

Great Lakes Regional Collaboration Strategy



To Restore and Protect the Great Lakes



December 2005

GLRC 

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Executive Summary





EXECUTIVE SUMMARY

The Resource

The Great Lakes are a unique and extraordinary resource that have provided vast amounts of fresh water to nourish the history, culture, economy, and well-being of the people in this part of the United States. They have done so for millennia for the region's Native Americans whose life ways and communities have been and remain intertwined with the natural resources found in their ancestral homelands. And, for the past few hundred years since the earliest journeys of European explorers, the Great Lakes natural bounty has provided for the needs of a growing nation.

Today, more than 35 million Americans receive the benefits of drinking water, food, a place to work and live, and transportation from the Great Lakes. Millions of people enjoy fishing, hunting, swimming, boating, and the sheer beauty of the Lakes in remote parks and on the stunning shorelines of some of our largest cities, and agricultural fields yield abundant harvests of a large variety of crops. The region's many Native American communities rely upon the Great Lakes' natural resources to meet their subsistence, economic, cultural, medicinal, and spiritual needs. We have thrived on the richness the Lakes have brought us, but have not protected them adequately to ensure that future generations will be able to enjoy them as we have.

Challenges

The challenges we face on the Great Lakes are many in number and serious in nature. Aquatic invasive species continue to arrive at the rate of one every eight months, adding to the more than 160 already causing serious ecological and economic damage. At the same time, past and ongoing development has compromised Great Lakes habitats, and threatens the plants and animals that need them to survive. Many of our coastal areas, in particular, also suffer from massive sewer overflows that contaminate the water and close the beaches. The thirty-one areas identified more than 15 years ago where the most significant harm to the resources has occurred continue to be of great concern; none of them has been fully restored to date. Continued pollution from non point sources in these areas and many others contribute to impaired water quality and related problems. Although releases of toxic pollutants have been reduced significantly over the years, there is a legacy of contamination in sediments and fish throughout the system, and mercury and other pollutants continue to enter the Great Lakes from nearby and distant sources. While large amounts of data and information on the Great Lakes have been collected over the years, not enough of that has been transformed into knowledge about the key indicators of the health of the ecosystem. In addition, many of the practices of industry, agriculture, communities, and private citizens simply have not been sustainable.

Collectively, these problems and others have seriously compromised the environmental health of the Great Lakes. Because the stressors to the Great Lakes have developed over time and there has usually been a delay in the Lakes' response to the stressors, many believe that we have time to counter these stresses and restore the Lakes. However, in many areas of the Lakes, historic stressors have combined with new ones to reach a point where ecosystem-level changes occur rapidly and unexpectedly. As a result, there is a new sense of urgency for action on the highest priorities for restoring and protecting the Great Lakes.



Since 1970, governments, citizens, industry, and agriculture have worked together extensively to restore and protect the Great Lakes. Although much progress has been made, some of the problems have become more serious, many have not been solved, and new ones continue to develop. Despite good intentions and hard work, the strategies and efforts to date simply have not been effective enough to do the job of cleaning up the Great Lakes or preventing further degradation. A much more concerted effort over a longer period of time is essential for the restoration and protection of the resource and the prevention of future problems.

The Great Lakes Regional Collaboration

In December 2004, the Great Lakes Regional Collaboration of National Significance (GLRC) was launched, creating a unique partnership of key members from federal, state, and local governments, tribes, and other stakeholders for the purpose of developing a strategic plan. This Strategy is intended to build upon the extensive regional efforts to date, working together toward a common goal of restoring and protecting the Great Lakes ecosystem for this and future generations.

An Executive Committee made up of senior elected and appointed officials from different levels of government has helped guide the GLRC over the past year as the Strategy has been developed. Eight Strategy Teams, each focusing on a different issue affecting the Great Lakes basin, began work in January 2005 to develop recommendations for action. More than 1,500 people from diverse backgrounds have participated on these Teams. A Draft Strategy was released on July 7, 2005 for public comment. Comments were solicited and received through a series of public meetings, the Internet, and in writing. This Strategy is the result of that collaborative process but it should not be construed as an endorsement or approval by the GLRC members of each and every Strategy Team recommendation. Implementation will proceed promptly after the Strategy is released. Because we share the Great Lakes with Canada, we must do everything possible to make sure that our plans and actions are compatible and synchronized with their efforts.

Strategy Team Recommendations

The work of the Strategy Teams includes many recommendations for action focused on the steps that should be taken over the next five years to proceed with restoration to achieve the greatest results. The actions identified by the Strategy Teams highlight the highest priorities recommended by the Teams for early implementation. Much more will need to be done to fully restore and protect the Lakes. Those additional actions, as well as much more supplemental information, are included in the Appendices to the Strategy. The Strategy Teams considered the overarching issues of human health, tribal interests and perspectives, and research, and factored them in to the extent possible. The Strategy Teams worked to characterize the problems faced in the Great Lakes, and to establish goals and milestones. The key recommendations crafted by each Strategy Team are set forth below.

Immediate action to stop the introduction of more **aquatic invasive species** (AIS) can prevent significant future ecological and economic damage to the Great Lakes. The steps needed include:

- prevention of AIS introductions by ships through ballast water and other means;
- stopping invasions of species through canals and waterways;
- restricting trade in live organisms;
- passage of comprehensive federal AIS legislation;
- establishing a program for rapid response and management; and
- education and outreach on AIS introduction and prevention.

The plants and animals of the Great Lakes need habitat in order to survive in the future, and there is a need for significantly more **habitat conservation and species management**. The recommendations focus on:

- native fish communities in open waters and near shore habitats;
- wetlands;
- riparian (streams) habitats in tributaries to the Great Lakes; and
- coastal shore and upland habitats.

The **near shore waters and the coastal areas** are the region's largest source of drinking water and experience a variety of recreational activities. To minimize the risk to human health resulting from contact with near shore waters, actions needed include:

- major improvements in wet weather discharge controls from combined and sanitary sewers;
- identify and control releases from indirect sources of contamination;
- implement a "risk-based approach" to manage recreational water;
- protect sources of drinking water; and
- improve the drinking water infrastructure and support source water protection.

The United States identified the 31 most contaminated locations on the Great Lakes under the Great Lakes Water Quality Agreement with Canada more than 15 years ago. None of them have been restored to date. To remedy this situation, a dramatic acceleration of the cleanup process at these **areas of concern** (AOC) is needed. The actions recommended are:

- amend the Great Lakes Legacy Act to increase funding and streamline the process;
- improve federal, state, and local capacity to manage the AOC cleanups;
- create a federal-state AOC coordinating committee to work with local and tribal interests to speed cleanups; and
- promote clean treatment and disposal technologies as well as better beneficial use and disposal options.

Non point sources of pollution contribute significantly to problems in the Areas of Concern, as well as to other locations in the Great Lakes, including the open waters. Actions to address these problems include:

- wetland restoration;
- restoration of buffer strips;
- improvement of cropland soil management;
- implementation of comprehensive nutrient and manure management plans for livestock operations; and
- improvements to the hydrology in watersheds.

Toxic pollutants continue to stress the Great Lakes ecosystem, posing threats to human and wildlife health. Persistent toxic substances such as mercury and PCBs remain present in fish at levels that warrant advisories and restrict consumption throughout the Basin. To address this ongoing problem, actions are needed to:

- reduce and virtually eliminate the discharge of mercury, PCBs, dioxins, pesticides and other toxic substances to the Great Lakes;
- prevent new toxic substances from entering the Great Lakes;
- institute a comprehensive research, surveillance and forecasting capability;

- create consistent, accessible basin-wide messages on fish consumption and toxic reduction methods and choices; and
- support efforts to reduce continental and global sources of toxics to the Great Lakes.

With a resource as large and complex as the Great Lakes ecosystem, it is essential to have a **sound information base and representative indicators** to understand what is happening in the system. This information must then be communicated to the public, to decision makers, and all others involved. To improve over the current situation, the following actions are needed:

- better coordinate the collection of critical information regarding the Great Lakes ecosystem and support the U.S. Integrated Earth Observation System (IEOS) and the Integrated Ocean Observing System (IOOS) as key components of the Global Earth Observation System of Systems (GEOSS);
- promote the continued development of science-based indicators, including those developed through the SOLEC process;
- double funding for Great Lakes research over the next five years;
- establish a regional information management infrastructure; and
- create a Great Lakes communications workgroup to manage scientific and technical information.

Ensuring the long term **sustainability** of the Great Lakes resource will require a number of significant changes in the way we approach such things as land use, agriculture and forestry, transportation, industrial activity, and many others. To start this process, we need to:

- adapt and maintain programs that promote sustainability across all sectors;
- align governance to enhance sustainable planning and management of resources;
- build outreach that brands the Great Lakes as an exceptional and competitive place to live, work, invest, and play; and
- provide leadership for sustainable development through implementation of the Strategy recommendations.

This document provides the full range of recommendations, options, and ideas generated by the Strategy Teams. While better coordinated use of existing resources will allow for some recommendations to move forward early in the implementation process, others will require modest additional funding, and some will be impossible to implement absent substantial new expenditures on the part of the various Collaboration partners. While the release of this Strategy does not constitute a commitment of additional resources on the part of any member of the Collaboration, the members are committed to continuing to work together in partnership toward the goals identified in the Strategy.

The Collaboration partners have rallied around a shared vision of a restored, sustainable Great Lakes ecosystem that has generated optimism and engendered a spirit of cooperation. What is needed now is the will to act and the leadership to proceed if we are to realize our vision and reach our goals. The time to begin is now.

Introduction





A National Treasure

When the United States is photographed by satellite cameras, the Great Lakes stand out as one of the few recognizable features. In the west, Lake Superior, the Ojibwas' "Gichigami" and Longfellow's "shining big sea water," is the largest freshwater lake in the world. Some 750 miles to the east, in the land of James Fenimore Cooper's Hawkeye and Chingachgook, Lake Ontario's average outflow of two million gallons per second gives birth to the St. Lawrence River—the connection to the Atlantic Ocean. In between, more than 35 million U.S. residents live, work, and play supported by the waters of the Great Lakes basin.

The Great Lakes are the largest single source of fresh surface water in the Western Hemisphere. The Lakes support thriving fisheries, a strong agricultural sector, and vibrant tourism. A draft study for the Army Corps of Engineers shows that one-third of all registered recreational boats in the United States are located in the eight Great Lakes States, where boating results in \$35.6 billion of annual economic activity and supports 246,117 jobs. In addition, U.S. Fish and Wildlife survey data indicate that fishing, hunting and wildlife watching generate almost \$18 billion in annual revenues in the Great Lakes region.

The Great Lakes Region is the ancestral homeland of thirty-five federally-recognized Indian Tribal Nations whose reservations are located in the Basin or which retain treaty-guaranteed rights to hunt, fish or gather in the Basin. Although each Tribal Nation is unique and distinct in its own right, all Great Lakes Tribal Nations share much in terms of historic, cultural and social underpinnings of their respective communities, particularly regarding their interdependence with and reliance upon natural resources to meet subsistence, economic, cultural, spiritual, and medicinal needs. Tribal governments play a vital role in Great Lakes protection and restoration efforts. They provide a range of governmental services to promote the health, welfare and security of their peoples and their physical/biological communities.¹

A Time of Growth

The first European explorers encountered the Tribal Nations as they used the Great Lakes travel routes to open the interior of what would become the United States of America. As the young country began to grow, the Great Lakes region's natural resources sparked its development. Iron ore from Michigan, Wisconsin, and Minnesota was shipped to mills in Indiana and Ohio to meet the expanding demand for steel forged in furnaces fueled by Pennsylvania coal. Millions of board feet of timber were cut and shipped to build growing cities. New European immigrants came to the region to farm the land and open businesses. The boundless fisheries of the Great Lakes helped feed a rapidly growing population.

As the cities grew, commerce expanded, and the Lakes became the major transportation route to move goods back and forth through the region and, with construction of canals, to cities on the Atlantic coast. Henry Ford launched the automobile industry in Michigan. Other manufacturing followed—paper, chemical, heavy manufacturing and steel—all supported by Great Lakes shipping



¹ A more detailed discussion of Great Lakes Tribal Nations and the perspectives that they bring to the Collaboration is provided in Great Lakes Regional Collaboration, Tribal Nations Issues and Perspectives, Version 1.0 (April 26, 2005) that is contained in the Appendices to this Plan.

By the 1900s, the Great Lakes region, with its manufacturing might and economic strength, was the industrial backbone of America.

Completion of the St. Lawrence Seaway in 1959 removed the last obstacle to international shipping and world commerce. The promise for long-term economic vitality seemed to be fulfilled.

The Price of Prosperity

But these advances had a price. Physical changes to the Great Lakes ecosystem wrought by heavy industry, agriculture, and rampant development endangered the future of the Lakes.

For example, the St. Lawrence Seaway, in opening the Lakes to the world, also became a doorway for destructive exotic species. Within just a few years of the arrival of the sea lamprey, the once ubiquitous lake trout were nearly gone. Other species soon followed the lamprey, many arriving in ballast holds of international ships. The Pandora's Box had been opened. More than 160 exotic species now exist in the Lakes.

In the meantime, some of the region's largest cities were regularly dumping raw sewage into the Lakes. Most industries had no treatment systems beyond those needed to support their industrial processes, and their discharges poisoned rivers throughout the basin. By the 1970s, the Great Lakes' image as a symbol for the nation's strength was tarnished. While many areas, such as the Kakagon River Sloughs in Lake Superior, remained pristine, other areas became a national embarrassment. The image of the Cuyahoga River aflame in 1969 epitomized the decades of abuse and its sorry consequences.

Looking for Solutions

Fortunately, America was waking up to its environmental problems. Strong environmental laws, including the Clean Air Act and Clean Water Act, began to address the lax pollution controls of the time. Recognizing the need for shared action to protect the Great Lakes, the U.S. and Canada developed the Great Lakes Water Quality Agreement of 1972, and amended it in 1978. A new philosophy, the ecosystem approach was embraced as the way to restore the Great Lakes' ecological integrity.

In 1987, thirty-one locations in the U.S. were designated Areas of Concern and energized groups of stakeholders developed plans to clean up these polluted hot spots. In addition, States, Tribes, local governments, federal agencies, advocacy groups and many individual citizens came together to create consensus recommendations for the actions necessary to restore each of the five Great Lakes. Because these consensus plans identified gaps in existing programs and critical funding needs, there was a growing expectation that the planning process would lead to the technical and fiscal resources essential to implement the recommendations. This expectation was never realized.

As a result, the problems remained and in some instances have become more serious.

- The number of exotic species has exploded in the Great Lakes region. As a result, millions of dollars are directed annually to protect water intakes at industries, water utilities, and power plants.
- Although phosphorus reductions at wastewater treatment plants led to successful algae reduction, cladophora again fouls some beaches and near-shore habitats.
- There is no appreciable natural reproduction of lake trout in the lower four lakes. Other desirable fish population levels remain severely depressed.

- Municipal wastewater treatment infrastructure is old and deteriorating, and sewage overflows during storm events allow inadequately treated wastes to enter the Lakes.
- Contaminated sediments continue to leach toxic pollutants into the food chain, causing elevated levels of PCBs and mercury in fish, wildlife, and humans.
- Once a cleanup success story, Lake Erie has become the scene of dissolved oxygen depletions and resultant avian botulism outbreaks, killing thousands of migrating birds.
- Aging and obsolete factories that once fueled the country's growth were abandoned, leaving behind brownfields that challenge municipal governments' redevelopment efforts.
- Drinking water supply contamination risks remain, threatening the health of Great Lakes residents.
- Tributary flows and habitats, essential to the fish of the Lakes, have been negatively altered by local watershed activities that change hydrology.
- Wetlands that provide habitat and serve as pollution filters have been lost.
- Growth patterns have diminished public access to much of the Lakes' shoreline.

These problems have catalyzed actions by dedicated constituencies who have continued the call for help. But it has been a challenge to effectuate a national action plan to restore and protect the Great Lakes. A Government Accountability Office (GAO) review of Great Lakes restoration programs concluded that leadership and interagency coordination were lacking. The GAO also found that improved coordination was essential to increase the effectiveness of existing and future programs.

Re-energizing Restoration Efforts

In 2003, at the request of a Great Lakes Congressional delegation, the Great Lakes Governors identified nine priorities for Great Lakes restoration and protection as a first step in providing the leadership and coordination all agree was needed. Since their release, these priorities have been adopted by the Great Lakes Mayors, the Great Lakes Commission, and other Great Lakes leaders. These priorities form the organizing principle for this plan. The first of the priorities—ensuring the sustainable use of our water resources—is being advanced through the Governors' efforts, in partnership with the Premiers of Ontario and Québec, to implement the Great Lakes Charter Annex of 2001. This plan describes the actions needed to achieve the objectives that relate to the other eight priorities.

A key piece of the puzzle was put into place when President Bush issued an Executive Order in May 2004. This Order recognized the Great Lakes as a “national treasure” and created a Federal Great Lakes Interagency Task Force to improve federal coordination on the Great Lakes. The Order also directed the U.S. EPA Administrator to convene a “regional collaboration of national significance for the Great Lakes.” This collaboration process was needed to develop, by consensus, the national restoration and protection action plan for the Great Lakes.

The Collaborative Process

In December 2004, the region's leaders kicked off the Great Lakes Regional Collaboration. Since then, the Collaboration has developed a Strategy that provides a set of recommendations to restore and protect this national treasure. More than 1,500 people representing the federal, state, local and tribal governments; non-governmental entities; and private citizens have participated on eight issue-specific Strategy Teams to develop the plan. The Strategy is a reflection of this partnership and recognizes that we must all work in concert in order to be successful.

The GLRC Strategy is based on “Recommendations from the Strategy Teams” which represent each Team’s highest priority recommendations for actions that can be taken over a period of time to effectuate improvements in the Great Lakes basin. They do not represent all that needs to be done to completely restore the Great Lakes. Other recommendations the Teams developed during the collaborative process, as well as much supporting information, appear in the appendices.

The overarching issues of human health, research and information, and tribal perspectives were considered by each of the Strategy Teams as they pursued their work. Human health issues are discussed by a number of recommendations made by the Strategy Teams, particularly the Coastal Health Team, the Persistent Toxics Team, and the Areas of Concern/Sediment Team. Research and information issues are included chiefly in recommendations from the Indicators and Information Team.

