

# GREAT LAKES ADVISORY BOARD

September 15, 2015

The Honorable Gina McCarthy, Chair  
Great Lakes Interagency Task Force  
1200 Pennsylvania Avenue, N.W. 1101-A  
Washington, DC 20460

Dear Chair McCarthy:

The Great Lakes Advisory Board (GLAB) is pleased to provide you, the Interagency Task Force, and Regional Working Group on the Great Lakes (collectively, IATF) with the attached recommendations on principles and process for integrating adaptive management (AM) into the implementation of the Great Lakes Restoration Initiative (GLRI.) We fully recognize that much good work along these lines is already underway in Federal agencies as well as with State partners and other stakeholders. At the same time, we believe there is much room for expansion and refinement of the management practice.

It is our hope that this document will be helpful to all engaged in our collective enterprise of protecting, restoring, and sustaining the global freshwater treasure we share called the Great Lakes. The principles and process included in our recommendations are designed to get the maximum return on investment of GLRI dollars in the form of ecosystem improvement. We especially want to emphasize the importance of a clear articulation of consistent goals and objectives, robust monitoring of environmental results at the project scale and regional ecosystem scale, and comprehensive information and data systems to inform future decision making.

It is an honor for all of us to serve on the Great Lakes Advisory Board and we look forward to working with you on the full implementation of GLRI and adaptive management in a way that helps achieve the maximum in ecosystem improvements.

Sincerely,



David A. Ullrich, Chair  
Great Lakes Advisory Board



Patty Birkholz, Vice Chair  
Great Lakes Advisory Board

# **GREAT LAKES ADVISORY BOARD RECOMMENDATIONS INCORPORATING ADAPTIVE MANAGEMENT INTO THE GLRI PROGRAM**

## **September 15, 2015**

The term “adaptive management” refers to a method by which federal agencies, resource managers, scientists, and others can use management outcomes to refine decision-making and enhance ecosystem improvement. The Great Lakes Advisory Board (GLAB) offers the following adaptive management principles and process recommendations to help federal agencies incorporate adaptive management into the implementation of the Great Lakes Restoration Initiative (GLRI).

### **Principles of Adaptive Management**

1. There must be a common understanding among federal agencies, resource managers, scientists, and GLRI practitioners of what adaptive management is, and a commitment to AM implementation for the duration of all GLRI-related activities.
2. Existing AM procedures used by federal agencies can inform the development and implementation of AM into the GLRI program and can help to ensure that limited funds are not used to duplicate existing AM processes.
3. Realistic objectives for the GLRI program are critical. Such objectives must include not only measures of progress as described in the GLRI Action Plan II, but also a suite of ecosystem indicators against which overall progress can be evaluated.
4. A comprehensive and effective monitoring program to measure and evaluate the environmental results generated by GLRI projects and the GLRI program as a whole is essential.
  - At a minimum, monitoring for purposes of GLRI implementation should be performed at two scales: the project scale and the regional (i.e. ecosystem) scale. For some projects or issues, monitoring at an intermediate scale also may be necessary and appropriate.
  - Consistent criteria that can be used to evaluate monitoring needs for projects of different types and across different focus areas are necessary to ensure that data and information about GLRI projects are transferable.
  - Data should be collected in a consistent manner and in a way that supports GLRI priorities and broader Great Lakes restoration goals.
  - Long-term funding for the monitoring system is necessary to maximize the impact of a coordinated monitoring program capable of revealing ecosystem-scale results.
  - Existing monitoring systems and equipment (where it exists) should be relied upon if possible.
5. An effective data and information management system is necessary to assist the agencies in collecting, managing, integrating, and making available the data and information that informs GLRI decision making.

These principles are explained in detail below.

### **Incorporating Adaptive Management into the GLRI**

AM can be incorporated into the GLRI program by utilizing a multi-step process that includes the following general steps:

1. Identify and evaluate AM procedures and processes already in use in environmental restoration programs.

2. Develop consensus-based objectives for the GLRI program that include appropriate metrics and indicators that can be used as targets or benchmarks in implementing and evaluating GLRI projects and initiatives.
3. Compile a master list of agency-specific GLRI priorities and projects that collectively are designed to achieve the objectives.
4. Define a comprehensive monitoring program for the region that includes the minimum monitoring activities required to support the lake specific objectives and to evaluate progress in achieving GLRI priorities.
5. Create or adopt multi-agency regional information management system capable of collecting, managing, and making accessible to the agencies and the public the data and information necessary to evaluate the effectiveness of GLRI projects and initiatives and to periodically adapt/refocus the GLRI program to achieve program objectives.

