Drinking Water

Surface Water

Protection of Wildlife

Economic Development

Groundwater

Water Resource Management in Northeast Ohio:

Opportunities for Environmental Protection and Sustainable Economic Growth

June 30, 2008

John Hoornbeek
Center for Public Administration and Public Policy
Kent State University

Holly Burnett-Hanley
Center for Urban and Regional Studies
Youngstown State University

Ohio Urban University Program (UUP)

Water Resources:

Northeast Ohio's Paramount Asset

"Of all of this region's assets, none comes close to matching the importance of its abundant supply of freshwater."

Cleveland Plain Dealer, December 2, 2007

"The river is one of our greatest assets."

Dave Ruller, City Manager, Kent, Ohio
Quoted in the March 29, 2008 *Akron Beacon Journal* speaking of the Cuyahoga River.

"It's imperative that we do everything we can do to protect this resource."

Ohio Governor Ted Strickland
Quoted in the March 30, 2008 *Cleveland Plain Dealer* speaking about the Great Lakes.

TABLE OF CONTENTS

This report is a product of the Center for Public Administration and Public Policy (CPAPP)at Kent State University (KSU). The authors and the Center and its staff are appreciative of the valuable support and assistance provided by the Center for Urban and Regional Studies at Youngstown State University, the Northeast Ohio Research Consortium (NEORC), the Ohio Urban University Program (UUP), and the numerous experts and stakeholders who have assisted with this project since its inception in the latter half of 2006.

This research was funded by the Ohio Urban University Program (UUP) through the Northeast Ohio Research Consortium (NEORC). The NEORC is a cooperative initiative of northeast Ohio's public universities: The University of Akron, Cleveland State University, Kent State University, and Youngstown State University. The UUP is a unique network linking the resources of Ohio's urban universities with the communities and students they serve, in a cooperative effort to improve the state's urban regions.

EXECUTIVE SUMMARY

Northeast Ohio possesses extraordinary water resources that provide a foundation for a prosperous future. However, current management practices do not optimize use of this abundant resource. Recent debates on water resources in northeast Ohio have focused on the Great Lakes Compact and its importance for the region's future, but there has been little discussion about ways in which the region can manage its water resources more effectively and in ways that foster sustainable and long-term economic growth.

In the summer of 2006, the Northeast Ohio Research Consortium (NEORC) — a research arm of the Ohio Urban University Program (UUP) supported by the Ohio Board of Regents — provided a planning grant to Kent State University's (KSU) Center for Public Administration and Public Policy to assess water resource management practices and needs in northeast Ohio. Working in cooperation with the Center for Urban and Regional Studies at Youngstown State University (YSU), the center's staff conducted thirty-two interviews with water resource experts and stakeholders between Fall of 2006 and Spring of 2008. The staff involved also conducted a literature review and participated in meetings and conferences to collect information about water resource management in northeast Ohio.

The views expressed by the experts and stakeholders interviewed suggest that northeast Ohio possesses water resource management strengths, as well as opportunities for water resource management improvements. These improvements can serve the region's long-term economic, public health, and environmental interests. Overall, the region's drinking water management practices were rated more highly than practices in water management sectors relating to groundwater management, economic development, and other areas. However, while the interviews yielded divergent ratings of current water resource management practices, there was little disagreement regarding key areas of need and opportunity.

The interviews identified six areas of need relating to water resource management in northeast Ohio. Three needs that were identified can yield substantive steps to improve regional management of water resources. These steps focused on improving protection and restoration of area waterways, increasing access to water resources, and expanding educational efforts to foster water resource management improvements. The interviews also identified three broad categories of need relating to ways in which the region could build the capabilities to foster more effective long-term decision-making relevant to the management of its water resources. These included increasing investments in the area's capability to manage its water resources, enabling more effective decision-making on a regional scale, and further strengthening planning and coordination among those involved in water resource management.

This study also suggests that research, technical assistance, and training are viable tools for fostering water resource management improvements. It offers a range of possible projects that could be undertaken to help the region take advantage of these opportunities, and suggests that they can serve as a starting point for a useful regional dialogue about how to use water more effectively. KSU, YSU, and the Ohio Urban University Program stand ready to assist the region in realizing this more prosperous future.

I. INTRODUCTION

Hardly a week goes by without the release of a major news story about water-related problems confronting some state, region, or locality in the United States. Water supply problems in the southwest are well known and are reaching near-crisis proportions. Droughts in the southeast have led to political battles and major reform efforts for water management in Georgia and surrounding states. On a nationwide scale, major aquifers and water supplies are stressed, as at least thirty-six states are expecting water shortages in the coming years (US GAO, 2003). At the same time, the US Environmental Protection Agency (USEPA) reports that approximately forty percent of American surface waters are impaired by a range of pollutants (US EPA 2000). And in the Great Lakes region, concerns are being raised about both declining water levels (Lydersen, 2008) and water quality (Brookings Institution, 2006; NRDC, 2007).

This report seeks to enable a regional dialogue about water resource management in northeast Ohio.

These facts provide context for the debate that is now surrounding the Great Lakes Compact. This Compact was created by state and provincial leaders in the US and Canada, and it seeks to ensure that water from the Great Lakes will not be plundered by other areas of the country seeking to solve their water problems with Great Lakes resources. Fresh water is one of northeast Ohio's greatest assets. It is also an asset that the region can build upon to create a more prosperous future.

This report seeks to enable a regional dialogue about water resource management in northeast Ohio. It focuses current discussions about the Great Lakes (Brookings Institution, 2006; Dolan, 2008) on the question of how to maintain and use northeast Ohio's water resources to provide a strong foundation for its future. While the report describes current practices, needs, and opportunities for water resource management improvements, it is best viewed as a planning study informed by experts and stakeholders rather than a comprehensive assessment.

The findings presented here suggest that northeast Ohio is not maximizing its water resource strengths. After providing background information on the project and the research methods used, we present our findings in Part IV. In the first subsection of Part IV, we describe current northeast Ohio water resource management practices in five water resource management sectors. In the second subsection, we identify areas of need and opportunities for water resource management improvements. While there is overlap between the discussions in these two subsections, we have sought to enable each subsection to be read as a self-contained whole. As a result, those reading the entire set of findings will find some overlap in factual content between the two subsections.

Regardless of the format used to present the findings, it is important to note that an aggressive effort to implement the action items specified in this report would help northeast Ohio reap economic and environmental benefits from its abundant and flowing water resources. The report also suggests ways in which the capabilities of area universities and others may be tapped to assist this effort.

II. BACKGROUND

In the summer of 2006, the Northeast Ohio Research Consortium (NEORC) – a research arm of the Ohio Urban University Program (UUP) supported by the Ohio Board of Regents – provided a planning grant to the Center for Public Administration and Public Policy (CPAPP) at Kent State University (KSU) to assess water resource management practices and needs in northeast Ohio. The KSU Center enlisted the support of Youngstown State University's (YSU) Center for Urban and Regional Studies to assist it in carrying out the project.

The purposes of the planning grant were to create a shared understanding of current water resource management practices in northeast Ohio, describe key needs, and identify opportunities for improving the region's management of this valuable resource. It was also envisioned that the report emanating from the project would yield an agenda for research, technical assistance, and education that might tap the strengths of area universities. Specific projects could then be conducted to implement this agenda.

Watershed management practices take a variety of forms, and they vary based on habitat conditions, pollutant sources, and pollutants in the areas where they are implemented.

There are two broad categories of water pollution:

*1. **Point** sources (where the pollution can be traced back to a particular point or pipe).*

*2. **Nonpoint** sources (where the pollution has diffuse sources and it is difficult to identify them).*

Northeast Ohio is an appropriate place to assess water resource management practices, as it holds a special place in the history of American water resource management. The burning of the Cuyahoga River in 1969 was a real and symbolic event that helped galvanize support for the environmental movement, and it provided ample evidence of the need to strengthen the Federal Clean Water Act (CWA) — an Act that was substantially re-written in 1972 to address widespread water pollution stemming from industrial processes and municipal sewage discharges. Since that time, the CWA has been amended on several occasions. To a greater extent than previously, it now seeks to focus attention on protecting entire watersheds as opposed to specific waterways that are contaminated by industrial discharges. This, in turn, focuses greater attention on nonpoint sources of water pollution that flow diffusely from agricultural operations and populated areas.

Watershed management practices take a variety of forms, and they vary based on habitat conditions, pollutant sources, and pollutants in the areas where they are implemented. Industries and communities throughout northeast Ohio have been issued "point source" permits to discharge pollutants to area waterways, and there are growing efforts to address nonpoint sources of pollution deposited in waterways as a result of runoff that occurs during and after storm events. Because "nonpoint" sources are becoming a larger part of the region's water pollution problems, management actions to address these sources are becoming more important as well. These management actions include the establishment and maintenance of natural areas to border streams and lakes, efforts to minimize non-permeable surfaces which prevent contaminated water from being treated by natural processes in the soil, and habitat alterations such as dam removals that may improve the ability of streams and rivers to assimilate pollutants.

Watershed boundaries and political jurisdictions do not coincide. This presents difficulties for water resource management efforts — both in northeast Ohio and throughout the country. Practices implemented by one jurisdiction to manage water resources tend to affect persons, communities, and ecosystems downstream, and the areas affected by these practices may themselves reside in more than one political jurisdiction. Failures to implement appropriate water management practices also have impacts on downstream jurisdictions.

Watershed boundaries and political jurisdictions do not coincide.

This presents difficulties for water resource management efforts – both in northeast Ohio and throughout the country.

There are two major drainage basins in northeast Ohio, and these drainage basins and the watersheds that comprise them overlap numerous political jurisdictions. The Lake Erie drainage basin covers a large part of the region and drains all or parts of Cuyahoga, Summit, Portage, Medina, Geauga, Lake, and Ashtabula Counties, along with counties west of Cuyahoga County. The Ohio River drainage basin receives waters from Mahoning, Trumbull, and Portage Counties, as well as a number of other counties to the south. These two drainage basins and the northeast Ohio counties that are addressed in this report are home to a number of watersheds. The Cuyahoga River, Euclid Creek, the Ashtabula River, the Chagrin River, the Grand River, the Conneaut River, and the Rocky River watersheds all flow toward Lake Erie. The Mahoning River watershed flows toward the Ohio River, and eventually to the Mississippi River. Figure 1. (see next page) shows these watersheds and the counties through which they flow.

In spite of significant progress in reducing water pollution from industrial sources in recent decades, major water quality challenges remain throughout northeast Ohio. Streams and water bodies throughout the region fail to meet water quality standards set by the state to protect public health and environmental quality. Indeed, virtually all of the region's major watersheds are impaired in some fashion (Ohio EPA, 2006). There is also continuing concern about declining water levels and a "dead-zone" in Lake Erie, as well as a growing prevalence of non-native and invasive species. At the same time, public reports suggest that water quality in northeast Ohio is expected to decline in coming years, reversing gains of the last several decades (NOACA, 2000).

While these challenges are substantial and need to be addressed, northeast Ohio's water resources also present major opportunities. Throughout the country, cities such as Los Angeles, Pittsburgh, Boston, and Philadelphia are seeking to revitalize their rivers in order to achieve economic goals. Communities in northeast Ohio are also taking steps to make better use of their water resources, but the region as a whole can do more to take full economic advantage of its abundant water resources. In contrast to many other areas of the United States, northeast Ohio is in the enviable position of having multiple opportunities to make better use of the waters available to it. This report seeks to illuminate some of these opportunities, so they may be acted on by water resource stakeholders and others with an interest in the region's future.

