CHAPTER 7
RESOURCE IMPROVEMENT STANDARD FOR WATER RESOURCES PROJECTS

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7.1. INTRODUCTION

Directive #3 of Annex 2001 to the Great Lakes Charter calls for a new decisionmaking standard that is based, in part, on "an Improvement to the Waters and Water-Dependent Natural Resources of the Great Lakes Basin." This chapter describes an analysis of the "resource improvement" concept that explores issues and options in the application of the standard to the Great Lakes Basin, as illuminated by case studies. Although resource improvement was not part of the original project work plan, the Project Management Team agreed to support research on the topic to assist the regional policy development effort.

7.1.1 METHODOLOGY

In early March 2002, the study team conducted a Focus Group conference call to define the focus and scope of the analysis effort. Focus group participants included members of the Governors' Charter Annex

Working Group, some members of the Project Management Team and the Stakeholders Advisory Council for the WRMDSS project, and representatives of the Great Lakes Protection Fund. Focus Group participants discussed a background paper that was distributed prior to the call, and addressed two primary objectives: 1) to clarify definitions of key terms used in Directive #3's statements of the principles upon which a new decisionmaking standard is to be based; and 2) to obtain direction on the way that the new standard would be interpreted and applied. The guidance received during the call would be used to prepare a briefing paper on the topic.

During the conference call, there was some consensus, and some diverse viewpoints were expressed. There was general consensus that the issues paper should:

- Define the improvement concept, and case study examples are best;
- Focus on improvements to ecological health, not human users; and
- Explore the relationship between use and improvement.

Diverse viewpoints were expressed related to whether mitigation should be a component of Annex 2001, and the authors were asked to distinguish between mitigation and improvement in the briefing paper. The Focus Group discussion provided direction for the structure of the briefing paper, and focused the research.

In June 2002, a briefing paper on analysis and prospective application of the resource improvement standard was prepared by Limno-Tech, Inc. (see Appendix X). The paper presents the definition of improvement as defined in Annex 2001, and discusses the goals of resource improvement, and how these goals have changed over time. Ten case study applications in different settings and for different purposes from within and outside the Great Lakes are presented and discussed. These case studies were selected to provide a sampling and a range of examples to stimulate discussion on how the improvement standard may be applied to implementation of the Great Lakes Charter Annex.

The background material provided in the briefing paper has served as a departure point for discussions as efforts to interpret and apply the improvement standard move forward. The final section of the briefing paper poses four questions that are critical to implementing a resource improvement standard. They are associated with the definition, interpretation, and application of the resource improvement standard.

The Great Lakes Commission convened a Resource Improvement workshop on July 31, 2002 to discuss the issues raised in the paper, and to focus on key questions that might be considered that are associated with the definition, interpretation, and application of the resource improvement standard. Participants included members of the Annex Working Group, the Project Management team and Stakeholder Advisory Council, and the Great Lakes Protection Fund, and Observers.

7.1.2 OBJECTIVES

The objective of this effort was to explore the resource improvement standard concept; its various definitions; applications in different settings and for different purposes; and issues and opportunities in interpreting and applying it to support implementation of Annex 2001 to the Great Lakes Charter of 1985.

7.1.3 ORGANIZATION OF CHAPTER

This chapter is structured as follows:

Section 2 discusses the goals of resource improvement, the resource improvement standard concept as defined in Annex 2001, the concept of mitigation, and specific frameworks used in other settings. **Section 3** describes several case study improvement standard applications in different settings and for different purposes from within and outside the Great Lakes Basin. **Section 4** presents some key questions related to

applying the resource improvement standard to implementation, and summarizes discussion of those questions at the July 2002 workshop. **Section 5** presents findings and recommendations.

7.2. RESOURCE IMPROVEMENT STANDARD CONCEPT

The term "Improvement to the Waters and Water Dependent Resources of the Great Lakes" is defined in the Annex as meaning:

> *"additional beneficial, restorative effects to the physical, chemical, and biological integrity of the Waters and Water-Dependent Natural Resources of the Basin, resulting from associated conservation measures, enhancement or restoration measures which include, but are not limited to, such practices as mitigating adverse effects of existing water withdrawals, restoring environmentally sensitive areas or implementing conservation measures in areas or facilities that are not part of the specific proposal undertaken by or on behalf of the withdrawer."*

The research for this paper focused on this definition and, in particular, on the following terms: *conservation, enhancement, restoration,* and *mitigating adverse effects.*

This section discusses the goals of resource improvement and how these goals have changed over time. The concept of mitigating adverse effects and the relationship of mitigation to improvement is also discussed.

7.2.1 GOALS OF RESOURCE IMPROVEMENT

The concept of resource improvement is subjective, and depends on the valuation framework that the observer applies to the natural world (Tietenberg, 1996). Time perspective and the importance assigned to human uses of natural resources are two key dimensions of the framework by which we value resources.

One polar case is to value resources only on the basis of the current services they provide to human populations. This valuation framework aims to maximize current human welfare. However, such a static and wholly anthropocentric view of resource valuation can threaten the viability of natural systems, sacrificing future environmental health to achieve short-term gain.

Many reject this static view of resource valuation in favor of a longer-term perspective, favoring measures that enhance both current and future resources. In their view, for example, forestry management should be forward-looking, valuing the future health of the forest along with its current health.

If so, then what weight is to be given to the future services to be provided by natural resources, relative to current services? One answer is to assign dollar values to future services and discount them using an interest rate, as we would do to evaluate the future economic payoff from a capital investment. This puts investments in natural resources on the same footing as other investments, in terms of comparing their costs and benefits. The decision to maintain the forest would depend on the value of future yields, relative to payoffs from other investments.

Some would argue, however, that this mode of resource planning assigns too little value to the environment that will be inherited by future generations, because they cannot participate in today's decision process, and that we must do more to advocate for unborn generations. The concept of sustainability provides a way to do so, dictating that every generation should inherit an environment whose resources are maintained and not degraded.

Even within the umbrella of sustainability, there are alternatives depending on the importance assigned to human use services. What exactly is to be sustained? One view is that the services provided to human populations should be sustained at current levels. In this view, a forest might be managed so that its yield of lumber does not decline with time.

