Great Lakes Water Quality

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PRIORITIES 2007-09 SERIES

Workgroup Report on Nearshore Framework

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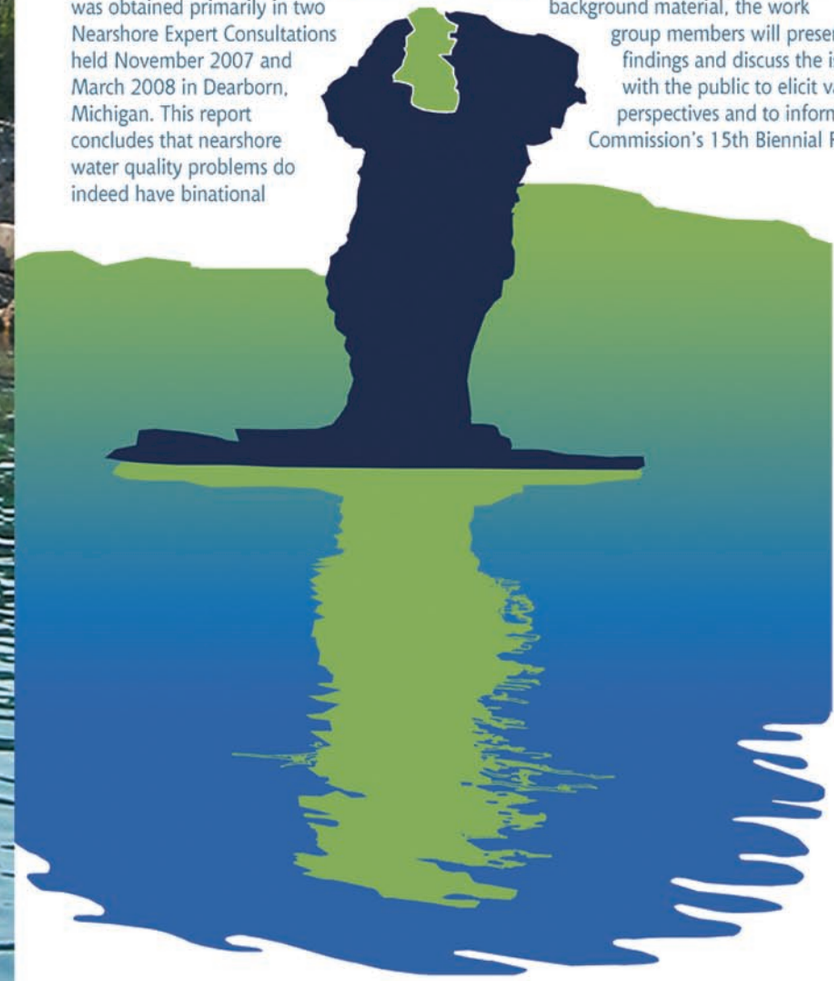
"Can I 'rethink' the Great Lakes?"

The nearshore is a critical component of the Great Lakes Basin Ecosystem as the interface between the watershed and offshore waters, and where much human activity takes place. This report covers the nearshore framework, an "umbrella" activity for the Commission's 2007-09 Priorities under the Great Lakes Water Quality Agreement. The report includes the latest scientific, policy and governance information on the nearshore waters of the Great Lakes with a focus on 1) the Agreement and its review; 2) the binational implications for addressing nearshore issues, and 3) critical science, policy and management needs. Information was obtained primarily in two Nearshore Expert Consultations held November 2007 and March 2008 in Dearborn, Michigan. This report concludes that nearshore water quality problems do indeed have binational implications, and that the updating of the Great Lakes Water Quality Agreement is an opportunity to make vague and implicit references to the nearshore in the current Agreement clear and explicit. The recommendation is that a nearshore framework should not be a separate institutional arrangement. Rather, the nearshore needs to be addressed more comprehensively as part of an adaptive-management framework embedded in the Lakewide Management Plans (LaMPs). In addition to preparing this report, the work group will host a session on the Nearshore Framework on Wednesday, October 7, 2009 at the GLWQA Biennial Meeting in Windsor, Ontario. Using the work group report as background material, the work group members will present findings and discuss the issue with the public to elicit various perspectives and to inform the Commission's 15th Biennial Report.



