assist your efforts to modify the plan, if necessary ("Modifying your Action Plan", page 52).

There are several different types of criteria that can be used as interim milestones. Some major examples include:

1) Tracking total numbers of management measures implemented. Milestones can track management measure implementation by a certain date or timeframe, e.g., the number of wet detention basins installed or the number of golf courses reducing fertilizer use. A milestone could track implementation in terms of the percentage or number of recommended management measures implemented by a certain date or timeframe.

2) Tracking social response and public involvement to action plan. Milestones can track the "buy-in" of local residents, businesses, industry and government to your action plan. For example, one recommendation in your plan may have aimed at a reduction in home car washing; to track implementation, you could survey local car washes to see if business has increased.

Lake Springfield Watershed

Sangamon County

In a Section 319 funded project in the Lake Springfield Watershed, the IEPA approved evaluation criteria that assessed the project in terms of plan implementation as well as criteria based on water quality conditions. For one recommended management measure—the installation of 200 linear miles of filter strips—the Lake Springfield plan included evaluation criteria that assessed this recommendation in terms of implementation: installation of 135 miles was defined as "threshold success"; 200 miles were defined as "meets all expectations"; and 235 miles were defined as "surpasses expectations." For another recommendation—reduction of atrazine use in agriculture—the plan included evaluation criteria that focused on reductions in the concentration of atrazine in the waterbody.

Lake County Forest Preserve District, Jim Anderson, (Before)

CMAP Staff (After)

Before and After: Long Lake shoreline images (Lake County, Illinois). Section 319 funded restoration project to reduce shoreline erosion and sedimentation.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a description of interim, measurable milestones for determining whether nonpoint-source pollution management measures are being implemented. The strategies identified above, as well as similar milestones tailored to your specific watershed, satisfy this requirement.

Clean Water Act Section 319 Incremental Funding: Required Component

In order to be eligible for Section 319 funding, a watershed plan must include a set of criteria that can be used to determine whether pollutant-loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and guidelines. The approach outlined in "Evaluating Success" satisfies this requirement. Moreover, a watershed plan must include criteria for determining whether the watershed plan needs to be revised. The approach outlined in "Modifying your Action Plan" satisfies this requirement.

3) Tracking number of funding sources secured. Milestones can track your success in receiving funding for the implementation of your action plan. This milestone can also measure the number of partnerships developed with private organizations and local units of government that provide financial and/or technical assistance for plan implementation.

Modifying your Action Plan

Your watershed plan should also lay out a mechanism by which your planning and technical committees can address any deficiencies in the action plan which are uncovered by your monitoring component and evaluation criteria. At a minimum, these committees should establish a meeting schedule that keeps stakeholders involved and informed after the completion of the watershed plan.

The basic questions that must be addressed in your watershed plan regarding plan evaluation and modification are: (1) when will the plan be re-evaluated and possibly modified; (2) who will do it; (3) who will be responsible for overseeing the implementation of any modifications; and (4) what will happen if any new regulations are developed or when a Total Maximum Daily Load (TMDL) is developed for your watershed?

Most groups will schedule full planning committee meetings at quarterly or six month intervals to track implementation of the plan. Leading stakeholders and agencies, of course, will continue to meet and work toward plan implementation on a more regular basis. Larger end-of-year meetings may also be held to present monitoring data to stakeholders and the general public as well. Similarly, holding an annual meeting of the full planning committee can facilitate review and evaluation of monitoring data and thus the effectiveness of the implemented (portions of the) action plan.

When deficiencies in the action plan are uncovered by monitoring data—which in terms of water quality improvements may not become apparent for several years, while for other criteria, like plan implementation, deficiencies may become apparent more quickly—the planning and technical committees should seek to revise the plan. The underlying causes or reasons behind the newly exposed deficiencies must be understood. In order to revise the plan, the committees will essentially need to repeat the planning process outlined in this document, paying special attention to new data sources that can help guide goal-setting, watershed assessment and management measure recommendations.

If a TMDL is developed for your watershed, your watershed-based plan will need to be revised to incorporate and work towards the water quality goals established in the TMDL. You can check the 303(d) list—discussed in Chapter 2—to check the list of impaired waters in your watershed and if/when TMDLs are scheduled for those waters.

That's it!?