Making the Final Plan

As set forth in the Framework that established the parameters of this collaborative effort, the members of the Great Lakes Regional Collaboration are issuing the final Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes. These members, who each have representation on the Executive Committee, are Federal Government Cabinet Officials, Great Lakes Governors, Mayors, and Tribal leaders. Representatives of Congress and of the Canadian government serve as observers. In developing the final Strategy, the Executive Committee and Strategy Team leadership addressed the following:

- The implementation process will emphasize some new actions to be taken as well as stressing the importance of making more effective use of the authorities, programs and funding already available at all levels of government, and will demonstrate opportunities for doing so. The President’s Executive Order charges the Federal Interagency Task Force with improving coordination among the approximately 140 different federal programs operating in the Great Lakes basin. An untold number of state, municipal, and tribal programs—as well as the efforts of non-governmental entities—must also be coordinated and managed as efficiently and effectively as possible as a necessary first step in restoring and protecting the Great Lakes;
- Part of this coordination is the recognition that no one Collaboration partner can be the sole source of support for implementing the Strategy. The Collaboration partners expect that, to the extent the Strategy’s goals cannot be accomplished under current resources or programs, responsibility will continue to be shared among those who value and currently invest in the preservation and restoration of the Great Lakes; and
- The Executive Committee acknowledges the funding climate in which implementation is likely to occur. While better coordinated use of existing resources will allow for some recommendations to move forward, others will require modest additional funding, and some will be impossible to implement absent substantial new expenditures on the part of the various Collaboration partners. While, the release of this Strategy does not constitute a commitment of additional resources on the part of any member of the Collaboration, the members commit to continuing to work together toward the goals identified in this document.

The Role of Tribal Nations

The Collaboration recognizes Tribal Nations as valuable partners under this Plan. It also acknowledges the United States’ unique treaty obligations and trust responsibilities toward Tribal Nations and their communities. Accordingly, the Framework Agreement establishes the need for

this Plan to address Tribal interests and perspectives as an overarching issue. The Collaboration recognizes the efforts of each Strategy Team to consider and address Tribal perspectives. These general comments are offered to complement and help integrate the Teams' efforts.

Tribal Nations count upon the United States government to adequately fund their natural resource and environmental management programs pursuant to various laws² and long-standing federal policies.³ Consequently, Tribal programs are particularly vulnerable to federal budgetary reductions. The loss of what might be considered a small amount of funding to others usually constitutes a large percentage of a Tribal program's funding, resulting in a correspondingly large reduction in services to Tribal communities, if not a de facto elimination of that program.

The Collaboration recognizes the need to maintain base funding levels for Tribal programs to ensure that the Tribal Nations are able to provide for the health and welfare of their communities. A secure, on-going funding base ensures the capacity to carry out the primary purposes of basic natural resource and environmental management programs. It further assures essential, culturally-appropriate research and monitoring of consumption patterns and risk exposures of Tribal members who engage in subsistence life ways, who use natural resources for medicine and in ceremonies, and whose livelihood is based upon natural resources. And, only with this funding can Tribal Nations remain effective partners in Great Lakes protection and restoration efforts.

The Collaboration acknowledges that most environmental problems, and particularly habitat degradation, disproportionately impact the culture, religious practices and other life ways of Tribal communities. Accordingly, it acknowledges and supports particular priorities that Collaboration member Tribal Nations have identified, including the prevention and control of invasive species, the reduction and prevention of toxic pollutants, and habitat protection and restoration. With this Plan, the Collaboration pledges its commitment to address these priorities to help sustain the overall health and well-being of Tribal communities and of the natural resources upon which they rely.

Creating a Shared Vision

The collaborative process that has produced this Strategy has engendered a new spirit of shared responsibility and optimism. Most importantly, the Collaboration has rallied around a shared vision of a restored, sustainable Great Lakes ecosystem. The Collaboration has reaffirmed a number of important underlying principles to guide not only decision makers as they move forward in implementing key actions, but also every Great Lakes citizen as they carry out everyday activities.

While the Strategy is a best effort to identify some means of moving closer to that shared vision, the Collaboration recognizes that it can not possibly identify every action or funding avenue that will help achieve the desired end. The members of the Collaboration hope that those whose activities impact the Great Lakes basin will use the Strategy as a benchmark to guide their decisions in a way that supports the ultimate shared vision. From thinking about the practices of the everyday household consumer, to the processes of Great Lakes industries, the Strategy can and should be used to identify how everyone in the Great Lakes basin might contribute to a cleaner, healthier environment.

² Such laws include dozens of treaties between the United States and Great Lakes Tribal Nations and a number of federal statutes such as the Indian Self-Determination and Educational Assistance Act, the Clean Water Act, and the Clean Air Act.

³ These policies are stated in a number of Executive Branch documents such as President Bush's Memorandum to the Head of Executive Departments and Agencies (September 23, 2004), President Clinton's Executive Order 13175 (November 6, 2000), EPA's Policy for Administration of Indian Programs on Reservations (November 8, 1984) and the USFWS Native American Policy (June 28, 1994). Most federal agencies have now adopted similar policies.

Similarly, the Collaboration expects that the Strategy will be used by decision makers and funding sources as an important benchmark in judging funding requests and project proposals by the various Collaboration partners that are consistent with the Strategy. The Strategy will succeed only if it is fully utilized in a dynamic, adaptive fashion to leverage even more and greater opportunities to protect and restore this national treasure.

Continued Role of the Regional Collaboration

With the release of the Great Lakes Regional Collaboration Strategy, the Collaboration partners will continue to fulfill the role that was articulated in the Framework Document, released in December 2004, which is to serve as a broad forum to address regional issues that relate to Great Lakes ecosystem protection and restoration. The Executive Committee will develop a formal addendum to the Framework document outlining plans for the continuation of the GLRC, including the Executive Committee and the Executive Subcommittee's function and operation by March 30, 2006.

Strategy Team Recommendations



Acknowledgement of Recommendations from the Strategy Teams

The GLRC Executive Committee acknowledges the valuable recommendations provided by the eight Strategy Teams. The Strategy Team reports provide information on actions that will help guide restoration activities at all levels of government and by the private sector over the coming years, and will serve as an important tool to use in selecting and weighing competing priorities with respect to Great Lakes restoration activities.



STRATEGY TEAM RECOMMENDATIONS

AQUATIC INVASIVE SPECIES

I. Problem Statement

Significant progress over the previous three decades to restore the Great Lakes has been interrupted and undermined by the present crisis of Aquatic Invasive Species (AIS). Invasive species come from outside an ecosystem, degrade habitat, kill native and naturalized species, and short-circuit food webs needed to maintain and rehabilitate biological resources. The Great Lakes region continues to face wave after wave of aquatic invasion. Sadly, even after decades of high-profile invasions like the sea lamprey and zebra mussel, the rate of new introductions has not slowed.⁴ Our Great Lakes, which are the world's greatest freshwater lakes, are succumbing to an irreversible "invasional meltdown"⁵ that may be more severe than chemical pollution, as AIS often make the Great Lakes home, they reproduce and spread, rendering eradication impossible. Existing measures to prevent the introduction of new species and to control species that are already established are woefully inadequate. The Great Lakes cannot afford even one new invader, and as invasions are irreversible, prevention is paramount.

An "invasive species" is defined as a species: 1) that is not native, and 2) whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.⁶ AIS have entered or may enter the lakes through vectors such as maritime commerce (e.g., ship ballast), aquaculture, canals and waterways, recreational activities, and the trade and use of live organisms. The AIS Strategy Team's plan addresses species invasion through these vectors. More than 160 non-native aquatic species are established in the Great Lakes, and during the last several decades established populations have been discovered at an average rate of one every 8 months.⁷ Not all of those species are invasive, but economic losses in the Great Lakes Basin from those that are were estimated in 2005 at \$5.0 billion per year.⁸ Moreover, 42 percent of threatened and endangered species in the U.S. are at risk, mainly because of invasive species.

Recommendations below apply only to the U.S. While a heightened U.S. response to AIS is welcomed and overdue, the U.S. should work closely with Canada to ensure commensurate action on both sides of the border, especially with regards to ballast water controls for ships



⁴ □
Great Lakes. [online] URL http://www.iaglr.org/scipolicy/ais/ais_iaglr02.pdf.

⁵ Ri □
Can. J. Fish. Aquat. Sci. 58: 2513-2525.

⁶ Executive Order 13112. <http://www.invasivespecies.gov/laws/eo13112.pdf>.

⁷ Mills, □
ductio □
invasive species in the North American Great Lakes accelerate? BioScience 55:4; Holeck KT, EL Mills, HJ MacIsaac, MR Dochoda, RI □
Lakes. BioScience 54:919-929; Holeck KT, EL Mills, HJ MacIsaac, MR Dochoda, and A Ricciardi. 2005. [Letter] Response from Holeck and colleagues. BioScience 55:4-5.

⁸ □
economic and environmental assessment. Environ. Manage. 35(1): 1-11.

transiting the St. Lawrence either in ballast or declaring no ballast on board. Bi-national cooperation is required to prevent introductions of AIS into the Great Lakes via maritime commerce, canals and waterways (including Long Lac and Ogoki diversions, St. Lawrence Seaway, and Welland Canal), trade of live organisms, and recreational activities.

II. Goals and Milestones

Goal: Prevent all new introductions of AIS into the Great Lakes.

Goal: Stop the spread of AIS within the basin, extirpate harmful AIS, or if impossible, then control to levels that ensure sustainable ecosystems and the social, economic and cultural uses they support.

Interim Milestones: A complete list of all milestones developed to measure progress through 2010 toward reaching the goals is included in AIS appendix A. The most important interim milestones supporting the recommendations are to:

- Enact comprehensive federal legislation (*specifically* legislation that would incorporate all of the terms contained in S. 770, H.R. 1591 and 1592 as introduced in the 109th Congress; collectively the *National Aquatic Invasive Species Act*—NAISA; with modifications as outlined in recommendation #3) to authorize and fund AIS programs;
- Provide expanded federal support for AIS research and outreach programs; and
- Develop a binational plan of action to prevent additional species invasions, and control established populations of the most damaging AIS.

III. Recommendations

The AIS Strategy Team offers the following five recommendations. A complete list of recommendations is included as Appendix A. Dollar figures have been included in the recommendations, where available. The dollar amounts provided are often incomplete estimates; more realistic figures should be developed.

1) Ship and barge-mediated introductions and spread of AIS in the Great Lakes should be eliminated, through the immediate promulgation of environmentally protective standards for ballast water, and the implementation of effective ship-board treatments and management measures. Specifically:

- Immediately require, verify, and enforce (in the current shipping season under existing authorities) that ocean-going vessels in the no ballast on board condition (NOBOB) implement practices that are an improvement over current practices⁹;
- Immediately require, verify, and enforce best performing ship-board ballast water treatment and hull management methods for ocean-going vessels (with a set approval period), with continued upward ratcheting of the treatment floor as treatment performance improves. Approved treatment must be to an environmentally protective standard by 2011;
- Immediately require monitoring, reporting, and public dissemination of all ballasting activities, prevention practices, and outcomes such that progress toward the goal is measurable and enforcement practical;
- Review and apply best-performing ballast water management practices to non-ocean-going vessels operating exclusively within the Great Lakes (including application of ballast water treatment for new ships) to eliminate the spread of AIS already introduced into the system; and

⁹ The Steering Committee of the Collaboration has requested the Strategy Teams put forward recommendations that can be implemented even before the process is finalized in December, 2005. The AIS Strategy Team recommends this action on NOBOBs as one for immediate implementation.

- Immediately and significantly expand research, testing, and evaluation of policies and technologies as alternatives to on-board treatment. Alternatives to be investigated should include (but not be limited to) cargo transfer, shore-based treatment, use of Clean Water Act discharge permits, and state/regional actions. Programs under which these investigations can be conducted include the Ballast Water Technology Demonstration Program and the Environmental Technology Verification Program. These investigations will hasten development of effective shipboard treatment systems. If ship-board treatments are shown to be inadequate, the team recommends implementation by 2011 of effective alternatives that prohibit ballast water from ocean-going ships from being discharged into the Great Lakes.

Rationale: The failure to install meaningful and enforceable regulations for treatment of ballast water from ballasted and NOBOB ocean-going ships remains a major inhibitor for achieving the protection and restoration of the Great Lakes. Moreover, some AIS have limited means to disperse throughout the Lakes without the help of ships. Clearly, the status quo is unacceptable and does not protect the Great Lakes. Ocean-going ships are the prime vector for AIS introductions into the waters of the Great Lakes, so stopping those introductions is a top priority. Also, preventing the spread of AIS by the Great Lakes shipping industry is also a priority, so ballast water management practices for ships that operate within the Great Lakes should be reviewed and modified. Quick passage and immediate implementation of comprehensive federal legislation is required to prevent ship-mediated introductions of AIS into the Great Lakes. The government has significant authority under existing law to take immediate action, particularly in the management of NOBOB ships. Ship-board treatment actions must be fully implemented now, and evaluated well in advance of 2011. This will require immediate action by the Coast Guard to promulgate ballast water regulations. In addition, research and planning on alternatives is needed immediately so that methods may be applied by 2011, in the event best-performing ship-board treatment fails to fully protect the Great Lakes and the nation.

Cost: \$13.2 million annually for five years.

2) Federal, state, and/or local governments must enact measures that ensure the region's canals and waterways are not a vector for AIS, including full federal funding of the Chicago San-Ship Canal barrier and the sea lamprey control program. Specific recommendations are to:

- Complete construction of barrier II, make barrier I permanent, provide federal funds to operate both dispersal barriers in the Chicago Waterway system, and complete a study of options for permanent hydrological and/or biological separation of the Great Lakes and Mississippi River systems;
- Fully examine options and their economic benefits and costs to prevent the spread of AIS via the Lake Champlain Canal and other canal systems linking the Great Lakes with other basins;
- Close or modify, through the use of physical barriers or control structures, canals that have fallen into disuse or disrepair—if rebuilt, prevent passage of aquatic invasive species;
- Prohibit development of new cross-drainage basin connections;
- Address intermittent flood-related connections;
- Initiate measures to prevent or reduce the movement of AIS into stream segments opened up by dam/impediment removal or culvert construction, and fully consider benefits to native species and impacts from AIS when evaluating cost-benefits of proposed fish passage projects;
- Develop and implement AIS monitoring plans to provide comprehensive monitoring and reporting of AIS through the canal vector; and

- Fully fund the Great Lakes Fishery Commission’s sea lamprey control program.

Rationale: A unified (federal) approach is preferred, but some canals and waterways are under state or local jurisdiction that will require state or local legislation. Canals facilitate the conveyance of bulk goods and commodities and are used for recreational activities, but they also facilitate the spread of AIS by allowing cross-basin transfer between watersheds. Canal closure can re-establish the natural geographic separation of the Great Lakes from other drainage basins. Work to complete the barrier system on the Chicago Waterway is moving forward, and provisions supporting this project exist in the pending NAISA legislation and in the Senate version of the Water Resources Development Act of 2005 (S. 728). New legislation is needed to study options for hydrological separation and to address issues in other canals, particularly in un-used waterways. Existing canals and waterways should include dispersal barriers, flood control barriers, physical barriers, and other provisions to ensure hydrologic separation of historically disconnected watersheds. Wherever possible, canals that have fallen out of use should not be improved and, in fact, should contain physical barriers to prevent the free-flow of organisms. Dam removal, while often an important element of habitat rehabilitation, should be done carefully, with full coordination of federal, state, and local agencies, so as not to solve one problem by creating another, an AIS pathway. The sea lamprey control program, successfully carried out by the Great Lakes Fishery Commission, should be fully funded so that this species, which entered the system through canals, remains under suppression.

Cost: \$45 million annually for five years.

3) Federal and state governments must take immediate steps to prevent the introduction and spread of AIS through the trade and potential release of live organisms. Specifically:

- Develop a list of species of concern for the Great Lakes basin and an immediate moratorium by the States on the trade of species on that list, until the species are screened and approved for trade ;
- Implement provisions of the pending NAISA legislation, as introduced, that establish a federal screening process for organisms proposed for trade¹⁰;
- Modify the pending NAISA legislation mandating that the screening process should classify species proposed for trade into three lists—prohibited, permitted, and conditionally prohibited/permitted;
- Modify NAISA to clearly state that the screening process established must place the burden of proof of non-injuriousness on the importer;
- Allocate sufficient resources to heighten the number of species under the Lacey Act as “injurious,” to prevent the interstate transportation of harmful species; the Fish and Wildlife Service FWS should list black, bighead, and silver carps as injurious under the Lacey Act;
- Significantly increase resources for the enforcement of laws governing the trade of live organisms; and
- Develop and implement risk models for organisms in aquaculture.

Rationale: The trade of live organisms is vibrant. Hundreds of millions of fish and hundreds of thousands of invertebrates, plants, and other organisms are traded live each year. However, serious problems and many loopholes in the trade regime exist. In many cases, trade is unregulated, facilitating importation, interstate commerce, and trade among the pathways that pose the greatest risk for introduction of invasive species into the Great Lakes ecosystem. This recommendation is designed to close the loopholes in the trade regime. It calls for an immediate listing of species and

¹⁰ For predictions about which fish species from Eurasia would be most damaging to the Great Lakes, and thus for insights into an immediate candidate list for damaging species that should be listed in the Lacey Act, see: Kolar, C.S. and D.M. Lodge. 2002. Ecological predictions and risk assessments for alien species. *Science* 298:1233-1236.

a state moratorium on trade of those species. It supports the provisions of NAISA that establish a screening process and it proposes that the screening process be based on a three-list approach. The recommendation also improves the implementation of key federal laws that restrict the interstate transportation of injurious species and calls for increased law enforcement to ensure the laws are implemented properly. Underlying the recommendation is the requirement that the burden of proof demonstrating that an organism is not injurious be placed on person(s) who proposes to import it. When the screening process is developed pursuant to NAISA, it will be important to place the burden of proof on the importer. Placing the burden on the government to demonstrate injuriousness (which occurs usually after it is too late to address the problem, if at all) does little to contain the spread of AIS through trade, and does not protect the Great Lakes.

Cost: \$17 million annually for five years.

4) Establish a Great Lakes Aquatic Invasive Species Integrated Management Program to implement rapid response, control, and management programs and assess the effectiveness of those programs. This program, which will require authorization, must:

- Allocate funds for development and implementation of State and Interstate Aquatic Nuisance Species Management Plans through the Aquatic Nuisance Species Task Force, with a particular emphasis on the immediate use of techniques to control or slow the spread of AIS;
- Develop voluntary agreements and codes of best practices for industrial trade groups;
- Encourage investigation of economic requirements and incentives (e.g., bonds or insurance) to prevent new introductions;
- Establish a revolving fund for rapid response actions;
- Establish an interagency, Great Lakes Federal Rapid Response Team, that will conduct activities on federal lands, and in other locations with State, Tribal, and local cooperation; and
- Allocate funds to implement a system of enhanced monitoring and ecological surveys in the Great Lakes;
- Support additional research to develop and implement new control methods for uncontrolled species of concern;
- Establish a coordinated data management system, through the Smithsonian Institution, the Great Lakes Environmental Research Laboratory, or other suitable entity, to develop an accessible, integrated, and centralized database that allows for the reporting and tracking of AIS infestations; and
- Ensure overall coordination and accountability through the Invasive Species Council, including developing regular and comprehensive reports summarizing the status of AIS activities (including those of the Aquatic Nuisance Species Task Force and the Great Lakes Panel on ANS in implementing the National Invasive Species Management Plan), formulating a complete AIS federal budget request, overseeing progress in addressing AIS, evaluating the collective response to AIS, and communicating AIS needs and problems to Congress and the public. The National Invasive Species Management Plan should include specific focus on AIS in the Great Lakes.