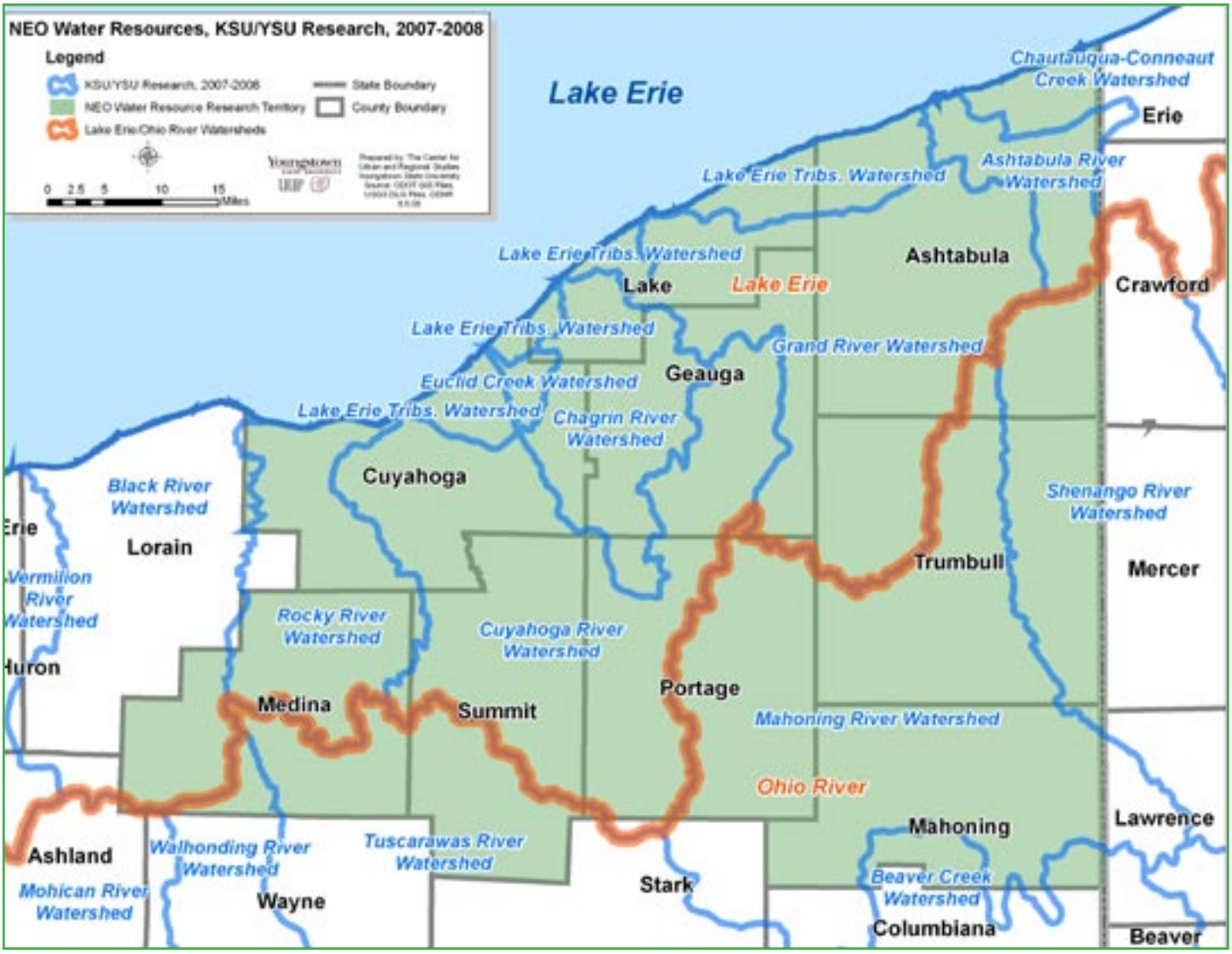


Table 1:

Two major drainage basins exist in northeast Ohio. These drainage basins and the watersheds that comprise them overlap numerous political jurisdictions. The Lake Erie drainage basin covers a large part of the region and drains all or parts of Cuyahoga, Summit, Portage, Medina, Geauga, Lake, and Ashtabula Counties, along with counties west of Cuyahoga County. The Ohio River drainage basin receives waters from Mahoning, Trumbull, and Portage Counties, as well as a number of other counties to the south.

III. RESEARCH METHODS

Water resource management is a broad field and it encompasses a wide range of activities undertaken by large numbers of jurisdictions and organizations. Because of the breadth of the activities to be assessed and the nature of the charge for this project, exploratory methods are used. They include: (1) interviews with experts and stakeholders; (2) attendance and information collection at water-related meetings and conferences, and; (3) a review of literature relevant to water quality management in northeast Ohio. The result is an assessment which seeks to illuminate water resource management practices, needs, and opportunities in northeast Ohio to inform subsequent research, technical assistance, and educational efforts.

Because of the breadth of activities to be assessed and the nature of the charge for this project, exploratory methods are used. They include:
1. Interviews with experts and stakeholders;
2. Attendance and information collection at water-related meetings and conferences;
3. A review of literature relevant to water quality management in northeast Ohio.

While the sample of experts and stakeholders interviewed for this report is not strictly representative in a statistical sense, it does reflect a broad cross-section of individuals with differing backgrounds relevant to water resource management in northeast Ohio. The pool of those interviewed included state officials from the Ohio EPA, the Ohio DNR, and the Ohio Department of Health, all of which have key water management related responsibilities. It also included a number of local officials: elected officials; planning staff; public works professionals; and others. Non-governmental experts in academia and the private and non-profit sectors were also interviewed, as they too have important water resource insights and responsibilities. National officials with responsibilities relevant to northeast Ohio were interviewed as well.

Thirty-two standardized interviews were conducted between the Fall of 2006 and Winter 2008. The research team used a key-informant approach to identify the specific experts and stakeholders to be interviewed. Through preliminary discussions with individuals familiar with water quality management in northeast Ohio, the project team identified a range of water resource experts and stakeholders to interview. While the interviews focused primarily on water resource management practices in nine counties — Cuyahoga, Geauga, Lake, Ashtabula, Mahoning, Trumbull, Portage, Summit, and Medina — there is no reason to believe that a more extensive effort involving larger numbers of counties in northeast Ohio would yield findings that are significantly different than those outlined in this report.

The standardized questionnaire used to guide the interviews consisted of five broad categories of questions. Biographical information was solicited to enable the interviewer to guide the interview in ways that were relevant to the person being interviewed. The questionnaire also asked those interviewed to rate current water resource management practices in five areas, and provide reasons for the ratings they gave. Open-ended questions were also included to solicit insights on key needs and opportunities for water resource management improvements. In addition, because of the wide range of jurisdictions and stakeholders involved in managing water resources in northeast Ohio, two questions relevant

to coordinating activities across jurisdictions and within the research community were also included. And, finally, those interviewed were also asked to identify other persons who might be good sources of insight and information, and the contact information provided could be used in follow-up efforts as appropriate. A copy of the questionnaire used to guide the interview process is provided in the Appendix.

Thirty-two standardized interviews were conducted with northeast Ohio water resource experts and stakeholders.

Members of the project team also attended meetings and conferences that focused on water resource management in northeast Ohio. These included Lake Erie Commission conferences, meetings of watershed groups, a state Department of Health public meeting on proposed rules governing onsite sewerage systems, water-related training programs in northeast Ohio, and water-related meetings of area planning agencies. Through this process, the project team was able to collect information by speaking with participants and attending presentations.

And finally, throughout the project period, the research team collected information, reports, and studies on various aspects of water resource management in northeast Ohio. These materials included reports, journals, website stories, and articles from area newspapers. These written materials were reviewed for relevance to key issues raised during the interview process and/or at meetings and conferences attended by members of the research team. A subset of the materials collected and reviewed is included in the reference list at the end of this report.

IV. PROJECT FINDINGS

The findings that follow characterize water resource management practices in northeast Ohio. They also identify areas of need and opportunity. These needs and opportunities, in turn, allow us to identify research, technical assistance, and education projects that can help the region improve its water resource management practices now and in the future.

IV. a. Assessing Current Practices

The five water management sectors assessed are:
(1) drinking water
(2) surface water
(3) wildlife protection, enhancement
(4) economic development
(5) groundwater

Regions and communities manage water in a variety of ways. This report draws upon previous research (Hoornbeek, 2004), and defines five sectors of water resource management around which to assess current practices. The five water management sectors assessed are: (1) drinking water; (2) surface water; (3) protection and enhancement of wildlife; (4) economic development; and (5) groundwater.

Those interviewed were asked to rate the quality of northeast Ohio's water resource management practices in each of these sectors using a one to five scale, with a five value being "great" and a one value being "poor". They were also asked to explain why they rated management practices in each sector as they did.

Table 1 presents a quantitative summary of the ratings provided by those interviewed for each of these five water resource management sectors. The narrative that follows overviews major reasons given for the ratings that were provided.

The overall average of the respondents' ratings of the region's water management practices was in the middle (three) of the five point scale provided. Those interviewed suggested that the region possesses valuable water resources, as well as institutions and human resource capabilities that would allow it to take advantage of these resources. They also suggested, however, that current practices are not optimal and that there are a range of needs and opportunities for improvement that the region can and should address. While some of these needs and opportunities are mentioned in the discussion of current practices that follows, they are addressed in greater detail in Section IV. b.

Table 1.
Ratings of Current Water Resource Management Practices, by Sector*

Water Sector	*N***	*Mean*	*Standard Deviation*	*Maximum Value*	*Minimum Value*
Drinking Water	28	3.6	.820	5	2
Surface Water	26	3.0	.760	4	2
Protection & Enhancement of Wildlife	23	3.0	.953	5	1
Economic Development	24	2.9	.897	5	1
Groundwater	25	2.6	.860	4	1
Overall	26	3.0	.572	4	2

* The actual wording of questions used to guide the interviews can be found in the Appendix.
** While 32 persons were interviewed using the standardized format shown in the Appendix, the number who felt comfortable providing ratings varied by sector.

While the numerical ratings showed variations in perspectives, the explanations provided for the ratings were largely consistent across respondents.

Those interviewed varied in their assessments of existing practices, but they were generally more positive about current drinking water management practices than they were about practices in the four other water resource management sectors that were assessed. Concerns about current practices were strongest in the areas of economic development and groundwater management, but significant concerns about water resource management practices in other sectors were also expressed. The responses regarding overall ratings tended to be clustered more closely around the mid-point in the scale (note the relatively small standard deviation in the "overall" row in Table 1) than were responses for the ratings for any particular sector. There appeared to be particularly wide variations in the ratings given by respondents to current efforts to protect and enhance wildlife, foster economic development, and manage groundwater, and this suggests divergences among perspectives in these areas. However, while the numerical ratings showed variations in perspectives, the explanations provided for the ratings were largely consistent across respondents. Taken together, these explanations present a picture of northeast Ohio's current water resource management practices. The discussion that follows reviews these explanations and current practices for each of the five water management sectors. It also outlines strengths and weaknesses identified for each sector.

IV. a. i. DRINKING WATER

Of all of the water management sectors, drinking water is the sector that tends to be most visible to the public, and is often viewed as being of greatest importance.

Collectively, those interviewed suggested that northeast Ohio manages drinking water more effectively than the other water sectors assessed.

Managing drinking water involves protecting drinking water sources, collecting and treating water, and distributing drinking water for use by residences, businesses, and communities. Of all of the water management sectors, it is the sector that tends to be most visible to the public, and it is often viewed as being of greatest importance. For example, a review of major United States (US) government accomplishments in the 20th century found the delivery of safe drinking water to be the 6th most important accomplishment of government during the last half of the twentieth century (Light, 2000). Citizens in northeast Ohio also value their drinking water, as a recent survey of citizens in Mahoning County found that safe drinking water ranked at the top of a list of environmental concerns (OEPA, 2006).

There are 5,455 public water systems in Ohio which must meet basic standards specified in the federal Safe Drinking Water Act, and 1,193 of them are in the nine northeast Ohio counties that are addressed in this report (OEPA, 2008). A number of these water systems are publicly owned and operated municipal systems, but others are owned and operated by private companies. While most of these systems draw their water from groundwater sources, the vast majority of people in northeast Ohio are served by large systems such as those in Cleveland and Akron which draw their water from surface water sources (Lake Erie and Lake Rockwell, for example).