Work Group Report on Nearshore Framework

Great Lakes Water Quality Agreement Priorities 2007–09 Series

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Table of Contents

Acknowledgments

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Nearshore Waters of the Great Lakes: The Vital Link Between the Watershed and Offshore Waters

Introduction

The nearshore area of the Great Lakes is where most people live, work and play. It is also the link between the watershed with its many tributaries and wetlands and the offshore waters of the Great Lakes as well as the zone where large quantities of groundwater discharge. Nearshore waters impact the quality of offshore waters. In addition, it is the nearshore where perturbations most often first appear, including degradation of water quality, water-level fluctuations, and effects of climate change on human and ecosystem health.

Despite these good reasons to give nearshore waters more attention, they historically have been overlooked at the federal level in favor of offshore programs in the Great Lakes. The International Joint Commission (IJC) alerted governments to this concern by means of two letters in 2007.The IJC also directed its internal resources to degradation of the Great Lakes nearshore as the focus of its 2007 – 2009 priority activities under the Great Lakes Water Quality Agreement. The purpose of the priority activity was to assemble and report on the latest scientific, policy and governance information on the nearshore of the Great Lakes with focus on: 1) binational implications; 2) the Great Lakes Water Quality Agreement and its review and 3) critical Great Lakes science, policy and management needs of the nearshore.

Five themes were identified that have science, resource management and policy implications in the nearshore including eutrophication, beaches and recreational water quality, chemicals of emerging concern, risks and benefits of fish consumption and aquatic invasive species. Work groups were established for these themes, consisting of representatives of all of the International Joint Commission's Agreement advisory boards, and their findings and conclusions are reported separately. (http://meeting.ijc.org/reports/).

This report summarizes how the nearshore is approached in the current Great Lakes Water Quality Agreement and explores the need for a binational nearshore framework to better address the science, resource management and policy issues of the Great Lakes nearshore. This information was obtained primarily from two nearshore expert consultations held in November 19-20, 2007 and March 12-13, 2008 in Dearborn, Michigan, and from activities and discussions by the Water Quality Board and Science Advisory Board during the past several years.

The Great Lakes nearshore is defined in the U.S. EPA and Environment Canada 1996 State of the Great Lakes Ecosystem Conference (SOLEC) report in terms of living ecosystems, both on land and in the water:

> *"The land areas are those ecosystems directly affected by the lakes. The water areas the relatively warm shallow areas near the shores. The nearshore zone also includes coastal wetlands that are dependent on lake levels. In both directions, nearshore areas are generally within 16 kilometers (10 miles) of shore. Exceptions are in Lake Superior, where warm water seldom extends far from shore, and in Lake Erie, where both the central and western basins are relatively shallow and warm and thus considered to be 'nearshore' in their entirety.*
>
> *On land, the nearshore zone is that area affected by the Lakes waves, wind ice, currents, temperature, and the rising and falling of lake levels that constantly shape and modify the entire shoreline.*
>
> *In water, the nearshore zone consists of areas with enough warm water to support a community of warm-water fish and associated organisms. These areas represent approximately 25 percent of each of Lakes Michigan, Huron, and Ontario; 90 percent of Lake Erie; and only 5 percent of Lake Superior because of its very deep and cold nature. In general, these are coastal areas of less than 30 meters (98 feet) in depth except in Lake Superior where they are less than 10 meters (33 feet) in depth. The nearshore waters also include the connecting channels and virtually all of the major embayments of the system."*
>
> (http://www.on.ec.gc.ca/solec/solec96-e.html).