An alternative view of sustainability is ecosystem-oriented, advocating not just for unborn human generations, but also for all living things, present and future: that the environment should be managed in such a way that native populations of plants and animals remain healthy and viable, regardless of the services that they may or may not provide to human populations.

Over the course of the past 150 years, popular views of resource management have evolved to take an increasingly long-term perspective, and are increasingly ecosystem oriented. The Annex 2001 definition of improvement appears to reflect this evolution, focusing on the "physical, chemical, and biological integrity of ... resources," rather than the services that resources may provide to human populations. Based on Focus Group and workshop discussions, we understand this to be the prevailing view of the Governors' Annex Working Group. It should be recognized, however, that the definition may be open to differences in interpretation (e.g. some might argue that an increase in current commercial fishing yields due to the construction of a new dock might be described as "a beneficial effect ... resulting from enhancement measures"), and that the public's view of resource valuation will very likely continue to evolve over time. The implementation of Annex 2001 should be consistent with current societal values and needs, but also flexible enough to incorporate future changes in overall environmental goals.

7.2.2 MITIGATION VERSUS IMPROVEMENT

The definition of improvement in Annex 2001 includes "such practices as mitigating adverse effects of existing water withdrawals." Some participants in the Focus Group cited this language and emphasized that, with the exception of mitigating the adverse effects of existing water withdrawals, mitigation is not a component of the Annex because a principle of Directive #3 is no significant adverse impacts.

Many of the resource improvement programs that exist today in the regulatory arena are designed to compensate for past damages or future unavoidable impacts, although some also require measures that go beyond mitigation and are directed at resource improvements. A common feature of the examples provided in Section 3 is that they try to match activities that have negative effects with offsetting positive actions, and there is an effort to scale the positives and the negatives through some type of trading ratios. The challenge in applying these types of programs to implementation of Annex 2001 is how to scale improvements when there are no negative impacts allowed, and therefore available for use in scaling required positive actions.

Many existing mitigation programs apply the definition issued by the President's Council on Environmental Quality (40 CFR Part 1508 Section 20), which includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the impact by replacing or providing substitute resources or environments.

Other approaches to resource improvement include programs, such as those run by conservation groups like the Nature Conservancy, which are not matched with resource use. Although these programs may

have features that are applicable to the Annex 2001 improvement standard, they were not reviewed because of this missing link to resource use.

In the case studies discussed below, the role of mitigation in the program is highlighted and discussed, as appropriate.

7.2.3 FRAMEWORKS FOR RESOURCE IMPROVEMENT

Few existing regulatory programs currently specifically mandate resource improvement. The programs that have an element of resource improvement generally use different terms to describe it, or the improvement is implicit to the program rather than being explicitly stated in the regulations. An example is compensatory restoration as part of Natural Resource Damage Assessments. These compensatory measures are directed at overall improvements to the ecosystem to compensate for past damages, yet there is no specific language in the authorizing Acts that describes a "resource improvement standard." For this reason, the concept is discussed below in the context of illustrative case studies, and relevant language from regulations or guidelines is cited as appropriate.

Proposed approaches also exist; for example, a consortium of nongovernmental organizations submitted suggestions to the Council of Great Lakes Governments in May of 2002 (Miller et al., 2002). These included requirements that improvements function in perpetuity; that they be tied to restoration plans; that they be matched to withdrawals by subbasin where possible; that they be measured in terms of ecological rather than economic value; and that the withdrawals and improvements be scaled according to size, type, and potential for unknown harm. Other approaches and diverse views exist on each of these aspects of improvement.

The importance of considering cumulative impacts in implementation of Annex 2001 was highlighted during the Focus Group and workshop discussions. During the review of case study examples, the examples were examined to determine if cumulative impacts of multiple stressors (including multiple water withdrawals) are addressed through the program. Some programs implicitly account for cumulative impacts by nature of the program design. For example, water quality trading programs take a whole watershed approach, and focus on improvements as an outcome of trading between multiple dischargers that may have a cumulative impact. Canada manages fisheries habitat under a "net gain" policy that is designed to achieve an improvement in habitat while allowing for multiple uses with potentially cumulative impacts. Other programs focus only on the particular project under review and do not address cumulative impacts. An example of this type of program is compensatory improvements as part of Natural Resource Damage Assessments.

7.3. CASE STUDY IMPROVEMENT STANDARD APPLICATIONS

In this section, specific applications in different settings and for different purposes from within and outside the Great Lakes are discussed. For each case study, the following information is provided:

1. **Case study overview** provides a general description of the project or program. For each example, the "environmental currency" in which required future resource improvements are measured is described;
2. **Definition and application of resource improvement concept** describes why this example was selected as illustrative of an improvement concept;
3. **Associated issues** highlights relevant issues, including whether the case study is an example of mitigation; and

4. **Potential applicability to Annex 2001 implementation** discusses how a similar framework might be applied to implementation of Annex 2001.

These case studies do not constitute a comprehensive collection of all relevant examples in the universe of programs that may illustrate the resource improvement standard concept. Rather, they were selected to provide a sampling and a range of examples to stimulate discussion on how the improvement standard may be applied in implementation of the Great Lakes Charter Annex. Each of these case studies illustrates certain features that could be applicable to resource improvement, rather than approaches that are consistent with Annex 2001 in every respect. Several additional program examples were brought to the authors' attention shortly before this chapter went to press. These include the Electric Consumer Protection Act of 1986 (U.S. Congress, 1986), which provides for "mitigation of damage to ... enhancement of ... and preservation of ... environmental quality" as a licensing consideration, and a U.S. federal program facilitating the restoration of wetlands from agricultural uses (included with case studies below).

7.3.1 NATURAL RESOURCE DAMAGE ASSESSMENTS: COMPENSATORY IMPROVEMENTS

The objective of natural resource damage assessments (NRDAs) is to restore and improve injured resources in compensation for past and expected future damages. Damages are quantified in terms of dollar values, and this provides the currency in which required future resource improvements are measured.

Case Study Overview

NRDAs are based in the legal doctrine of public trust, under which title to natural resources is held by the state in trust for the people. The purpose of the trust is to preserve resources in a manner that makes them available to the public. The state may convey to private owners the right to use land and natural resources, but private interest is subservient to preserving the public's right to use and enjoy those resources.