Collectively, those interviewed suggested that northeast Ohio manages drinking water more effectively than the other water sectors assessed. To support their positive ratings of the region's drinking water management practices, the experts and stakeholders interviewed pointed to the region's relatively abundant supply of fresh water – both in Lake Erie and elsewhere. Many of them also noted that the region is home to a number of well managed water utilities. They also mentioned that source water assessment reports developed by Ohio EPA for public water systems hold the potential to enable these systems to protect their water supplies from future contamination. Some respondents also suggested that stormwater control plans now in place for many urban municipalities hold the potential to provide further protections for drinking water sources. Still other respondents suggested that some jurisdictions in the region are supplying leadership in this area by enacting local ordinances to protect headwaters (waters at the uppermost reaches of a watershed), and those jurisdictions can serve as an example for other jurisdictions.

The experts and stakeholders interviewed did, however, express concern about the need to manage threats to area drinking water supplies. A number of those interviewed pointed out that many water systems had not yet developed or implemented source water protection plans that built upon the source water protection assessments that the Ohio EPA prepared for them (Table 3 in the following section provides more information on these efforts). These systems appear

to remain vulnerable to identified threats to their source water supplies. Other respondents pointed out that some communities have already experienced significant issues relating to drinking water quality, and several said that land use controls are not adequate to ensure protection of water supplies from nonpoint source water pollution sources over the long term. Still other respondents suggested that current efforts to protect groundwater sources are inadequate and that a lack of strong protections for groundwater threatens drinking water supplies now and in the future. Evidence of these kinds of effects can be found in Copley Township where toxic chemicals have contaminated some private water supplies (Downing, 2007A). Counties throughout the region are facing potential contamination issues associated with failing home sewage systems (CT Consultants, 2001).

While most water systems, both public and private, draw their water from groundwater sources, the vast majority of people in northeast Ohio are served by large systems, such as those in the Mahoning Valley, which draw their water from surface water sources.

IV. a. ii. SURFACE WATER

Increasingly, those working in the surface water sector are also concerning themselves with nonpoint source runoff associated with rain events as water flows over streets, fields, and workplaces collecting pollutants, which are then deposited in nearby streams, lakes and rivers.

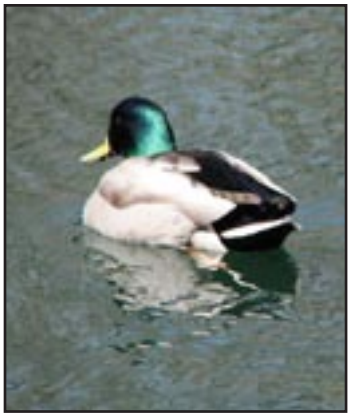
The management of surface waters involves a wide range of activities to protect rivers, streams, and lakes and to enable their use by individuals and communities for purposes of recreation and tourism. The federal government and the Ohio EPA operate a system for permitting discharges of water pollutants to surface waters to ensure that wastewaters emanating from industries and municipal sewage systems do not contaminate streams, rivers, and lakes. Increasingly, those working in the surface water sector are also concerning themselves with nonpoint source runoff associated with rain events as water flows over streets, fields, and workplaces and collects pollutants which are then deposited in nearby water bodies. A variety of mechanisms are being developed to address these runoff related pollution problems, and many of them are voluntary. However, regulatory mechanisms have been developed to address certain categories of storm-water runoff such as required storm-water management programs for larger municipalities and construction sites, as well as prohibitions against overflows of contaminated wastewaters from sewage systems after major rain events.

To support positive rankings of surface water management practices, some of those interviewed suggested that there is an appreciation in northeast Ohio of the value of the region's surface water resources. They also suggested that there is substantial organizational and regulatory capacity to protect rivers, lakes, and streams from point source water pollution discharges flowing from sewage treatment systems and industrial activities. A number of respondents spoke highly of the staff in state agencies with water quality responsibilities, often while arguing that these staffs needed more resources to do their jobs effectively. Other respondents highlighted water quality improvements in the Cuyahoga River and in Lake Erie that have been achieved over the past thirty years as evidence of the region's success in improving surface water quality. Still others pointed to what they said were relatively healthy fishing stocks in many areas of the region that have benefited from water resource management improvements, and which now provide economic advantages to the area.

However, a number of concerns were also raised with both environmental and economic implications. Environmentally, those interviewed pointed to concerns about combined sewer overflows (CSO's), nonpoint source storm-water runoff, and legacy problems associated with past polluting activities such as the contamination of the Ashtabula River and Mahoning River and their sediments with heavy metals, polychlorinated biphenyls (PCBs) and other pollutants (Scott, 2007). While some of those interviewed suggested that point source water pollution controls are well institutionalized in regulation and current management practices, a number of respondents said that stronger controls over land uses and nonpoint source water pollution runoff are necessary to ensure adequate protection of water quality and reasonable costs for water quality management over the long term.

A variety of mechanisms are being developed to address these runoff-related pollution problems. Many are voluntary.

Economically, a number of those interviewed expressed concern about the investments needed to maintain existing sewage infrastructure over time. Respondents raised another concern about the extent to which current access to surface waters can support growth in the tourism and recreation economies. Some of those interviewed pointed out that the cities of Cleveland and Akron alone face billions of dollars of costs to eliminate combined sewer overflows which contaminate area water bodies. Others were uneasy about the costs required to maintain water and wastewater infrastructure that is created to support sprawling development patterns – costs that could be avoided if denser and more consolidated development patterns were employed. Still other respondents verbalized that access to the area's waters for tourism and recreational use is more limited than it should be, and that concerns about access result from water pollution from CSO's and other sources, as well as insufficient public access to some water bodies in the area. Others suggested that the region's failure to coordinate effectively among political jurisdictions on water quality management issues represents a significant long-term threat in and of itself — one that threatens surface water quality and raises long-term water quality management costs.



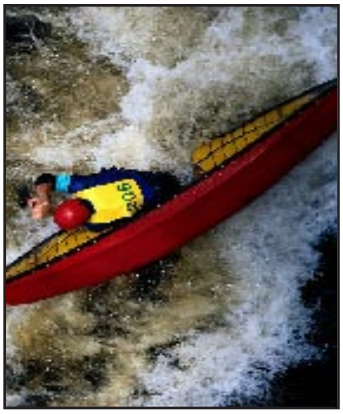
IV. a. iii. PROTECTION OF WILDLIFE

Management interventions in this sector are varied and involve a wide range of organizations and institutions.

The water management sector focusing on the protection and enhancement of wildlife recognizes that water is essential for life. It also acknowledges that plants and animals rely on healthy watersheds for their existence. Management interventions in this sector are varied and involve a wide range of organizations and institutions. These organizations and institutions include non-profit land conservancy organizations such as the Trust for Public Lands and the Western Reserve Conservancy, as well as federal and state agencies with both pollution control and resource conservation responsibilities. The management practices carried out by these organizations and institutions include land preservation efforts, water quality requirements that are based on assessments of natural habitats, required permitting and mitigation of development projects that destroy wetlands, and a wide range data and information collection efforts.

As is evident from the range of numerical responses presented in Table 1, the stakeholders and experts interviewed varied in their assessments of current practices in this area. Respondents with relatively positive evaluations pointed to a number of successes, such as the return of the bald eagle to Cuyahoga National Park (Johnston, 2007) and the return of pollution sensitive fish to the Cuyahoga River (Kuechner, 2006). Some respondents suggested that the region has been particularly active in setting aside land for conservation, illustrated by the Cuyahoga National Park, state and local park systems, and land conservation programs led and funded by a variety of active organizations, including the Clean Ohio program and the Western Reserve Land Conservancy. They also pointed to strong fishing stocks in a variety of areas in northeast Ohio and programs that the ODNR has put in place to protect flora and fauna.

Those respondents with more negative assessments of wildlife protection and enhancement efforts suggested that northeast Ohio does not value wildlife and ecosystems adequately. They reported that this lack of concern is evidenced by lenient wetland policies that enable development at the cost of wildlife protection and enhancement. Several respondents were particularly critical of wetland mitigation policies that allow development of wetlands and enable it to be compensated for by the creation of man-made wetlands that are of lesser value and/or which lie in areas outside of the watershed in which wetlands are destroyed. This practice, they argued, does not prevent damage to the watersheds within which the original development occurs, and this means that flora and fauna are not adequately protected. Others pointed to problems associated with invasive species such as zebra mussels in Lake Erie, and there was also concern expressed because the region does not possess strong institutional mechanisms to ensure protection of wildlife and ecosystems across broad areas. The upshot is that current efforts and practices – while in some cases substantial – may not be sufficient from a regional perspective, or adequately targeted.



IV. a. iv. ECONOMIC DEVELOPMENT

Historically, work in economic development relating to water has focused on hydropower generation and projects that support navigation and commerce. People are now beginning to think more broadly about the relationship between water and the economy for tourism and other purposes. However, with the exception of Port Authorities, the institutions and organizations that focus on this relationship are not yet well developed.

The experts and stakeholders interviewed varied in their assessments of the extent to which current water management efforts fostered appropriate economic development efforts. Some pointed to the region's abundant water resources as a clear economic advantage and suggested that the area's significant land preservation efforts (noted above) provide good support for tourism and other forms of recreation that have valuable economic benefits. They also pointed to the Lake Front Master Plan for downtown Cleveland and efforts to make better use of waterfront properties in that area as promising steps which seek to make better use of the region's water resources for economic development purposes.

However, these apparent advantages were offset by a range of threats and concerns. Foremost among the threats sited was urban sprawl and the high aggregate cost of water and wastewater infrastructure associated with it. Others suggested that the region has done an inadequate job of ensuring access to water resources to foster tourism and recreation — a potentially promising long-term focus for the northeast Ohio economy. Still others suggested that there is a need to think further about the economic value of the region's water resources and to enable a dialogue that focuses on the monetary importance of water to the region and to the potential for using water to foster economic development. This kind of focus, in turn, might encourage decision-making processes that enable region-wide economic development efforts which build upon better use of northeast Ohio's water resources.

People are now beginning to think more broadly about the relationship between water and the economy for tourism and other purposes.

However, with the exception of port authorities, the institutions and organizations that focus on this relationship are not yet well developed.

IV. a. v. GROUNDWATER

Like the economic development sector, the groundwater sector is not well developed institutionally or organizationally.

Further, there is no single agency or institution in the state or the region that is responsible for ensuring continuing protection of groundwater quality, and there are no formal standards in Ohio for groundwater quality.

Like the economic development sector, the groundwater sector is not well developed institutionally or organizationally. State agencies such as OEPA, ODNR, and the Ohio Department of Health all have responsibilities that intersect with groundwater management, but their connections to groundwater are often secondary to other core functions such as the provision of drinking water, the preservation of natural resources, and the protection of public health. There is no single agency or institution in the state or the region that is responsible for ensuring continuing protection of groundwater quality.

Respondents varied in their assessments of the region's efforts to manage its groundwater resources. Some respondents suggested that they were not aware of large numbers of identified groundwater quality problems to date and that this is a good thing. Others pointed to the Source Water Assessments that have been developed by Ohio EPA to protect groundwater sources and source water aquifer mapping projects by ODNR as evidence of productive groundwater management. Others directed attention to the introduction of new and more stringent rules governing home sewage systems as further evidence of state and regional concern about groundwater protection. However, these rules were effectively overturned by the State Legislature during the summer of 2007.

Others interviewed were far more critical of the region's groundwater management efforts. They suggested that little attention is being paid to groundwater resource management in general, and that public awareness of groundwater problems is limited. They pointed out that there are no formal standards in Ohio for groundwater quality, and suggested that current groundwater protection efforts lack focus and resources. In support of this contention, they brought up the failure of many municipalities to develop and implement plans to follow up on completed source water assessments, the widespread prevalence of failing home sewage systems which threaten groundwater supplies, and problems with legacy pollutants in areas where manufacturing processes and fueling stations were located in the past.