Rationale: The Government Accountability Office (formerly the General Accounting Office) observed that more than 20 federal agencies in ten departments are involved in AIS management and that States also play a significant role¹¹, and much better coordination of federal, state, and local actions is needed. One entity should be empowered to coordinate the AIS actions in the Great Lakes. For example, fifty years ago the governments of the U.S. and Canada mandated and funded

¹¹ Government Accountability Office (formerly General Accounting Office). 2002. Invasive Species: Clearer Focus and Greater Commitment Needed to Effectively Manage the Problem. Report GAO-03-1.

the development of successful control techniques for sea lampreys. A similar mandate is required for other AIS. Part of improved coordination is the systematic collection and free dissemination of AIS information. There must be a central place for the public, researchers, managers, and others to report AIS infestations. This information, in turn, should be available to anyone and should be used in implementing AIS programs. To achieve better detection and management of AIS, States and the federal government must cooperate in the development of AIS management plans, including plans allowing for monitoring, rapid response, and control. Moreover, codes of best practices for industry and the use of economic incentives (for example insurance and posting of bonds prior to engaging in practices where there is a risk of unintentional release) would significantly help industry participate in AIS management. When an AIS is first detected in the Great Lakes, States and the federal government must be prepared with pre-approved plans and funds to mount a rapid response action. Implementing an integrated pest management program in the Great Lakes will result in immediate cost-effective benefits.¹²

Cost: \$44 million annually for five years.

5) Federal, state and tribal agencies, academic institutions and other organizations should receive adequate support to conduct and evaluate cost-effective AIS vector-specific outreach and education programs. These programs should focus on behavior change and responsibility of resource users. Specifically, the following actions should be taken:

- Support programs that educate Great Lakes boaters and anglers on how to take preventive actions against AIS;
- Continue AIS-focused Hazard Analysis and Critical Control Point (HACCP) training and plan implementation for research and management agencies within and outside of the Great Lakes basin;
- Support a program that educates all facets of the Great Lakes maritime commerce industry including ports, carriers, shippers, mariners, resource users and users of goods produced from cargoes transported to and from the Great Lakes by ships, about the urgency and cost-effectiveness of preventing/containing AIS, the status of prevention, and what is needed to advance prevention; and
- Support a new comprehensive AIS Organisms-in-Trade educational campaign including the bait industry, modeled on the Sea Grant AIS-HACCP and Pet Industry Joint Advisory Council/Sea Grant/USFWS Habitattitude™ campaigns. Measurable objectives and timetables for these programs are included in Appendix F.

Rationale: People of all walks of life play a role in preventing the introduction and spread of AIS and, therefore, must be involved. Education and outreach are critical in an effective program to address AIS. Several entities have developed and implemented extremely successful educational campaigns (e.g., Sea Grant's HACCP program, U.S. Fish and Wildlife Service/Aquatic Nuisance Species Task Force's Stop Aquatic Hitchhikers™ campaign, and Pet Industry Joint Advisory Council/Sea Grant/U.S. Fish and Wildlife Service Habitattitude™ campaign). These programs should be expanded, emulated, and applied to all aspects of AIS, and particularly applied to reach people who pose the greatest risks of AIS introductions. The proposed educational campaign targeting maritime commerce, for instance, would involve shippers, ports, consumers, and others touched by the marine shipping industry, thus involving all people who work in and benefit from shipping. Effective educational campaigns rely on repetition and sustained messages from multiple sources.

Cost: \$19.5 million annually for five years.

¹² For background on the cost-effectiveness of slowing the spread of AIS, see: Leung, B., D.M. Lodge, D. Finnoff, J.F. Shogren, M. Lewis, and G. Lamberti. 2002. An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species. *Proc Royal Soc London B* 269: 2407-2413.

GLRC HABITAT/SPECIES ISSUE AREA STRATEGY TEAM REPORT

I. Problem Statement

The landscape and aquatic ecosystems in the Great Lakes basin have been altered due to human settlement and activities, resulting in the loss or degradation of many habitats, and threatening the species they support. Invasive species, non-point source runoff, and aquatic food web disruption are some of the key threats to the health and sustainability of Great Lakes habitats and species they support; additional key threats are loss of fish spawning substrate and nursery areas, disruption of sediment transport, contaminants, altered lake levels, loss of floodplains and riparian buffers, hydrological changes, and landscape fragmentation and alterations. Great Lakes habitat loss and degradation is a pressing concern. The Great Lakes have lost more than half of the region's original wetlands and 60 percent of forest lands, and the region only has small remnants of other habitat types such as savannah or prairies. These changes in habitat type and extent have contributed to numerous plant and animal extirpations throughout the Great Lakes basin.

These impacts are of concern, as human health and prosperity, as well as the sustainability and biodiversity of Great Lakes wildlife, fish, and plant species and their habitats, are dependent on the health of the entire ecosystem. Natural habitats and native fish and wildlife communities play a critical role in maintaining ecosystem health and function, and contribute to the social and economic vitality of both the region and the nation. Nearshore and open waters provide drinking water for municipalities and habitat for numerous species of fish, aquatic life, and birds. The 10,000 miles of coastline consist of over 530,000 acres of coastal wetlands, sand and cobble beaches, and the largest system of freshwater dunes in the world buffer upland areas from storms. More than 30,000 islands scattered throughout the Lakes are refuges for rare and sensitive species. Thousands of tributaries and streams transport sediments, nutrients, and organic material throughout the watershed. Inland, thousands of lakes and wetlands support a diversity of fish and wildlife and are important reservoirs for water. Forest lands and rare savanna and prairie remnant ecosystems contribute to clean air, filtered water, and stabilized soil. The full array of these habitat types are vital for sustaining the many important Great Lakes species, particularly species targeted for restoration programs like trumpeter swans and lake trout in the lower four lakes. Appendix 2 contains a complete list of representative biodiversity in the Great Lakes.

In addition to supporting sustainability and biodiversity, Great Lakes resources have substantial economic value. Current estimates indicate that boating, fishing, hunting and wildlife watching generate over 50 billion dollars of economic activity annually and generate hundreds of thousands of jobs (additional economic statistics are included in Appendix 1). Healthy and diverse Great Lakes ecosystems are also of great value to the Tribal Nations who rely on these resources to meet their subsistence, economic, cultural, spiritual, and medicinal needs. Habitat and species restoration and protection efforts are vital to the maintenance and recovery of these valuable Great Lakes resources. The following systems are identified as the initial priorities for which protection and restoration efforts should be focused: 1) Fish and wildlife populations in the Open and Nearshore Waters; 2) Wetlands; 3) Riverine Habitats; 4) Coastal Shore and Upland Habitats.



The causes and impacts of habitat degradation and species loss are many and transcend state boundaries. Likewise, the benefits of Great Lakes protection and restoration efforts extend far beyond the Great Lakes states. Successful campaigns for the protection and restoration of the Great Lakes ecosystem require substantial financial resources, the talents of a broad range of stakeholders, and coordination among local, state, tribal, federal, and international agencies. There are currently numerous policies, regulations, and ongoing management efforts to address these issues (see Appendices 3 and 5). Many of these ongoing activities have demonstrated that smaller successes can be achieved, increasing the feasibility of system-wide success. A coordinated concentrated effort, with a focus on the initial priorities for protection and restoration efforts, as well as a broader viewpoint that puts individual projects into a broader region-wide Framework, will help to address impacts to Great Lakes ecosystem health.

II. Goals and Milestones

Goals and milestones are guided by population and habitat objectives from plans which were developed through the cooperative efforts of teams of qualified scientists and other experts (Appendix 5 includes a complete discussion of ongoing efforts). An overarching long-term goal that applies to all habitat types is to continue progress on recovering state and federally listed species and communities as well as taking proactive steps to prevent future listings. In addition, a process should be created or adopted to prioritize conservation actions, and the actions recommended should consider the full range of habitat and species biodiversity and be scientifically justified with measurable outcomes. These actions must also be considered from a basin wide perspective and therefore must include coordination with Canadian conservation efforts.

Open/Nearshore Waters

Long-term goals:

- Open and nearshore waters possess a full array of safe and healthy natural habitats required to meet the growth and reproductive needs of fish and wildlife, in accordance with the Joint Strategic Plan for the Management of Great Lakes Fisheries.
- Open and nearshore waters harbor self-sustaining fish and wildlife communities that include
 - reproducing native fish species, especially lake herring, deepwater ciscos, lake trout, yellow perch, walleye, lake whitefish, coaster brook trout, lake sturgeon, American eel, and Atlantic salmon as a significant component.
- Self-sustaining populations of non-native game fish contribute to stabilize fish communities.
- Competition for habitat, predation, and disruptions to the food webs from invasive species are
 - eliminated or neutralized by preventing new introductions and managing existing invasive populations.
- Food webs are free of toxic contaminants.
- Healthy fish communities support sustainable commercial, subsistence, and recreational fisheries.

Short-term actions:

- Develop and evaluate lake trout restoration efforts through strategies such as a 40 percent increase in the number of lake trout stocked, using guidance from existing fishery management plans (Appendix 5).
- Develop an initiative to re-establish native lake sturgeon and coregonines in five areas of the Great Lakes from which they have been extirpated.

- Refine or develop techniques or models to improve assessment and exploitation strategies and management protocols for important fish species such as yellow perch, lake whitefish, lake trout, and walleye stocks.
- Develop an understanding of factors involved in recruitment of lake trout and other important native species, and remove or mitigate major impediments to recruitment.

Wetlands

Long-term goals:

- Wetland conditions should be sufficient to provide a full range of ecosystem services including hydrologic retention, nutrient and sediment trapping, spawning, nesting, and nursery habitats, and other habitat needs of fish and wildlife.
- Fish, wildlife, and plant communities and their habitats are protected and conserved.
- Wetlands in hydrologically modified environments are maintained and improved.
- Non-native plant and animal species are managed or prevented.
- One million acres of high quality wetlands in the basin are protected or restored.
- Self-sustaining non-endangered population levels for all currently listed wetland wildlife species, as determined by the state Departments of Natural Resources.

Short-term actions:

- Restore or protect 550,000 acres of wetlands and associated uplands (1.1M acres).
- Achieve at least 1.54 million breeding pairs of waterfowl (annual breeding population under average environmental conditions).
- Update inventory and mapping of wetland habitat types in the Great Lakes basin.
- Acknowledge, develop and enhance federal and state regulations and enforcement for coastal and inland wetland protection that also facilitate and accelerate wetland restoration.

Riverine Habitats and Related Riparian Areas

Long-term goals:

- Lakes, streams, rivers, wetlands, and connecting channels are conserved or restored to ensure their connectivity to floodplains.
- Intact stream corridors sustain native and migratory fishes, other aquatic biota, and wildlife.
- Barrier-free access to cold and warm water tributary spawning and nursery habitats is sufficient to sustain migratory fishes.
- Rivers and streams are adequately buffered to reduce sedimentation and nutrient inflow.
- Natural flow regimes (including groundwater infiltration) are restored or emulated.

Short-term actions:

- Restore ten Great Lakes tributaries (five tributary barrier projects and five riparian habitat projects).
- Restore coaster brook trout and lake sturgeon in Great Lakes tributaries.
- Adopt a method to characterize or classify watersheds based on degree of altered hydrology.

Coastal and Upland Habitats

Long-term goals:

- Coastal shore habitats and natural processes that sustain them—such as sediment transport, lake-level fluctuation, and wetland migration—are protected, restored and/or managed.
- Coastal and upland habitats sustain long-term diverse and abundant populations of native resident and migratory fish and wildlife species, especially those that are threatened and endangered.
- Sufficiently large and connected inland habitats are protected and restored, contributing to ecosystem health and biodiversity, and providing migration corridors for species.
- Highly altered environments are managed to emulate natural ecosystems.
- New invasions of non-native species are prevented and existing non-native populations are eliminated or controlled.
- Erosion is controlled and groundwater is recharged.
- The vitality of these habitats provides a broad range of social, cultural, and economic benefits.

Short-term actions:

- Inventory and assess all Great Lakes coastal habitats and prioritize them for protection and restoration.
- Protect or restore 10,000 acres of high priority coastal and upland habitats per year across the basin.
- Conduct detailed monitoring of Areas of Concern in coastal shore areas.
- Protect and restore 1,100,000 acres of upland associated with wetlands.

III. Overall Recommendation

Habitat Conservation and Species Management Funding Should Be Increased by \$288.7M/year.

While there are currently a variety of targeted authorization levels, appropriations have failed to match the authorized funding levels. As appropriations shrink, there is a growing expectations gap between those who supported legislative actions to achieve results and those entities implementing protection and restoration programs. As funding is diminished, program effectiveness is diminished. As an example, under the Farm Bill Wetland Reserve Program there is a program to restore wetlands, but there is not enough funding to meet the demand and it is oversubscribed for private landowner enrollment. Similar appropriation shortfalls are evident in budgets related to other federal legislation designed to protect and restore the critical habitats and promote important species management needs of the United States. Therefore, the recommended actions are premised on a tiered approach to reflect different options for the implementation approaches which include:

- Increasing appropriations to match previously authorized levels;
- Increasing the authorized funding level where existing levels are inadequate to achieve specified results; and
- Creating new authorizations and appropriations where program gaps currently exist.

These recommended actions are a significant step towards meeting habitat/species goals, but reaching full restoration and protection objectives for the entire basin will require more resources and more time. Federal, state, tribal, and local government involvement along with private or

industrial landowner implementation is crucial for all of the recommendations including funding. The outcomes resulting from these recommended actions should be measurable. The immediate measure of project success may be, for example, the amount of area impacted by the project. After a few years, the assessment may shift to species numbers and/or population diversity in response to the habitat changes.

The Overall Recommendation for habitat conservation and species management funded at \$288.7 million annually should be allocated as listed below.

1. Native Fish Communities in Open water/Nearshore Habitats - \$20 million annually

Provide 20 million additional dollars annually for efforts to promote the restoration and protection of native fish communities in the near shore and open lake waters. Fishery resources and associated uses are among the most sensitive of all uses made of the Great Lakes and are an integral part and indication of ecosystem quality. This funding would support implementation of the fishery goals and objectives developed via the Joint Strategic Plan for Management of Great Lakes Fisheries, adopted in 1981 and updated in 1985 and 1997 by all state, provincial, tribal, and federal agencies with fisheries management authority in the Great Lakes. This funding would be used for research, population assessments, restorative stocking efforts, predictive fisheries modeling, development of regulations, and enforcement surveillance to protect stocks and promote sustainable harvests.

2. Wetlands – \$188.7 million annually

To achieve the goals of the Great Lakes regions specified in the North American Waterfowl Plan and related Joint Ventures, target 57 million new dollars annually for acquisition, restoration, and other protection tools for wetlands. Wetland restoration costs are estimated between \$1,000 and \$1,700 per restored acre, based upon average costs of wetland restorations undertaken by Ducks Unlimited and USDA's Wetland Reserve Program. An estimated sixty-six percent of historic Great Lakes wetlands have already been lost. Therefore, primary emphasis would be on wetland protection and restoration directed at achieving a net increase of wetlands in the basin, and would include a monitoring component. Currently, authorizations exist in several federal agencies (see Appendix 5, Ongoing Efforts). Improved coordination and joint targeting efforts could lead to project designs and locations that provide both non-point source pollutant controls (for water quality benefits) as well as increased amounts of critical wetland habitat. See Appendix 6 for more information on this recommendation.

3. Riparian Habitats – Great Lakes River Restoration - \$40 million annually

There is currently no national program to specifically support restoration of the physical integrity of our nation's rivers. Rivers are critically important to the establishment of self-sustaining Great Lakes fish communities and estuarine fish and wildlife populations. Congress should therefore develop legislation to restore Great Lakes rivers. It should provide \$40 million annually to implement watershed projects that restore the hydrology, protect and restore the riparian habitats for wildlife, restore in-stream habitats needed for fish spawning or nursery sites, and promote access for anadromous fish migrations while restricting exotic species expansions. The program could work jointly with USDA programs like the CREP riparian buffer programs to achieve systemic results through improved inter-governmental coordination and watershed targeting. Funding should be allocated to states and tribes on a formula basis based on watershed size, tributary miles, populations in the basin, and miles of Great Lake shoreline.

4. Coastal Shore and Upland Habitats - \$40 million annually

We recommend creating a coastal shore and upland habitat conservation program to coordinate funding to ensure Great Lakes native species and communities of greatest conservation need are protected, restored, and appropriately managed. We further recommend an increase in funding for existing landowner incentive programs to encourage private and corporate landowners to conserve habitat and help to protect important native species. With recommended funding levels of \$40 million per year for five years, we expect the results to be the prevention of habitat and species loss and the conservation of coastal shore and upland habitats supporting healthy populations of numerous species. This funding should be directed to existing state, tribal, and federal natural resource management programs. Funding would also provide grants for cost share projects, acquisitions, easements or other incentives for private and corporate landowners and municipal governments to provide long term habitat and species protection and restoration efforts.

There are common priority themes which would drive protection and restoration of coastal and upland areas across the basin and include:

- Habitats specified in endangered species recovery plans;
- Habitats that represent rare, threatened or endangered species;
- Rare or unique habitats like islands or dunes or rocky coastlines; and
- Habitats critical to species restoration programs.

While these themes are categorized as common priorities, monitoring, indicators, and measurable objectives, they would differ across the basin in recognition of the natural variations. It may therefore be necessary to suggest a temporal approach to monitoring which evolves as the projects develop and the biological systems subsequently begin to respond.

COASTAL HEALTH

I. Problem Statement

Contact (including external, ingestion, and inhalation)¹³ with nearshore waters of the Great Lakes can pose a risk to human health.¹⁴ As the primary source of drinking water, supplier of fish for both personal and commercial benefit, and recreational outlet for millions of U.S. residents, the nearshore waters of the Great Lakes should pose a *minimum* risk to human health through contact. (The Great Lakes are a natural body of water and hence the achievement of null risk is unrealistic.) To reduce human health risk, Great Lakes nearshore waters should be drinkable (with conventional treatment), swimmable, and the fish harvested should be consumable at all times. The need to close beaches, issue boil water notices, publish fish consumption advisories,¹⁵ and mechanically remove stranded algae should be minimized. These factors have led to the following trends and events in the Great Lakes.