Once you have developed all the materials in this chapter and included them in your watershed plan document, we've come to the end of the initial phase in a watershed planning process. But, as should be apparent from much of the discussion in this chapter, your watershed planning efforts are far from over. Once your plan is complete, your planning committee will still have much to work towards, from securing funding for action plan implementation to monitoring success and perhaps even re-evaluating the plan itself. Remember that watershed planning is a dynamic process and that you will likely have to adapt your efforts to new conditions and funding realities as time progresses. However, if you follow the approach presented in this document, you can look forward to the ultimate payoff for your efforts—a healthy environment and natural resource base that is the foundation to a quality of life that we all expect and desire.

Jim Nachel, Chicago Wilderness

Painted Turtles, *Chrysemys picta*, can live 15 to 25 years and are the most widespread turtle in North America.

Glossary

Aquifer
an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted by means of a well. The study of water flow in aquifers and the characterization of aquifers is called hydrogeology.

Best management practice (BMP)
a resource management measure or method that has been determined to be the most effective, practical means of preventing or reducing nonpoint-source pollution.

Biological stream characterization (BSC)
a stream classification system that is also used in the determination of designated use attainment.

Critical area
refers to a particular place within the watershed where a cause or source of impairment is present at a disproportionately high level.

Designated use
refers to a recognized and beneficial use of a waterbody; Illinois waters are designated for various uses including, but not limited to, drinking water, aquatic life, and primary contact recreation (e.g., swimming).

Geographic information system (GIS)
allows for creating, storing, manipulating, and analyzing spatial data and associated attributes; includes a computer, application software, and a trained analyst.

Hydromodification
man-made change(s) to the shape, size, or flow characteristics of a river or stream; from the term: hydrologic modification.

Impairment
refers to a broad category of related adverse impacts that can prevent designated- or desired-use attainment.

Index of biotic integrity (IBI)
a multi-metric index that compares fish communities in a waterbody with those in an undisturbed area.

Land cover
characterizes the features and patterns of the earth's surface, such as water (e.g., lake, river), type of vegetation (e.g., forest, grassland), and human-appropriated land (e.g., urban areas).

National Pollution Discharge Elimination System
a federal permit program, authorized by the Clean Water Act, that controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Pollutant load
a quantity of pollutant delivered to a waterbody; more technically, the mass or weight of pollutant that passes a cross-section of a river during a particular period of time (e.g., tons/year).

Revised Universal Soil Loss Equation
an erosion prediction model; a tool for conservation planning.

Riparian corridor
a continuous area adjacent to and somewhat upland from a river or stream; this area is subject to lateral flow as a river floods/widens and recedes/shrinks back into it's low-flow channel. Riparian areas are composed of both aquatic and terrestrial species and are, therefore, biologically rich features of the landscape. From a water quality perspective, riparian areas also act as sinks for pollutants.

Special service area
an area designated by a municipality or county for special service(s) and taxable at a rate or amount of tax sufficient to produce revenues required to provide for such service(s).

Stakeholders
individuals, organizations, or agencies that have an interest in the well-being or outcome of the use of a natural resource.

Stormwater
water from a rainstorm that rather than infiltrating the ground, accumulates on land and impervious surfaces and picks up impurities (i.e., nonpoint source pollution) as it drains downhill to a receiving waterbody.

Topography
a geographic term; a description of the physical features of a place or region.

Total Maximum Daily Load (TMDL)
a water pollution budget for an impaired waterbody; sets the pollutant load reduction target(s) for a watershed and thus, the amount of pollution a waterbody can receive while still attaining water quality standards and/or designated uses.

Use-support levels
level of attainment for each applicable designated use; "full support" means that the waterbody attains the designated use. "Partial support" means that the waterbody attains the designated use at a reduced level; "Nonsupport" means that the waterbody does not attain the designated use to any degree. Waterbodies that are rated as partial or in nonsupport of their designated use(s) are deemed impaired.

Water quality
a term used to describe the chemical, biological, and physical characteristics of water; the measure of which determines the suitability of water for human consumption and to support life in general.

Water quality limited segment
any segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by sections 301(b) and 306 of the Clean Water Act.

Watershed
an area of land that receives rain and snow and drains to a common point such as a river, lake, or the ocean. Watersheds are variable in size with small ones typically nested within increasingly larger ones.