If water resources represent a comparative advantage for northeast Ohio, then there is good reason to restore impaired waters and protect waterways from being polluted.

IV. b. NEEDS and OPPORTUNITIES

At least fifty percent of those interviewed mentioned needs and/or opportunities in six different areas. The first three of these areas are substantive, and focus on activities that will result in improved water quality, increased access to area waterways, and enhanced knowledge regarding water quality management. The remaining three areas focused on ways northeast Ohio might improve its management capabilities to foster more effective water resource decision-making. A list of these six areas of need and opportunity is provided below.

i. **Improve protection & restoration of area waterways;**
ii. **Increase access to water resources;**
iii. **Expand water education;**
iv. **Invest in northeast Ohio's paramount asset;**
v. **Enable more effective regional decision-making, and;**
vi. **Strengthen planning and coordination.**

The subsections that follow discuss these needs, and the opportunities associated with them. More specifically, they focus on describing the needs identified, reviewing current efforts to address them, and identifying potential options for improving upon current efforts.

IV. b. i. Improve protection and restoration of area waterways

A number of the interviewees suggested that water resources bring advantages to northeast Ohio. Therefore, there is good reason to restore impaired waters and protect non-polluted waterways. This view was expressed by a number of individuals who participated in the interview process.

Identified Needs

While there has been significant progress in cleaning up the seriously degraded water quality conditions that existed in northeast Ohio several decades ago, significant water quality problems remain throughout the region – most of which stem from nonpoint sources (NOACA, 2000; NEFCO, 2003). Furthermore, a number of the experts and stakeholders interviewed suggested more could be done to ensure that planning efforts underway in the region are actually implemented in ways that protect and restore water resources.

The Ohio EPA regularly submits a report listing impaired waters within the state to the US Environmental Protection Agency (Ohio EPA, 2006). One of the most recent reports – the 2006 Integrated 303/305 b report – suggests that there has been progress achieved in cleaning up larger rivers throughout the state. It suggests that the proportion of larger rivers in Ohio meeting water quality standards for aquatic uses increased from 64% to at least 70% (Ohio EPA, 2006, p. viii). Even with this progress, significant legacy problems remain in some of northeast Ohio's larger rivers. Current efforts to dredge polluted sediment from the Ashtabula River, and the need to restore the formerly industrialized Mahoning River remind us of the ongoing need to fix past mistakes and protect healthy waterways.

While there has been significant progress in cleaning degraded water quality that existed in northeast Ohio several decades ago, significant water quality problems remain throughout the region – most of which stem from nonpoint sources.

The 2006 integrated report also identifies major water quality challenges throughout the state. It reveals that at least 263 of 331 watersheds in Ohio are known to be impaired in some fashion (OEPA, 2006, p. viii). Furthermore, according to the report, northeast Ohio and the state as a whole are experiencing growing water quality threats in tributary streams from nonpoint sources (OEPA, 2006, p. 11). These threats will eventually touch not only the tributary streams, but also the major rivers to which their waters flow. In addition, virtually every major watershed in northeast Ohio remains impaired by pollutants such as phosphorus, bacteria, and metals, and by altered habitat conditions that reflect degradation from a variety of sources.

Under federal law, the Ohio EPA must develop Total Maximum Daily Loads (TMDLs) for polluted waters (that do not meet state water quality standards). A TMDL is the maximum total amount of a pollutant that a water body can receive and still maintain compliance with water quality standards. Once developed, a TMDL can be used to help establish water pollution control permit conditions and to guide other actions aimed at reducing non point source water pollution. Table 2 lists major watersheds in the northeast Ohio, along with pollutants and impairment sources identified in recent TMDL reports developed by the Ohio EPA and other sources.

Table 2.
Major Northeast Ohio Water Ways: Pollutants and Sources of Impairment

Watershed or Water Body	*Pollutants and Sources of Impairment*
Cuyahoga River	Nutrients, Dissolved Oxygen Deficiencies, and Impaired Habitat
Euclid Creek	Phosphorus and Impaired Habitat
Chagrin River	Nutrients, Impaired Habitat, Bacteria, and Suspended Solids
Grand River	Sediment and Chromium (in selected areas)
Ashtabula River*	Contaminated Sediment – PCBs and Metals
Rocky River	Nutrients
Lake Erie**	Oxygen Depletion, Bacteria
Mahoning River***	Bacteria, Heavy Metals, Chromium, Iron, Zinc, Polychlorine biphenyls, Lead, Arsenic, Cadmium, Polycyclic Aromatic Hydrocarbon

Sources: Ohio EPA, 2006 Integrated 303/305 B Integrated Report, individual TMDL Reports, TMDL report drafts, press releases developed by Ohio EPA, and other sources (the other sources are: *=Scott, 2007 A & B; ** = USEPA, 2007 & NRDC, 2007; *** Ohio EPA, 1996 Biological and Water Quality Study of the Mahoning River Basin, Chemical Sediment Quality, pg. 25). The TMDL reports and press releases are available through www.epa.state.oh.us/dsw/tmdl/.
Note: This table provides examples of pollutants reported in various sources to be present in water bodies. It does not provide a comprehensive assessment or complete listing of pollutants and sources of impairment.

...at least 263 of 331 watersheds in Ohio are known to be impaired in some fashion.

Northeast Ohio TMDL documents suggest that a common cause of water quality problems is development patterns which fail to ensure that natural riparian protection areas are maintained around streams and water ways to help them absorb pollutants which enter streams from nonpoint source runoff. At bottom, this concern is tied to the choices communities make in allowing development in certain areas, and in the forms of development that they choose to allow. Some years ago, the NOACA published a model storm-water ordinance to help guide storm-water management in ways that are supportive of water quality concerns. In addition, over the last several years, many communities in the region have been implementing required storm-water management programs to address some of these problems. Even so, questions remain about the collective adequacy of these programs and some observers question continued reliance on engineered solutions as opposed to ecosystem restoration efforts. Stormwater management remains a significant issue that is appropriately addressed through land-use decision-making and management processes that are sensitive to water quality considerations.

Water quality problems also affect Lake Erie, and several are worthy of mention. First, bacterial contamination is apparent at many beaches on Lake Erie, particularly in and around Cleveland. While there are several potential causes of these bacterial problems, they are often attributed to combined sewer overflows (CSO's) which occur after large rain events when rain-waters overwhelm waste-water treatment plant capacities and release contaminated sewage into Lake Erie and other area waters. Second, nutrients such as phosphorus are also present in Lake Erie in high concentrations, which can lead to the removal of oxygen from the water and may contribute to "dead zones" in which fish cannot live or thrive. And, finally, invasive species of various kinds are now present in Lake Erie, and threaten

the natural systems in place in the lake. The most well-known of these invasive species is the Zebra Mussel, but others are also present. Recent concerns, for example, include the Asian Carp which is apparently making its way up the Mississippi River toward Lake Michigan, where it could begin affecting food chains in the Great Lakes.

Current Efforts

A wide range of water quality protection efforts are currently under way in northeast Ohio. The Ohio EPA issues permits to point source dischargers to control water pollution discharges throughout the region, and a number of state and federal grant programs provide funding to local and regional groups to address nonpoint source water pollution problems of differing kinds. In addition, non-profit groups such as the Western Reserve Conservancy, the Trust for Public Lands, and others invest money and effort to protect lands that are valuable for water quality protection purposes. Some area municipalities are also implementing programs and changes in land-use requirements that provide additional protections for area waters.

Water quality planning also has a long history in northeast Ohio. ... the federal Clean Water Act has required that water quality management plans be developed to guide decisions regarding wastewater treatment system development and financing.

Water quality planning also has a long history in northeast Ohio. For several decades now, the federal Clean Water Act has required that water quality management plans be developed to guide decisions regarding wastewater treatment system development and financing. These plans have been required by Section 208 of the law. They are developed by three different planning organizations in northeast Ohio: the Northeast Ohio Area Coordinating Agency (NOACA); the Northeast Four County Planning Organization (NEFCO); and the Eastgate Regional Council of Governments.

More recently, additional water quality assessment and planning activities have been required to enable the submission of Total Maximum Daily Load reports to the US EPA for approval. Unlike the 208 plans, which have often focused on wastewater treatment needs, the TMDL reports are to allocate amounts of acceptable pollution to point and nonpoint sources and provide a basis for reducing pollution loads to acceptable levels. These TMDL reports, in turn, are supplemented by watershed plans that are often developed by watershed groups and may lead to endorsements by the Ohio DNR.

In addition, in 2000, the state adopted a Lake Erie Protection and Restoration Plan, for which the Ohio Lake Erie Commission and the state agencies which comprise it have responsibilities. As was noted, the Ohio EPA has also engaged in a systematic effort to assess source waters for area drinking water systems in recent years. These efforts have sought to identify potential sources of contamination to assist public water systems in protecting their water supplies. Once the assessments are completed, the implementation of plans to protect vulnerable source waters is left to individual water systems.

When viewed as a whole, these various planning efforts have produced a large volume of information on actions that can and/or should be taken to protect

area water ways. However, comparatively little attention appears to be paid to determining the extent to which these identified actions are actually implemented. Through the course of this research we identified three kinds of efforts in this area. First, the Lake Erie Commission does issue Progress Reports on the implementation of the Lake Erie Protection and Restoration Strategy every other year. The most recent report identifies actions taken by state agencies which are consistent with the recommendations made in the plan.

Second, the Ohio EPA publishes information on its worldwide web site which specifies whether they have received implementation assurances relating to source water protection from water systems throughout the state. However, efforts to develop and implement plans for source water protection appear to have been inconsistent to date. As of November 5, 2007, 1,291 out of 5,455 water systems in Ohio had submitted an outline of their plan to implement protective measures to prevent contamination of their source waters.

While planning efforts have produced a large volume of information on actions that can and/or should be taken to protect area water ways, comparatively little attention appears to be paid to determining the extent to which these identified actions are actually implemented.

Table 3 provides county-by-county information on the number of water systems that have assured Ohio EPA of their intention to implement source water protection plans. As the data in the table indicate, 27.3% of area water systems have committed to implementing source water protection plans. While this figure is slightly higher than the comparable figure for the state as a whole, it falls far short of a comprehensive region-wide effort. However, while it is evident from this data that most water systems in northeast Ohio have not yet taken action to implement source water protection plans, it is also evident that Ohio EPA is making an effort to track implementation of these plans -- and that is a step in the right direction.

Table 3.
Ohio Public Water System*
Submission of Source Water Protections Plan Assurances to Ohio EPA

County	*Total Public Water Systems***	*Public Water Systems Intending to Develop Source-water Protection Plans (as of 11/07)****	*Percent of Public Water Systems Which Have Demonstrated Intent to Implement a Plan*
Ashtabula	66	25	37.9%
Cuyahoga	14	3	21.4%
Geauga	275	82	29.8%
Lake	29	8	27.6%
Mahoning	98	31	31.6%
Medina	86	25	29.1%
Portage	186	49	26.3%
Summit	330	80	24.2%
Trumbull	109	23	21.1%
Regional Total	1,193	326	27.3%
Statewide Totals	5,455	1,291	23.7%

* Public Water Systems include Community Water Systems (serves residences and businesses, for example), Non-Community Non-Transient Water Systems (serves schools, for example), & Transient Water Systems (serves highway rest stops, for example).
** Compiled from information drawn from Ohio EPA, 2008.
*** Information available on the Ohio EPA Worldwide Web Site – accessed March 29, 2008. The plan submission information available on the worldwide web was updated through November 5,

2007 (www.epa.state.oh.us/ddagw/pdu/swap-protection.html).