- The estimated volume of combined sewer overflow (CSO) discharges in the U.S. is 850 billion gallons per year, with most of these CSOs located in the Great Lakes and Northeast regions;¹⁶
- In 2001-2002, 23 States reported 65 waterborne disease outbreaks affecting 2,536 individuals (61 hospitalized, eight died) which represent the largest number to occur since reporting began in 1978. Five of these outbreaks were attributed to water bodies in Great Lakes states (MI, WI);¹⁷ and
- The NRDC's annual survey of water quality monitoring and public notification at U.S. beaches finds that there were 51 percent more beach closings and advisories in 2003 than in 2002. Across the country, pollution caused more than 18,000 days of closings and advisories at ocean and Great Lakes beaches last year – more than ever recorded in the survey's 14-year history.¹⁸



¹³ Contact includes various levels of body contact experienced by swimmers, water skiers, users of personal watercraft, scuba divers and tribal communities who live along the shore.

¹⁴ Coastal Health is affected by the overall health of the natural ecosystem addressed in the Great Lakes Collaboration Habitat/Species strategy chapter. Coastal Health is also affected by the legacy of industrial pollution addressed in the Persistent Bio-accumulative Toxics Reduction and Areas of Concern/Restoration Sediments strategy chapters.

¹⁵ The Persistent Bio-accumulative Toxics Team will address fish consumption advisories.

¹⁶ 2004 CSO/SSO Report to Congress.

¹⁷ Morbidity and Mortality Weekly Report, CDC. 2004

¹⁸ NRDC Testing the Waters 2004.

II. Goals and Milestones

Goal: By 2020¹⁹ or sooner where possible, eliminate inputs of untreated or inadequately treated²⁰ human and industrial waste to Great Lakes basin waters from municipal wastewater treatment systems and on-site disposal systems.²¹

Interim Milestones:

- By 2006, EPA and the Great Lakes States will actively enforce NPDES authority to ensure pretreatment programs are properly implemented;
- By 2007, U.S. EPA and the Great Lakes States will undertake a thorough review of their ongoing wet weather control programs to identify and correct deficiencies, including adequate staffing and funding, to ensure that programs are achieving the requirements of the Clean Water Act (CWA), including anti-degradation;
- By 2007, watershed planning and applications of best management practices to promote infiltration and reduce impervious cover shall be components of wet weather management implemented by local governments;
- By 2007, Congress should fully fund the Clean Water State Revolving Fund;
- By 2008, U.S. EPA, in cooperation with Great Lakes States, will promulgate rules governing the disbursement of new wet weather management grant funds;
- By 2009, Congress will appropriate grant funds for a wet weather control program;
- By 2009, local governments shall develop ordinances to ensure proper construction, siting, and maintenance of on-site disposal systems, including conducting inspections at the time of property transfer;
- By 2010, or as soon as possible, all municipalities with wet weather overflows in the Great Lakes basin will have adopted and begun to implement comprehensive storm water control programs with the objective of meeting all appropriate state and federal regulations; and
- For communities with wet weather problems that have not proceeded with required planning and implementation by 2010, the States or U.S. EPA will apply necessary enforcement actions (administrative order or judicial action) to require correction of the problems by a date certain with appropriate penalties.

¹⁹ The date given in this goal assumes approximately five years for communities who have not done so already to create their long-term control plans (LTCPs) or other comprehensive wet weather solutions. The U.S. EPA CSO Control Policy of 1994, the driving engine for the LTCPs, did not provide a date by which communities needed to submit their plans for approval. However, the CSO Guidance for Financial Capability Assessment and Schedule Development of 1997 recommends a CSO control implementation period of 15 years for communities with high financial burden, while acknowledging that the time boundary is not intended to replace the negotiations and deliberations necessary to balance all of the environmental and financial considerations that influence the site specific nature of the controls and implementation schedules. Since the schedule recommendations laid out in the 1997 guidance have not been met in some communities, and considering the seriousness of CSOs' environmental impacts, the sense of the Coastal Health Strategy Team is that CSO control should be expedited. Therefore, the Team recommends a goal of implementing the LTCPs consistent with the guidance recommendations and, where feasible within 10 years of their approval. The recommended federal grant program would provide communities with the funding resources and storm water incentives to accelerate both their planning process and their LTCP (or other comprehensive wet weather solution) implementation. Particularly given the recommended 45 percent local match to this federal grant program, local funding would significantly leverage this accelerated schedule.

²⁰ Elimination and the adequacy of treatment are defined by the Clean Water Act, the 1994 CSO Control Policy, and subsequent federal guidance.

²¹ This goal is intended to capture the intent of the U.S. Policy Committee's 2002 Great Lakes Strategy goals, several of which are now outdated. For example: • "By 2003, U.S. EPA and States will assist local governments in establishing alternate funding vehicles to implement CSO/SSO abatement construction projects. Storm water permits will be in place for all phase II storm water discharges • By 2005, 100 percent of all CSO permits in the Great Lakes will be consistent with the national CSO policy. • By 2010, all sewer systems will be operated under LTCPs which will optimize performance and minimize discharges from SSOs. • By 2010, 90 percent of monitored high priority Great Lakes beaches will meet bacteria standards more than 95 percent of the swimming season." See the Nonpoint Source chapter for goals and action items related to minimizing storm water runoff from urban and agricultural areas. See the Persistent Bio-accumulative Toxics chapter for more on preventing discharges of industrial and pharmaceutical wastes from municipal sewage treatment systems.

Goal: Achieve a 90-95 percent reduction in bacterial, algal, and chemical contamination at all local beaches. Steps to achieve this include: identify indirect pollution sources capable of adversely impacting Great Lakes coastal health; educate communities regarding their environmental impact; and remediate all potential indirect pollution sources through identification, estimation of relative contribution (based on historical data and sanitary inspection), and remediation of these sources. This will result in 90-95 percent of all Great Lakes public bathing beaches being classified as having “good” water quality.

Interim Milestones:

- By 2005, the BEACH Act will be fully funded to continue routine compliance monitoring of coastal waters;
- By 2006, real-time testing methodologies will be evaluated and trialed at Great Lakes beaches;
- By 2006, coastal states will have complied with the BEACH Act requirements for public notification;
- By 2006, a standardized sanitary survey form will be drafted;
- By 2007, standardized sanitary surveys will be trialed at select coastal communities;
- By 2008, states will add to their existing water quality monitoring programs a standardized tool for conducting sanitary surveys that will identify sources of contamination at the local level in those instances when bacterial indicator levels exceed published standards;
- By 2009, real-time test methodologies will supplant existing test methods (which take in excess of 18 hours before results become available) under the BEACH Act of 2000; and
- By 2010, regional predictive models will be available using local data and forecasts of water mass movements derived from the Great Lakes Observation System.

Goal: At the local level, individual contamination events will occur no more than five percent of available days per bathing season, sources of these contamination events will be identified through standardized sanitary surveys, and remediation measures will be in place to address these events.

Interim Milestones:

- By 2007, coastal communities will have an education and outreach program in place for K-12, college, the general public, and coastal decision-makers, with assistance of the Great Lakes Sea Grant Network;
- By 2008, enforceable city ordinances will be in place that call for the placement of signs regarding the health risk associated with bather shedding, provision of adequate sanitary facilities for bathers, availability and importance of proper boater waste disposal, and prohibition of practices that attract nuisance wildlife to which fines are attached for violations;
- By 2008, use sanitary surveys to identify 90 to 95% of all indirect pollutant sources resulting in beach closures;
- By 2009, begin to control, manage, and/or remediate pollutant sources identified through sanitary surveys; and
- By 2020, nutrient loading will have decreased as evidenced by a decrease in nuisance algal blooms and ambient water concentrations of nitrogen and phosphorous in coastal areas.

Goal: The quality of Great Lakes basin drinking water from coastal and tributary sources will be protected from chronic and episodic threats of chemical and biological contamination that pose unacceptable risk following conventional water treatment.

Interim Milestones:

- By 2007, amendments to the Safe Drinking Water Act (SDWA) will be adopted to enhance flexibility in how State Revolving Funds may be used for infrastructure system improvements and the Clean Water SRF will be fully funded;
- By 2007, Bioterrorism Act amendments will be adopted to require implementation of security measures that address potential resource/facility vulnerabilities;
- By 2010, states will have strategies for protecting water quality for the intended use of public water supply; and
- By 2010, all states and local municipal water supply systems will complete plans for infrastructure upgrades that address aging system deficiencies and integrate security measures for vulnerable resources/facilities.

III. Recommendations

Based on assessments that identify existing pollution sources and potential threats to water quality, multiple actions are available to remediate and prevent adverse impacts on human health in nearshore waters. These include control/abatement and remediation of direct and indirect pollution sources into coastal and tributary Great Lakes waters, and protection of drinking source water quality. The following actions are required to achieve the Coastal Health goals for a minimum risk to human health within the Great Lakes.

1) Eliminate to the extent provided by existing regulation inputs of untreated or inadequately treated human and industrial waste to Great Lakes basin waters through implementation of wet weather programs, including improvements to wastewater treatment systems. Conditions governing this recommended action are presented in *Appendix C*.

- U.S. EPA and the States should fully implement, enforce, and report on their wet weather control programs to identify and correct deficiencies to ensure the requirements of the CWA are achieved in a timely manner.
- As part of a 55/45 percent federal/local cost share, \$7.535 billion²² in federal grants should be made available over five years. These monies would then support state and local resources in the amount of \$6.21 billion, thereby raising \$13.70 billion to fund wastewater treatment improvements.

²² U.S. EPA's Clean Watersheds Needs Survey (CWNS) 2000 Report to Congress (www.epa.gov/owm/mtb/cwns/index.htm) breaks down costs by watershed and need category. For the Great Lakes watershed, the total cost for need categories I-V is 13.75 billion in January 2000 dollars. This total includes I. Secondary Wastewater Treatment, II. Advanced Wastewater Treatment, III-A. Infiltration/Inflow correction, III-B. Sewer replacement/rehabilitation, IV-A. New collector sewers and appurtenances, IV-B. New interceptor sewers and appurtenances, and V. Combined sewer overflow correction. [However, the CWNS Report to Congress states that its estimated cost to control CSOs (Needs Category V) is based on "capturing 85 percent of the flows that enter the combined sewer system during wet weather events." Furthermore, this cost is only for "providing those flows with the equivalent of primary clarification, solids and floatables disposal, and disinfection of the effluent." (CWNS 2000 Report to Congress, page 3-8). To the extent that implementation of CSO controls exceeds 85 percent capture and/or provides treatment for those flows equivalent to more than primary clarification, solids/floatables disposal, and disinfection, this level of funding will be inadequate. Future estimates of the needed funding must be increased to reflect the actual levels of CSO capture and treatment undertaken in the Great Lakes watershed.] The Coastal Health team's recommendation is derived by allocating \$13.70 billion of this total to support a federal grants program, and the remaining \$50 million of this total to support the three Great Lakes U.S. EPA regions (\$10 million) and the eight Great Lakes States (\$40 million). To put this figure in some context, the Report found that the estimated total cost of the upgrade projects necessary to meet the objectives of the CWNS is \$181 billion. The Coastal Health team independently derived the 55/45 percent federal/local cost share for the grants program, resulting in a federal cost of \$7.535 billion over five years. On an annual basis, the team's recommendation calls for \$1.507 billion in federal grants per year for five years. Although this amount is essentially all new funding, a small fraction may be supplied by the State Revolving Fund (SRF). According to NRDC, \$393 million is budgeted for the Great Lakes States' SRF in 2005, and \$260 million budgeted for 2006. The portion of this budget that goes to communities actually within the Great Lakes basin is a much smaller amount. If the SRF continues at its current level, it could represent an approximate \$100 million (estimated) in existing

- \$10 million²³ should be made available over five years to the three U.S. EPA regions to review and upgrade their Great Lakes wet weather programs—including the CSO Control Policy, NPDES permit issuance and enforcement, and storm water management—to ensure that issues are addressed comprehensively.
- \$40 million²⁴ should be made available over five years to the Great Lakes States to administer a new grants program, review, and upgrade all of their wet weather programs (including NPDES permits and enforcement), and implement anti-degradation rules in relation to sewage system expansions.

Rationale: Direct sources of contamination affecting coastal health are those that originate from a single, identifiable, fixed point such as rivers, streams, sewer pipes, septic systems, or a point of industrial discharge. Aging or overburdened sewage infrastructure, which can release raw sewage to source waters in urban areas through sanitary sewer overflows (SSOs) or CSOs, still exist in many Great Lakes municipalities where storm and sanitary systems remain co-mingled (see *Appendix A*). Substantial reduction of the discharge of untreated sewage into the Great Lakes will reduce health risks for bathers and bacteria load in drinking water supplies. Given the potential impact on human health, overflows of untreated human and industrial waste into Great Lakes waters must be controlled through comprehensive solutions that may include structural controls such as separating storm and sanitary sewers, constructing storage capacity or controlling infiltration/inflow; non-structural controls such as land use planning and aggressive use of best management practices to allow no net increase in storm water run-off; and regulatory controls such as issuing, updating, and enforcing National Pollutant Discharge Elimination System (NPDES) permits.

Cost: \$13.75 billion in new funds over five years, with \$7.54 billion provided by the federal government and \$6.21 billion provided by non-federal partners.

2) Identify indirect pollution sources capable of adversely impacting Great Lakes coastal health and, upon identification, promulgate and enforce regulations, provide public education, promote research, and initiate remediation to reduce the impact of these sources.

- These may include, but are not limited to, bacterial loading from foreshore beach sand and submerged sediments, avian/animal deposition, algal blooms (can appear during dry weather, but are caused by nutrient loading during wet weather and aquatic invasive species), bather shedding, and untreated onboard boater waste.
- State and local public health agencies provide public education and/or incentives to reduce impacts from nutrient-loading, household and industrial products, attraction of nuisance wildlife, improper discharge of onboard boater waste, and bather shedding.
- Request that the Great Lakes Sea Grant Network make this an education/outreach priority for the region and a component of a Great Lakes Centers for Ocean Science Education Excellence (COSEE) program through NSF.
- State and local governments promulgate and enforce existing regulations which take action against boaters who discharge waste to the nearshore or open waters of the Great Lakes.
- Require regulations regarding the availability of adequate toilet and shower facilities based on projected bather density to receive BEACH Act grant funds.

funding that could be subtracted from the team's recommended total on an annual basis. The CWNS 2000 Report states that "the needs must have existed as of January 1, 2000, to be included in the CWNS 2000." Therefore, the costs contained in the report do not have an implied timeframe or end date. The Coastal Health team, accordingly, recommends that the full cost of addressing these needs be provided over a five-year period. The CWNS is repeated and updated every five years. When the January 2005 data are published, the Coastal Health team's recommendations should be updated to reflect the most recent data.

²³ *Ibid.*

²⁴ *Ibid.*

- Assess extent of contaminated sediments, especially in Areas of Concern, that contribute to water quality concerns. (Addressed in AOC/Sediments chapter.)
- Research to clarify sources and transport of biotoxins (i.e., botulism) through foodweb.

Rationale: Indirect sources of contamination are sources whose origination cannot be traced to a single point such as a storm drain or sewer outfall (see *Appendix A*). The effects of indirect sources of contamination are diffuse and, therefore, determining their origin may require intensive investigation. For example, determining a correlation between increased bacterial level density at the bathing beach and various coastal processes, predominating weather conditions, and natural and human sources is often difficult. Remediating contamination sources responsible for indirect pollution water quality failures will reduce human health risks, increase availability/access to Great Lakes recreation, improve ecosystem health, promote sustainable practices, decrease economic loss (millions of dollars are lost each year due to beach closures), and increase commercial benefits.

Cost: Depends on indirect pollution sources identified at individual beaches based on annual sanitary surveys (see *Appendix E*). The costs associated with conducting educational campaigns and initiating remediation range between \$20,000 and \$1 million per source identified, based on the size of the population served, the extensiveness of the impact, and the need for infrastructure improvements. The cost would be shared between state and local agencies (possible through fines levied against offenders in some instances) and through the availability of federally approved loans or grant funding.

3) Standardize, test, and implement a risk-based approach²⁵ to manage recreational water.

- U.S. EPA to build the approach upon existing water quality monitoring programs and employ the latest technology for microbial assessment and standardized sanitary survey criteria, based on a holistic watershed assessment.
- U.S. EPA to take responsibility for accelerating the process necessary for field testing and approval of real-time test methodologies.
- Once these two tools are in place they can be tested at the local level, adopted by the federal government, and implemented at the state and tribal level.
- Federal, state, tribal and local municipalities have begun to work together to standardize the microbial assessment of recreational water and these working groups can also standardize the sanitary inspection process.

Rationale: Beach and coastal assessment methods (microbial and physical) are the front lines of defense for determining when contaminant influxes are most likely to impact human health in the context of surface water encounters. Tools available to beach managers and authorities responsible for monitoring these water bodies should accurately reflect risk, provide timely notification to the public, and enable investigation of potential contamination sources (both direct and indirect) thus leading to remediation of these sources.

Cost: \$2.0 million²⁶ annually to the Great Lake states to standardize, trial, and implement a risk-based approach to beach/coastal assessment, a portion of which could be appropriated from U.S. EPA BEACH Act funds (assuming that they are re-appropriated at the federal level). \$7.2 million for U.S. EPA to conclude and analyze data from National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study (\$9.0 million of the total cost of \$16.2 million has already been funded).

²⁵ WHO, Annapolis Protocol, U.S. EPA National Beach Guidance and Required Performance Criteria for Grants, June 2002, EPA 823B02004.

²⁶ Note that the dollar amount appropriated for BEACH Act funds to the eight Great Lakes states in 2005 was \$1,965,460.

4) Protect drinking source water quality.

- U.S. EPA will establish ambient water quality criteria for parasites, pathogens, and disinfectant by-product (DBP) precursors for states to implement.
- The Clean Water State Revolving Fund (CWSRF) should be fully funded, and states should implement programs to assure that ambient water quality, following conventional treatment, does not pose an unacceptable risk to consumers.
- States should work with public water systems to reduce vulnerabilities identified in the source water assessments.

Rationale: In addition to effective implementation and enforcement of existing Safe Drinking Water Act (SDWA) and CWA requirements by EPA and the states, this action requires a combination of enhanced federal policy requirements to include ambient water quality criteria for parasites, pathogens and disinfectant by-product precursors, full federal funding and greater flexibility in how State Revolving Funds may be used. Ambient water quality criteria related to drinking water following conventional treatment are needed to support source water protection programs. Water quality criteria for pathogens, such as cryptosporidium, have not been promulgated under CWA authority, nor have criteria for DBP precursors been developed, while risk-based standards are being developed for finished water supplied by public water systems.