A detailed explanation of each of these steps is offered below.

**Step 1: Identify and evaluate AM procedures and processes currently utilized by each of the federal agencies that receive GLRI funding.**

A necessary first step in incorporating AM into the GLRI program is for the agencies to evaluate AM procedures and processes already in use in GLRI implementation and in other environmental programs. Reviewing and evaluating each agency's AM procedures would enable agency leadership to combine, streamline, expand, and enhance the procedures to establish a comprehensive definition of AM, both for phosphorous and the GLRI program as a whole.

One way to undertake this evaluation would be to:

1. Identify each agency's current, top-most priority or priorities when implementing the GLRI.
2. With respect to the identified priority or priorities, detail how the agency has used AM in the past, identifying lessons-learned, examples of successes, and examples of failures.
3. Evaluate existing AM procedures and processes by considering the following:
  - a. Has the agency adopted processes that encourage innovation?
  - b. What kind of on-going monitoring does the agency require?
  - c. What data/information currently are/is collected?
  - d. Where are the collected data retained?
  - e. What suggestions do agency representatives have for data retention/management and distribution?
  - f. Does the agency use the data collected to refine GLRI priorities? If so, how? If not, are the data used in another way?

We also suggest that the agencies consider experiences and lessons learned by agencies operating in other large scale aquatic ecosystems (e.g., the Chesapeake Bay, the Everglades) when tailoring AM procedures already in use to the Great Lakes region.

**Step 2: Select specific goals, objectives, and commitments for the GLRI program that include both measures of progress and a suite of ecosystem indicators against which overall progress can be evaluated.**

The second step in incorporating AM into the GLRI program is to identify goals and select specific, realistic, and concrete objectives and commitments, as has been done in the GLRI Action Plan II. Such objectives and commitments should include measurable improvement in lake condition and should be used as targets or benchmarks in evaluating GLRI projects and initiatives. Clear, realistic, and consensus-based objectives and commitments can reduce monitoring costs while assuring that progress is being achieved and maintained.

It is exceedingly important that the goals, objectives, commitments, and measures of the GLRI Action Plan II be aligned with the general objectives, lake ecosystem objectives, and substance objectives of the Great Lakes Water Quality Agreement (GLWQA). Although GLRI alone cannot be expected to accomplish the objectives of the GLWQA, it is the largest single source of funding for Great Lakes protection and restoration and certainly needs to be aligned in a way that results in significant progress toward the GLWQA objectives. It is good to see that the GLRI Action Plan II “Long Term Goals for the Great Lakes Ecosystem” already closely match the “General Objectives” of the GLWQA. As EPA is working with Environment Canada to develop the “Specific Objectives” for lake ecosystems and substances, a good starting point would be for the Regional Working Group of the Inter Agency Task Force to review the GLRI Action Plan II objectives and commitments. The GLRI Action Plan goals actually align very well with the GLWQA general objectives, with 7 of the 8 goals being very close to 6 of the 9 general objectives. The “delisting” GLRI goal is somewhat of a catch all for almost all of the GLWQA general objectives. The GLWQA general objectives 4 and 9 are somewhat “catch alls” as well. The only one that does not match is GLWQA general objective 8 related to groundwater, which does not present a problem. The point is that to be successful with adaptive management, there needs to be a common set of goals, objectives, commitments, measures of progress, and indicators/metrics towards which all the government agencies and broader stakeholders are working.

We emphasize that objectives for the GLRI program must include not only measures of progress (e.g., area of wetland restored), but also desired ecological outcomes (e.g., sustainable wetland ecosystems with high biological integrity). In other words, the objectives should include not only “measures of progress” as defined in the GLRI Action Plan II, but also consensus-based metrics and indicators that have been developed to assess the overall health of the Lakes. The objectives must be sufficiently inclusive to effectively account for progress at the project level, to incorporate progress attained by individual projects into an annual planning cycle and periodic Action Plans, and to define overall program success on a lakewide and ecosystem scale.