NRDA provisions were included in U.S. legislation authorizing CERCLA, OPA, the National Marine Sanctuaries Act, and the Park System Act in order to establish specific public agencies as trustees for natural resources, and give them the right to recover damages on behalf of the public. Because trustees have a responsibility to make the public whole in cases of injury to resources, damage assessments take into account the cost to restore the resource, rather than just any diminution in the value of the resource, and the trustees are required to apply any damages collected toward "restoring, rehabilitating, replacing, or acquiring the equivalent of the injured resource." NRDA activities constitute mitigation of injuries, in that they identify and quantify damage that has been done and require an equivalent resource improvement, in terms of dollar value of services, with the goal of making the public whole.

Figure 1 (Jones, 2000) illustrates the NRDA concept. In the example shown, because of a historical release at time t_0, there is a loss of services provided by natural resources. An example might be a reduction in fishing recreation. In Figure 1, the economic valuation of those total losses is represented by areas A + B, under a natural recovery scenario. Under active restoration, the resource recovers faster and future losses are reduced: in the figure, losses are equal to only area A, because the portion of future losses represented by B is prevented. NRDA procedures provide for compensatory resource improvements, requiring provision of additional services with a value of C, in addition to the restoration of baseline services. Compensation is sufficient and complete when the present discounted value of losses A and of compensatory restoration C are equal and offsetting. Thus, NRDA requires active restoration to reduce losses, if possible, and also provide restoration to fully compensate for interim losses.

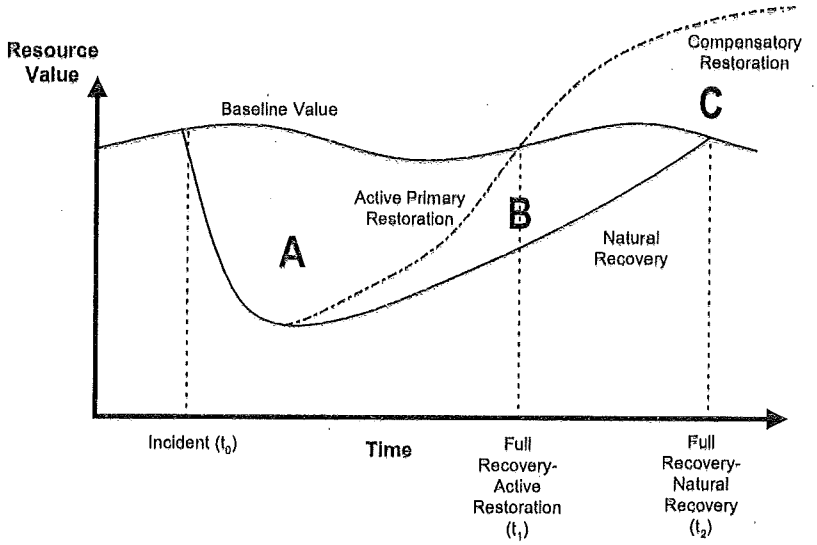

Figure 1. Relationship between Compensatory Restoration and Interim Lost Value (from Jones 2000)

Definition and Application of Resource Improvement Standard

The baseline for NRDA, according to the definition in US Department of Interior (USDOI) regulations, is "the condition or conditions that would have existed at the assessment area had the discharge of oil or release of hazardous substance not occurred." Thus, the damage to resources is not measured relative to pristine conditions: rather, it is measured relative to a hypothetical state in which this discharge did not occur but all other ongoing impacts did occur. Thus, the historical discharger must compensate the public for the effects of the discharge, but not for any other concurrent environmental degradation.

Damages are determined by identifying injured resources, quantifying services lost due to the injuries, and then determining the dollar values of those lost services. *Injury* is defined by USDOI regulations (43CFR Subtitle A) as "a measurable adverse change ... in the chemical or physical quality or viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance...." *Services* are defined as "the physical and biological functions performed by the resource including the human uses of those functions." *Compensable value* is "the amount of money required to compensate the public for the loss in services provided by the injured resources between the time of the discharges and the time the resources and the services those resources provided are fully returned to baseline conditions."

Associated Issues

It should be emphasized that the human use of natural resources is the basis of NRDA. Damage is assessed only to the extent that resources provide services that are of measurable value to human populations. This includes both use (for example the benefits of recreation) and nonuse (also called passive or existence) values (for example, valuing the knowledge that resources exist and are uninjured). Resources have no intrinsic value in NRDA, other than their value in providing these human services.

A controversial issue in NRDA is the estimation of nonuse values of resources. Although there is little doubt that people place value on the existence of natural resources from which they do not personally obtain any tangible services, there is much less agreement whether specific dollar estimates of those

values are real and meaningful. Because active uses require users to make economic choices, indirect but objective estimates of these values can often be made. In contrast, nonuse values are estimated through questionnaire methods, asking people what they would be willing to pay to effect a specific resource improvement. Because it is not practical to put respondents to a real test of their true willingness to pay for nonuse services, their answers are not verifiable.

Although dollars are the standard currency of resource improvement in NRDA, services have been employed as an alternative currency in some cases. Most commonly this has been done through "habitat equivalency": habitat improvement is required as compensation for past habitat degradation, and full compensation requires that resource services gained by the improvement are sufficient to offset services previously lost due to the release. For example, services might be measured in terms of ability to support endangered migratory bird populations.

Potential Applicability to Annex 2001 Implementation

One possible distinction between the NRDA approach and Annex 2001 is NRDA's human use valuation of resources. Members of the resource standard Focus Group and workshop conducted for this report expressed a strong preference for ecosystem sustainability as a basis for resource improvement, rather than human use values.

Another important difference between NRDA procedures and the contemplated resource improvement standard under Annex 2001 is that NRDA is retrospective, whereas Annex 2001 is prospective. The Annex 2001 resource improvement standard would not be applied as compensation for effects of past withdrawals from the Great Lakes Basin.