Cost: Fund the CWSRF at least to the level appropriated for FY 2004 (\$1.35 billion nationally and \$225 million to the Great Lakes States).

5) Use the Drinking Water State Revolving Fund to improve drinking water infrastructure and support source water protection.

- The Drinking Water State Revolving Fund (DWSRF) should be fully funded and increased flexibility should be given in how the funds may be used by the states and local municipalities for water infrastructure improvements.
- States and local public water supply systems to implement and enforce infrastructure improvement plans that include security measures to address resource/facility vulnerabilities and critical infrastructure facilities governed under the Bioterrorism Act.

Rationale: Protection of drinking water quality by public and private water supply systems throughout the Great Lakes basin must be improved. In addition to effective implementation and enforcement of existing Safe Drinking Water Act (SDWA) requirements by U.S. EPA and the states, this action requires a combination of enhanced federal policy requirements to include full federal funding and greater flexibility in how State Revolving Funds may be used to upgrade drinking water infrastructure, systems, and implementation of water infrastructure improvement plans with security measures for vulnerable resources/facilities to reduce chemical contaminant and bioterrorism risks to drinking water supplies.

Cost: Fully-fund the DWSRF at levels authorized by the SDWA (\$260 million to the Great Lakes States) through 2010.

AREAS OF CONCERN/SEDIMENTS

I. Problem Statement

In 1987, the U.S. and Canada committed to restoring the most degraded portions of the Great Lakes basin. Working through the International Joint Commission (IJC), the Great Lakes states and provinces designated 43 Areas of Concern (AOCs), including 26 in U.S. waters and five in binational waterways. AOCs were identified based on 14 types of impairment, reflecting human uses—such as eating fish, drinking water and swimming—and ecological impacts, such as loss of diversity in aquatic life and destruction of fish and wildlife habitat.

AOCs vary widely in geographic scope and extent of environmental problems. Some are confined to small harbors and others encompass an entire river watershed. Some are impacted primarily by one large contaminated sediment site and others face multiple sources of pollution and extensive loss of habitat.

The most common sources of impairment are contaminated sediments; sewage treatment plant discharges and combined sewer overflows; nonpoint source runoff; runoff from hazardous waste sites; and habitat degradation and destruction. Many of the sources that impact the AOCs are addressed in the other chapters of the Great Lakes Regional Collaboration report. Contaminated sediment is linked to impairments in all 31 U.S. AOCs. Due to the widespread, severe impacts of contaminated sediments, and because no other chapter covers them, this is the only pollution source this chapter will address.

Though progress has been made in the AOCs, much remains to be done. Restoration of AOCs has historically been approached through an array of programs, most designed for other purposes and none adequately funded. This is particularly true for the remediation of contaminated sediments. In January 2005, the U.S. Policy Committee for the Great Lakes identified 75 remaining sites in the AOCs with a total estimated volume of nearly 75 million cubic yards of contaminated sediments. Depending on the remedy, total cleanup costs for these sites could range from \$1.5 billion to \$4.5 billion.

There are three primary barriers to achieving further progress in restoring the AOCs: 1) optimizing program administration and effectiveness; 2) addressing contaminated sediments (including disposal and destruction technology issues); and, 3) establishing final restoration targets to facilitate “delisting” of AOCs – formally removing them from the list of designated Areas of Concern in the Great Lakes.

Program Administration and Effectiveness

At its inception, the AOC program generated much enthusiasm as a comprehensive, ecosystem-based approach with a strong emphasis on community leadership and stakeholder involvement. Federal funding has supported much of the planning, restoration, research and monitoring conducted in the AOCs. The states, capably assisted by local advisory councils in most AOCs, played an important role in engaging stakeholders, advising federal agencies, and implementing many planning and restoration efforts.

By the late 1990s, however, progress in some AOCs slowed due to diminished funding and a lack of organized federal program direction. Consequently, state, tribal, and local efforts declined. In



2002, the General Accounting Office (GAO, now called the Government Accountability Office) produced a report (<http://www.gao.gov/new.items/d02563.pdf>) documenting administrative problems in the AOC program. Since then, significant changes have begun to reinvigorate the program. However, there remains a need for more efficient processes and adequate, stable funding for federal, state, local, and tribal partners to carry out and achieve complete restoration and delisting of the AOCs.

Contaminated Sediment Issues

It is critical to address unstable and/or bioavailable concentrated deposits of contaminated sediments before they reach the lakes, where cleanup can be much more difficult and expensive. Many remediation projects are constrained by the complexity and cost of design and implementation, limited alternatives to contaminated sediment dredging and disposal, limited disposal capacity, and a lack of clear standards for beneficial re-use of some sediments.

Delisting

Despite the time and effort invested in the AOC program, no U.S. AOCs have been delisted and there is no consistent way to track progress in restoring these waterways. Further, most impacts are not clearly aligned with existing federal water quality regulations, making it difficult to meaningfully document environmental improvements in the AOCs. AOCs need scientifically justified, measurable delisting targets that address AOC-specific conditions and are consistent with federal, state, local, and tribal regulations and policies. Research, remediation and monitoring needed to achieve these restoration targets must be identified, funded, and implemented.

II. Goals and Milestones

The goal of the Great Lakes Regional Collaboration is to restore all the U.S. Great Lakes AOCs. Milestones toward this ultimate goal include:

- by the end of 2006, U.S. EPA should expand the existing U.S. EPA-State RAP Workgroup into a Federal-State AOC Coordinating Committee to better coordinate efforts and optimize existing programs and authorities to advance restoration of the AOCs;
- by the end of 2007, Congress should revise and reauthorize the Great Lakes Legacy Act;
- by the end of 2008, delisting targets for each U.S. AOC should be developed collaboratively by federal, state, local, and tribal partners;
- by the end of 2010, 10 AOCs should be delisted (restored to target goals); and
- by 2020, all known contaminated sediment sites in the AOCs should be remediated. Coupled with restoration measures identified in other chapters, this will facilitate complete restoration of the AOCs.

III. Recommendations

The following recommendations address obstacles to restoring the AOCs by:

- addressing inefficiencies in the Great Lakes Legacy Act and increasing available funding to a level sufficient to reach the goal of cleaning up all contaminated sediment sites in the AOCs by 2020;
- providing for the program capacity needed to develop measurable endpoints, design and implement remedial actions, and measure results;

- making better use of existing programs and funds through increased coordination at the federal, state, local and tribal levels; and
- working toward better alternatives to removal and disposal of sediments.

1) Great Lakes Legacy Act Funding, Amendments, Reauthorization and Guidance

- Over the next five years, the Administration should request and Congress should appropriate \$150 million annually for the Great Lakes Legacy Act to remediate contaminated sediment sites in the AOCs. Continued funding at this level over an additional ten years will be needed to achieve the goal of cleaning up all known contaminated sediment sites in Great Lakes AOCs by 2020.
- The Great Lakes Legacy Act should enhance and accelerate the pace of sediment remediation in the AOCs by serving as the primary remediation authority or supplementing existing remediation programs addressing contaminated sediments (such as CERCLA, RCRA, state remediation statutes and WRDA § 312, among others). Congress should amend the Act to allow for more efficient implementation of the program, as follows:
 - The “maintenance of effort” language in the Legacy Act should be dropped because it is not appropriate in the context of sediment remediation where costs often vary widely from year to year and, as a result, it can lead to inadvertent disqualification of otherwise eligible and valuable projects.
 - The life of appropriated Legacy Act funds should be extended beyond two years (as envisioned by the Legacy Act) to accommodate both responsible remediation and long-term monitoring of the effectiveness of implemented remedies, which is consistent with the 2002 *Great Lakes Strategy*.
 - The current 35 percent level of matching funds/in-kind services required under the Legacy Act from the nonfederal sponsor at “orphan sites” should be adjusted to 25 percent, or at a minimum, Legacy Act funds should be available for planning and design work with no match or reduced match, in order to “tee-up” projects and maintain momentum.
 - The current limitation in the Legacy Act which requires exclusive federal agency project implementation precludes disbursement of funds to other entities to assume the lead in project implementation. This requirement restricts the efficient implementation of remedial work in some cases, and should be amended to allow direct disbursement of project funds, which would allow for greater flexibility in implementing the program.
- U.S. EPA should develop guidance to clarify and reiterate the Legacy Act’s original intent to permit potentially responsible parties (PRPs) to participate as the non-federal sponsor for projects funded under the Act. The guidance should confirm that PRPs are neither excluded from eligibility to serve as nonfederal sponsors nor absolved from their liability for remediation of contaminated sediments under federal and state remediation programs. The eligibility of PRPs to provide some or all of the nonfederal share of a Legacy Act package should be evaluated on its merits on a site-specific basis, in the context of the concept of “added value.” Examples of circumstances where PRP participation in Legacy Act project funding would provide “added value” include, but are not limited to, sites where an “orphan share” exists or where the remedy will be enhanced (such as where the scope—quality or quantity—of the remediation is improved, innovative methods are employed or the remediation will be accelerated).

Rationale: Before the Great Lakes Legacy Act, there was no specific federal authorization for a contaminated sediments remediation program for the AOCs. The Act fills this gap and holds the

potential for an accelerated sediment remediation program that builds on considerable preparatory work by federal, state, local, and tribal agencies and PRPs to evaluate contaminated sediments and to design and implement remedial options.

Appropriations under the Legacy Act have lagged substantially behind authorized levels. U.S. EPA received \$9.9 million in FY 2004 and \$22.3 million in FY 2005, compared to authorized funding of \$50 million annually for remedial activities. If Congress were to appropriate the full \$50 million annually, the interim milestone of delisting ten AOCs by 2010 can be achieved. However, this spending level will not be adequate to reach the ultimate goal of remediating all contaminated sediment sites in the AOCs by 2020. Based on estimated volumes of contaminated sediments and depending on the remediation options selected, \$150 million (on average) each year matches up with both resource needs and state, local, and tribal capacity to plan and implement remedial projects.

2) AOC Program Capacity

- The Administration should request and Congress should appropriate \$10 million annually to the Great Lakes states and community-based coordinating councils in the AOCs; and \$1.7 million to U.S. EPA's Great Lakes National Program Office for regional coordination and program implementation.
- Furthermore, the U.S. Army Corps of Engineers Great Lakes Remedial Action Plan Program, authorized in Section 401 of the Water Resources Development Act of 1990, should be included in the President's budget to enable the Corps to participate in the Federal-State AOC Coordinating Committee and to request funding for projects that advance restoration of the AOCs.

Rationale: Restoration of the AOCs is critical to the restoration of the Great Lakes, yet the Clean Water Act provides no specific regulatory authority or funding for the AOC program. The decline in program effectiveness in the late 1990s, which corresponds directly to declining federal financial support and the associated loss of federal, state, tribal, and local programmatic capacity, is testament to the need to build and maintain core capacity among the partners involved in AOC restoration. Current funding levels should be enhanced to the recommended levels to ensure adequate technical capacity at the federal, state, local, and tribal levels so that large-scale cleanup programs, such as the Great Lakes Legacy Act, are utilized effectively.

To further enhance AOC program capacity, U.S. EPA and each state, in consultation with local AOC advisory groups, should establish cooperative agreements that outline their respective roles and responsibilities, priorities, anticipated outcomes, resource needs, staffing levels, and procedures for documenting and reporting progress.

The core funding recommended above also will enable more rapid development of the delisting targets that are a necessary foundation of remedial projects. Federal, state, local, and tribal partners should collaboratively develop delisting targets for each U.S. AOC by the end of 2008, in accordance with the Delisting Principles and Guidelines adopted by the U.S. Policy Committee in December 2001.

3) Federal-State Collaboration

The existing U.S. EPA/State RAP Work Group should be expanded to a Federal-State AOC Coordinating Committee to better coordinate efforts and optimize existing programs and authorities to advance restoration of the AOCs.

Rationale: No single agency at any level of government has the legal authority or programmatic resources to fully restore the AOCs. Further, the current lack of a coordinating mechanism means existing resources are not used as effectively as they could be. A sustained, outcome-oriented collaborative process is needed to effectively consolidate existing resources available for restoring the AOCs.

The Federal Interagency Task Force is charged under the Executive Order with coordinating the Great Lakes activities of federal agencies. While this is a valuable objective, much of the work to restore the AOCs is administered at the state, tribal, and local levels. Therefore, a broader collaborative framework is needed. The Coordinating Committee should act as a clearinghouse to move specific projects forward through technical assistance, data collection and sharing, identification of available resources, and joint work efforts. States should help local AOC councils and tribes access the support of the Coordinating Committee, plan and schedule restoration work, and identify nonfederal matching funds as necessary.

4) Promote Development of Environmentally-Sound Sediment Treatment and Destruction Technologies, Beneficial Re-Use of Sediments, and Best Available Disposal Options.

U.S. EPA, the U.S. Army Corps of Engineers, the states, and the tribes should actively examine innovative approaches to the ultimate disposition of contaminated sediments as an alternative to the current practice of disposing of them in Confined Disposal Facilities (CDFs) or landfills. Congress should fully fund, at \$3 million annually over the next five years, the research and development program authorized in Section 306 of the Great Lakes Legacy Act. This research will test and promote viable treatment technologies that allow for the separation, immobilization, neutralization or destruction of contaminants in sediments, in-situ or upon removal. A significant focus of this work should be on the development of technologies that produce no new contaminants and do not release contaminants to the environment.

Rationale: While it undoubtedly improves the condition of waterways, the removal and transporting of contaminated sediments to a disposal facility simply relocates the contamination. Disposal facilities can be difficult and expensive to site and build, and the lack of adequate disposal capacity keeps cleanups from moving forward. Alternatives to disposal would address these issues.

Federal, state, local, and tribal agencies should examine the feasibility of developing facilities where dredged sediments can be managed for disposal, treatment, destruction and/or beneficial re-use at a single location. Treatment technologies for decontamination and/or beneficial re-use of the dredged material at the facility should be included in project costs. In order to increase limited disposal capacity, the Corps and state and tribal agencies should encourage local communities to “mine” existing CDFs to facilitate the environmentally-sound beneficial re-use of dredged materials. There should be early, broad public outreach in siting decisions regarding disposal or treatment of contaminated sediments.

NONPOINT SOURCE

I. Problem Statement

Water pollution from nonpoint sources is a substantial contributor to the impairment of waters across the Great Lakes basin. Nonpoint source pollution is present throughout the basin, in many forms and with many interactions. The complexity of the pollutants and their presence in soil, water and air make pollution abatement for nonpoint sources particularly difficult to address. Strategies to date have failed to deliver widespread stream and lake restoration necessary for the protection and maintenance of the Great Lakes. This strategy recommends actions for mitigating stressors that cause nonpoint source pollution.

Nonpoint source impacts vary greatly in frequency and severity across the Great Lakes. Impacts have been particularly severe in the coastal wetlands and tributaries that once buffered the Lakes from environmental damage. Other prime impact areas include western Lake Erie, Saginaw Bay, Green Bay, the coastal region of Ohio, selected Areas of Concern (AOCs), and selected tributaries or near-shore areas. Due to this variability, the tools and strategies required to address nonpoint source pollution must be tightly coordinated among partner agencies and organizations and must be geographically targeted. In addition to working directly to address pollutant stressors, effective reduction of nonpoint sources will also include integrating control strategies with local land use and smart growth issues.

Nonpoint Pollution Stressors: Five nonpoint source pollution stressors – physical or chemical changes that occur within the ecosystem – significantly impact the biological components, patterns, and relationships in the natural system of the Great Lakes: these are nutrients, contaminants, pathogens, sedimentation, and altered flow regimes. These stressors enter the Great Lakes through three primary pathways: surface runoff, groundwater infiltration, and atmospheric deposition. Nonpoint source pollution in each of the five forms damages flora and fauna in the Lakes, threatens human health, reduces recreational opportunities, and increases the cost of treating drinking water and dredging our harbors and marinas. Actions against stressors have direct short-term costs, but often save money in the longer-term and sometimes make new sustainable growth possible.

Existing Programs and Their Effectiveness: The total input of stressors from nonpoint source pollution today considerably exceeds that from point sources. Work on point sources approaches a point of diminishing returns; funding to increase point source control beyond 90 percent or 95 percent is less effective than providing the same amount of funding to address nonpoint sources. Many governmental agencies, non-governmental organizations, including universities and colleges, and the regulated community, are already at work at, or interested in, reducing nonpoint source pollution in the Great Lakes. The combination of federal, state, tribal, and local institutions and programs that is already actively involved in reducing nonpoint sources has resulted in many successful projects across the basin. However, despite these successes, pollution from nonpoint sources has led to a Great Lakes ecosystem that is deteriorating in health and quality. Existing programs must be coordinated for efficient tracking of results, evaluated routinely for effectiveness, and held accountable for achieving environmental outcomes.

Monitoring: Water quality monitoring is an essential component of programs designed to protect and restore our water resources. Water



quality monitoring is needed so we can: set appropriate goals for water quality which promotes equitable water quality protection/restoration across the country; assist resource managers to effectively implement programs and help prioritize future efforts by collecting adequate water quality data and linking this information directly to relevant decision criteria; track the effectiveness of our programs; and reliably report on water quality changes; associate such changes with programmatic efforts, and establish the cost-effectiveness of our actions at appropriate spatial scales.

BMP Maintenance: It must be stressed that in order to be effective, BMPs typically require maintenance. Studies have shown that oftentimes BMPs are not maintained adequately. When implementation measures are being planned and put into practice, it is critical that this issue is adequately addressed.

There are three fundamental barriers to addressing nonpoint source pollution more effectively in the long-term: authority, funding, and coordination.

Authority: The authorities in place are spread out over a variety of jurisdictions primarily through voluntary programs and their application and implementation is inconsistent. While they have high participation rates, they can only penetrate so far into the market responsible for the nonpoint stressors.

Funding: Funding currently available to these programs is far less than is needed to achieve maximum penetration using voluntary measures. Current funding levels will not come close to reaching the levels of implementation needed to make a difference in the Great Lakes.

Coordination: These programs and the agencies implementing them often are not integrated. In the few places where there is an integrated watershed-based effort, it is usually at the sub-watershed area or smaller. To be effective for the Great Lakes, agencies and programs at all levels—federal, regional, state, tribal, and local—must coordinate to accomplish efficient delivery and utilization of resources, targeting of critical areas, and monitoring of progress toward common objectives.

II. Goals and Milestones

Goal: Protect existing wetlands and restore wetlands in both urban and rural areas so that rivers, streams, and lakes across the Great Lakes region function as healthy ecosystems.

Interim Milestones:

- By 2010, restore, recover, and protect a net increase of 550,000 acres of wetlands within the Great Lakes basin.²⁷
- By 2015, restore, recover, and protect a net increase of 1,000,000 acres (450,000 additional) of wetlands within the Great Lakes basin.