Measuring overall program success by reference to desired ecological outcomes will be complicated. It is important to recognize two points. First, until now, the GLRI has used only measures of progress; it is necessary to develop or adopt appropriate indicators that can assess ecological state. Second, AM typically is implemented at the project level, whereas referencing the GLRI Action Plan II in Figure 1 of the document entitled “Science-Based Adaptive Management Process for Great Lakes Restoration Initiative Action Plan II” (draft, November 26, 2014) (“AM Framework”) suggests that AM is primarily used to track the effectiveness of the totality of GLRI activities.

The process of identifying Great Lakes ecosystem indicators has progressed well and has involved workgroups under the Great Lakes Executive Committee, the International Joint Commission, the State of the Lakes Ecosystem Conference, and others. These ecosystem indicators developed as part of these efforts need to be consistent and are likely sufficient to define desired ecosystem outcomes under the GLRI program.

**Step 3: Compile a master list of GLRI projects to be implemented by each agency to achieve the objectives.**

The overarching goal of the GLRI program is clear (“to protect and restore the Great Lakes”), and Action Plan II establishes the agencies’ collective priorities for implementing the GLRI program. Additional planning is necessary, however, to identify each individual agency’s GLRI priorities and specific implementation strategy. Collectively, agency priorities and strategies can be combined into a consensus-based master list of GLRI priorities and projects, and can be used for purposes of allocating limited GLRI funding to future project investments.

Agency priorities and strategies should be consistent with Action Plan II and should be coordinated across agencies to achieve overall GLRI objectives. Transparency with Great Lakes stakeholders during this priority setting process will be integral to achieve the buy in needed from the Great Lakes community for continued support and success of the GLRI program.

**Step 4: Determine appropriate monitoring requirements and implement a coordinated Great Lakes monitoring program.**

Monitoring on the Great Lakes has been underfunded and not as systematic as needed to provide for effective adaptive management. By contrast, evaluating long term success in achieving GLRI objectives requires monitoring at appropriate locations, time intervals, and scales. It is perhaps for this reason that the agencies are “exploring ‘how much is enough’ monitoring so that it advances, and does not detract from, the core purpose of the GLRI.” (Charge Questions, March 17, 2015).

At a minimum, monitoring for purposes of GLRI implementation should be performed at two scales: the project scale and the regional (i.e. ecosystem) scale. For some focus areas, it may be appropriate to monitor at an intermediate scale. Overall, the scope of monitoring should be sufficient to evaluate progress in GLRI project-level implementation and to determine if measurable improvement in lake condition (e.g. by SOLEC indicators) is being achieved.

It could be useful for the GLRI to develop a framework that divides projects into three categories.

1. One category would include projects that rarely or never require monitoring. This category would include projects where the effectiveness of a restoration practice is well-established and little risk of failure is anticipated. Following the language of the AM Framework, these projects would use *proven restoration methods* that are established and tested, and have relatively high certainty of success in localized areas.
2. A second category could include projects where the probability of success is less certain than proven methods, and *knowledge of restoration practice is still developing*. This may be because practitioner experience remains modest, projects use methods that have been employed in other situations but application to the Great Lakes is novel, or simply projects considered to be of moderate risk and uncertainty. Here, monitoring could focus on a sub-sample of projects, perhaps aiming for a modest sample that is stratified to encompass a range of restoration methods, habitat settings, or by some other variable of interest.
3. A third category would include restoration projects considered to be *highly innovative, requiring new and emerging restoration methods*. These projects would require a greater investment in monitoring and provide greater return in learning and improved future practice.

An important principle when designing a monitoring program is to ensure that data collected by agencies and others, whether GLRI funded or not, is collected in a consistent manner that supports GLRI priorities and broader Great Lakes restoration goals. Thus, whatever monitoring program is developed, monitoring should be relatively consistent across the basin to assure that lessons learned are transferable. In addition, to maximize the impact of a coordinated monitoring program capable of revealing ecosystem-scale results, long term funding is necessary so that the system includes ecosystem condition data needed to effectively incorporate AM into GLRI implementation.