Watershed resource inventory (WRI)
a catalog and/or quantification of the various resources that are collectively present in a watershed.

Wetlands
a general term to describe an ecosystem that is neither completely terrestrial nor entirely aquatic. There is great diversity among wetland types, but they are distinguished by hydrology, characterized by hydric soils, and support hydrophytic vegetation.

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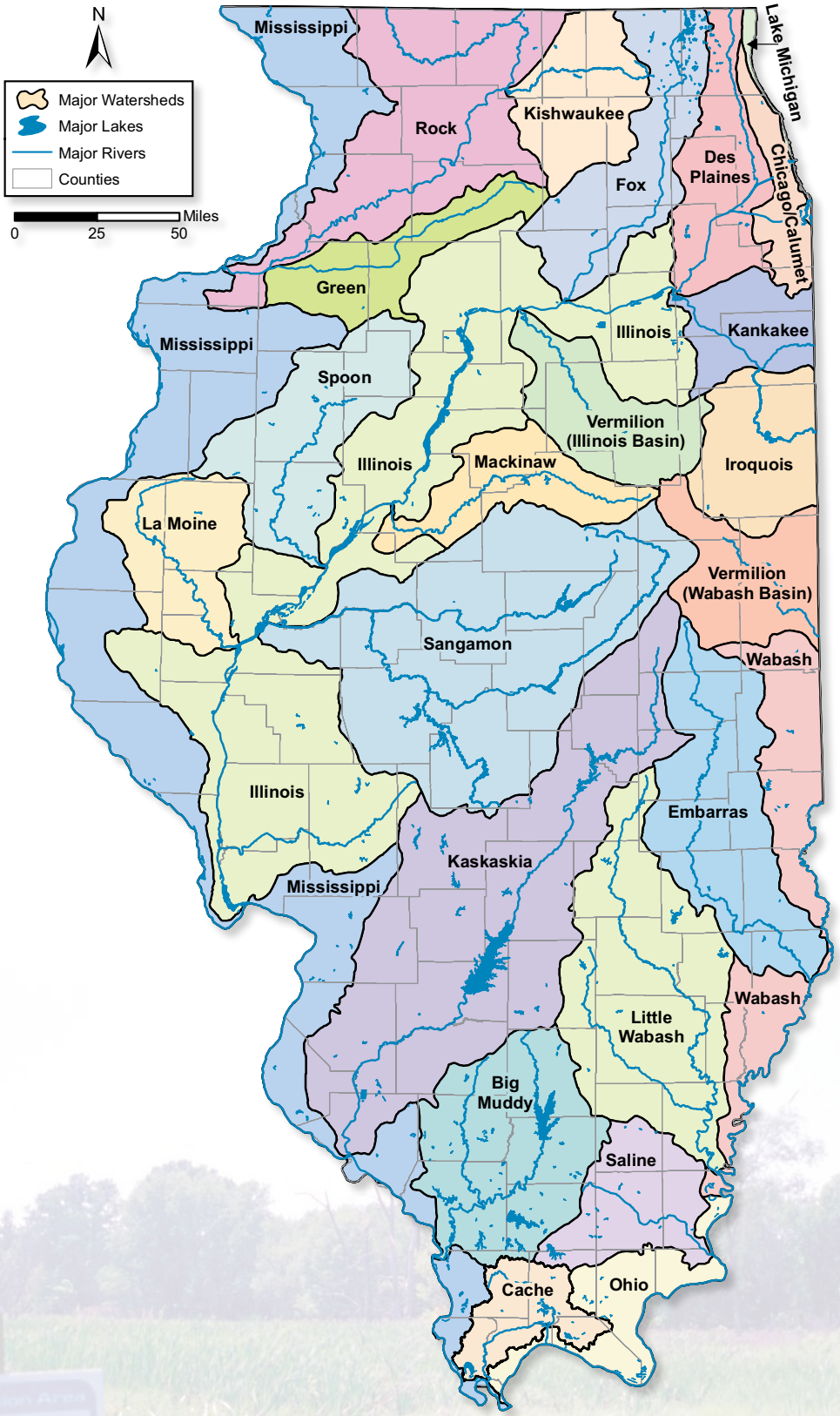
Major Watersheds of Illinois



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