The Nearshore in the Current Agreement

The Great Lakes Water Quality Agreement of 1978 was last amended by Protocol in 1987 (http://www.ijc.org/rel/agree/quality.html). Most of its 64 pages long address offshore water quality. The nearshore is implied in many provisions in the Agreement but is only specifically mentioned in Annexes 3 and 11. The General and Specific Objectives (Article III and IV respectively) are for the "Great Lakes System" that implies inclusion of the nearshore. Stronger implications of the nearshore are included in Article VI (Programs and Measures), recognizing that the pollution from municipal, industrial and agricultural sources and dredging activities are inherently nearshore problems. Annex 2 calls for Remedial Action Plans (RAPs) in the Areas of Concern (AOCs) that are all located in tributaries, tributary mouths, connecting channels and embayments. Annex 3 (Control of Phosphorus) includes the goal of "the elimination of algal nuisance in bays and in other areas wherever they occur." Annex 4-6 (vessel discharges), Annex 7 (Dredging), Annex 8 (Discharges from Onshore and Offshore Facilities) and Annex 14 (Contaminated Sediment) all imply nearshore sources of pollution or discharges from tributaries primarily affecting the nearshore. Annex 11 (Surveillance and Monitoring) and Annex 13 (Pollution from Non-Point Sources) are more explicit about the nearshore. Annex 11 calls for "Whole lake data including that for nearshore areas (such as harbours and embayments, general shoreline and cladophora growth areas..." Annex 13 includes wetlands protection and reduction of contaminants "...contained in drainage from urban and rural land..."

Perhaps the strongest support for inclusion of the nearshore in Agreement activities is found in the purpose (Article II) of the Agreement"...to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem." The drainage basin or watershed of the Great Lakes is included in the purpose of the Agreement and the nearshore is the natural link between the watershed and offshore waters. Yet, most of the Agreement addresses water chemistry (chemical integrity) with hardly a mention of physical or biological integrity. Watershed management plans are called for in Annex 13 but have not been developed in the context of the Agreement. The International Joint Commission in its "Advice to Governments on their Review of the Great Lakes Water Quality Agreement" recommended that "the Agreement should use watersheds as the operating framework for

protecting and restoring the chemical, physical and biological integrity of the Great Lakes basin ecosystem (IJC, 2006)." The nearshore is indeed the vital link between the watershed and the offshore waters. In conclusion, there is nothing in the current Agreement that precludes attention to water quality in the nearshore waters of the Great Lakes, but most references to the nearshore are vague and implicit.

There is now however a great opportunity to address the nearshore much more explicitly. The Parties announced in June 2009 their commitment to amend the Agreement, and negotiations are expected to strengthen and modernize the Agreement to better address current and emerging challenges.

It is recommended that:

- **The Parties in amending the Great Lakes Water Quality Agreement explicitly recognize the nearshore and its importance to the Great Lakes basin ecosystem as a vital link between the watershed and offshore waters, and as the region where most people interact with the lakes.**

Towards a Nearshore Framework

As work on the 2007-2009 nearshore priorities was unfolding, the Water Quality Board and Science Advisory Board held joint meetings. Among other business, the boards recommended that the Commission exercise its alerting function and advise the Parties on important nearshore issues. The Commission accepted this advice and sent two letters to governments (Appendix I and II).

In a July 12, 2007 memorandum to the Co-chairs of the Binational Executive Committee (BEC), during the Agreement public comment period, the Commission alerted the BEC of its concern about the lack of sufficient attention to the nearshore waters during its review of the Agreement (Appendix I). In addition, the Commission stated that:

"The nearshore area serves a vital ecological link between watersheds, tributaries, wetlands, groundwater, and the offshore waters of the Great Lakes, and supports critical habitat for fish, invertebrate and wildlife populations. In addition, the nearshore is where most people live, work and play.

However, nearshore waters also are where perturbations most often first appear, including water quality degradation, water level changes, and effects of climate change on ecosystem health. Beach closings, nuisance algal growth, establishment of alien invasive species, and habitat loss are just some of the symptoms of these developments, and act as harbingers of future changes in offshore waters.

Despite their vital importance, the current Agreement contains few specifics on nearshore waters. The Commission views this as an issue significant enough to warrant opening the Agreement on this basis alone for substantive revisions or replacement to provide the means to address the critical science, resource management, governance and policy needs related to the nearshore waters."

Immediately following the first of two nearshore expert consultations, held on November 19 and 20, 2007, the Commission provided additional advice directly to the governments in its letter of December 21, 2007 (Appendix II). Based on the initial workshop, the Commission concluded that:

- Nearshore water quality problems are serious in most areas of the Great lakes and the need to address them is clear.
- Water quality problems in nearshore areas have binational implications and binational cooperation will be needed to solve them.