Area universities have also made efforts to assess the implementation of water quality related efforts. The Countryside Program at Cleveland State University has surveyed area municipalities on land use requirements which may affect water quality, although these efforts have been limited by a lack of resources. Likewise, the Center for Public Administration and Public Policy at Kent State University is working to develop a preliminary design for a tracking system focused on the implementation of recommendations made in TMDL reports.

Potential Improvements

While there are a number of differing kinds of water management plans being created in northeast Ohio, there do not appear to be consistent efforts to track progress in implementing them. Existing planning efforts are often required by federal law, but judgments about implementation and tracking are made both at the state and local levels in northeast Ohio. Not surprisingly in this context, one theme that emerged relates to fostering the actual implementation of planned efforts to improve water quality.

To address this situation, it would seem appropriate to identify key elements of existing plans that could be implemented and to devise appropriate ways to track and publicize progress. While this could become a large task because of the numerous entities involved in various aspects of water resource management, it could also be quite fruitful. Such an effort would enable assessments of progress regarding water quality protection and restoration activities. It might also be used to publicize progress, and could serve as a basis for transfers of information regarding successful implementation practices that could be useful for water resource stakeholders. It is one clear and potentially important step that northeast Ohio could take to protect and restore its rivers, lakes, and watersheds.

Of the 312 miles of Lake Erie shoreline, only 41.5 miles (13.3 %) are open to public access. This level of access limits efforts to develop the tourism economy and attract new companies and workers.

In some cases, public access is limited by water pollution. In 2006, for example, the 20 Lake Erie beaches in Ohio were the subject of health advisories a total of 629 times.

IV. b. ii. Increase access to water resources

A number of those interviewed suggested that northeast Ohio's valuable water resources are shielded from public use to a greater extent than they should be, and that this has implications for recreational opportunities, tourism, and economic development. This is the case, in part, because of limited public access to area water-ways and, in part, because water pollution limits recreational uses of some water bodies.

Identified Needs

While Ohio possesses extraordinary water resources, they could be made more accessible for public use. There is relatively limited public access to the

Lake Erie coastline, both in the City of Cleveland and along the Ohio-Lake Erie coastline as a whole. One individual interviewed, for example, suggested that there are very few — if any — good restaurants with views of Lake Erie in downtown Cleveland. Others contrasted Cleveland's use of its urban shoreline with other cities such as San Antonio and Chicago, both of which have made extensive use of their water assets to foster economic development and quality of life.

Water access concerns are not limited to downtown Cleveland. Of the 312 miles of Lake Erie shoreline, only 41.5 miles (13.3 %) are estimated to be open to public access (ODNR, 2007). This level of access limits efforts to develop the tourism economy and attract new companies and workers. Access to water resources in other areas of the region is also problematic. Many of northeast Ohio's municipalities do not make full use of the rivers, streams, and lakes in their vicinity.

Efforts are being made to improve access and use of a number of northeast Ohio waterways. The downtown re-development planning efforts undertaken in Cleveland envision greater use of the Lake Erie shoreline, and discussions regarding the relocation of the City of Cleveland's commercial port appear to be taking public access concerns into account.

In some cases, public access is limited by water pollution, rather than direct obstructions to access. In 2006, for example, the 20 Lake Erie beaches in Ohio were the subject of health advisories a total of 629 times (NRDC, 2007). In fact, the Natural Resources Defense Council (NRDC, 2007) reported that Ohio had the worst record for beach bacteria in the country in 2006. By and large, Ohio beach advisories appear to result from CSO's, although there are other potential sources such as birds and wildlife, as well as failing home sewage systems which are cited in northeast Ohio TMDL reports as potential sources of pathogens for watersheds in the region. The far eastern watersheds in the region also have pollution problems that limit public access, as is evidenced by bacteria problems (US EPA, 2003) and contaminated sediment (Ohio EPA, 1996) in the Mahoning River.

Current Efforts

Efforts are being made to improve access and use of a number of northeast Ohio waterways. The downtown re-development planning efforts undertaken in recent years in Cleveland envision greater use of the Lake Erie shoreline, and discussions regarding the relocation of the City of Cleveland's commercial port appear to be taking public access concerns into account (Breckenridge, 2008). In addition, the Ohio Trust for Public Lands is undertaking an effort to expand public access to Lake Erie from the Tow Path Trail to Canal Basin Park in Cleveland and on to Lake Erie at Wendy Park and Whiskey Island (TPL, 2007). The City of Kent is also taking the initiative to address this issue, as it is seeking grant funding to assist it in creating a whitewater rafting park in downtown Kent that would effectively improve access to the Cuyahoga River.

Efforts are also being made to clean up polluted waters that can limit access to the region's water resources. Over the long term, the dredging of the Ashtabula River should yield greater accessibility. Efforts by cities around the region to address CSO problems are also likely to improve access eventually, although the solution to these problems still appear to be both many years and billions of dollars away. More recently, there have also been efforts to address widespread problems associated with failing home sewage treatment systems. In January 2007, the State Department of Health imposed new and more stringent

rules relating to the management of home sewage treatment systems. However, the Ohio State Legislature over-turned these rules in the summer of 2007 after hearing complaints regarding the costs associated with their implementation. Even so, some area counties appear to have strengthened their oversight of these systems in recent years (Downing, 2007B).

Potential Improvements

One point that emerged from the interviews is that there is value in thinking more systematically about access to water and the economics of growth. One individual interviewed suggested the importance of the public knowing that poor water management results in dollars removed from their pockets — a point that seems indisputable given the tens of millions of dollars now being spent to dredge 1.3 miles of the Ashtabula River. (The much larger restoration of the Mahoning River will encompass 31 miles of the industrialized corridor.) There is corollary to this point as well, however; strong water resource management may put dollars into people's pockets. If northeast Ohio is to take advantage of its water resources to support a sustainable economic future, it is important to improve our understanding of the relationship between water and economic growth.

At least two sets of potential economic opportunities appear worthy of attention.

At least two sets of potential economic opportunities appear worthy of attention. The first, and perhaps most obvious, opportunity relates to tourism and increasing both the number of visitors to northeast Ohio and the amount of money they spend. Tourism is already big business in the region, as it generates approximately $8.7 billion in direct sales and employs 146,800 in northern Ohio (Huntley, 2006). It also generates almost $600 million in state and local tax revenues (Huntley, 2006). A range of strategies might be used to build upon this economic foundation. Increasing access to attractive water resources is one strategy, as is working to couple water resource access with other amenities that might be attractive to tourists – museums, hiking trails, hotels and accommodations convenient to water based attractions, etc. Another strategy is to invest more heavily in marketing the region's assets and to focus on its water resources as one of its more attractive features. Ohio does not rank high in its investment in tourism marketing (Huntley, 2006), so the state and the region might be on firm ground in seeking this kind of investment from state officials.

The first: Increasing both the number of visitors to northeast Ohio and the amount of money they spend.

A second set of opportunities for using water to help foster economic growth would be to identify water intensive industries and look systematically at companies in those industries, and recruit them to the area.

A second set of opportunities for using water to help foster economic growth would be to identify water intensive industries, look systematically at companies in those industries, and seek to recruit them to the area. One study conducted by Case Western Reserve's Weatherhead School of Management sought to assess whether water could become a driver for enhanced economic vitality in northeast Ohio. This study concluded that there may be limited opportunities in this area, but that aquaculture and electrolysis-based fuel cell production — both of which require significant amounts of water -- hold potential for growth in northern Ohio over the long term (Awasthy, et. al., undated). A more recent study suggested that private, public, and university capabilities in northeast Ohio relating to water technologies could yield a bright future in that area (EcoCity Cleveland et. al., 2007). In addition, as current efforts to move the Port of

The very wide range of individuals, organizations, and institutions involved in managing water resources in northeast Ohio demands an education strategy.

Even those who are well educated regarding hydrology, engineering, chemistry, biology, regulations, and policies relating to water need to learn how to work together to resolve technical and policy issues.

Cleveland suggest, there may also be additional opportunities relating to boating and water transportation.

Thus, while there are efforts underway to improve access to the area's water resources, more could be done. This research did not uncover any systematic and region-wide effort to inventory areas where access to waterways was limited, so that land purchasing or other strategies might be used to open up access further. This kind of effort would seem to be both feasible and desirable. In addition, there does not appear to be any systematic effort to assess the economic potential of water-ways in and around the region, so that judgments regarding priority areas for improved access might be undertaken. And finally, this research did not uncover any current effort to systematically define water intensive industries and recruit them to the area. Further activities in all of these areas might be undertaken with productive results.

IV. b. iii. Expand water education

A large number and variety of stakeholders are involved in managing water resources – water and wastewater utilities, local public works departments, local government officials, state and federal officials from a range of agencies, non-profit watershed groups, county health and sanitation officials, and organizations representing major water users such as tourism organizations, to name a few. Individuals from all these groups have roles to play in managing regional water resources effectively, and they are in need of training and education.

Identified Needs

Because of the very wide range of individuals, organizations, and institutions involved in managing water resources in northeast Ohio, education is a key element in any strategy to improve water resource management over the long term. Even those who are well educated regarding hydrology, engineering, chemistry, biology, regulations, and policies relating water need to learn how to work together to resolve technical and policy issues effectively as they arise in different jurisdictions and settings.

One particularly important audience to target for expanded educational efforts is local government policymakers who are involved in overseeing water and wastewater utilities, public works departments, and zoning and land use decision-making. There are more than 250 local governments in the nine counties covered by this report, and many of them play important roles in managing water resources. A problem sited by interview respondents is that these officials often do not know the central role they play in water resource management, or at least they are not sufficiently aware of it to take it into account on an ongoing basis as they make decisions which affect the water resources used and released by their communities.

Over the long term, however, it is important for educational programs

regarding water resource management to reach a wide range of audiences, including the public at large. As diffuse water pollution sources have come to occupy a larger proportion of existing water quality problems, the behaviors of individuals become a bigger part of northeast Ohio's water resource management processes. If the general public can become more educated about the impact of everything from lawn chemicals to oil change residues and paving practices regarding water quality, then the collective decisions of hundreds and thousands of individuals over time can play a valuable role in improving water management in the region.

Current Efforts

At least two major strategies for increasing educational efforts are available:

One would involve establishing educational requirements relevant to water resource management for key audiences such as local elected officials, public works professionals, health officials and others.

Providing additional funding for water-related educational programs is another option.

A wide range of organizations and institutions are playing important roles in fostering water resource management education for policymakers, stakeholders, and the general public throughout northeast Ohio. The Ohio Lake Erie Commission assumes a valuable role in supporting conferences and training programs targeted toward stakeholders and public officials in the Lake Erie Drainage basin. Likewise, in the Ohio River Drainage basin in Mahoning and Trumbull counties, the Mahoning River Watershed Consortium and the Eastgate Regional Council of Governments are playing valuable educational roles for these audiences. Watershed groups in the Lake Erie basin are also providing water resource management education, as groups such as the Cuyahoga River Remedial Action Program and the Chagrin River Watershed Partners provide educational programs in their regions on an ongoing basis. And state agencies such as the OEPA and the ODNR are also providing educational programs on water-related topics that are of interest and concern.

Universities are also playing continuing educational roles. Cleveland State University's Countryside Program has made contributions in enabling educational opportunities relevant to land use management and local decision-making. Recently, Kent State University's Center for Public Administration and Public Policy has included educational programs relating to water infrastructure management and financing in programs it offers for local officials.

Youngstown State University's Center for Urban & Regional Studies has implemented environmental field trips for middle schools in which students engage in stream monitoring at parks and nearby streams. Through a partnership with the Youngstown City Schools, General Motors Lordstown, and Earth Force-GREEN (a national environmental non-profit funded by GM), the program engages 500 students in seventh grade annually in hands-on activities at a local stream, where they learn first-hand the importance of clean water for humans and wildlife. The program — easily replicated by other schools — will mark its eighth year in the 2008-2009 school year.

