

Science and the Great Lakes Water Quality Agreement
Science Advisory Board Recommendations to the IJC Based on the 132nd Meeting of the
Board, held February 4 – 6, 2004,
Michigan League, Ann Arbor, Michigan

Introduction

The Parties are required to “conduct a comprehensive review of the operation and effectiveness of the Agreement” following release of the Commission’s 12th biennial report in 2004. The Commission has committed to issue a special report providing advice to the Parties regarding the review and its role in the review. The Commission instructed its Boards / Council to explore the nature of the advice that it could provide. The lead was assigned to the Water Quality Board, with the Science Advisory Board, International Air Quality Advisory Board, and the Council of Great Lakes Research Managers contributing in their areas of expertise.

The Science Advisory Board is the scientific advisor to both the Commission and the Water Quality Board. To develop the requested advice, the Science Advisory Board held a workshop to review of the Agreement from a scientific perspective. Attendees included Board members, invited experts, IJC scientific staff and the Canadian Cochair of the Commission – a group of approximately 50 people.

Workshop Structure

- The adequacy of the Agreement to accommodate present and future stressors that impact Great Lakes water quality.
- Suggest specific areas of the Agreement where, from a scientific perspective, provisions might be added, revised, or deleted.

Workshop Questions

The fundamental question considered is whether the stated purpose of the Agreement is necessary and sufficient to meet present and future challenges.

The workshop focused on several themes related to the following other questions:

- What is the present state of the science associated with this element of the Agreement? Is the scientific knowledge implicit in the Agreement necessary and sufficient to achieve the purpose of the Agreement? Why or why not?
- If not, what new or additional scientific information is required?
- What new elements might be considered and what is the state of the science to support them?
- Can the existing Agreement accommodate present and future issues, including but not limited to alien invasive species, habitat, land use, climate

change, biodiversity, pathogens, new chemicals, and long-range transport of atmospheric pollutants?

Finally, to conclude the workshop, the linkages between research, science and policy were addressed by the questions:

- Do current institutional arrangements under the Agreement help or hinder the application of science?
- Are current Great Lakes research institutions organized to deliver science in the 21st century? If not, then what organizational changes would be suggested?
- How can science-policy linkages be strengthened?
- How might a detailed scientific review be undertaken by the Parties?

Proposed Recommendations Based on Scientific Principles, Overarching and Specific Recommendations

Scientific Principles

It is recommended that the following scientific principles be reflected in a revised Agreement:

- **Managing the Great Lakes needs to be broader than water quality.** Scientific knowledge is not adequate at present to manage the basin as an ecosystem. Present scientific knowledge is sufficient for a broad integrated understanding of water quality problems, involving the major ecological functions and the components of the watershed, the airshed, and groundwater.
- **A new Agreement must encompass numeric as well as process approaches in order to benefit from the latest scientific knowledge and information.** Two complementary scientific approaches are currently being used: a numerical one, based on objectives, and a process oriented one, based on the most current understanding of the dynamic performance of the system. There are merits to the continued inclusion of both approaches.
- **The interrelationship of water quality, ecosystem health, and water quantity is well established scientifically, and should be recognized as such in a new Agreement.** Examples of the interrelationship include: tributary flow, groundwater recharge, and wetland dynamics in which the quality of the ecosystem is highly dependent on the amount of available water.
- **A binational scientific infrastructure to provide surveillance and monitoring information to support policy and management must**

underpin any Agreement and should be institutionalized as an essential component and a means of linking science and policy.

- **The Agreement must be consistent and integrated with numerous other transboundary instruments.** Some of its challenges are continental, for example addressed under NAFTA by the CEC and global, for example addressed by the International Maritime Organization through the International Convention for the Control and Management of Ship's Ballast Water and Sediments. The Agreement would benefit from establishing scientific linkages among these other instruments such as those developed for the control of persistent toxic substances, including the UNECE Convention on Long Range Transboundary Air Pollution and the UNEP-POPs Treaty, to ensure that Great Lakes policies are coherent and effective.