- Urban and agricultural non-point sources of pollution are key contributors to the continued and excessive loadings of phosphorus to nearshore waters and they need to be reduced.
- Nutrient-control programs as outlined in Annexes 3 and 13 of the Agreement need to be funded and implemented.
- Most programs to monitor Great Lakes phosphorus loadings were terminated fifteen years ago and need to be reinstated.
- There are significant gaps in our understanding of the science and linkages between land sources and waters in the nearshore and offshore.

As noted above, the first of two nearshore priority expert consultation workshops was held in November, 2007 in Dearborn, Michigan. Six discussion papers on nearshore science, policy and governance were commissioned for the workshop. The authors of the papers and other invited speakers from government, academia and the private sector engaged in dialogue with Commissioners, advisory board/council co-chairs and members and IJC staff (Appendix III). A summary of major findings from the workshop include:

- Effective binational leadership is the key to enhanced focus on the nearshore and progress under the Agreement.
- Among the binational institutions reviewed, the Commission has historically been the most engaged – and best positioned – to address nearshore issues. This capability is compromised by several factors. The Commission's oversight authority with respect to parties' implementation of nearshore components of the Agreement is limited and only minimally exercised. Despite multiple articles and annexes referencing nearshore issues, the current Agreement lacks a cohesive nearshore focus commensurate with the importance of this ecosystem component and associated issues.
- Although there are exceptions, there is no coordinated or easily accessible database to monitor and tabulate loadings of pollutants from direct dischargers and from diffuse and land-based sources. Data dealing with shoreline development; remediation; and land use changes is not centralized or provided in an inventory. Hence, understanding progress or priorities in nearshore areas is difficult.
- There is little emphasis on coordinating policies and programs dealing with nearshore matters among the various jurisdictions, institutions, and agencies responsible for them. For example, there are often no common goals and targets focused on nearshore needs. There are programs undertaken by the federal, state

and provincial governments, municipalities, watershed organizations, or conservation authorities that address some nearshore issues and that are yielding a positive result. An overall policy framework to guide and integrate these activities is absent.

- Within any one nearshore area, there is an array of local, state/provincial, and federal laws, policies and programs. The issue is not whether there is jurisdictional fragmentation, but whether there are mechanisms to coordinate plans, programs and activities. Coordination and collaboration among binational institutions on nearshore issues has improved, but must be enhanced to ensure efficiency, effectiveness and comprehensiveness. Activities continue to be more issue-driven than strategic.
- Institutional arrangements for addressing nearshore issues in the binational context are most critical where they are presently most limited: at the watershed level. The U.S. lacks local/regional governance arrangements similar to Ontario's Conservation Authorities, and coverage of critical nearshore areas via watershed councils or councils of government are limited at best.

The second nearshore priority expert consultation workshop was held on March 12-13, 2008 also in Dearborn, Michigan. The workshop addressed specific issues with a view towards developing an adaptive management framework for Great Lakes nearshore waters. The workshop was organized to accomplish this in four sessions:

1. Overview of adaptive management and a Maumee River watershed case study;
2. Assessment of external stressors (note: internal stressors were addressed in the first workshop);
3. The utility of LaMPs for nearshore science and management, and
4. Towards an adaptive management framework for the nearshore waters.

A summary of major findings include:

- Watershed-based sources of nutrients are not adequately managed to achieve the water quality goals of the Agreement and large scale land use stressors such as agricultural practices and urban development have a basin impact that will require greater management to alleviate nearshore degradation of water quality.
- Implementation of nearshore management and BMPs will require a significant investment of resources beyond the current level, and need be undertaken as a binational priority, with major commitments similar to the construction of publically owned waste treatment works that were made to implement the Agreement in the 1970's.

- Groundwater hydrology and climate change are significant external influences that have an important impact on nearshore areas and need to be accounted for in management actions.
- Nearshore integrity depends on protecting fish and wildlife habitat, and food web management, including changing physical and hydrological conditions and invasive species competitive success.
- Links between airborne contaminants, development and nearshore degradation are real, but not well defined. Further research needs to be undertaken in priority locations that are affected by known pollutant sources.