Potential Improvements

In spite of all of these efforts, however, interview respondents suggested that more can and should be done to educate policymakers, stakeholders, and the

One need that emerged from the interviews relates to money and the investments necessary to build and maintain the capabilities to protect water resources and leverage them appropriately for economic development.

Federal funding for water resource management nationally has declined significantly in recent years.

public on their roles in fostering effective management of northeast Ohio's water resources. While the process of education will never be completed, current challenges and opportunities suggest that this process be approached with vigilance and on an ongoing basis.

At least two major strategies for increasing educational efforts are available. The first would involve establishing educational requirements relevant to water resource management for key audiences such as local elected officials, public works professionals, health officials and others. Some other states (Mississippi, for example) do have educational requirements relating to water management for local officials, and Ohio could look to these states as potential models. The second strategy would involve providing additional funding for water-related educational programs, and this might be an appropriate avenue to pursue given recent cutbacks in water quality management programs.

IV. b. vi. Investing in Northeast Ohio's greatest asset

A number of those interviewed expressed concern about the fact that public sector financial commitments for water resource management have diminished in recent years, and needs relating to this situation are discussed below.

Identified Needs

One need that emerged from the interviews relates to money, and the investments necessary to build and maintain the capabilities to protect water resources and leverage them appropriately for economic development. Federal funding for water resource management nationally has declined significantly in recent years. The federal Wastewater Construction Grants program which financed substantial improvements and expansions of wastewater infrastructure in the 1970's and 1980's was phased out in the late 1980's and 1990's. It was replaced by a federally supported state shared revolving loan program, which expanded to include drinking water projects in the 1990's. Federal funds for these programs have diminished by about 20% between 2003 and 2007 (ASIWPCA, 2007). Federal funding for nonpoint source water pollution control has also been cut by 16% during this same time period (ASIWPCA, 2007).

Current Efforts

The State of Ohio operates a number of programs which support water resource management activities, and many of them focus on water infrastructure. A visit to the Ohio EPA's Division of Environmental Infrastructure Financing worldwide website (www.epa.state.oh.us/defa/) provides an overview of these

programs, most of which focus on financing infrastructure of various kinds. Other state funding sources that can be used to support water resource management programs include the Ohio Lake Erie Commission, the ODNR, and the Clean Ohio Fund. These state investments are valuable and important, but many of those interviewed expressed concern about their collective adequacy for the water resource management challenges that lie ahead.

While there appear to be isolated cases of increased water resource management investments, there does not appear to be any coordinated northeast Ohio response to this funding situation. In 2006, the board of the Northeast Ohio Area Coordinating Agency voted to increase the local share of investment in its water quality assistance program. Late last year, EcoCity Cleveland and Cuyahoga County released a report funded by the Cleveland Foundation which recommended the development of a Regional Water Center to catalyze northeast Ohio as a potential center of excellence for water resources (EcoCity Cleveland, et. al., 2007). These are valuable contributions, but they are just a beginning.

Over the long term, if sustainable economic growth is to emerge based on our plentiful water resources, it will be necessary to invest in managing the region's water resources.

Potential Improvements

One obvious approach to address funding deficiencies would be to pursue additional monetary support from the state and the federal government. While state and federal investments in water resource management could increase in the future, substantial increases may be difficult in the near term because of funding shortfalls in Columbus and Washington D.C. For this reason, it seems appropriate to investigate solutions to funding concerns that are local and regional, as well as state and national. This situation is not unique to northeast Ohio, as regions throughout the country are facing water resource management funding challenges.

Over the long term, if sustainable economic growth is to emerge based on the region's plentiful water resources, it will be necessary to invest in managing the region's water resources. It would seem appropriate in this context to initiate a more complete assessment of funding needs relevant to water resource management, and an evaluation of alternative funding sources. Potential funding sources to be assessed might include fees to fund water and wastewater utilities (including storm-water utilities), charges for developing or extending new water and wastewater infrastructure, and/or special purpose charges on activities relevant to water quality management (eg. non-permeable surface charges, etc.). While this kind of broad assessment should be occurring in individual communities, a region-wide assessment would also be beneficial. This region-wide assessment might address not only funding sources, but also cost efficiencies that might be achieved if water resource management processes were consolidated and/or coordinated more closely on a regional level.

IV. b. v. Enable more effective regional decision-making

Over the last half century, northeast Ohio has experienced a sprawling development pattern. The rate at which the region is utilizing land for urbanization exceeds its pace of population growth by a significant margin – by a factor of five, according to one estimate (EcoCity Cleveland, 2000). Not surprisingly in this context, another theme that emerged from the interviews conducted was a sense that land use decision-making in northeast Ohio is out of control, and that this is making water resource management unduly costly in both economic and environmental terms.

Over the last half century, northeast Ohio has experienced a sprawling development pattern.

The rate at which the region is utilizing land for urbanization exceeds its pace of population growth by a significant margin – by a factor of five, according to one estimate.

Identified Needs

One respondent declared that the region had "already lost" its war on urban sprawl. This suggestion reflects a need to reduce and contain sprawl on a regional level that was widely recognized among those interviewed. This need, in turn, suggests that opportunities for enabling stronger regional influence on decision-making processes should be pursued.

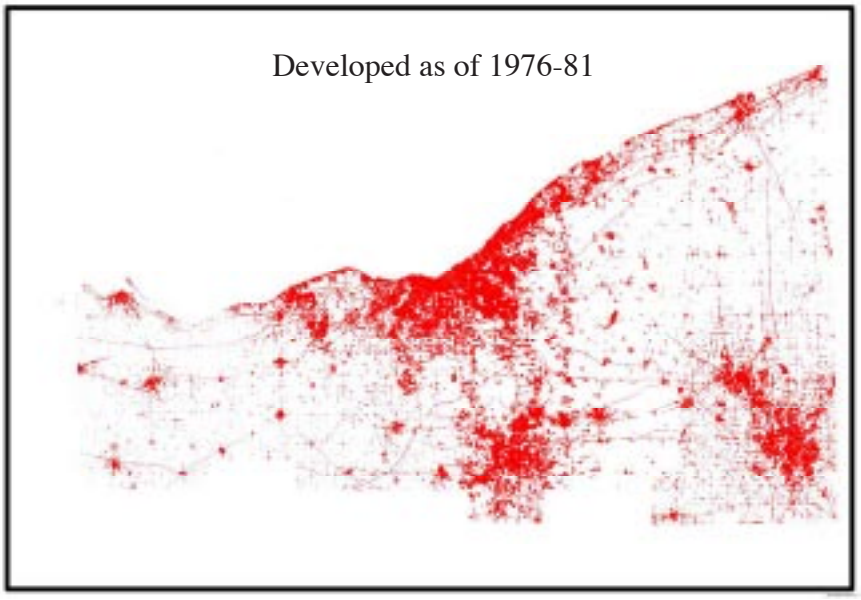
Sprawling development patterns yield at least two major concerns with respect to water resource management. First, sprawl increases the cost of providing water and sewage services, as it requires large capital expenditures to fund these services over an expanding land area. As sewers and water lines are developed, they come to require ongoing maintenance and this further increases the cost of basic water-related services that support economic development and human needs. These impacts are particularly negative when inner cities lose population, and at the same time continue to require the maintenance of existing water and wastewater infrastructure. This is precisely what is occurring in northeast Ohio, as Cleveland and Akron lose population to surrounding counties which then fund further infrastructure development which raises the overall costs of water management for everyone involved.

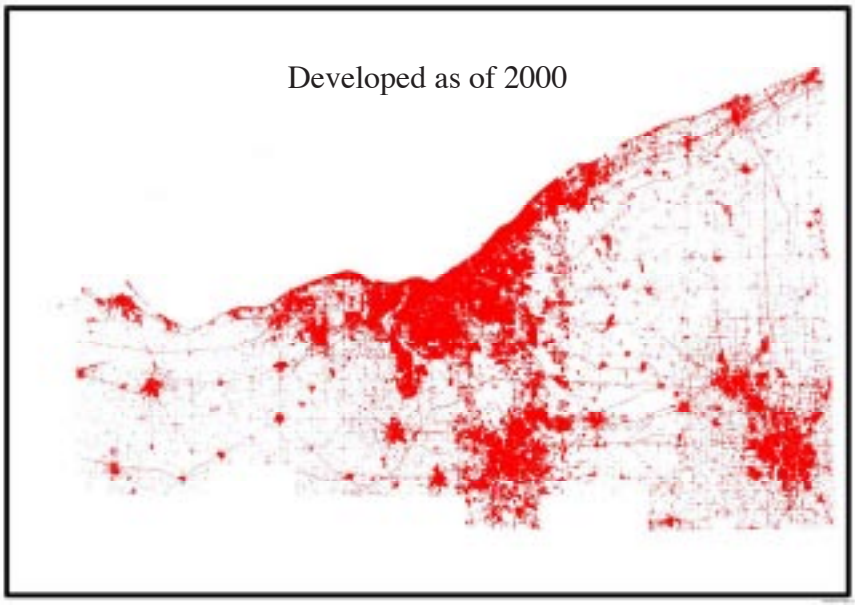
Northeast Ohio already faces significant issues relating to the funding and maintenance of its water and wastewater infrastructure. It is not unique in this regard. Estimates from the US Environmental Protection Agency suggest that the nation as a whole faces a spending gap of about $534 billion dollars for water and wastewater infrastructure investment during the first two decades of the twenty-first century (US EPA, 2002). A recent report by the US Conference of Mayor's Water Council reported that local government expenditures for sewer and water services had almost doubled over the last fifteen years, growing from $45 billion in 1992 to $82 billion in 2005 (US Conference of Mayors, 2007). The Ohio EPA has identified almost $18 billion in unmet water and wastewater infrastructure needs statewide (Ohio EPA, 2007), and projected expenditures for combined sewer overflow corrections in northeast Ohio alone run into the billions of dollars. If northeast Ohio could develop ways to manage its water infrastructure more

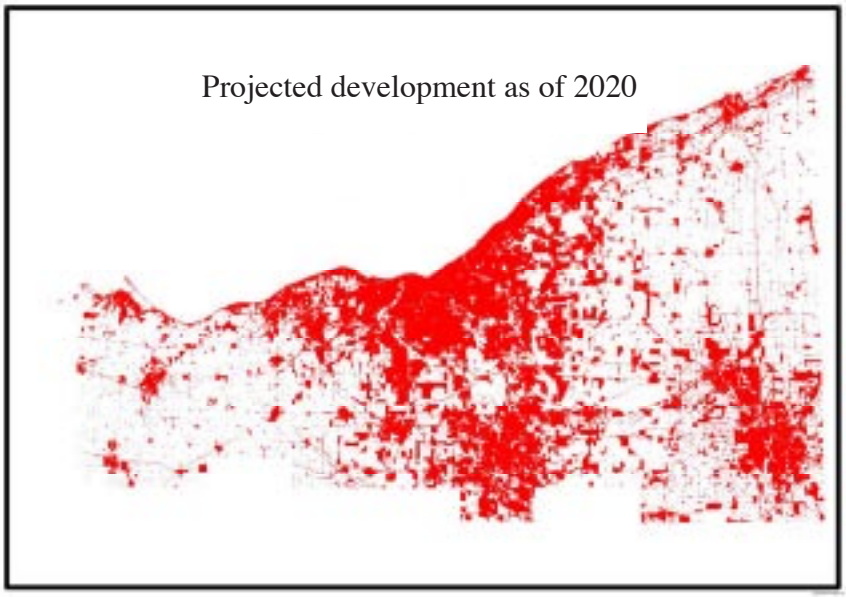
Sprawling development patterns yield two major concerns with respect to water resource management.

First, sprawl increases the cost of providing water and sewage services.

Second, sprawling development patterns have negative impacts on the region's natural hydrologic systems, which use natural processes to remove contaminants from water and moderate floods.