Goal: Measurably reduce at least hundreds of thousands of tons of sediment, pounds of phosphorous loading, and pounds of nitrogen loading in to the Great Lakes basin.

Interim Milestones:

- By 2010, create 335,000 new acres of buffer strips within the Great Lakes basin.
- By 2020, create 1,000,000 new acres (665,000 additional) of buffer strips within the basin.

²⁷ These 550,000 wetland acres are the same acres recommended by the Habitat Strategy Team.

Goal: Reduce the amount of sediment reaching the Great Lakes through installation and continued use of management practices on cropland, especially those that increase crop residue left on the surface.

Interim Milestones:

- By 2010, have 2,000,000 new acres of Great Lakes basin cropland under appropriate residue management. This increase corresponds to 40 percent decrease in soil loss.
- By 2015, extend to 2,800,000 new acres (800,000 additional new acres) of Great Lakes basin cropland under appropriate residue management.

Goal: Reduce livestock agriculture's contribution to nonpoint source loading by 40-70 percent through comprehensive nutrient management planning (CNMP) and practice implementation.

Interim Milestones:

- By 2008, 70 percent of all livestock farmers will attend education programming regarding nutrient management.
- By 2010, all acreage utilized for livestock production in a major phosphorous-impaired Great Lakes watershed in each Great Lakes State will be covered by certified CNMPs.
- By 2010, triple the number of certified CNMP providers in the basin that directly assist farmers.
- By 2015, 70 percent of all livestock production in the U.S. portion of the Great Lakes basin will be covered by certified, phosphorous-based CNMPs.

Goal: Improve flow regimes to meet sediment reduction goals and restore sustainable biological communities.

Interim Milestones:

- By 2010, in all watersheds classified as severely or moderately impacted based on degree of altered hydrology and ecological sensitivity using scientifically defensible indicators: develop better understanding of baseline conditions (appropriate time frame, natural vs. human influences) and relationship between stressors and ecological endpoints (water quantity as stressor, effectiveness of BMPs, cumulative impacts); develop appropriate assessment criteria (numeric vs. narrative; relate to societal values); develop/refine new methods (decision support systems, monitoring technology); and apply most strategic remediation alternatives to foster goal of restoring natural flow regime.
- By 2015, restore/manage the hydrologic regime in ten select watersheds to restore sustainable biological communities and reduce excessive sediment loadings.
- By 2020, document improvements in: measurable changes in hydrology (reduction in peak flow and volume); measurable reduction in bank erosion and sediment loading; and measurable improvement in the health of the biological community in significant portions (stream orders 1-3) of ten urban watersheds and/or sediment loading into areas where these watersheds discharge to the Lakes.

III. Recommendations

In general, programs need coordination at a higher level and a focus on mitigating specific problem areas, such as Areas of Concern. Although agencies offer grants to states, tribes, and local groups to address these concerns, the grants are given without any overall, interagency focus or strategy. Effectively targeting and addressing problems will require not only federal agency budget enhancements, but also coordination of efforts and data so that agencies at all levels concentrate their energies on the same priority problems. To this end, the NPS Strategy Team suggests designating or establishing an organization to coordinate efforts, roles, and initiatives among federal, state, and local agencies and private organizations in the Great Lakes basin.

1) Between \$77 million and \$188.7 should be provided annually over five years to fund restoration of 550,000 acres of wetlands.²⁸

- USDA and U.S. EPA will form a task force that includes, at a minimum, USACE, USFWS, NOAA and other federal, state, tribal and local agencies. Agencies will work in partnership with other federal, state, and local agencies and organizations.

Rationale: More than 50 percent and perhaps as much as 70 percent of historic Great Lakes wetlands have already been lost. This loss (through filling or draining) is primarily due to agriculture, urban uses, shoreline development, and resource extraction. These same causes continue to threaten the natural Great Lakes wetlands that remain in existence today. The loss of wetlands poses special problems for hydrological processes and water quality because of the natural storage and cleansing functions of wetlands.

Wetland priority areas for the Great Lakes exist in many active ongoing plans. To appropriately address NPS issues, wetland conservation efforts should occur throughout the watershed in areas strategically selected to best impact water quality concerns. Immediately available priority areas with active partnerships and implementation teams include: several watersheds currently active under USDA's Conservation Reserve Enhancement Programs in the Saginaw Bay watershed, the Maumee River watershed, and the western and central Lake Erie watersheds (OH and PA), River Raisin and Macatawa watersheds (MI), and Eastern Wisconsin riparian areas, and areas noted in the National Strategy to Restore Coastal and Estuary Habitats. The proposed funding would help restore up to 550,000 acres over the five year period, with an estimated restoration cost of \$1,000 per acre.

Cost: \$110 million annually for five years.

2) \$335 million should be provided to restore 335,000 acres of buffers over five years:²⁹

- Funds will be used to create a new program to address education and installation of buffers in urban and suburban environments.
- USDA, NRCS, and FSA will be the lead agencies and will work in partnership with other federal, state, tribal, and local agencies and organizations.
- Critical Geographies: Land areas draining to western and central Lake Erie, the Maumee River watershed, Green Bay, Saginaw Bay, Lake St. Clair, nearshore waters of Lake Michigan, and AOCs.

²⁸ The cost for wetland restoration is the same as that identified in the habitat/species protection strategy team chapter and addresses restoration of the same 550,000 acres of wetlands over the five year period.

²⁹ This level of funding and restored buffer acreage should be continued at the same rate over 15 years (until 2020) for a total of \$1 billion provided to restore one million acres of buffers.

Rationale: Buffer strips include a variety of practices including riparian buffers, filter strips, grassed waterways, windbreaks, living snow fences, contour grass strips, cross-wind trap strips, field borders and other vegetative barriers. Vegetative buffer strips slow water runoff, trap sediment; enhance infiltration within the buffer while trapping fertilizers, pesticides, pathogens, and heavy metals; and reduce blowing soil in areas with strong winds.

The anticipated results and benefits of increasing riparian buffer acreage will be improved water quality based on a measurable reduction of sediment load and of fertilizer, pesticide, pathogen and heavy metal contaminants, subsequently improving overall stream and riparian ecology for fish and wildlife habitat. A history of the program indicates that landowner willingness to participate exceeds program goals and that a state's ability to increase its acreage goal is directly related to the availability of adequate funding.

Cost: \$67 million annually for five years.

3) \$120 million should be allocated by 2010 to achieve a 40 percent reduction in soil loss in ten selected watersheds:

- By 2015, an additional \$48 million should be invested to reach a total of \$168,000,000.
- USDA and NRCS to lead in partnership with other federal, state, tribal, and local agencies and organizations. Utilize EQIP as the lead federal program to provide financial and technical assistance.
- Critical Geographies: Land areas draining to western and central Lake Erie, the Maumee River watershed, Green Bay, Saginaw Bay, Lake St. Clair, nearshore waters of Lake Michigan, and AOCs.

Rationale: Although conservation tillage has been heavily promoted in many areas of the Great Lakes region, many farmers still choose to use conventional tilling methods, which plow crop residues into the soil. Keeping crop residues can assist in preventing erosion between planting seasons. Achieving a 40 percent reduction in sediment loss from croplands will result in greater water clarity, greater desirable aquatic plant growth, less algae, better fish habitat, and less sedimentation of bays and harbors. The 40 percent reduction is largely consistent with the percent reduction in sediment and phosphorus loads (where information is available) to meet designated uses. Based on a cost of \$60/acre and a 2.5 ton/acre reduction in soil loss, this level of funding should lead to a 40 percent reduction in soil loss in these watersheds.

Cost: \$24 million annually over five years.

4) \$106 million in funding should be provided to support the development and implementation of comprehensive nutrient and manure management on livestock farms:

- This includes \$96 million to assist the approximate 12,000 farms with more than 50 animals (estimated cost of \$8,000 per CNMP), \$5 million for educational material development grants, and \$5 million for increased technical assistance at NRCS.³⁰
- USDA and NRCS to lead in partnership with other federal, state, tribal, and local agencies and organizations.
- Critical Geographies: Phosphorous impaired watersheds and leading livestock producing counties.

³⁰ 50 animals is the number used to derive 12,000 farms in accordance with the 2002 Agricultural Census. The number does not reflect a regulatory or statutory threshold for what defines an animal feeding operation; it is a value selected to ensure that resources go toward correction of problems on farms with greater nutrient management risk.

Rationale: Manures and nutrients generated by livestock production facilities contribute to nonpoint source pollution in the absence of conservation planning. If poorly controlled, manure and nutrient products can contaminate surface and ground waters, cause odor problems, and serve as a source of infectious disease. Increased comprehensive management of nutrients and manure on livestock farms will greatly reduce livestock agriculture’s contribution to nonpoint source loading.

The anticipated results and benefits of the recommendation will be a 40-70 percent reduction in nonpoint source contribution of phosphorus from livestock agriculture. This result is from the fact that farms with certified CNMPs apply 20-30 lbs of phosphorous less per acre than farms that do not have CNMPs and minimize nutrients leaving the farm through site-specific conservation planning. The actions would provide livestock farmers with financial and technical assistance to complete certified CNMPs, reward farmers that complete and maintain CNMPs, and increase market demand for certified CNMP providers.

Cost: \$106 million over five years.

5) \$18 million should be provided annually over five years³¹ to hydrologically improve ten urban watersheds of various sizes.

- Four federal agencies, the Army Corps of Engineers (USACE), the U.S. Geological Survey (USGS), United States Department of Agriculture (USDA), and U.S. EPA have resources, expertise, and experience to assist in various aspects of any new federal initiative. USDA would modify/expand its focus to incorporate off-site impacts into their conservation programs. The CWA Section 319 funding for nonpoint source control programs would be used to address urban stream flow issues related to aquatic life impairments; however, traditional non-pollution abatement activities are the current focus. Lead agencies will work in partnership with other federal, state, tribal, and local agencies and organizations.
- Critical Geographies: The new program should focus on urbanized areas where runoff from development and the associated impairments directly affect natural waterways and their confluence with the Great Lakes or connecting waters. Likely candidates include smaller watersheds or sub-watersheds within the Duluth, Milwaukee, Green Bay, Gary, Detroit, Cleveland, Toledo, and Buffalo metropolitan areas.

Rationale: Alterations in the natural hydrology of surface and ground water in the Great Lakes basin, such as in the form of floods, droughts, reduced base flow, or altered timing of natural flow regimes, has resulted in changes to the structural and functional integrity of the physical, chemical, and biological elements in these ecosystems. Current federal assistance, regulatory and grant programs, and related state programs do not focus on in-stream flows in urban areas. A new, integrated federal initiative is needed to address flow regime issues in urban watersheds including infiltration and groundwater recharge. The anticipated results and benefits of protecting, conserving, and improving the hydrology of watersheds will be reduced infrastructure costs due to elevated stream flows and excessive sediment loadings, improved shipping capacity, increased public use, and improved aquatic ecosystem health.

State and local governments should also review zoning and building codes, setback ordinances and planning efforts to ensure that they reflect the use of green infrastructure and low impact development.

Cost: \$18 million per year over five years.

³¹This level of funding should be continued at the same rate for a total of 20 years (until 2025). Including a higher proportion of dollars in the first five years for the upfront costs may make restoration efforts more likely to succeed.

TOXIC POLLUTANT STRATEGY

I. Problem Statement

While certain persistent toxic substances (PTS) have been significantly reduced in the Great Lakes Basin Ecosystem over the past 30 years, they continue to be present at levels that pose threats to human and wildlife health, warrant fish consumption advisories in all five lakes, and disrupt a way of life for many in the basin, particularly the life ways and culture of tribal communities.

PTS releases from contaminated bottom sediments, various industrial processes, and non-point sources, loadings from atmospheric deposition, contaminated groundwater, and continuous cycling of PTS within the Great Lakes themselves, all contribute to this ongoing problem. More recently, researchers have documented the presence of additional chemicals of emerging concern that may also pose threats to the Great Lakes. Characteristics of these substances, such as sources, releases, fate, transport, persistence, bioaccumulation, and toxicity, must be better understood.

II. Goals and Milestones

To establish and maintain the chemical integrity of the Great Lakes Basin Ecosystem, as called for in the Great Lakes Water Quality Agreement, this Strategy sets forth the following goals:

- Goal 1: Virtually eliminate the discharge of any or all persistent toxic substances (PTS) to the Great Lakes basin ecosystem.
- Goal 2: Significantly reduce exposure to persistent toxic chemicals from historically contaminated sources through source reduction and other exposure reduction methods.
- Goal 3: Reduce environmental levels of toxic chemicals to the point that all restrictions on the consumption of Great Lakes fish can be lifted.
- Goal 4: Protect the health and integrity of wildlife populations and habitat from adverse chemical and biological effects associated with the release of PTS.

Interim Milestones, Goals 1-4:

- By 2008, collect 1M lbs waste pesticides per year.
- By 2010, 50 percent reduction in Basin-wide household garbage burning.
- By 2010, commence significant reductions in mercury emissions from coal-fired power plants.³²
- By 2015, full phase-outs of intentionally added mercury bearing products, as possible.³³
- By 2025, full phase-out of all PCB equipment in the basin.
- By 2025, significantly reduce PTS inputs from international sources.



³² A consensus on the rate of reductions of mercury emissions from coal fired power plants was not reached. The Federal Clean Air Mercury Rule (CAMR) is published at <http://www.epa.gov/air/mercuryrule/>. Six of eight Great Lakes State Attorneys General have challenged the CAMR in federal court.

³³ Examples include thermometers, thermostats, and manometers.

Goal 5: Prevent the discharge of toxic substances in toxic amounts.

Interim Milestones, Goal 5:

- By 2008, include pollution prevention and energy efficiency (P2/E2) provisions in federal and state rule making.
- By 2010, implement 200 P2/E2 projects for businesses in the Great Lakes States.

Goal 6: Protect the general public from toxic substances through effective outreach and education, including protective fish consumption advice throughout the Great Lakes Basin Ecosystem.

Interim Milestones, Goal 6:

- By 2007, commence basin-wide PTS public information campaign.
- By 2009, adopt consistent Great Lakes basin fish consumption advisories.

Goal 7: Identify and fill the gaps in our scientific understanding that limit our ability to effectively manage the risks of toxic substances found in the Great Lakes.

Interim Milestones, Goal 7:

- By 2008, initiate a central Great Lakes PTS database.
- By 2010, a basin-wide surveillance program of chemicals of emerging concern at wastewater treatment plants will be established. At least 50 percent of the large in-basin WWTPs will participate in the program.
- By 2010, implement a Great Lakes human PTS biomonitoring program.³⁴
- By 2010, complete an intercomparison study of mercury and PCB models.³⁵

III. Recommendations

This Strategy seeks to comprehensively address PTS issues in the Great Lakes, to 1) reduce and virtually eliminate sources of current priority pollutants, 2) prevent new chemical threats from entering the basin, 3) develop a sufficient knowledge base to address toxic chemicals in the Great Lakes environment, 4) protect public health and engage the public to do its part in reducing PTS sources, and 5) address international sources. The recommendations below are guided by a number of important principles. Historically, collaborative efforts within the Great Lakes basin to address PTS reduction have served as a model for statewide, national, and international efforts. These efforts provide a strong foundation for further endeavors. In particular, the principles, tenets and concepts embodied in the Great Lakes Binational Toxics Strategy (Binational Strategy) are incorporated here as the starting point for the Toxic Pollutant Strategy. This strategy also builds on the efforts of the Lakewide Management Plans (LaMPs) to help implement lake-specific high priority chemical reduction efforts and on recommendations from Remedial Action Plans to address beneficial uses impaired by PTS in Areas of Concern.

³⁴To be based on the PTS monitoring component of CDC's National Health and Nutrition Survey (NHANES).

³⁵Specifically, atmospheric fate and transport models on continental and global scales.

Effective and meaningful PTS reductions require both regulatory and non-regulatory approaches. Existing regulatory programs, particularly federal and state permitting and enforcement, must be adequately funded and implemented. Non-regulatory approaches can sometimes achieve results efficiently and are encouraged to the maximum extent practicable. New regulatory approaches must also be considered where necessary. Finally, significant amounts of PTS from both international and regional sources are deposited to the Great Lakes. Five key recommendations are presented below³⁶ :

1) Reduce and virtually eliminate the principal sources of mercury, PCBs, dioxins and furans, pesticides and other toxic substances that threaten the health of the Great Lakes basin ecosystem, through coordinated intergovernmental strategies.

- Mercury³⁷: Coal fired electric utilities constitute the largest remaining domestic source of mercury emissions. Utility sources must implement control measures to reduce these emissions. Mercury is still used in numerous products basin-wide. A basin-wide mercury product stewardship strategy should be developed to complete phase-outs of mercury uses, including a mercury waste management component, as practicable.
- PCBs: Consistent with the Stockholm Convention on Persistent Organic Pollutants, PCB-containing electrical equipment should be decommissioned and properly disposed.
- Dioxins and Furans: Uncontrolled burning of household waste constitutes the largest known airborne source of dioxins and furans to the Great Lakes. State, tribal and local authorities should address deficiencies in communities related to infrastructure for household waste collection, and/or enforcement to stop illegal burning. Agricultural waste burning should be addressed, as well.
- Cancelled Pesticides: State, tribal, and local waste pesticide collection efforts are very effective in reducing stockpiled sources of cancelled pesticides to the Great Lakes, but these programs are inconsistently supported. Each State should implement a robust and ongoing waste pesticide collection program.

Rationale: Principal sources of priority pollutants continue to threaten the health of the Great Lakes and drive fish consumption advisories, and should therefore be systematically reduced and virtually eliminated:³⁸

Implementation: The Great Lakes Binational Strategy in a coordinating role, LaMP chemical committees, EPA, state environment and agriculture agencies; The Great Lakes Cities Initiative, Great Lakes municipalities, and industry.³⁹

Costs⁴⁰: \$10M/yr - Burn Barrel Initiatives (all new), \$3.4M/yr - Clean Sweeps (\$2.0M/yr new).

³⁶Note that there is a matrix of all recommendations of the PBT Team included in the appendix.

³⁷ See appendix for information on mercury, PCBs, dioxins and furans.

³⁸ A comprehensive list of priority pollutants, sources and reduction activities may be found in the 2004 Great Lakes Binational Toxics Strategy Annual Report.

³⁹ The Binational Strategy engages a forum of Stakeholders from government, Industry and NGOs from the US and Canada that regularly gather to collaborate on toxics reduction projects, with a focus on priority pollutants such as mercury and PCBs.

⁴⁰ Costs are presented as current plus new (new funding in parenthesis). Costs are fully itemized in appendix A.

2) Prevent new toxic chemicals from entering the Great Lakes basin: Target production, use and sound disposal of toxic chemicals across the Great Lakes basin through strategic deployment of pollution prevention and waste minimization programs.