Overarching Recommendations

It is recommended that the following general improvements be adopted as pertaining to the broad aspects of the Agreement:

- **Agreement language needs to define the term “ecosystem approach”.** As well it should provide clear guidance on how that approach can be implemented to advance Agreement goals and objectives.
- **“Integrity” needs definition and to have common understanding.** Restoring and maintaining integrity needs greater expression in order to provide a renewed purpose in a new Agreement.
- **“Restoration” is a term that needs to be defined scientifically, and understood as a goal and a vision to sustain progress and commitment to Great Lakes improvement.** One suggestion might be to define it in terms achieving beneficial uses. Restoration to a pre settlement benchmark is not a realistic basis for Great Lakes efforts.
- **The Agreement should specify responsibility for reporting, interpretation and accountability.** Who is responsible for progress and what is the schedule for reports and responses? The institutional arrangements required to support and implement the Agreement should be updated and their roles clarified, especially governance mechanisms that facilitate binational cooperation, coordination and ecosystem management. The Agreement needs to indicate that the Parties' responses to all IJC recommendations are to be provided in a timely, public and substantive manner.
- **The review process needs to be strengthened, defined and driven by scientific understanding.** An independent binational scientific review of the Agreement should be conducted, similar to the one that occurred in 1985 with the binational NRC/RSC report “GLWQA – An Evolving Instrument for Ecosystem Management.”

- **The Agreement needs to be proactive as well as reactive, especially including emerging issues such as AIS, land use, habitat protection, biodiversity and climate change.** Flexibility is needed to accommodate new scientific information. This could be accomplished by institutionalizing a routine assessment of emerging issues explicitly in a new Agreement.
- **Public health should be explicitly addressed as a basin issue that is affected by water and air quality, and land use.** It requires an integrated approach among all orders of government and a greatly enhanced awareness and sharing of information among health professionals and practitioners.
- **The Agreement should reflect a methodology that determines risk, and uses that determination in guiding binational priority setting and action to reduce risk.** Understanding exposures as well as effects in the context of risk is needed. Risk assessment, management and communication need to be encompassed within the broader policy context of the precautionary principle rather than a regulatory one which drives management decision making.
- **Several annexes could be combined to improve their general effectiveness especially streamlined implementation, and reporting.** Examples include Annexes 4-6 with 8-10, Annex 3 with 13, and Annex 2 with 7 and 14.

Specific Recommendations

It is recommended that the following specific revisions be applied to a revised Agreement:

- **Article 1 – Additional definitions are needed to clarify scientific meaning in the Agreement.** These include general terms such as risk, airshed, restoration, integrity and watershed - whose definitions could be context specific. Exemplar definitions are provided for current and prospective terms as follows:
 - Ecosystem approach” means a science and policy framework that recognizes the fundamental interconnections of all ecosystem components, and emphasizes the maintenance of biological diversity, of natural relationships among all species including humans, and dynamic processes that ensure ecosystem sustainability.”
 - Aquatic nuisance species” means non-indigenous (nonnative), water-dwelling plants, animals or other viable biological materials that enter an ecosystem beyond their natural range, are harmful, and threaten the diversity or abundance of native species; the ecological stability of infested waters, wetlands or other property; or the commercial, agricultural, aquacultural or recreational activities dependent on such waters, including human health.

- “Native species” means those plant or animal species originally living, growing or produced in an ecosystem within their historic range.
 - “Biodiversity” means the full range of variety and variability within and among living organisms and the natural associations in which they occur.
 - “Ecosystem stressor” means an agent of change in the physical, chemical and/or biological characteristics of the ecosystem, often the result of human activity, that compromises ecosystem integrity.
 - “Biodiversity Investment Area” means a geographic area within the Great Lakes Basin Ecosystem which is determined to support exceptionally rich biodiversity and/or endemism and contributes significantly to the integrity of the ecosystem. Such areas contain habitat which supports natural, self-sustaining productivity and long term ecological integrity.
 - “Habitat” means the physical, chemical and biological characteristics at a particular locality that collectively support an organism, population or community, including the basic life requirement of food, water, substrate, and cover or shelter.
 - “Stewardship” means the careful and responsible management of ecosystem resources entrusted to humans in the interest of achieving and protecting ecosystem integrity for its intrinsic value and/or for the benefit of current and future generations
 - “Sustainable use” means the consumption or employment of a resource which, all other factors being equal, does not cause depletion that harms the resource or constitutes a threat to ecosystem integrity for present and future generations.
- **Article 2; para (c) This section needs to emphasize science based planning and best management practices to ensure an ecosystem approach and apply to all orders of government with shared responsibilities for planning, particularly local governments with respect to land use.** The cumulative impact of isolated land use decisions need to be integrated at the basin level to determine the desirable and appropriate level of development that can be sustained and at same time protect the integrity of the Great Lakes for future generations.
 - **Article 3 –General objectives need to be expressed positively, and speak to a vision of the Great Lakes that can be acted upon to achieve progress.**
 - **Article 4 – This article is linked with Annex 1 and the topic was evaluated by the SAB at the *Review of Annex 1 of the Great Lakes Water Quality Agreement* workshop held in Ann Arbor, MI on March 21, 2001.** The recommendations contained in the 1999-2001 IJC Priorities are still valid and are reiterated for the purpose of this review. (attachment 1)