Source: EcoCity Cleveland (analysis by NODIS).

effectively, efficiently, and in regional fashion, this innovation might constitute a comparative advantage in and of itself, given the volume of water infrastructure expenditures expected both in Ohio and around the country.

Second, a major concern with sprawling development patterns is that they have negative impacts on the region's natural hydrologic systems, which use natural processes to remove contaminants from water and moderate floods. In a natural hydrological environment, water drains through pervious materials and is used by vegetation to enable its growth. These natural patterns process water in ways that enable removal of contaminants and minimize the extent to which large volumes of water pass over particular areas in very short periods of time ("flashy" events, which can lead to floods). As an area urbanizes, it tends to remove natural vegetation and creates larger areas covered by impervious surfaces. These effects of urbanization result in the deposition of increasing amounts of nonpoint source contaminants in the region's waters and contribute further to its susceptibility to severe flooding events. This appears to be what is occurring in northeast Ohio.

Other regions of the United States and metropolitan areas in other parts of the world have developed processes and practices to enable less sprawling land-use patterns. For example, water authorities can help govern land-use decision-making on state and/or regional scales.

Current Efforts

The well-known negative impacts of sprawling development patterns — diffusing tax revenues, increasing automobile use and air pollution, higher costs for highways and transportation, among others — are leading to a continuing dialogue about sprawl and ways in which it may be contained. In recent years, there has also been much talk about "regionalism" in northeast Ohio and the need for comprehensive approaches to addressing a range of issues affecting all of northeast Ohio. Recently, the Northeast Ohio Mayor's and City Manager's Association has become involved in these kinds of discussions, as have a number of private sector organizations.

The discussions undertaken to date, however, have not yet focused extensively on water resource management, except perhaps for the Ohio Lake Erie Commission's efforts in the Lake Erie drainage basin. The region's failure to address water resource management in an integrated and regional fashion is problematic. Alternative land uses and their effects on water quality are probably best addressed from this regional perspective, and controls on the availability of water infrastructure are potentially valuable tools in efforts to control sprawl. In addition, northeast Ohio operates as a regional economy and it relies on aquatic resources flowing to both Lake Erie and the Ohio River to support these economic activities. In spite of much discussion, however, there does not yet appear to be any clear strategy for improving regional decision-making that has been adopted by local decision-makers in the region or at the state level.

Potential Improvements

Other regions of the United States and metropolitan areas in other areas of the world have developed processes and practices to enable less sprawling land-

use patterns. In the United States, both Portland, Oregon and Minneapolis-St. Paul, Minnesota have developed regional processes and institutions to help them manage land-use patterns, and both of these regions appear to have had greater success in containing sprawl than has been the case in northeast Ohio. Across the oceans, metropolitan regions in Australia, in an effort to address the need for more sustainable development and escalating water infrastructure costs, have used water authorities to help manage land-use decision-making. One obvious next step to dealing with sprawl would be to look closely at these kinds of examples in an effort to develop models and approaches that may be useful in northeast Ohio. The interviews and research conducted as a part of this study suggest that water resource management can and should become a larger part of this discussion than it has been to date.

One factor affecting the need for the wide range of organizations and individuals involved in water resource management to plan and coordinate is the growing importance of nonpoint water pollution sources.

IV. b. vi. Strengthen existing planning and coordination

Questions focusing specifically on coordination were included in the interview questionnaire, so it is not surprising that the experts and stakeholders interviewed identified issues relating to planning and coordination. Even so, while nearly everyone identified some area where planning and coordination could be improved, many of those interviewed also spoke about significant and useful efforts that are already occurring in this area.

Identified Needs

Because of the wide range of organizations and individuals involved in water resource management, there were a wide range of planning and coordination needs mentioned. Some mentioned the need for federal and state agencies involved in water management to coordinate better with one another. Others pointed out that planning processes themselves are multi-faceted and in need of improvement. Still others focused on the multitude of regional and local organizations involved in water resource management, and suggested that stronger planning and coordination at regional and watershed levels would be appropriate. While there was a consistent recognition by those interviewed that significant planning and coordination efforts are being undertaken, there was an equally consistent view that changing circumstances and needs required continuing vigilance in this area.

One significant factor affecting the need for planning and coordination is the growing importance of nonpoint water pollution sources. As industries have reduced their discharges of water pollution to northeast Ohio waterways over the last several decades, nonpoint sources of water pollution have become a larger component of the region's water quality problems. Unlike point sources, which come from defined sources and are regulated, nonpoint sources come from a range of sources and are often not subject to regulation by the state and the

federal government. This changing composition of water pollution sources means that coordinating actions among multiple local governments, organizations, and individuals is becoming a more central element of the region's water resource management efforts.

Current Efforts

Regional planning for water quality has been evident in northeast Ohio for many years. Three planning organizations — the Eastgate Regional Council of Governments, the Northeast Ohio Area-wide Planning Agency, and the Northeast Four County Regional Planning Agency — have jurisdiction and water quality planning responsibilities in portions of northeast Ohio. These agencies develop and maintain water management plans required by federal law, and they also provide forums for addressing water quality coordination issues within their jurisdictions. The boundaries for these planning agencies coincide with county lines, rather than watersheds. This geographic reality creates a potential for planning and coordination issues among regional planning agencies and among other units of government within their jurisdictions. Even so, individuals interviewed as a part of this project pointed out that these planning agencies do talk with one another on reasonably regular bases, and they also make efforts to foster coordination and cooperation.

Three planning organizations — the Eastgate Regional Council of Governments, the Northeast Ohio Area-Wide Planning Agency, and the Northeast Four County Regional Planning Agency — have jurisdiction and water quality planning responsibilities in northeast Ohio.

In recent years, efforts have also been made to improve water resource planning and coordination efforts at the watershed level. These efforts have taken several forms. Watershed groups of various kinds have organized around specific river drainage basins, and the Ohio Lake Erie Commission was established in 1990 to help foster coordinated efforts to protect the entire Lake Erie drainage basin. In addition, the USEPA Great Lakes Program provides additional funding support for areas of concern throughout the Great Lakes, including northeast Ohio.

Many watersheds in northeast Ohio have groups which seek to foster planning and coordination among municipalities and institutions within their watersheds. The Cuyahoga River alone has multiple watershed groups that seek to protect and coordinate activities associated with the management of the Cuyahoga River basin. While area watershed groups benefit from funding support provided by both EPA's Great Lakes Program and various state agencies, they are not as well funded as they might be. In addition, because they do not have explicit authority to plan or direct water quality management activities, these groups sometimes have difficulty garnering the attention that is needed to actually coordinate activities within their watersheds.

The Ohio Lake Erie Commission consists of the directors of major state agencies in Ohio, and it has a professional staff. It serves as a funding and coordinating entity for watershed protection activities in the Lake Erie drainage basin. The Commission funds projects through its Great Lakes Protection fund, and has established a balanced growth program which is currently working to foster balanced growth in four watersheds in northeast Ohio. The Commission also holds regular meetings and an annual conference, and provides periodic progress

reports on implementation of the Lake Erie Protection and Restoration Strategy. Notably, there is no similar organization with jurisdiction over the Ohio River Drainage basin and/or in the far eastern part of the region (Mahoning and Trumbull counties, for example).

The efforts of local watershed groups and the Ohio Lake Erie Commission are also enhanced through programs and funding support provided by the US Environmental Protection Agency's Great Lakes Program. The USEPA Great Lakes Program, which is based in Chicago, provides funding for Remedial Action Programs (RAPs) in areas identified as being of concern for Great Lakes water quality. In northeast Ohio, these areas of concern include the Ashtabula and Cuyahoga River basins.

Efforts to enable further planning and coordination could involve strengthening existing planning and watershed management institutions; taking steps to help foster further coordination among them; and/or developing ways to enable and encourage further cooperation among existing political jurisdictions.

Potential Improvements

While there are significant efforts underway to enable planning and coordination in the management of water resources in northeast Ohio, the comments made by those interviewed suggest that further coordination of efforts would be beneficial. Two areas of focus seem particularly appropriate from a regional perspective. First, there is no planning organization that spans all of northeast Ohio, so there may be some value in efforts to foster coordination and mutual learning across the planning organizations described above — NOACA, NEFCO, the Eastgate Regional Council of Governments, and the Ohio Lake Erie Commission. And second, it seems likely that more intensive coordination efforts among local governments in area watersheds would also be valuable.

Efforts to enable further planning and coordination in these two areas could involve strengthening existing planning and watershed management institutions, taking steps to help foster further coordination among them, and/or developing ways to enable and encourage further cooperation among existing political jurisdictions. Specific options that could be considered include:

a) Increasing funding for area planning and coordination agencies, so they can expand their work.

b) Establishing regular region-wide forums for communications among planning agencies, watershed groups, municipalities, and others with watershed management interests and concerns.

c) Creating region-wide clearinghouses of information on useful practices and programs to help foster more effective learning and/or the transfer of valuable or successful practices to other communities.

In any human enterprise, there will always be needs for improved coordination, and multiple ways to address these needs. The potential solutions identified above provide a set of ideas which could be pursued. However, in the end, it is likely that the best solutions will emerge from communications and commitments from the individuals and organizations whose involvement is of central importance. What may be most important, therefore, is the creation of incentives and the identification of parties who may assist by administering incentives and facilitating coordination progress.

V. Where from Here?

The previous section of this report outlined a number of water resource management needs and opportunities facing northeast Ohio. Other specific needs and opportunities may also arise in the course of subsequent discussions that are informed by this assessment. The listing below overviews research, technical assistance, and educational projects and programs that could be carried out in response to the needs and opportunities identified above. In all cases, they are aimed toward improving regional water resource management practices and leveraging sustainable economic development.

Research, technical assistance, and educational projects and programs could aim toward improving regional water resource management practices and leveraging sustainable economic development.

V. a. Research

• Assess the extent to which water management plans are actually implemented and document, where possible, relationships between implementation of recommended actions and measured changes in habitat and/or water quality.

• Conduct intensive studies of particular watersheds that are polluted and in need of clean up strategies.

• Assess and specify relationships between land-use patterns, pollutant loadings, and water quality.

• Inventory access points to Lake Erie, major rivers, and – to the extent possible – tributary streams, and identify areas of opportunity for enhanced recreation, tourism, and economic development.

• Research regional governance models to ascertain lessons that might be applied in northeast Ohio to control sprawl and improve water resource management.

• Assess long-term financing mechanisms associated with the management of water resources and infrastructure.

V. b. Technical Assistance

• Establish a facilitated forum to foster coordination and planning across regional political jurisdictions. The effort could supplement and complement current forums provided by regional planning agencies, watershed groups, the Ohio Lake Erie Commission, and others.

• Develop and implement a system for tracking water quality improvement efforts on the part of local jurisdictions, watershed groups, and others, and highlight

efforts with strong potential for transfer to other areas and jurisdictions.

• Create an expert speaker's bureau which draws on university professionals and/or others to appear before communities to provide information relevant to development choices brought before zoning boards, city councils, and other local governing bodies.

• Provide in-depth analyses and assistance for communities facing significant water quality management challenges.

Useful RESEARCH steps could include:

• Assessing the extent to which water management plans are actually implemented.

• Identifying ways to research regional governance models to ascertain lessons that might be applied in northeast Ohio to control sprawl and improve water resource management.

V. c. Education

• Establish a region-wide clearinghouse for information on water quality management practices and activities which can be made available for the benefit others. This clearinghouse could rely on a world-wide web site, as well as advice and information which could be transferred by telephone.

• Deliver training for local decision-makers on topics relevant to water quality management in the region.

• Deliver educational programs for school age children in order to build a water conscious population in the region.

The research, technical assistance, and educational efforts summarized above grow from the interviews and research underlying this report. When viewed in totality, they appear ambitious – at least in the short term. However, moving forward with at least a subset of these ideas would be beneficial if we are to take full advantage of the water resources that have been bestowed on the northeast Ohio region.