- To provide easier access and broaden dissemination of these programs to small and medium sized businesses, States should “bundle” technical assistance services, such as compliance assistance, pollution prevention (P2) audits, and energy efficiency (E2) audits, in “one-stop-shop” programs.
- Tax incentives and low interest loans should be utilized to promote investments in energy efficiency upgrades and pollution prevention projects.⁴¹
- Federal and state agencies should ensure that traditional regulatory programs, including enforcement, provide incentives to conduct pollution prevention and energy efficiency projects.

Rationale: Preventing new toxic substances from entering into the Great Lakes is as important to protecting ecosystem health as addressing current priority pollutants. Twelve federal agencies are responsible for chemical safety management pursuant to nearly 20 federal statutes, and subsequently promulgated regulations, and the United States is responsible through International Agreements (e.g., United Nations Environment Program, Prior Informed Consent)⁴² U.S. EPA’s many pollution prevention and waste minimization programs are described online at www.epa.gov/p2⁴³. These programs should be aggressively marketed and made available to Great Lakes businesses, their suppliers and customers through technical assistance providers⁴⁴.

Implementation: U.S. EPA, State technical assistance providers, Manufacturing Extension Partnerships, city environmental departments

Costs: \$16M/yr (\$15.12M/yr new), \$50M tax incentives/fund capitalization (all new)

3) Institute a comprehensive Great Lakes research, surveillance and forecasting capability to help identify, manage, and regulate⁴⁵ chemical threats to the Great Lakes basin ecosystem. A Great Lakes basin-wide coordinated program that incorporates and augments current efforts should be created to better characterize links between PTS sources and exposure. The multi-party program should preferably be housed within an existing program or organization and call upon the combined resources of federal agencies, states, academia, the private sector, and our Canadian neighbors. To be successful, the effort should include:

- Screening/long-term monitoring of PTS sources and concentrations in environmental media, including humans and wildlife, including:

⁴¹ EPA should award assistance for states and other eligible entities to authorize or enhance low-interest revolving loan funds that can be coupled with technical assistance efforts to assist in the implementation of P2 and E2 measures for both private and public sector facilities.

⁴² United States National Profile on Management of Chemicals, January 1997, OPPTS, U.S.EPA.

⁴³ EPA’s Sustainable Futures program promotes a number of innovative non-regulatory pollution prevention (P2) programs including the The PBT Profiler and Design for the Environment (DfE) which help industry screen out potential toxic substances and design safe non-toxic products, and the The Green Suppliers Network (GSN) and Environmentally Preferable Purchasing which promote PTS-free alternatives in production and purchasing. The Resource Conservation Challenge promotes a number of innovative waste minimization programs such as The Plug-In To eCycling Program, Product Stewardship Partnerships and The WasteWise Partnership Program.

⁴⁴ Providers include the Department of Commerce Manufacturing Extension Partnerships, State P2 technical assistance providers, and municipal environmental officials.

⁴⁵ Regulations include development support for TMDL, criteria, and water quality standards and permit issuance.

- a strategic review of TSCA-regulated substances and other federally regulated substances, using current pollution prevention models; and,
- enhanced Great Lakes monitoring programs to include chemicals of emerging concern.
- Research on chemical properties, exposure, and long term effects.⁴⁶
- Modeling, including evaluation and enhancement of current models, to better predict environmental impacts of reduction actions at various geographic scales, and to examine exposure scenarios.
- Information management, an easily-accessible, central Great Lakes PTS database for monitoring data, emissions and releases information, and research results, including a clearinghouse for toxicity data used to develop GLI criteria, and State GLI water quality standards.

Rationale: To manage and assess regulatory and voluntary PTS programs, Great Lakes lawmakers, program managers, and stakeholders need accurate information. This requires a coordinated system which monitors PTS sources and environmental conditions, tracks reduction actions, projects future trends in exposure and effects, and uses this information for decision-making. For many PTS, past and existing monitoring and research have given us a good understanding of sources, transport, and exposure pathways. However, in order to make cost-effective decisions, improved understanding of relative contributions of different sources to human exposure is also needed. For example, local sources may have a greater effect on exposure in a community than in the basin as a whole.

Implementation: The Great Lakes Binational Toxics Strategy, federal agencies, states, academia.

Cost: \$5-10M/yr (\$300K/yr current/balance new).

4) Protect human health through consistent and easily accessible basin-wide messages on fish consumption and toxic reduction methods and choices.

- With regard to PTS exposure, the Great Lakes Sport Fish Advisory Task Force should create consistent advice on fish and wildlife consumption to citizens in the Great Lakes basin, especially to sensitive populations, and to health care professionals, in multiple languages.
- Current state advisory programs should be fully funded and implemented to adequately protect the entire basin.
- To help the public do its part to reduce the use and release of PTS, a basin-wide public education and outreach campaign that focuses on habits of individuals, households, the workplace, and schools, should be developed in coordination with existing messages and stakeholder groups.^{47,48} Take-back and waste collection programs should be promoted as well.

Rationale: A consistent set of messages from federal, state, tribal, and local health and environment agencies is needed to protect the public from health effects of PTS exposure, and to provide the public with information about lifestyle choices which will help reduce PTS uses and releases to the Great Lakes.

⁴⁶ Expert program reviews of current regulatory and monitoring programs have defined some research needs.

⁴⁷ This would include high priority outreach topics such as backyard trash burning, mercury use reduction, energy conservation, personal care product use reduction, (non-toxic household cleaners, and reduction in household pesticide use.

⁴⁸ This outreach message should be conveyed through existing communication channels including lake stakeholder forums, human health networks, newsletters, conferences and other existing delivery mechanisms. A consistent outreach message could be included in the biennial LaMP reports and/or the annual public-friendly lake brochures.

Implementation: Great Lakes Sport Fish Advisory Task Force, National Sea Grant Program, state and tribal departments of public health, environment and natural resources, the GL Human Health Network, U.S. EPA, FDA.

Cost: \$15.9M/yr (\$11.7M/yr new)

5) Support efforts to reduce continental and global sources of PTS to the Great Lakes basin.

- As a leader in management of toxic chemicals, the United States should ratify the Stockholm Convention on Persistent Organic Pollutants.
- The United States should also support international PTS management and monitoring programs, in coordination with the Commission for Environmental Cooperation (CEC) and the United Nations Environment Programme (UNEP), and support capacity building and technology transfer programs, such as those administered by EPA's Office of International Activities.
- In particular, federal support should be provided to efforts to reduce international sources of mercury, including funding and technical support for UNEP's mercury efforts.

Rationale: Significant amounts of PTS come to the Great Lakes through air deposition from sources well beyond the U.S. border. International toxics reduction and monitoring programs are therefore essential to the protection of the Great Lakes.

Implementers: Congress, federal agencies, the Great Lakes Binational Strategy in a coordinating role.

Cost: \$7.725M/yr (\$6M/yr new)

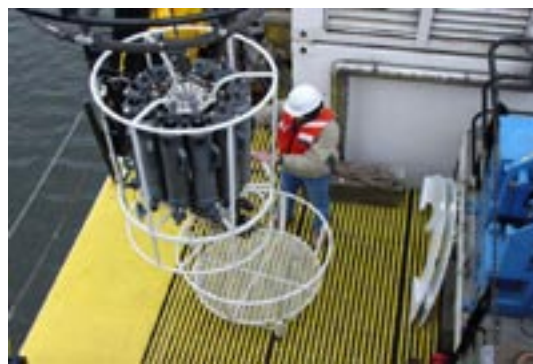
INDICATORS AND INFORMATION

I. Problem Statement

The Great Lakes ecosystem, the largest freshwater system in the world, is a dynamic and complex interaction of biological, chemical and physical components that is not yet fully understood. The sensitivity of this system to human influence, however, has been repeatedly demonstrated in recent decades. Environmental degradation, caused by problems such as the introduction of invasive species, point source and non-point source pollution, and declining fisheries, has pointed to an urgent need for protection and restoration. Protection and restoration of the Great Lakes ecosystem require a well-documented, collaborative strategy, access to the best scientific information available, and coordinated action. A successful restoration strategy for the Great Lakes must also include an informed decision making process based on consistent methods to measure and monitor key indicators of the ecosystem's function. Such measurements need to occur before and after the initiation of restoration efforts at local and basin-wide scales. Once collected, information needs to be compiled and communicated consistently to inform the restoration process, decision makers and the public. These activities will provide resource managers, elected officials, and other stakeholders with the timely, accurate and cost-effective information necessary for making decisions concerning the protection and restoration of the Great Lakes ecosystem so as to sustain healthy societies, economic activities and natural systems. Unfortunately, ecosystem monitoring, observation, research, indicator development and modeling efforts in the Great Lakes region are currently under-funded, lack comprehensive ecosystem approaches and exist only as piecemeal programs.

Despite these drawbacks, the volume of data collected for the Great Lakes and their tributary watersheds has expanded considerably in recent years, coinciding with an increase in the complexity of issues that need to be addressed. The current lack of accessible, integrated information management systems limits decision-making abilities and application of adaptive management principles for the protection and restoration of ecological resources. Adaptive management requires one to identify priority issues, gather information, establish metrics, evaluate options, implement actions, track progress, reevaluate actions based on observed responses, communicate results and adjust both management approaches and monitoring activities. Although such capabilities are advancing within the Great Lakes basin, they exist only in piecemeal fashion and are have not been fully integrated for the comprehensive management of the Lakes. To further complicate matters, decisions made on one issue often affect other issues. Observing systems, monitoring programs, indicators, research, modeling and analysis, information management and communication must therefore be integrated into a holistic decision-making process.

Observing systems, including sensors, stations, networks and field data collection are the primary means for gathering information on the chemical, biological and physical characteristics of the Great Lakes ecosystem. These observations are used in a host of monitoring programs to take the pulse of the Great Lakes, assess natural variability, drive ecosystem forecasting models, and assess the progress of restorations efforts. Current challenges facing observing and monitoring include: incomplete inventories of federal, state/provincial and municipal observation and monitoring activities; insufficient spatial density of basic observations across the system; incomplete coverage over varying time scales (real-time to historic)



and over space (site-specific, watershed, and region-wide); a reluctance to adopt uniform or fully compatible monitoring protocols; and an inability to establish long-term financial commitments, all resulting in poor availability of information on condition and trends to managers and other stakeholders. Additional observation and monitoring are needed across the Great Lakes basin, including the open waters, coastal areas, tributaries and watersheds. Desired data collection efforts reach beyond measurement of the Great Lakes components and include such things as socio-economic data, inventories of pollutant releases or hazard potential and satellite remote sensing.

Some of the observations required are essential indicators that provide information on the state of the Great Lakes and progress toward achieving goals. Continued efforts are needed to ensure the viability of an informative and scientifically-based set of indicators (e.g., the State of the Lakes Ecosystem Conference (SOLEC) indicator suite) that are useful for management decisions and to inform the public. The SOLEC indicator suite has been refined over the last decade to be comprehensive yet practical and actionable. Several of the Great Lakes Regional Collaboration strategy teams have, however, identified that other indicators are needed to track progress on specific restoration areas both locally and across the Great Lakes – St. Lawrence River basin. These will require additional research to develop realistic endpoints, cause-effect relationships, appropriate metrics and monitoring protocols. Indicators also need to be flexible enough to account for the unique conditions of each Great Lake, differences in temperature, trophic status, native biota, etc. In addition, indicators should be used in relation to realistic “end points” or desired results which are accepted by most stakeholders. When identifying end points, stakeholders must recognize that variability is the norm in natural systems; therefore, many targets and goals should not be expressed as discrete numbers but rather as a ranges of desired, natural levels.

The U.S. Commission on Ocean Policy highlighted the need for “unbiased, credible and up-to-date scientific information” to properly manage the human activities that effect the nation’s oceans coasts and Great Lakes. The Commission found that new scientific findings demonstrate the complexity and interconnectedness of natural systems and that management approaches have not been updated to reflect this complexity with responsibilities remaining dispersed among a confusing array of agencies at the federal, state, and local levels. Managers, decision makers, and the public require timely access to reliable data and solid scientific information that have been translated into meaningful products. The Commission urged Congress to double the federal research budget over the next five years and to fund and adopt an integrated observing system on a regional basis.

Research on the Great Lakes specifically provides the understanding necessary to make informed, scientifically-supportable decisions and actions, to assess the associated risks, expectations and timelines of management actions, to plan for effective observation and monitoring programs and to identify sensitive and meaningful indicators of ecosystem status. Restoration requires research to develop innovative approaches and monitoring to determine if restoration is successful in meeting targets and goals. The current funding level for Great Lakes research does not sufficiently support the level of research and development needed to address the host of ecological issues currently affecting the system to meet present-day demands. Any new restoration efforts will require coupled research and observations programs. Research has traditionally been focused on single issues. This focus must transition to an ecosystem approach with greater emphasis on predictive forecasting and adaptive management. Research should be directed towards improving the understanding of natural fluctuations and interactions of ecosystem components. Improvements in predictive capabilities are needed, particularly regarding the impacts of chemical, biological and physical changes on ecosystem structure and function. Development of such capabilities requires a comprehensive research coordination strategy across partnering institutions.

Information produced by research and observations must be made readily available to managers, decision-makers and the public. This will require information integration, management and communication. Integration and management of information are hampered by institutional management approaches restricting access by outside entities and policy constraints that restrict a user's ability to discover the existence, location and characteristics of Great Lakes data. Data quality is also often not documented or communicated to data users. Coordination needs to be improved to ensure that critical decisions are made using the best available data. Standards for metadata (information about data) are required. Many institutions do not have the technological tools to implement data sharing protocols and applications such as Geographic Information Systems (GIS) and remote sensing techniques. Legal and institutional constraints, such as proprietary data and security provisions, can also adversely affect information sharing. A lack of strong, formal data exchange partnerships among Great Lakes organizations underlies many of these constraints.

Various methods are used to communicate information to those that require it, but coordination needs strengthening for the sheer breadth of information collected over the region. The lack of a coordinated message can make it difficult for audience groups to interpret and understand information. The audiences that require information are also diverse, requiring that complex information needs to be sufficiently repackaged to meet their needs. Some information, such as lake conditions and beach closings, requires rapid delivery. In addition, two-way communication needs to be promoted so that user needs are conveyed back to those producing the information. A comprehensive, two-way communication strategy has not been developed to address these needs.

II. Goals and Milestones

Goals:

- Stakeholders and decision makers will widely recognize and accept that physical, chemical, biological, socio-economic research and scientific information needs to be conducted/collected and disseminated.
- A widespread network of monitoring / observing systems will provide a steady stream of data and scientific findings that are translated into practical information and products for decision makers, educators, and the public. This network must be continually improved to adapt to technological advances and emerging informational needs of Great Lakes managers and stakeholders.
- Robust information gathering and integration tools will be made available to support scientifically informed decisions. Decision-support tools must be flexible, not constrain the user's viewpoint, and offer enhanced abilities for multi-participant decision making. Predictive modeling tools should be applied to priority restoration issues and be spatially integrated to provide lake-wide assessments.
- Great Lakes research programs will be conducted in a comprehensive, strategically coordinated manner and designed to meet user needs. Research should also be targeted at ecosystem level predictions.
- Progress achieved in the design of the scientifically-verified set of indicators for the Great Lakes ecosystem will be exploited. Indicators need to be implemented to meet the distinct needs of all user groups. A formalized approach for refinement of existing and development of new indicators should be followed to respond to evolving science, user needs, and ecosystem conditions.
- Standardized information management systems will be implemented by organizations within the region and connected through an integrated network of information systems. This should include application of appropriate information technology infrastructure and development of policies to share information across institutional and jurisdictional boundaries.

- Communication efforts in the Great Lakes will deliver accurate scientific and technical Great Lakes information to fulfill the needs of the decision makers, stakeholder groups, and the general public. Communication avenues must also be two-way, conveying user needs to information providers.

III. Recommended Actions

Each of the following recommended actions call for greater coordination within the Great Lakes region, including participation of numerous partners at the federal, state, local/municipal, Native American, and binational levels and partners from industry, academia, and public interest groups. Additional recommendations, further rationale and supporting information are contained in an appendix to the Information and Indicators strategy.

Recommendation 1: To provide accurate, complete and consistent information, the Great Lakes region must increase and better coordinate the collection of critical information regarding the Great Lakes ecosystem. The Great Lakes Interagency Task Force and other stakeholders need to implement the U.S. contribution to the Integrated Earth Observation System (IEOS) and the Integrated Ocean Observing System (IOOS) as part of the Global Earth Observing System of Systems (GEOSS). Monitoring must be better coordinated through the existing Great Lakes management entities, both at a lake-wide and region-wide basis.

Rationale: Observing systems and monitoring programs are the primary means for gathering information on the chemical, biological and physical characteristics of the Great Lakes ecosystem. These programs are needed to take the pulse of the Great Lakes, assess natural variability, drive ecosystem forecasting models, and assess the progress of restoration efforts. Monitoring and observing systems require continued improvements to adapt to changing technologies and informational needs of Great Lakes resource management. Initial activities should be focused on implementing the Great Lakes Observing System (GLOS) as the regional component of IOOS. Efforts should be continued to establish IEOS within the Great Lakes region.

Concerted action to address lake-wide and basin-wide problems requires consistent and coordinated information collection across municipal, state and national boundaries. U.S. agencies must lead the way in expanding and coordinating ecosystem-based and issue-focused monitoring programs including protocols, scientific rationale, and integration of indicators. Such coordination should be done on a binational basis for each lake through the Lakewide Management Plans (LaMPs).

Cost: \$28 million for five years

Recommendation 2: To meet the information and management needs of Great Lakes restoration activities, the Great Lakes Interagency Task Force should promote the continued development and implementation of science-based indicators, including implementation of indicators developed through the SOLEC process.

Rationale: Restoration of the Great Lakes ecosystem must begin by setting clear and quantifiable goals and desired endpoints for critical Great Lakes attributes. A set of measurable and meaningful indicators is essential for determining progress in meeting these goals and in helping decision-makers adapt their management actions in accordance with the ecosystems response. High-priority, management-relevant indicators must be identified, scientifically developed and tested for each critical restoration issue. Current indicators should be extended to include watershed issues and enhanced to draw in more stakeholder and scientific involvement. As an established and successful binational effort, the SOLEC process needs to receive increased financial support and stakeholder participation to accomplish the goals of comprehensive regional assessments.

Cost: \$4 million for five years

Recommendation 3: To support Great Lakes restoration activities with appropriate scientific foresight, planning and assurance of results, the overall federal research budget to the Great Lakes should be doubled over the next five years. In addition, adequate funds should be made available to support a Great Lakes Research Office as authorized in the 1987 Clean Water Act Amendments (33 U.S.C. 1268) to coordinate these research efforts. Finally, for all new appropriations in support of Great Lake' restoration activities, at least 10 percent of these funds should be dedicated toward research to aid planning and assessment.