Nevertheless, the methods used in NRDA to value resources are available provisions to be considered for use under Annex 2001, with some history to illustrate their pros and cons. Any expected impact from Great Lakes water withdrawals would be evaluated in terms of reductions in resource services, and their associated use and nonuse values. The applicant would be required to provide compensation, in an equal amount or including a premium to account for uncertainty of estimation methods, either in cash or through in-kind resource improvement projects. A resource improvement standard would direct either form of compensation toward improvements providing sufficient services to offset the impact of the proposed water withdrawal. In practice, it would be desirable for the Great Lakes states and provinces to estimate the service losses associated with generic withdrawals in each Great Lakes sub-basin, and develop and maintain a list of desired improvements and their estimated service values. This would facilitate matches between water withdrawal applicants and compensating resource improvements.

Another potentially applicable concept is habitat equivalency. Expected potential natural resource service losses (e.g. decline in wildlife populations or diversity) due to proposed water withdrawals could be estimated for the various Great Lakes sub-basins. Candidate habitat improvements could also be catalogued, along with estimates of associated service improvements. Proposed new water withdrawals would then be matched with required habitat improvements to protect resources from net degradation. Annex 2001 would require that this be accomplished in such a way as to prevent adverse impact to the resource

7.3.2 ENVIRONMENTAL TRADING PROGRAMS

Two types of environmental trading programs are reviewed and discussed in this section:

- Water Quality Trading Programs; and
- Wetland Mitigation Banking.

7.3.2.1 Water Quality Trading

Water quality trading provides an instructive resource improvement standard case study, because trading programs require that every trade accomplish an improvement in water quality. The basic currency of water quality trading programs is pollutant loading rates, so that resource improvements are measured in terms of reduced total loads.

Case Study Overview

The primary objective of water-quality trading is to reduce the cost of achieving water-quality goals, by providing dischargers with market-based flexibility. There can be numerous available means of reducing total pollutant loads to a target level, and trading programs allow dischargers to negotiate among themselves, selecting the most cost-effective method(s) and sharing the costs of implementation. A second objective is water-quality improvement: where agencies have allowed water-quality trading, they have also required resource improvements in the form of overall load reductions, relative to preexisting water-quality-based targets.

In practice, the most important avenue for trading is between point-source and nonpoint-source dischargers. In the recent decades the water-quality threat posed by nonpoint sources, such as agricultural runoff and urban stormwater, has become increasing clear. It is also often apparent that reductions in nonpoint-source loads can be achieved at lower cost than additional point-source load reductions, because point-source loads have been more aggressively controlled by past environmental policies. Water-quality trading allows a point-source discharger to earn credit toward its permit limits by financing a load reduction program for a nonpoint-source discharger, effectively purchasing credits for load reduction. In this way, dischargers as a group can reduce or eliminate sources in order of their cost-effectiveness.

The so-called trading ratio is the key to effecting resource improvement under environmental trading programs. This is the discount applied to any credits purchased, before they may be applied to meet the purchaser's permit requirements. For example, a 2:1 trading ratio requires one credit to be retired toward water-quality improvement for each credit used to meet permit requirements. In this case, a point source discharger requiring a 1000 kg reduction to meet its permit requirements would need to finance a 2000 kg reduction in nonpoint-source loads to satisfy its permit through trading. Trading ratios may vary on a case-by-case basis, but are set above 1:1 to facilitate improvements.

Definition and Application of Resource Improvement Standard

USEPA (2002) has recently released a proposed trading policy, for trading involving nutrients and sediments. According to USEPA's proposed policy, pollutant reduction credits may be expressed in rates or mass per unit of time. For example, if flow and concentration limits in a discharge permit effectively limit a discharger's phosphorus load in units of kilograms per month, then credits are expressed in the same units. The improvement of the resource brought about by a trading ratio greater than 1:1 would then likewise be measurable in units of kg/month.

The proposed USEPA policy also supports for the creation of credits "in ways that achieve ancillary environmental benefits beyond reductions in specific pollutant loads, such as the creation and restoration of wetlands, floodplains and wildlife and/or waterfowl habitat." Credits for these activities may be used to supplement pollutant load reductions made at a 1:1 point/nonpoint-source trading ratio, to bring about a net environmental benefit.

Associated Issues

USEPA's proposed trading policy contains numerous safeguards against trading that would degrade water quality in one location while improving it in another, a possibility that arises when trading partners are in different locations. Key provisions, intended to ensure consistency with the Clean Water Act, include:

- *Watershed basis*: all trading should be within a watershed, so that that the total pollutant load within the watershed is reduced.
- *No localized impairment*: any trades that would cause localized impairments of existing or designated uses are unacceptable.
- *Baselines for trades*: parties earn credits only when they improve upon levels derived from and consistent with water-quality standards. Where Total Maximum Daily Loads (TMDLs) have been established, the associated load allocations for dischargers constitute the baseline.
- *Trading ratios*: trades should require the retirement of a portion of credits earned, to achieve water-quality improvements and provide a margin of safety of load shifts between point and nonpoint sources.

Potential Applicability to Annex 2001 Implementation

Trading offers the potential to allocate existing Great Lakes water withdrawals to their most beneficial uses, while also improving Great Lakes resources. A trading framework for implementation of Annex 2001, analogous to water quality trading, would establish a baseline of Great Lakes water withdrawals, possibly at current levels, and would allow the flexibility for prospective users and existing users to trade in withdrawal credits. The most fundamental issue that arises in applying trading principles is whether Great Lakes water withdrawal rights can be established, at current or at any other levels.

To effect resource improvements in any trading program, trading ratios need to be greater than 1:1. In this instance, a portion of the allowed withdrawal could be retired upon purchase of withdrawal rights, or else the purchaser would finance some additional resource improvement. The latter option would be analogous the option in the USEPA proposed water-quality-trading policy for the creation of credits "in ways that achieve ancillary environmental benefits beyond reductions in specific pollutant loads." The creation and restoration of wetlands, floodplains and habitat are currently high priorities in the Great Lakes Basin, relative to reductions in water withdrawals below current levels. For this reason, requiring these ancillary activities would likely be a more beneficial way to achieve resource improvements than to retire water withdrawal rights.