While a range of organizations and institutions could act in follow up to these project suggestions, northeast Ohio universities are in a valuable position to help the region address its water resource needs and opportunities. They possess water-related expertise. They are also credible sources of information because of this expertise, and because they are relatively independent of existing stakeholders in the water resource management field. Furthermore, in northeast Ohio, the Urban University Program provides connectivity among four major educational institutions – Cleveland State University, Kent State University, the University of Akron, and Youngstown State University. These linkages could help enable the use of the multiple and diverse capabilities of these educational institutions, as well as a means to coordinate their activities. All of these traits position UUP educational institutions to assist with research projects, technical assistance efforts, and educational programs that can help leverage northeast Ohio's water resources toward sustainable economic development.

V. d. Conclusion

The research, technical assistance, and education efforts identified in the previous section provide a useful starting point for efforts to aid the northeast Ohio region in improving its water resource management practices. However, they are only a beginning for an effort that could yield significant environmental and economic benefits in the future. Over the long run, efforts of the kind mentioned above are likely to be most useful if they are used to support clearly defined goals and outcomes, and are implemented in strategic fashion.

Thus, while it is appropriate for area universities to move ahead in some or all of the project areas identified above, defining a process for specifying appropriate water resource management goals and outcomes in cooperation with area stakeholders would also be advisable. While the value of protecting the region's environment and public health over the long term should certainly be a part of this process, it is also important to focus on shorter term objectives which can demonstrate both progress and useful results. If this study can give focus to this kind of effort and help foster collaborative movement forward, it will have accomplished a useful purpose.

TECHNICAL ASSISTANCE *can include:*

- *Establishing a facilitated forum to foster coordination.*
- *Developing and implementing a system for tracking.*

EDUCATION *of the public at large can include:*

- *Establishing a region-wide clearinghouse for information.*
- *Delivering training for local decision-makers and educational programs for school-age children.*

References

Association of State and Interstate Water Pollution Control Administrators (ASIWPCA). 2007. Appropriations. Retrieved through the ASIWPCA, www.asiwpca.org, July 12.

Awasthy, Swati, Scott Borgert, Yanbing Chen, and Albert Lin. Undated. Water: A Driver for Enhanced Northeast Ohio Economic Vitality. Case Western University. The Growth Association, Cleveland.

Breckenridge, Tom. 2008. "Civic Leaders: Port's Move is a Good Idea", in the Cleveland Plain Dealer, February 20, pges. C-1 and C-6.

Brookings Institution. 2006. The Vital Center: The Federal-State Compact to renew the Great Lakes Region. Metropolitan Policy Program.

CT Consultants, Inc. 2001. Survey of Northeast Ohio Home Sewage Disposal Systems and Semi-Public Sewage Disposal Systems, prepared by Northeast Ohio counties coordinated by the Northeast Ohio Areawide Coordinating Agency (NOACA), April.

Dolan, Matt. Ohio Environmental Council. 2008. House Bill 416 Great Lakes Compact, prepared by the Ohio House Economic Development and Environment Committee, January 29.

Downing, Bob. 2007A. "Couple's Patience Running Dry", in Akron Beacon Journal, August 19, pges. A-1 and A-4.

Downing, Bob. 2007B. "Septic Mandate Cloud's Land's Future", in the Akron Beacon Journal, November 27, pges. A1 and A 6.

EcoCity Cleveland. 2000. EcoCity Cleveland Journal Special Issue Vol. 6, No. 4-6. "Citizens' Bioregional Plan for Northeast Ohio." October.

EcoCity Cleveland. 2006. "Smart Growth: Water Under Pressure." Retrieved from EcoCity Cleveland Worldwide Web site, http://www.ecocitycleveland.org/smartgrowth/, March 26.

EcoCity Cleveland and the Cuyahoga County Planning Commission. 2007. Global Water Ventures of Cleveland: The Cleveland Water Center Feasibility Study. December.

Fredmonsky, Matt. 2008. "Whitewater Park Economic Development: Main Street Kent sets sites on Cuyahoga." Portage County Record Courier, January 22.

Funders' Network. 2005. Public Sector Leadership: The Role of Local Government in Smart Growth, January.

Great Lakes Sports Fishing Council (GLSFC). 2007. Great Lake Basin Report: "Court finds Massive Power Plant fish kills illegal." March.

Hall, Noah and Bret B. Stuntz. 2007. Climate Change and Great Lakes Water Resources. National Wildlife Federation, funded by the C.S. Mott Foundation, November.

Hoornbeek, John. 2004. Policymaking Institutions and Water Policy Outputs in the European Union and the

United States: A Comparative Analysis, in the Journal of European Public Policy, Volume 11, No. 3.

Huntley, Melinda. 2006. "Economic Benefit of Lake Erie: Tourism", a presentation at the Lake Erie Protection and Restoration Conference, Lorrain Community College, Elyria, Ohio, September 7.

Johnston, Laura. 2007. "Eagles Return to Cuyahoga Valley", in the Cleveland Plain Dealer, May, 24, pges. B-1 and B-5.

Kuehner, John C. 2006. "A Cleaner Cuyahoga", in the Cleveland Plain Dealer, October, 18, pge. B-1.

Lake Erie Commission. 2007. "Linking Land Use and Lake Erie: Best Local Land Use Practices", a handout at a training sponsored by the Lake Erie Balanced Growth Program, March.

Light, Paul. 2000. "Government's Greatest Achievements of the Past Half Century". Reform Watch, No 2 (November): 1-16. Washington D.C.: The Brookings Institution, retrieved www.brookings.edu on January 4, 2001.

Lydersen, Kari. 2008. Great Lakes' Lower Water Levels Propel a Cascade of Hardships, retrieved from http://www.washingtonpost.com/wp-dyn/content/article/ 2008/01 /26/AR2008012601748_pf.html., January 27.

Mayor's Think Tank of Northeast Ohio. 2001. Policy Statement #7: Storm Water Management. Kent State University. Center for Public Administration and Public Policy (CPAPP), December.

Natural Resources Defense Council (NRDC). 2007. Testing the Waters 2007: A Guide to Water Quality at Vacation Beaches, retrieved at www.nrdc.org/water/oceans/ttw/. August?.

Northeast Ohio Areawide Coordinating Agency (NOACA). 2000. Clean Water 2000: 208 Water Quality Management Plan for Northeast Ohio, November 9.

Northeast Ohio Four County Regional Planning and Development Organization (NEFCO). 2003. Clean Water Plan: 208 Lake Erie Basin Water Quality Management Plan, June 19.

O'Brien, Kevin, Claudette Robey, Michael McGoun, Rebecca Salak, and John Storey. 2004. Funding Options for Emerging Public Works Infrastructure Investments in Cuyahoga County, prepared for Build-Up Greater Cleveland by the Center for Public Management, Cleveland State University, July.

O'Deal, Erwin. 2001. Testimony of Erwin J. O'Deal, Executive Director, Northeast Ohio Regional Sewer District, Cleveland, Ohio. Submitted to the Subcommittee on Fisheries, Wildlife and Water, Senate Committee on Environment and Public Works, Columbus, Ohio, April 30, retrieved from http://epw.senate.gov/107th/ode_0430.htm.

Ohio Department of Natural Resources. 2007. "Development of the Ohio Coastal Atlas", accessed http://www.ohiodnr.com/Portals/13/gis/pdf/coastalatlas2/CH1_introduction.pdf,
March 2008.

Ohio Environmental Protection Agency. 2006. "Household Sewage Treatment Systems and an Ohio EPA General NPDES Permit for Discharges," Fact Sheet, State of Ohio, February 10.

Ohio Environmental Protection Agency. 2006. Ohio 2006 Integrated Water Quality Monitoring and Assessment Report, March 27.

Ohio Environmental Agency. 2006. Protocol for Assessing Community and Environmental (PACE) Health – Preliminary Results, provided to the author.

Ohio Environmental Protection Agency. 2007. Water and Wastewater Infrastructure Assistance in Ohio: Challenges and Opportunities, a presentation for the Ohio Public Finance Officer's Training Conference, Center for Public Administration and Public Policy, Kent State University, June 21.

Ohio Environmental Protection Agency. 2008. Public Water System Information, provided by OEPA staff, April 1.

Ohio Lake Erie Commission. Undated. Linking Land Use and Lake Erie: A Planning Framework for Achieving Balanced Growth in the Ohio Lake Erie Watershed.

Scott, Michael. 2007 A. "Beach Bacteria Level Worst in the Nation", in Cleveland Plain Dealer, August 11, pges. A-1 and A-8.

Scott, Michael. 2007 B. "$62 Million Dredging Detoxes the Ashtabula", in the Cleveland Plain Dealer, August 27, pges. B-1 and B-6.

Silliman, Ken. 2003. A Green Infrastructure Development Authority for Greater Cleveland, prepared for EcoCity Cleveland for the BLUE Project, December.

U.S. Government Accountability Office. 2003. Freshwater Supply: States' Views of How Federal Agencies Can Help Them Meet the Challenges of Expected Shortfalls. GAO–03-514. Washington D.C., June.

U.S. Mayors Conference. 2007. Who Pays for the Water Pipes, Pumps, and Treatment Works? – Local Government Expenditures on Sewer and Water -- 1991 to 2005. Mayor's Water Council.

U.S. Environmental Protection Agency. 2000. The Quality of Our Nation's Waters: A Summary of the National Water Quality Inventory: 1998 Report to Congress. EPA 841-S-00-001, June, Washington D.C.

U.S. Environmental Protection Agency. 2002. "The Clean Water and Drinking Water Infrastructure Gap Analysis". U.S. EPA, Office of Water, EPA 816-F-02-017, September.

U.S. Environmental Protection Agency. 2003. Mahoning River Total Maximum Daily Load Report.

U.S. Environmental Protection Agency. 2006. "Growing Toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies;" Development, Community, and Environment Division, January.

U.S. Environmental Protection Agency. 2007. "Lake Erie 'Dead Zone'", accessed from USEPA Worldwide Web site http://www.epa.gov/glnpo/lakeerie/eriedeadzone.html, March 26, 2007.

Trust for Public Land (TPL), 2007. Opening the Lake Erie Shoreline for the People of Cleveland, in Water Resource Brochure: The Trust for Public Lands, Vol. 9, No. 1.

Appendices

Questions to Guide Water Resource Management Interviews

1. What is your role or interest in managing water resources in northeastern Ohio?

- How long have you been playing this role?

- Do you have other relevant experience relating to water resource management?

- What are your specific areas of focus in the water quality field?

2. On a 1 to 5 scale (with 5 being Great and 1 begin Poor), how well are water resources being managed in northeastern, Ohio with respect to the following objectives?

- Surface waters for recreation and tourism?

- Protection of groundwater?

- Protection of drinking water supplies?

- Fostering appropriate economic activity?

- Protection or enhancement of wildlife?

- Overall?

Please explain your reasons for the ratings you provide above?

3. What particular water resource management activities or processes are in need of improvement in the northeast Ohio region?

4. What additionl information, research, actions, or activities would help foster water resource management improvements with respect to the following objectives?

- for source water protection?

- for surface water quality?

- for groundwater quality?

- for economic development?

- for multiple benefits?

- on the relationship between land use/conservation and water resource protection?

5. Are there areas where further coordination of efforts among governing jurisdictions and institutions would be particularly helpful?

6. Are there areas where further coordination of research efforts would be particularly helpful?

7. Who else should we be speaking with to get a sense of water resource needs in this area?

8. Would you be interested in learning about the findings of this project?

* These questions were supplemented by questions that are particular to specific audiences and/or that arose during the course of the interview.

Photo Credits

Photos by Holly Burnett-Hanley: showboat; duck; river; students at stream; stream in winter.
Stock photos: drinking glass; kayaker; child spraying water; children on beach; meeting silhouette; people talking.
Photo of groundwater: photogallery.nrcs.udsa.gov