An Adaptive Management Strategy with Emphasis on the Nearshore

There was little support for a nearshore framework as a new, stand-alone institutional arrangement that emerged from the two nearshore expert consultations; rather, the tenor of the discussions centered on how existing institutional arrangements could be used or modified to better address problems in nearshore areas.. The cornerstone to better addressing the nearshore was deemed to be the adoption of an adaptive management strategy as the nearshore framework.

"Adaptive environmental assessment and management" was originally developed by C.S. Holling and Carl J. Walters during the 1970s (Holling 1978). Adaptive management is a structured, iterative process of optional decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. The basic elements of adaptive management are shown in Figure 1. The key to successful adaptive management is a thorough assessment of problems through research and monitoring. Programs based on the assessment are designed and implemented to overcome the problems identified. The ecosystem is then monitored and evaluated on how it has responded to the management programs. Based on evaluation of monitoring results, the programs are adjusted or modified or new programs are implemented in order to achieve resolution of problems. Consequently, adaptive management focuses on learning and adapting through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems.

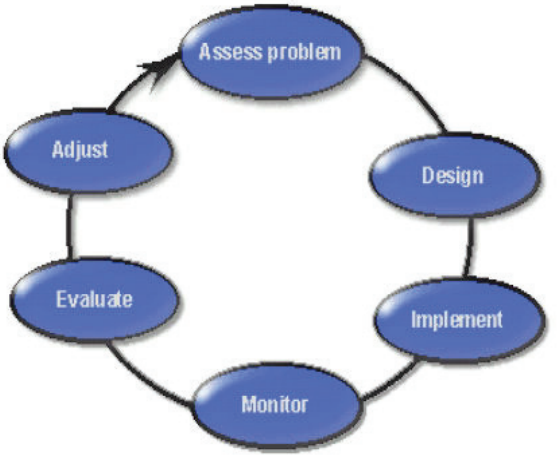

Figure 1. Diagram of the adaptive management six-step cycle.
(Source: http://www.doi.gov/initiatives/AdaptiveManagement/whatis.html)

Scientific Challenges and Opportunities. An adaptive management approach is particularly appropriate for the nearshore waters of the Great Lakes because of the dynamic nature of the nearshore zone increases the uncertainty of results obtained in research and monitoring data. The nearshore currents are influenced by discharges from tributary mouths and embayments as these waters variously mix with offshore waters. In fact, limnologists historically have been reluctant to study nearshore waters, preferring to focus on offshore waters as being representative of whole-lake ecosystem conditions. Similarly, fishery biologists historically have focused on sampling juvenile and adult fishes with nets in offshore waters even though nearshore waters are well-known to be important spawning and nursery grounds for fishes. This is changing with both limnologists and fishery biologists now focusing their attention to nearshore waters and their habitats in the Great Lakes with newly developed sampling and modeling methods.

Several recent initiatives are highlighted here are particularly promising for application in an adaptive management context in the nearshore waters of the Great Lakes, including the Great Lakes Environmental Indicators (GLEI) Project and the Canadian Aquatic Biomonitoring Network (CABIN).

The Great Lakes Environmental Indicators program is a multidisciplinary cooperative research effort with binational participation that is being overseen by the Natural Resources Research Institute at the University of Minnesota-Duluth (http://glei.nrri.umn.edu/default/). The program goal is to develop integrated environmen-

tal indicators to assess the condition of the coastal margins of the Great Lakes. The GLEI shows particular promise as part of a nearshore framework in an adaptive management mode because it transcends terrestrial, wetlands and aquatic ecosystems in the coastal margins. The indicators focus on five major categories of human stresses on the coastal margins, including habitat alteration, chemical disturbance, alteration of biological processes, alterations of physical processes and hydrologic disturbance.