As with water quality trading, it might also be beneficial to restrict trades to parties within common hydrological regions, in order to minimize adverse local effects. Finally, the baseline established for trading programs sets the target to be met by trading. If current rates of water withdrawal are satisfactory, then these could be used to set the baseline. If significantly lower withdrawal rates are desired, then this could be taken into account by setting a lower baseline.

7.3.2.2 Wetland Mitigation Banking

Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Permit applicants must provide justification for impacting wetlands and must avoid and minimize impacts to wetlands before a compensation (mitigation) proposal can be entertained. Applicants must compensate for all unavoidable wetland impacts by replacing the lost wetlands. Mitigation ratios result in a net gain of wetland acreage and range from 1.5: 1 to 3:1. This section focuses on wetland banking as a mitigation strategy.

Case Study Overview

A wetlands mitigation bank is a wetland area that has been restored, created, enhanced, or (in exceptional circumstances) preserved, which is then set aside to compensate for future conversions of wetlands for development activities. The following description of mitigation banking is excerpted from a 1997 Congressional Research Service Report (Zinns, 1997):

> Mitigation banking is relatively new, and federal mitigation banking policies continue to evolve... Banking can occur only after three steps are taken in the federal process for protecting wetlands. First, wetland development must be avoided if possible; second, when this is unavoidable, impacts must be minimized; and third, impacts that can not be minimized to an acceptable level must be mitigated. Mitigation banking is an option only when mitigation on-site is not possible. Bank sponsors create wetland "credits" at a bank site that can be acquired by those who fall within the purview of these two programs and are required to offset wetland losses, or "debits," at other sites...
>
> Mitigation banking has many definitions, but most center on the restoration, creation, enhancement, or, in exceptional circumstances, the preservation of wetlands which will compensate for unavoidable wetland losses at another site. Banking is designed to coordinate mitigation at one location for habitat losses allowed under federal programs at other sites. Mitigation banking is used primarily when on-site mitigation can not be achieved or is not as environmentally beneficial. Mitigation banking involves a process in which a client may be required to obtain wetland units with similar functions and values at a nearby site to satisfy federal permit or program requirements.
>
> Bank operations vary widely, but all follow the same general principles. These principles use the terminology of financial institutions: transactions are described in terms of credits and debits to wetland resources. A bank sponsor creates credits as it restores, enhances, or creates wetlands at the bank site. These credits are either debited (money is not involved) or purchased by clients (a financial transaction) who are being required to compensate for wetland losses. When clients obtain these credits, they are withdrawn from the bank and become unavailable for future transactions. Clients are usually required to make these withdrawals prior to or concurrently with their proposed activity that will result in wetland losses. Banks may be allowed to transfer some credits, usually to fund their operations, before the site is fully established.

U.S. EPA lists several benefits of wetland mitigation banking, including:

- Consolidation of numerous small, isolated or fragmented mitigation projects into a single large parcel may have greater ecological benefit.
- A mitigation bank can bring scientific and planning expertise and financial resources together, thereby increasing the likelihood of success in a way not practical for individual mitigation efforts.

The environmental currency in which future resource improvements are measured is acreage of wetland.

Definition and Application of Resource Improvement Standard

Mitigation ratios used in mitigation banking result in a net gain of wetland acreage and range from 1.5: 1 to 3:1. In terms of wetland acreage, this represents an improvement. However, some critics argue that even though mitigation banking involves obtaining wetland units with similar functions and values at a nearby site, wetlands cannot be replaced because wetlands cannot be created with the same functions and values, and they should not be destroyed under any conditions. According to USFWS (2001), the rate of

wetlands loss in the U.S. has slowed by 80 percent from 1986 to 1997 compared to the preceding decade. However, forested wetlands and freshwater emergent wetlands show the most losses, while open water pond acreage has been increasing, reflecting substitution between these different wetland types.

Associated Issues

Mitigation banking is controversial. Supporters claim that mitigation banking, when compared with mitigation on-site, provides better-organized planning, an improved regulatory climate, greater commitment to long-term wetland protection, and more consolidation of habitat. Opponents are concerned that banking is a loophole and facilitates additional wetland destruction, that some types of wetlands are difficult to create or restore as thriving ecosystems, and that wetland losses are sometimes allowed before the bank is fully functional. More generally, supporters view policy flexibility as critical to success, especially for commercial banks, while critics worry that flexibility will lead to unacceptable losses of wetland functions and values (Zinns, 1997).

The success of wetland mitigation programs in general is currently a topic of much debate. A recent self-assessment of New Jerseys' wetland program (Brouwer, 2002) revealed that New Jersey has lost 22 percent of its wetland acreage over a recent four-year period. This contrasts sharply with the state's goal of creating 2 acres of wetland for every acre lost. The study focused primarily on wetlands created from scratch, and the low success rate with these types of mitigation measures was cited in part for the poor results.

Potential Applicability to Annex 2001 Implementation

One of the benefits of wetland mitigation banking listed by USEPA is that it consolidates numerous small, isolated or fragmented mitigation projects into a single large parcel, resulting in greater ecological benefit. USEPA also mentions that banking brings scientific and planning expertise and financial resources together, thereby increasing the likelihood of success in a way not practical for individual mitigation efforts. These characteristics are consistent with opinions expressed during the Focus Group and workshop that improvement measures need to be within the context of regional water management/ecosystem restoration plans. Such measures would provide greater ecological benefit than many isolated measures throughout the basin.

An example of a similar application in the Great Lakes might be the development of "restoration banks" that may involve stream enhancement projects, projects that target exotic species invasions, nutrient reduction, or other restoration or enhancement projects. A bank sponsor would create credits as it carries out these projects at the bank site, and these credits would then be either debited or purchased by clients who are being required to provide a resource improvement in connection with a proposed water withdrawal. The water withdrawals may or may not be tied to the bank projects. An obvious difference between wetlands banking and Annex 2001 implementation is that wetlands banking requires a compensation for resources lost. If there is to be no adverse impact, then it is not obvious how to scale the resource improvement to be required for a given proposed water withdrawal. One possibility would be to base resource improvements on mitigation of potential cumulative harm, and to scale individual resource improvement projects according to their contribution to that potential cumulative harm (if mitigation of potential harm is permitted).