- **Articles 5 and 6** – Not the subject of discussion at the workshop
- **Articles 7 – 15** – No specific items for revision were identified for recommendation among these articles
- **Annex 1** – see Article 4 above.
- **Annex 2 – Binational priorities need to be set and remediation based on scientific rationale at AOC and LAMP level.**
 - Specify linkage to Annex 14 or combine with Annexes 7 and 14
 - Improve implementation and linkage to applied science, particularly sampling and monitoring.
 - Provide consistent binational delisting criteria that are scientifically based and at the same time provide flexibility to accommodate local needs.
- **Annex 3 – The scientific appropriateness of the target loads should be reaffirmed.** Phosphorus management needs to be revitalized using watershed planning, urban non point and storm water management, and land use best practices. The science to support these efforts is mature.
- **Annexes 4-6 and 8-10 – A new combined annex should be developed that includes a standard to protect the Great Lakes from international ships discharging ballast.** These annexes would benefit from being combined since the regulatory regime to support them is mature, the programs of both countries are closely coordinated, and the cooperation between the responsible agencies is excellent. Based on current scientific knowledge, a discharge standard for ballast water is required that is expressed in terms of a concentration which limits the number of organisms per volume of ballast water in order to achieve the goal of no new introductions of alien invasive species. Such a ballast water discharge standard must be scientifically sound, environmentally protective and enforceable and contain provisions for regular review and updating in light of new threats and technological capabilities.
- **Annexes 7 and 14 – Both annexes need to be combined and directly linked to Annex 2 or included as a subsection of Annex 2 in order to strengthen remedial action and restoration of beneficial uses as the goal of all sediment management activities in the Great Lakes.** The scientific approach to be adopted must be:
 - Risk based, in terms of both human and ecological health, encompassing both risk assessment and risk management.

- Quantifiable, in terms of remedial technologies, particularly where alternative and combination technologies, e.g. natural recovery, is proposed.
- Demonstrable in terms of effectiveness, by including post project monitoring throughout the planned recovery schedule.
- **Annex 11 – The renewal of this annex is required to support the implementation of a systematic, science-based program that has data quality objectives and data collection plans that are driven by models of ecosystem behavior and contaminant fate.**
 - Develop binational surveillance programs for water quality management similar to IADN (the Integrated Atmospheric Deposition Network)
 - Incorporate research elements into monitoring programs in a coherent fashion. Any surveillance program needs to be designed in the context of current models and current data collection techniques, such as the Earth Observation and Great Lakes Observation systems now under development. Some of the elements envisioned under such a system include:
 - remote sensing and GIS-based technologies
 - Biomarkers and bioindicators
 - Indices that combine validated indicators in a meaningful way
 - Satellite linked observation buoys/systems
 - Develop tools such as Qualitative Structure Activity Relationships (QSAR) to be used to anticipate contaminant problems of new chemicals before they occur. Similar approaches are being developed for microbial contaminants.
 - Develop integrated, consistent, effective data management/informatics capacity.
- **Annex 12 – This annex should include a greater emphasis on public health impacts resulting from changing exposures and include an institutional arrangement to enhance binational cooperation and coordination human health research and monitoring of Great Lakes critical populations.** While concentrations of many chemicals are declining, there are additional human health hazards that result from low exposures and mixture effects.
- **Annex 15 – A revised Annex should incorporate application of advancements in meteorology, chemistry and mathematical modeling and their combination to improve estimation of the nature and extent of**

impact of local, regional, and global emission sources on the basin. The Parties have been responsive to many aspects of the current Annex, particularly in the establishment of IADN. However, this improved integrative approach to science should also be used to better quantify the contribution of the Lakes and the Great Lakes Basin as sources to deposition in other locales, such as the Arctic.

- **Annex 16 – This Annex needs to better reflect the linkage between groundwater quantity and quality, and water supply and instream conditions.** The title and the provisions of the Annex need to reflect the broader pollution prevention focus inherent in current source water protection policies and programs in both countries.
 - Large scale groundwater assessments should be undertaken beyond that indicated in Annex 16
- **Annex 17 - A research strategy or framework should be developed that has flexibility to address new and emerging questions of concern as well as current research questions.** Any research strategy developed in response to new and emerging questions of concern should be linked to the fundamental scientific principles and purpose of the Agreement.