Perhaps the Science and Information Subcommittee that is being convened to support GLAB activities could be asked to consider appropriate levels of monitoring, including timelines for pre- and post-monitoring activities and possible use of models as a substitute for direct measurement.

For reasons of resource efficiency, the use of existing monitoring systems and equipment (where it exists) should be encouraged. For project-level monitoring, agencies, organizations, or institutions that currently operate monitoring programs could be offered an opportunity (a “first right of refusal”) to perform monitoring for project-level purposes, with the understanding that the standard monitoring protocol established for the GLRI would dictate this work. We suggest, however, that the consistency, reliability, and efficiency of regional monitoring programs would be enhanced if the agencies were to identify a lead agency to oversee, coordinate, and/or conduct monitoring activities across the entire GLRI program.

Designing a comprehensive monitoring plan presents challenges and applying such a triage system to restoration monitoring will be difficult. Many ecologists would argue that the ‘gold standard’ employs pre- and post-project monitoring of the restored site and a similar control or reference site that is monitored but does not receive restoration action. In environmental impact analysis, this is known as the “before-after-control-impact,” or BACI, design. It provides the most robust learning and strongest statistical inference.

We suggest that for practical reasons of cost and effort, many and even most monitoring likely will require a lesser degree of effort. A minimal level of monitoring would provide information on a project at its inception, and after some reasonable time has elapsed for system equilibration following restoration.

Monitoring can be accomplished by a variety of methods, ranging from site inspection to frequent field sampling. The level of monitoring rigor, as with all aspects of this process, should be governed by the information needed to complete the adaptive management cycle. It may be possible to develop guidance for the use of a triage system by retrospectively inspecting a number of GLRI projects to begin to develop a framework for assigning projects to each of the three suggested categories.

In addition, where it is necessary to evaluate projects on a project by project basis, the GLAB recommends establishing consistent criteria that can be used to evaluate projects of different types and across different focus areas.

**Step 5: Identify and implement a system for collecting, managing, integrating, and making available the data and information that informs GLRI decision making.**

A data and information management system is necessary to ensure that all agencies and levels of government, as well as the public, has access to data about GLRI programs and projects and the outcomes achieved through GLRI investments. Such a system also is necessary to identify and fill critical data and information gaps, enable the agencies to strategically allocate resources and future GLRI investments, and otherwise inform decision-making to maximize the effectiveness of the GLRI program.

We are very pleased to learn that the new Ecosystem Accomplishments for the Great Lakes (EAGL) has been adopted and will be up and running soon. We do not know enough about it to understand if it will address a majority of the data and information needs of Great Lakes scientists and managers to help inform decision making in a way that will allow for effective adaptive management under GLRI. We certainly hope it does.

What is really needed is an iterative system that serves as both a vehicle for collecting and reporting out project data and information and as a method of integrating that data and information generated by GLRI project, planning and prioritization activities into regional decision-making. A comprehensive and accessible system for collecting, managing, and interpreting data would ensure that full use is made of the many advances in Great Lakes science and management that are occurring throughout the basin.

Certain currently available platforms, such as the Information Management and Delivery System ([www.greatlakesinform.org](http://www.greatlakesinform.org)) and the Great Lakes Observing System ([www.glos.us](http://www.glos.us)), also should be evaluated and have the potential for collecting and managing GLRI data and information more effectively, but additional investigation and evaluation are necessary. We recommend that existing information management systems be evaluated to determine their potential value for collecting, managing, and making GLRI project- and region-level data and information accessible to users and the public.<sup>1</sup>

Once a system suitable for use in the GLRI context is selected, the agencies must embrace the single system. Each agency may be able to implement the system in stages. The earliest stage could include a pilot project using existing project-level data for projects in one focus area that demonstrates the usefulness of the system. Subsequent stages could include additional projects (whether existing or new) in one or more focus areas as budgets allow. Over time, the system would come to include data and information from many projects that users could aggregate across particular focus areas and “scale up” to inform priority-setting and future project investments. To this end, it will be important for ground-level data to be reported in terms of specific geographical references, so that data and information from individual projects is useful at various (nested) geographical scales.

Ultimately, an appropriate budget and long-term funding for the information management system will be required, keeping in mind that there is little reason to select and support a “Cadillac” information management system if the agencies are constrained to a “Chevette” budget.