7.3.3 RESOURCE IMPROVEMENT TRUST FUND

Several programs exist across the country in which a fee or tax is paid for a service or product, and the revenues are collected in a trust fund. The money in this fund is then used to fund a variety of programs including habitat and wetland conservation and environmental restoration and clean-up efforts.

Case Study Overview

There are many examples of resource improvement trust funds. Several are provided below, to illustrate the range of these types of programs.

- Minnesota Fishing License: The revenues collected from fishing licenses go to the general fund for the Division of Fisheries and support activities such as stream surveys, fishery management, lake rehabilitation and spawning habitat improvement.
- Michigan Natural Resources Trust Fund (MNRTF): The fund was established in 1976 to purchase lands for outdoor recreation and/or the protection of natural resources and open space. It also is used to assist in the appropriate development of land for public outdoor education. The MNRTF is supported by annual revenues from the extraction of non-renewable resources from state-owned lands, primarily oil and gas.
- Bottle Bills: When a soft drink container is purchased with a deposit and the bottle is discarded without redeeming the deposit, this money typically returns to the beverage distributor who initiated the deposit. However, Massachusetts, Michigan and California collect unredeemed deposits and direct all or a percentage of the funds to an environmental fund. Examples of funded projects include hazardous waste cleanups, municipal recycling programs, and brownfields redevelopment.
- Federal Gasoline Excise Tax: The gasoline tax is imposed on the manufacturer (the producer, refiner or importer) and is generally passed on to the consumer. Revenues collected from this tax primarily support the Highway Trust Fund, although 0.1 cent of the money collected supports the Leaking Underground Storage Tank Trust Fund to help fund clean-up efforts of leaking gasoline storage tanks.

The currency in which required future resource improvements are measured is dollars.

Definition and Application of Resource Improvement Standard

Each of the funds described above is dedicated to environmental improvement, with projects that range from remediation of contaminated sites to protection and enhancement of wildlife habitats. The amount of the fee or tax and the uses of the revenues can vary, but the common theme is that a benefit is created, either by those that use the resource (hunting and fishing licenses) or those who purchase certain products (bottle deposits and gasoline taxes).

Associated Issues

Issues can arise relate to management of these types of funds. There can be questions about who pays into it, what will the fees be, what projects get funded, where they are located, and who makes the project funding decisions. Historically, some of these types of funds have been redirected into general funds and have not been used for the original intended purpose. Alternatively, authorities may cut back on general fund-based activities, effectively using these fees to augment the general fund.

Potential Applicability to Annex 2001 Implementation

These types of resource improvement trust funds may offer a model for a "Great Lakes Ecological Restoration Fund." This fund could be used to finance restoration measures such as wetlands conservation, habitat restoration, or streambank erosion measures that have been identified in watershed restoration plans. Application of the trust fund payment procedure may simplify the implementation of

the improvement standard. By creating a uniform payment structure based on the characteristics of the water withdrawal, the fund could be administered to provide for local and/or regional improvements. The prioritization of projects and management of the fund may present challenges. While there would be interest in addressing local issues and concerns, there would also be interest in improvement projects that are consistent with broader regional water management and ecosystem restoration plans. Some states and provinces already have well-developed watershed management processes, while others including Ontario and Quebec are currently developing new systems of water resource regulation. A key issue related to this type of a program is whether Great Lakes governments have legal authority to charge a fee for water withdrawals.

7.3.4 ENDANGERED SPECIES ACT: HABITAT CONSERVATION PLANS

Habitat Conservation Plans (HCPs) are a conservation tool under Section 10(a)(2)(A) of the Endangered Species Act (ESA) to recover endangered and threatened species on non-federal lands. More than 300 HCPs have been approved, and more than 300 are pending.

Case Study Overview

The goal of a Habitat Conservation Plan is to improve the survival and recovery of listed species. When a "taking" of a listed species may occur as a result of a proposed project or action, an incidental take permit is required, and a Habitat Conservation Plan must accompany the permit application. The ESA defines "take" as any activity that harms a threatened or endangered species, and "harm" can include habitat modification that injures species.

An HCP protects listed species, protects unlisted species, and actively manages habitat. It includes measures to monitor, minimize, and mitigate the impact on the listed species. It can apply to an individual landowner or multiple landowners, and create improvements of entire regions. An HCP is made up of 5 components:

1. Biological Goals and Objectives: Guiding principles that reflect the best scientific information available;
2. Adaptive Management: Method to address uncertainty and significant data gaps;
3. Monitoring: Ensures compliance and gauges effectiveness of HCPs and informs choices under adaptive management;
4. Permit Duration: Varying lengths but up to 50 years; and
5. Public Participation: 30 to 60 days for public comment.

The environmental currency in which required future resource improvements are measured is habitat equivalency.

Definition and Application of Resource Improvement Concept

These Habitat Conservation Plans were selected as examples of an application of the resource improvement standard concept because they relate to water withdrawals, and their intent is to restore listed species, including improvements to degraded habitat and nonlisted species. HCPs allow operational activities to occur while applying conservation and recovery measures to degraded habitat. The plans lay out measures to preserve, restore, protect, and improve listed species, and non-listed species.

Associated Issues

Habitat Conservation Plans describe plans to minimize and mitigate for any "take" that may result from a project. In the examples provided, HCPs provide a mechanism for water withdrawals to continue and increase in the future, and for some harm in the form of a taking of listed species to occur in any cases where takings are a possible result. However, while these plans do involves mitigation measures to offset the harm, they go beyond individual species mitigation to include ecosystem restoration and improvement measures.

Potential Applicability to Annex 2001 Implementation

Habitat Conservation Plans may provide a model to allow for increased water withdrawals in the Great Lakes Basin while improving water dependent natural resources, degraded habitat, and water quality. HCP goals are similar to Annex 2001 objectives to protect, conserve, restore, improve and manage use of waters. The plan is implemented and monitored to assure that the goals are met. HCPs also provide a mechanism to bring together diverse stakeholders over a broad area or region(s) into a voluntary long-term agreement.

One issue with employing a similar approach in the Great Lakes is how to scale the resource improvement to be required for a given proposed water withdrawal. One possibility would be to base resource improvements on mitigation of cumulative harm, and to scale individual resource improvement projects according to their contribution to the cumulative harm. Habitat equivalency based on cumulative impacts could be used for this purpose.