Rationale: Additional research is required to: a) set management goals and expectations; b) assess risks in management alternatives; c) identify the most cost-effective restoration strategies; d) evaluate connectedness to other components of the ecosystem; and e) evaluate progress in achieving management goals and expectations. Research needs to be focused on improving predictive capabilities regarding the lakes, particularly regarding the impacts of chemical, biological, and physical changes on ecosystem structure and function. Per the U.S. Commission on Ocean Policy, overall research funding should be doubled over the next five years to fix the observation that “chronic under-investment has also left much of [the region’s] infrastructure in woefully poor condition.” The Great Lakes Research Office (GLRO) would work in conjunction with existing institutional entities to coordinate a comprehensive research strategy with an emphasis on predictive ecosystem-based research organized to address existing and emerging ecological issues. Great Lakes research programs need to be funded in accordance with an established research strategy, emphasizing research integration in the decision making process. The GLRO would closely coordinate all activities with the IJC’s Council of Great Lakes Research Managers. Research should also be a fundamental and integral part of a comprehensive Great Lakes restoration program. At least ten percent of the restoration funding should be devoted to the effort. To support independent and localized investigations, increased support of university-based Great Lakes science is needed through increased competitive grants for Great Lakes research through the National Science Foundation and other federal and state programs.

Cost: Overall doubling of current research funding (an annual increase of approximately \$35 million within five years), plus 10 percent of any additional restoration efforts and \$600,000 annually (or \$3 million over five years) would be used to support the research office.

Recommendation 4: To facilitate easy and accessible information exchange among all regional partners, stakeholders and decision makers and to create a consistent and comprehensive repository of Great Lakes data, the Great Lakes Interagency Task Force and all regional partners should augment the regional information management infrastructure (i.e. establish a network of networks), adopt standardized data management protocols and commit to open data availability.

Rationale: The U.S. Commission on Ocean Policy recognized that: “The data generated from increased research, enhanced monitoring networks, and new observing systems will be essential in improving our management of ocean and coastal resources. However, two major challenges face today’s data managers: the sheer volume of incoming data, which strains storage and assimilation capabilities, and the demand for timely access to the data in a variety of formats by user communities. Meeting these challenges will require a concerted effort to modernize the current data management system and will require greatly improved interagency planning and coordination.” In the Great Lakes, infrastructure is required to help turn data into useful information. Integrated and coordinated scientific and technical information is needed to adequately share results of ecosystem investigations with stakeholders. Long-term funding of an information management infrastructure to acquire and exchange timely, objective and accurate information is needed. The infrastructure will

facilitate two-way communication between scientists and stakeholders, also allowing stakeholder needs to inform the investigations. The information management infrastructure should mesh with and augment existing infrastructure, such as the Great Lakes Information Network (GLIN) and provide for sustainability of such a network as an independent regional asset. A workgroup of information management professionals is needed to implement the distributed network of servers and databases to support this infrastructure. The workgroup should include representatives from key stakeholders with recognized data stewardship expertise and would coordinate interagency and inter-jurisdictional partnerships and mitigate institutional and legal barriers. The workgroup would promulgate data standards, quality assurance protocols, metadata production and region-wide multi-server search and access capabilities.

Cost: \$2 million per year for five years

Recommendation 5: To coordinate and manage communication of scientific and technical information, the Great Lakes Interagency Task Force should establish a communications workgroup composed of public affairs specialists from Federal, State, and regional entities and key industries.

Rationale: Communications professionals from federal and state governmental agencies, environmental groups, regional and local organizations, Native American interests, relevant industry associations and academia would participate in the workgroup and provide oversight for the development and implementation of a comprehensive regional communications plan. The communication plan would include periodic reviews of audience needs and assess optimal methods of information delivery to decision-makers and the public. By sharing experience, tools and workloads, the workgroup would facilitate efficient and consistent delivery of Great Lakes information to disparate audiences and oversee small grants to regional and local organizations to enhance communications efforts. The workgroup should rely upon the expertise of established networks, such as the Great Lakes Sea Grant Network and the Great Lakes Information Network.

Cost: \$1 million per year for five years

SUSTAINABLE DEVELOPMENT

I. Problem Statement

Sustainable development is an approach to achieving balance between economic, societal, and ecological needs that has not been fully integrated into all aspects of the use, development, restoration, and conservation of Great Lakes resources. Sustainability works from the bottom-up, and is rooted in the actions and decisions by individuals, private enterprises and local communities. State and federal governments play important roles in promoting sustainable behavior through guidance, outreach, and support to enhance the capability of local communities, as well as policy and funding decisions.

Sustainable Development was examined with respect to six categories of services provided by the region's ecosystems: land use and development; agriculture and forestry; transportation; industrial activities; water infrastructure, and; recreation, tourism, and fishery. An evaluation of current and future human activities in the Great Lakes Basin highlights trends that continue to draw on ecosystem services and economic competitiveness, including:

- loss of natural and agricultural lands to development at rates far exceeding population growth;
- leveling or decline in conservation tillage practices;
- fragmentation of privately owned forest lands into smaller tracts and decreasing levels of active management on public forest lands;
- increased demands on ecosystems for recreation;
- aging transportation infrastructure that impedes more efficient intermodal systems;
- an aged water and wastewater infrastructure unable to handle current demands;
- disconnected programs for planning and management of ecosystem services;
- practices and policy disincentives that deter sustainability, and;
- outdated perceptions of the region ("rust belt") which fail to promote the potential of its sustainable ecosystem services.

II. Goals and Milestones

The goal is a Great Lakes Basin where human activities support a strong and vibrant economy, meeting societal and cultural needs in balance with a diverse and resilient ecosystem. A sub-goal that is essential to this desired state is a Great Lakes community that has fully embraced and routinely applies sustainability in all decisions and actions. While the near-term actions recommended herein will have specific milestones, the adoption and use of sustainability as a guide to local and regional decision making will take time. As sustainability becomes embedded in the fabric of individual, corporate and governmental thinking, the return on that investment should continue indefinitely.

III. Recommendations

This Team identified actions to promote sustainable development practices aligned with six categories of services provided by Great Lakes ecosystems. These include actions for all sectors of stakeholders, including federal, state, tribal and local governments, private business, industry and manufacturing, and nongovernmental organizations (NGOs). The complete set of these actions is provided in the full report of the Sustainable Development Team (Appendix) and are summarized by four major recommendations:



1. Adapt and maintain programs that promote sustainability across all sectors;
2. Align governance to enhance sustainable planning and management of resources;
3. Build outreach that brands the Great Lakes as an exceptional, healthy, and competitive place to live, work, invest and play; and
4. Provide leadership for sustainable development through the implementation of Strategy recommendations.

Each of these recommendations will be discussed with examples of near-term actions that can deliver measurable results, most without substantial new financial requirements.

1) **Adapt and maintain programs that promote sustainability across all sectors**

Among the most critical actions necessary to promote sustainability is to eliminate or modify existing programs that actually encourage non-sustainable practices. For example, some state and local tax laws and federal infrastructure aid programs inadvertently encourage urban sprawl and should be modified to give preference or additional funding attention to those projects and communities that encourage and practice sustainable actions. Some federal agricultural price supports tend to discourage conservation tillage practices, and need to be amended, and some taxes and user-fees impacting transportation may not encourage the most efficient and sustainable modes. Near-term actions to address these program shortcomings are:

Action (a): States should incorporate sustainable criteria into sewer and water infrastructure loan and grant programs in the Great Lakes as a means of prioritizing those projects that pursue sustainable objectives.

Timeframe: 2006

Lead: Governors and state agencies

Resources: Policy change; no new funding required

Action (b): Federal agencies should review existing grant, loan and subsidy programs applicable to the Great Lakes Basin and incorporate sustainable criteria to provide priority for those projects that pursue sustainable objectives.

Timeframe: 2006

Lead: Great Lakes Interagency Task Force

Resources: Policy change; no new funding required

Other programs that have greater potential to promote sustainability, but are under funded or need to be modified for greater effect include funding and tax incentive programs for brownfields and sustainable recreation, and incentives for development of renewable energy technologies, energy efficiency, and pollution prevention.

Action (c): Local communities should re-use brownfields to revitalize lakeside and tributary waterfronts, with emphasis on public access and recreational opportunities. Federal and state grant programs should give increased funding priority for these projects.

Timeframe: 2006-2007

Lead: Local governments, with priority funding from federal and state programs

Resources: Target existing program funds

Sources: Federal and state funding programs including: USEPA, Brownfields Program; U.S. Dept. of Housing and Urban Development (HUD), Brownfields Economic Development Initiative; US

Forest Service (USFS), US Dept of Interior (USDOJ) and US Fish & Wildlife Service (USFWS), Land and Water Conservation Fund; NOAA Coastal Brownfields and Portfields (with USEPA) programs, US Army Corps of Engineers (USACE), Great Lakes Remedial Action Plan, Beneficial Use of Dredged Material and ecosystem restoration programs.

An important tool in encouraging sustainable practices is to develop and apply specific metrics for sustainability, such as a set of standards for “green” marinas, sustainable forestry, or for sustainable urban, suburban and rural development. When creating and applying “green” standards and metrics, the integration of sustainable activities and cooperation within and among governmental jurisdictions is a key to success and should carry incentives. By recognizing preferred “green” practices with a “Contributing to a Healthy Great Lakes” label, the region can gain community support for sustainable practices.

Action (d): Conduct a review of examples of sustainable practices, evaluate their effectiveness and applicability to the Great Lakes Basin, and develop potential criteria for “green” certification and potential criteria for prioritizing proposals for funding programs.

Timeframe: 2006

Lead: Great Lakes Commission; Great Lakes Regional Planning Group; Sea Grant/University; contractors

Resources: \$200,000

Source: Federal and state funding programs including: USEPA, CEM funding through GLNPO/LaMP; NOAA, Coastal Zone Management (CZM) grants and Coastal Estuary Land Protection; Great Lakes Protection Fund

2) Align governance to enhance sustainable planning and management of resources

While the Great Lakes ecosystems are not aligned by political boundaries, human management of ecosystem services is. Our ability to balance economic, societal and ecosystem needs is challenged by the disconnection between economic drivers and the planning and management of ecosystem services. For example, existing programs for local and regional planning of land use are disjointed from the programs for planning and management of transportation, and water infrastructure. Recommend actions to realign governance institutions to sustain ecosystem services and integrate the planning and management of these services.

Action (e): Conduct a three-year demonstration project in three to four Great Lakes major metropolitan areas for development of a consistent, sustainable land use plan that uses best available new technologies to integrate with regional transportation plans and other public infrastructure plans including extensive public participation and local involvement. The regional 2040 framework plan of the Northeast Illinois Planning Commission provides a model.

Timeframe: 2006-2008

Lead: US Dept of Transportation (DOT), Federal Highway Administration and Federal Transit Agency; state DOTs; Regional Metropolitan Planning Organizations (MPOs)

Resources: 10-20 percent of selected demonstration MPOs’ annual Regional Transportation Plan (RTP) funding.

Sources: Funding 50 percent from RTP funds and balance from a range of existing program (that may vary by state) including: USEPA (Clean Water, Brownfields, LaMP), NOAA/Sea Grant; HUD Community Development Block Grant program, and; US Dept of Commerce (USDOC) Economic Development Funds; USDA programs; Foundations.

Activities to address the restoration of ecosystems should be integrated with activities that promote sustainable use of ecosystem services, especially where the uses and restoration are

linked. An ecosystem restoration plan that does not provide a path for economic development is as unsustainable as an economic development plan that fails to directly address ecological restoration and societal needs. The integration of restoration and sustainable use planning has been limited by the alignment of agencies along single purposes, and requires actions to promote integrated, multi-purpose planning.

Action (f): In order to start to address two critically inter-related issues, transportation and invasive species (aquatic and terrestrial), authorize and fund a comprehensive study that integrates long-term invasive species control and management with sustainable intermodal transportation for Great Lakes-St. Lawrence Basin.

Timeframe: 2006-2009

Lead: Congress

Resources: \$20 million over four years

Sources: Federal funding programs of USFWS, USDOT and USACE

Another element of governance that is limiting sustainability is the capacity of local communities, watershed councils, soil and water conservation districts, and MPOs which are challenged to attract and retain staff knowledgeable on sustainable practices due to unstable base funding. These organizations provide critical training, technical assistance, and are regional advocates for sustainability are challenged to maintain their institutional knowledge. Recommend actions to enhance the capacity of local and regional organizations to inform, promote, and implement sustainability.

Action (g): Identify, expand, and enhance existing online clearinghouses to provide additional capacity for education and outreach, tourism projects and products, and local watershed planning initiatives

Timeframe: 2006-2007

Lead: Great Lakes Commission/GLIN; Sea Grant/University

Resources: \$500K per year

Source: Federal and state funding programs including: USEPA, CEM funding through GLNPO/LaMP; NOAA, Coastal Zone Management (CZM) grants and Coastal Estuary Land Protection; Great Lakes Protection Fund

Action (h): Enhance the capacity of local communities to apply sustainability through training and technical assistance provided with priority funding from multiple federal and state grant and assistance programs.

Timeframe: 2006-2007

Lead: Watershed and regional councils, RAP groups, tribes, NGOs, soil & water conservation districts

Resources: \$2 million (ramping up to \$8 million in five years); \$100K per watershed per year

Source: US Dept Agriculture (USDA), Tech Asst Fund; USEPA, CEM funding through GLNPO/LaMP, Sec 319 grants through States; NOAA/CZM and Coastal Estuary Land Protection grants; USACE RAP Support (WRDA Sec 401) program; HUD Community Development Block Grant program, Great Lakes Protection Fund; Foundations

Action (i): Initiate two new and maintain two existing watershed or regional partnerships with emphasis on rural, multi-ecosystem watersheds that incorporate sustainable criteria and local government capacity enhancing programs into a comprehensive strategic planning initiative.

Timeframe: 2006-2007

Lead: Watershed and regional councils, RAP groups, tribes, NGOs, soil & water conservation districts

Resources: \$100-250K per watershed per year

Sources: USEPA, Section 319 grants through states; state watershed planning programs

Action (j): Enhance the capacity of Great Lakes ports and marinas to implement best management practices in partnership with the outreach initiative of the American Association of Port Authorities (AAPA)

Timeframe: 2006-2007

Lead: Port authorities, state, local and private harbor and marina interests, AAPA

Resources: \$300,000 annually

Sources: Federal and state funding programs, including USDOT and USACE

Commitments to existing partnerships that bridge governmental alignments and promote sustainability should be renewed and sustained. One example is the state/federal partnership of the Great Lakes Dredging Team.

3) Build outreach that brands the Great Lakes as an exceptional, healthy, and competitive place to live, work, invest, and play

In order to gain the public support, both within the basin and nationwide, to accomplish the recommendations identified in the Strategy and promote the sustainability of the Great Lakes as a national priority, a combination of marketing and outreach is required. Specific objectives of this outreach and marketing are to educate users and consumers on sustainable alternatives available and the consequences of decisions, build a sense of ownership and pride in regional ecosystems, attract new residents and businesses to the region with abundant ecosystem services and a society where sustainability is practiced, and develop national support for the restoration and protection of the Great Lakes because of its ecological and economic importance to the country.

Action (k): Develop and implement a marketing strategy for the Great Lakes targeted at a national audience that delivers messages of the region's ecological and economic importance to the nation/world

Timeframe: 2006-2008

Lead: Foundations and NGOs

Resources: \$2 million

Sources: Foundations and public interest funds

Action (l): Create new awards to recognize excellence in sustainable development within the Great Lakes

Timeframe: 2006

Lead: Foundations, business sector associations, NGOs

Resources: undetermined, but may not be required

Action (m): Develop additional education and outreach modules on sustainability (such as WET and Water Riches curricula for water conservation) and promote their incorporation into school curriculum (K-12)

Timeframe: 2006-2007

Lead: State resource and education agencies and NGOs in partnership with local school districts

Resources: \$2 million

Sources: State and federal funding programs, including: USEPA, Environmental Education grants; US Dept of Education grants; and state and local education funding programs

4) Provide leadership for sustainable development through the implementation of the Strategy recommendations

This Strategy document presents both short- and long-term actions required to restore and protect the ecosystem services provided by the Great Lakes. However, there is another critical step in moving forward from this document to the implementation of the recommended actions. That is the formulation of an implementation plan which provides the specifics for prioritization and sequencing of actions. This plan must also evaluate alternative actions, develop more detailed cost estimates, and assign responsibilities to assure that funds and human resources are used efficiently. Sustainable development cuts across all other priority issues addressed in this Strategy, it is future-oriented, and represents a sound platform for integrating efforts to restore and protect the Great Lakes.

Action (n): Congress should authorize and appropriate funding for development of a phased implementation plan for the recommendations in the Strategy that provides a scientifically sound process for prioritization, sequencing, development of detailed cost data, evaluation of alternatives, and assignment of responsibilities, utilizing sustainable development as the overarching guide

Timeframe: 2006

Lead: Congress

Resources: \$6 million over three years

A final action that is essential for the successful implementation of the Great Lakes Strategy is providing leadership. The Collaboration, a partnership of federal, state, tribal and local governments, is the logical choice for overseeing of the development of the implementation plan as well as tracking and reporting on its application. This will necessitate some changes to the Collaboration's charter and organization structure. It is also recommended that the Governors, Mayors and Tribal leaders provide leadership as the advocates for sustainable use, development and conservation of Great Lakes resources.

Action (o): The Great Lakes Regional Collaboration should amend its Framework to provide oversight of the development, approval, and application of a phased implementation plan for the Great Lakes Strategy using sustainable development as the overarching guide. The Collaboration should also monitor and report on the status of implementation.

Timeframe: 2006

Lead: Collaboration

Action (p): The Governors, Mayors, and Tribal leaders of the Great Lakes should renew and expand their commitments to the sustainable use, development and conservation of Great Lakes resources and utilize the Great Lakes Commission and Great Lakes and St. Lawrence Cities Initiative as a proactive advocates for sustainable development.

Timeframe: 2006

Lead: Governors, Mayors and Tribal leaders

Appendices



About the Appendices

The Appendices to the GLRC strategy (included on the CD) contain supplementary materials used or developed in the course of preparing the Strategy Team Reports included in the final GLRC Strategy. For example, they identify many successful ongoing efforts that contribute to Great Lakes protection and restoration, as well as recommendations that may be utilized for future action. They also contain valuable reference materials and other supplementary information that are an important part of the strategic collaborative process. However, the materials in the Appendices are not necessarily products of consensus and might not represent the views of all strategy team members; and, unless otherwise indicated in a particular item itself, have not received official endorsement by the Executive Committee, or the entities who are members of the Collaboration.