The Canadian Aquatic Biomonitoring Network (CABIN) is a collaborative program developed and maintained by Environment Canada to establish a network of reference sites useful in assessing the biological health of fresh water in Canada (http://cabin.cciw.ca). Once the reference sites are established based on minimal impacts by human use, a baseline can be determined for assessing impaired sites. The CABIN program with its strong emphasis on bioassessmen, especially using benthic (bottom-dwelling) organisms, has high potential for implementation in the nearshore waters of the Great Lakes as an integral part of an adaptive management strategy.

Governance Challenges and Opportunities. Tributary flows and land use are important watershed influences on nearshore water quality in the Great Lakes. Lake circulation patterns may result in adverse impacts from a nearshore source in one jurisdiction to another nearshore in another jurisdiction and also to offshore waters. Such movements of pollutants can cross provincial, state international boundaries. Consequently, nearshore water quality issues are clearly a binational concern.

The United States and Canada have diverse legislative, programmatic and policy tools for addressing water quality problems in nearshore waters of the Great Lakes at federal, state and provincial orders of government. Municipalities also have their own set of programs and policies that potentially can influence the quality of nearshore waters. There is also a patchwork of watershed programs through watershed councils in the United States and Conservation Authorities (CAs) in Canada. This patchwork is less of a problem in Canada where Conservation Ontario provides a framework for various CA programs and activities. Nonetheless, shorelines outside a designated watershed boundary often receives little attention in both countries, and existing programs at all orders of government often work in isolation and are unsure of each other. Facilitating collaboration could result in improved programs and water quality conditions in the nearshore.

As noted earlier, the current Great Lakes Water Quality Agreement focuses mostly on offshore water quality even though nearshore waters have a profound effect on offshore waters. As a permanent reference under the Boundary Waters Treaty (BWT), there always has been attention to avoiding pollution across the interna-

tional boundary (Article IV) that is mostly offshore. Moreover, the BWT excludes the International Joint Commission's authority in tributaries. Yet, the purpose of the Agreement includes the watershed and, mostly by implication, nearshore waters. The emphasis on offshore waters is further influenced by the U.S. Environmental Protections Agency and Environment Canada, the designated lead agencies for implementing the Agreement by the two federal governments, who both have more Agreement-related programs on the lakes, per se, than in the watershed.

The International Joint Commission in its advice to governments on Agreement Review (IJC, 2006) recognized this problem and recommended a new Binational Action Plan to improve the linkages between watershed planning, Remedial Action Plan (RAPs) and Lakewide Management Plans (LaMPs) for more effective results in reducing pollution on lands and in tributaries, thereby better protecting Great Lakes water quality. The Commission further noted that LaMPs have been moving beyond the focus on critical pollutants called for in the Agreement (Annex 2) and have adopted a broader watershed perspective. LaMPs have the potential to be the core instrument to engage a broader array of governments, agencies and programs in the watershed and in the nearshore and offshore waters of the Great Lakes basin ecosystem.

The Way Forward. A comprehensive and ecosystematic scientific assessment of condition of the nearshore waters and habitats of the Great Lakes is required. This should be developed within an adaptive management strategy and include in stepwise fashion:

- Research and assessment of conditions
- Diagnosis of problems
- Prioritization of actions to resolve identified problems, including restoration and protection actions
- Monitoring of ecosystem response to restoration and protection actions
- As necessary, based on monitoring and research results, identify modification of current actions, develop new actions and revised schedules for implementation and reporting.

This overall approach would constitute the "nearshore framework" nested within comprehensive basin-wide programs. This assessment of condition likely would be best implemented as part of the strategy announced at the April, 2009 Binational Executive Committee (BEC) meeting on improving the integration of Lakewide Management Plans (LaMPs) and the Cooperative Science and Monitoring Initiative (CSMI) for binationally coordinated research and monitoring on each of the Great Lakes on a five-year rotating basis.

It is clear that research and monitoring in the nearshore areas of the Great Lakes needs to evolve from chemical monitoring, as emphasized in the current Great Lakes Water Quality Agreement, to include biological and physical monitoring. The nearshore should be compared to benchmark or reference conditions, such as the CABIN approach, and an environmental status assessment that integrates the coastal zone into an indicator program, such as GLEI, that is highly suitable for reporting to resource managers, policymakers and the public.