7.3.5 FISH HABITAT PROVISIONS: CANADIAN FISHERIES ACT

Section 35 of the Canadian Fisheries Act instructs, "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat." It further states that the Minister is the only person who can authorize, under certain conditions, the alteration, disruption or destruction of fish habitat (HADD). This section discusses the policy and guidelines related to Section 35, and focuses on the policy objective of "net gain" in the productive capacity of fish habitats.

Case Study Overview

Fisheries and Oceans Canada (DFO) has decisionmaking authority for the conservation and protection of fish and fish habitat. DFO's "Policy for the Management of Fish Habitat" (1986) provides direction for interpreting the broad powers mandated in the Act in a way that is consistent with the concept of sustainable development. A key policy objective is the *Net Gain of Habitat for Canada's Fisheries Resources*, described as an "increase the natural productive capacity of habitats for the nation's fisheries resources, to benefit present and future generations of Canadians."

The DFO's Habitat Conservation and Protection Guidelines describe how the Net Gain Policy Objective goes beyond the principle of no net loss:

> "The long-term policy objective of the Department is to achieve an overall Net Gain in the productive capacity of fish habitats. A fundamental strategy for achieving this is to prevent further erosion of the productive capacity of existing habitat by applying the No Net Loss Guiding Principle to habitat management decisions related to the review of proposed works and undertaking."

Progress toward the objective of increasing productive capacity is achieved through three policy goals: conservation of the current productive capacity of habitats; restoration of damaged fish habitats; and development of new habitats.

The currency in which future environmental improvements are measured is productive capacity of fish habitat.

Definition and Application of Resource Improvement Concept

The net gain policy is directed at achieving an increase in the productive capacity of fish habitats. In this way, it designed to result in resource improvements over the long term. This is accomplished through measures that ensure no net loss of habitat, as well as measures that increase productive capacity. Examples of compensatory options (when residual impacts of projects on habitat productive capacity are deemed harmful after relocation, redesign or mitigation options have been implemented) include creating similar habitat, and increasing the productive capacity of an existing habitat.

Associated Issues

This example illustrates a program designed to mitigate harmful alteration, disruption or destruction of fish habitat. Applicants must pursue location and design options which will avoid impacts to fish habitats before DFO will consider authorizing works which would require habitat compensation to achieve a no net loss of fish habitat. When a project results in a HADD, and where the impacts are judged acceptable, compensatory restoration may be required. In some cases those measures are at or near the development site within the same unit (most preferred) and in other cases that are in different ecological units (less preferred). Like the wetland mitigation program described earlier, the policy of net gain in fish habitat is directed at an overall improvement that goes beyond no net loss in habitat.

Potential Applicability to Annex 2001 Implementation

The net gain policy for fisheries habitat is similar to the principle of a net resource improvement in Annex 2001. Also similar is the Annex principle on "no adverse impacts" and the no net loss of habitat policy in the Act. Some would argue, however, that the actions that are implemented under the Policy for the Management of Fish Habitat are mitigative in nature, and that mitigation is not a component of Annex 2001.

7.3.6 WETLANDS RESERVE PROGRAM (WRP)

The Wetlands Reserve Program (WRP) was mandated by Section 1237 of the Food Security Act of 1985 (PL 99-198), as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (PL-101-624) and the Federal Agriculture Improvement and Reform Act of 1996 (PL-104-127), to assist landowners in restoring and protecting wetlands. The WRP was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill).

Case Study Overview

The Wetlands Reserve Program is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance and protect wetlands. The USDA-Natural Resources Conservation Service administers the program. Funding for WRP comes from the Commodity Credit Corporation. The program offers three enrollment options:

Permanent Easement. This is a conservation easement in perpetuity. Easement payments for this option equal the lowest of three amounts: the agricultural value of the land, an established payment cap, or an amount offered by the landowner. In addition to paying for the easement, USDA pays 100 percent of the costs of restoring the wetland.

30-Year Easement. Easement payments through this option are 75 percent of what would be paid for a permanent easement. USDA also pays 75 percent of restoration costs.

For both permanent and 30-year easements, USDA pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance.

Restoration Cost-Share Agreement. This is an agreement (generally for a minimum of 10 years) to re-establish degraded or lost wetland habitat. USDA pays 75 percent of the cost of the restoration activity. This enrollment option does not place an easement on the property.

Definition and Application of Resource Improvement Concept

The program provides an opportunity for landowners to receive financial incentives to enhance and restore wetlands in exchange for retiring marginal land from agriculture. The program benefits the Great Lakes Basin by restoring and protecting wetland functions and values, and by developing fish and wildlife habitat. Wetlands also benefit the Great Lakes by improving water quality by filtering sediments and chemicals, reducing flooding, and protecting biological diversity. As of November 2001, there have been 1,074,245 acres enrolled in WRP in the entire United States.

To be eligible for WRP, land must be restorable and be suitable for wildlife benefits. Examples of eligible lands include: farmed or prior converted wetlands; pasture or production forage land where the hydrology has been significantly degraded and can be restored; riparian areas linked to protected wetlands; and lands adjacent to protected wetlands that contribute significantly to wetland functions and values. Ineligible lands include wetlands converted after December 23, 1985, lands with timber stands established under the Conservation Reserve Program, Federal lands, and lands where conditions make restoration impossible. Thus any wetlands in this program represent land that has been reclaimed from prior conversion to agricultural land or which support protected wetlands, resulting in a net gain in wetlands in the Great Lakes Basin. Use of these wetlands in mitigation efforts is prohibited by statute.

Associated Issues

On acreage subject to a WRP easement, participants control access to the land and may lease the land for hunting, fishing, and other undeveloped recreational activities. The purchase of a conservation easement by the US Government does not constitute an outright purchase of lands. At any time, a participant may request that additional activities be evaluated to determine if they are compatible uses for the site. This request may include such items as permission to cut hay, graze livestock or harvest wood products. Compatible uses are allowed only if they are fully consistent with the protection and enhancement of the wetland.