#### **Example: AM and Excess Nutrient Discharges**

EPA and the states have an important role in guiding – and accelerating - efforts that already are underway to reduce phosphorus loading in the Lakes. Annex 4 (Nutrients) of the Great Lakes Water Quality Agreement brings a welcome emphasis to the issue and efforts under the GLRI to incorporate an adaptive management approach to complex problems such as phosphorous loading present unique opportunities to tackle this threat in a sustainable manner.

The GLAB endorses an adaptive management approach as one appropriate mechanism for achieving the objective of phosphorus reductions in the Great Lakes. Specifically, utilizing the principles and process established by this memorandum, the agencies could be well served to engage with other Great Lakes organizations that are working on the nutrient issue to review current approaches to phosphorous reductions and determine if the current course can be expected to reduce phosphorus loading sufficiently to achieve the goal of fishable, swimmable and drinkable Great Lakes.

The adaptive management principles described in this document might be integrated into nutrient reduction programs in the Great Lakes region as follows:

1. Establish clear and measurable objectives for reducing excess phosphorus in the Great Lakes.
2. Focus efforts and resources on the high priority phosphorus tributaries that have been identified (e.g. Green Bay, Saginaw Bay, Western Basin of Lake Erie).
3. Encourage adaptive management plans for nutrient reduction at the appropriate watershed or sub-watershed scale, and enable both point and non-point sources, and groups of sources, of phosphorus to develop such plans as a means of reducing phosphorus loading.

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<sup>1</sup> This sub-committee previously considered information management needs and its recommendations were communicated to the IATF in a memo from GLAB Chair Ullrich dated Feb 20, 2015. The Science and Information Subcommittee is best suited to further explore how an information and management system should be used to arrive at adaptive management decisions.

4. Enable drivers – both regulatory and incentive-based – that encourage projects/programs that maximize nutrient reduction from the least cost sources. These could include Water Quality Trading, Public Private Partnerships, Private financing, and voluntary use of innovative technology.

Adaptive management plans will be critical for establishing sustainable success for phosphorous reduction programs and projects. Plans should describe specific actions to be implemented by various sources included in the plan to achieve significant reductions in phosphorus loading and contribute toward achievement of water quality goals. Among other relevant components, plans specific to phosphorous loading should:

1. Identify point and nonpoint sources of phosphorus and any other partners assisting in plan implementation
2. Include a baseline analysis that documents the frequency, amount, and/or concentration, as appropriate, of significant sources of phosphorus loadings in the watershed
3. Describe specific actions to be implemented by point and nonpoint sources in the plan to achieve significant reductions in phosphorus loading
4. Incorporate a monitoring plan to assess phosphorus loadings in the receiving water and to document progress
5. Identify specific metrics for evaluating the anticipated effectiveness of the plan over specific time horizons
6. Demonstrate that point and nonpoint sources and other partners assisting in plan implementation have the ability to fund and implement the plan
7. Demonstrate that conservation implementation will be sustainable, verified on a periodic basis, and of sufficient duration to ensure effective achievement of water quality goals.

## **Conclusion**

Progress in achieving Great Lakes protection and restoration can be accelerated if agencies adopt and share streamlined procedures. Cooperation is critical. By cooperating, agencies can implement restoration efforts through the GLRI program that achieve outcomes never realized on a scale as grand as the Great Lakes.

Adaptive management is a good way of ensuring that GLRI programs and initiatives are effective in achieving GLRI priorities over the long term. AM allows GLRI programs and initiatives to be refined to optimize the use of limited GLRI resources. However, inherent in AM is the ability to measure progress periodically, so that the path forward can be modified or refined (“adapted”) in response to data and information collected along the way.

A structured process is necessary for collecting and using the data and information developed during GLRI implementation to revise GLRI priorities and identify and implement additional or alternative GLRI projects and initiatives. This structured process completes the AM cycle, ensuring that future project implementation reflects lessons learned, and that future GLRI implementation reflects an improved understanding of restoration priorities.

Strategic, reliably-funded monitoring and information management are critical elements of the AM process. If consistent funding for monitoring and information management is not secured, GLRI investments are likely to be suboptimal over the long term. Likewise, developing AM processes and procedures that are realistically ‘fundable’ over the years required for full restoration is critical to the success of GLRI.