This framework would also allow the two countries to work domestically to deliver programs on prognosis and diagnosis binationally. Resolution of identified nearshore problems should proceed on land and up the tributaries as far upland and upstream as necessary to protect and restore water quality and habitats in the nearshore waters of the Great Lakes. Governance arrangements will need to be instituted and roles and responsibilities defined among orders of government to implement necessary existing or new programs. There may be the need to develop specific restoration and protection goals and targets for waters and habitat quality in the nearshore waters of the Great Lakes to properly focus the scientific conditions assessment and the institutional arrangement to achieve them.

It is recommended that:

- **The Parties in amending the Great Lakes Water Quality Agreement specify adaptive management as the framework for addressing nearshore waters and habitat quality problems in the nearshore waters of the Great Lakes.**

- **The Parties in amending the Great Lakes Water Quality Agreement consider the need for specific goals and objectives to protect and restore water and habitat quality in the nearshore waters of the Great Lakes, including, biological, physical and chemical integrity.**

- **The Parties undertake a binational condition assessment of the nearshore waters of the Great Lakes, using an adaptive management strategy. This assessment should be nested within comprehensive basin-wide programs and be an integral component of Lakewide Management Plans and the Cooperative Science and Monitoring Initiative.**

- **Based on the nearshore condition assessment, the Binational Executive Committee (BEC) should assume leadership for engaging Great Lakes basin institutions and agencies at all orders of government with a role to play in protecting and restoring nearshore water and habitat quality in the Great Lakes, including facilitating the development of shared priorities and coordinating programs, research, monitoring and management initiatives.**

Where Does the Ecosystem Approach Fit In?

An ecosystem approach to Great Lakes research and resource management was first articulated in a 1978 report by the Research Advisory Board (now Science Advisory Board). The Agreement does not specifically define "Ecosystem Approach" but it is widely accepted that the purpose of the Agreement broadly encompasses an ecosystem approach. "...to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem" (Article II). The term, "ecosystem approach" is used only once in the Agreement: "Remedial Action Plans and Lakewide Management Plans shall embody a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in Areas of Concern or open lake waters."

In spite of this lack of clarity on the ecosystem approach in the current Agreement, the Great Lakes Water Quality Agreement and the IJC Research Advisory Board report (1978) are widely considered to have influenced the implementation of the ecosystem approach elsewhere in North America and throughout the world. For example, the International Convention on Biodiversity has adopted the ecosystem approach as its operating principle that "...is a strategy for the integrated management of land, waters and living resources that promotes conservation and sustainable use in an equitable way... The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning in management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken even when some cause-and-effect relationships are not yet fully established scientifically" (http://www.cbd.int/ecosystem/).

The International Joint Commission in its 2006 report on advice to the governments review recommended that an ecosystem approach, with a focus on water quality, be considered in new or updated Agreement using watersheds as the geographic units for coordinating, interacting and implementing programs. The current lack of attention to the nearshore areas of the Great Lakes is the missing link in integrating programs between the watershed and offshore waters. An adaptive management strategy for addressing problems in the nearshore areas of the Great

Lakes is, most fundamentally, an ecosystem approach to management, protection and restoration.

It is recommended that:

- **The Parties in updating the Great Lakes Water Quality Agreement clarify and affirm the ecosystem approach to protection, restoration and maintenance of the waters of the Great Lakes basin ecosystem.**

References Cited

Great Lakes Research Advisory Board. 1978. The Ecosystem Approach: Scope and Implications of an Ecosystem Approach to Transboundary Problems in the Great Lakes Basin. Spec. Rept. to International Joint Commission, Windsor, ON, 47 pp.

Holling, C.S. (ed.). 1978. Adaptive Environment Assessment and Management. Chichester: Wiley. ISBN 0-471-99637-7.

International Joint Commission. 2006. Advice to Governments on their Review of the Great Lakes Water Quality Agreement: A Special Report to the Governments of Canada and the United States, International Joint Commission, Washington, D.C., Ottawa, ON and Windsor, ON ISBN 1-894280-67-9.

Appendices

Appendices are available in pdf format at:

http://www.ijc.org/en/priorities/2009/nearshore-framework/appendix