Implementation of WRP has illustrated the need for funding for technical assistance to landowners, not just financial assistance. NRCS and its partners, including conservation districts, provide a great deal of assistance to landowners as part of restoration activities. These include the design of wetland restoration practices and overseeing restoration activities. Easement acquisition is also an important part of the program, which guarantees that wetlands will be properly maintained, but which involves a great deal of time and effort to accomplish. NRCS and its partners also continue to provide assistance to landowners after completion of restoration activities. This assistance may be in the form of reviewing restoration measures, clarifying technical and administrative aspects of the easement and project management needs, and providing basic biological and engineering advise on how to achieve optimum results for wetland dependent species.

The case studies given to this point all have funding mechanisms that place the costs of restoration on the end user. The theory is that the end user can then pass restoration costs on to the consumer, as part of the

price of doing business. The agricultural producer is unable to pass on these costs, however, since the marketplace typically fixes commodity prices. Therefore a public benefit such as wetland restoration will require public investment in the form of cost-share payments, technical assistance, and purchase of conservation easements.

Potential Applicability to Annex 2001 Implementation

A key principle of Directive #3 is "No significant adverse individual or cumulative impacts to the quantity or quality of the Waters and Water-Dependent Natural Resources of the Great Lakes Basin." A similar program to WRP in the Great Lakes Basin would directly address the goals of this directive. Key issues related to this type of program that would need to be addressed include:

- Whether the Great Lakes government entity has the legal authority to acquire and hold easements;
- The financial costs of both the easement purchase and cost-share for wetlands restoration; and
- Technical ability of the government entity to design and implement wetland restoration.

Partnership agreements between Great Lakes government entities and NRCS, conservation districts, and environmental groups such as Ducks Unlimited could address the second and third issues. Also, there are other funding mechanisms besides direct appropriation of funds to a program, such as the sale of bonds by state or local governments.

7.3.7 RECENT PRECEDENT

It has been only 12 months since the signing of the Great Lakes Charter Annex and the Annex has not yet been implemented, so precedents are few. However, one case study in Michigan was found that may assist in the resource improvement work called for in Annex 2001.

Case Study Overview

The Perrier Group of American recently began operations at a water bottling facility in the Muskegon River watershed, which is located in west-central Michigan. At peak production, the plant will withdraw approximately 720,000 gallons per day of groundwater for purification, sterilization, bottling and distribution to consumers under the brand name Ice Mountain.

After conducting an extensive review and public hearing, the Michigan Department of Environmental Quality (MDEQ) issued a permit in August 2001 for the plant to construct and operate two wells. Hydrogeologic tests and analyses reported that there would be no significant adverse impact on adjacent private wells or on nearby surface waters and wetlands. In addition, studies performed by MDEQ to assess the potential effect of water withdrawals on fish and other wildlife reportedly showed no significant impacts.

There has been a great deal of interest and concern related to this project. Lawsuits from environmental groups and Native Indian tribes concerned about the impacts to groundwater levels and nearby surface water are currently pending. Another issue has been whether the sale of bottled water outside of the Great Lakes basin constitutes a diversion that would require application of the Water Resources Development Act (WRDA). The MDEQ concluded that it does not constitute a diversion based on the customary exemption of water that is used for food products, beverages or bottled water and the traditional definition of diversions as being bulk exports out of the Great Lakes basin (MDEQ press release, August 15, 2001). The issue of how much of the water will remain within the basin and how much will be shipped to other states or countries is an ongoing topic of debate.

In anticipation of the implementation of Annex 2001, the Perrier Group incorporated several environmental restoration and protection features into its final project. These actions were not required by MDEQ and were voluntarily initiated. The environmental protection and restoration features include:

- The endowment of a $500,000 environmental stewardship fund to finance educational and environmental restoration projects throughout the Muskegon River watershed;
- The acquisition of development rights for over 1,100 acres of land surrounding the wells to protect the groundwater recharge area; and
- The installation of over 60 monitoring wells to develop a long-term monitoring network, and data sharing.

The environmental currency in this case is water quantity and quality. Perrier is offering water quality protections in exchange for water quantity reductions.

Definition and Application of Resource Improvement Standard

The intent of the environmental protection and restoration environmental measures is to provide in many ways for an overall improvement in the Muskegon River watershed. In addition to demonstrating that the operations will have no significant adverse impacts, the applicants will also implement several measures to improve the quality of the watershed and advance the state of knowledge of water resources in the area.

The environmental stewardship fund was established to support efforts and programs that protect and enhance the natural resources. An outside consultant will manage the fund, and board members will include stakeholders within the community as well as a representative from the Perrier Group. The board will then oversee project grants and reach out to potential beneficiaries. This represents an improvement in the watershed by facilitating projects that improve water quality, restore natural wildlife habitat and restore and preserve critical wetlands, stream, and waterbodies.

The undeveloped land surrounding the bottling facility is primarily pervious and allows rainwater to infiltrate and replenish the groundwater. Acquiring the land surrounding the wells will prohibit the development of this area, minimizing surface runoff. By preserving the 1000 acres surrounding the wells, the groundwater is also protected from future sources of contamination.

The installation of the monitoring network serves as an early warning system if the pumping activities have any adverse impacts so that changes can be made before larger problems occur. Also, the information collected from these wells, such as water levels and concentrations of various constituents, will be shared with regulators, universities and the surrounding communities, allowing the groundwater behavior in the area to be better understood.

Associated Issues

The studies that were conducted prior to permitting indicated that there would be no significant adverse impacts due to the pumping. Therefore, the voluntary improvement measures defined above are not intended to mitigate adverse impacts. Rather, the watershed improvements are part of the project design. The measures are also an example of improvements tied directly to the use, a possible approach to the improvement standard, in that they relate to protections and restoration of the watershed that provides the water for the facility.

Potential Applicability to Annex 2001 Implementation

The environmental protection and restoration measures in the final project plans may provide a precedent for future projects. To the authors' knowledge, the Perrier Group was the first party that intentionally developed a plan to incorporate the principles of Directive #3.

One comment expressed during the Focus Group was that improvement measures should be developed within the context of regional water management/ecosystem restoration plans. This case study is an example of a project that is in keeping with that vision.

7.4. APPLYING THE RESOURCE IMPROVEMENT STANDARD TO IMPLEMENTATION

7.4.1 KEY QUESTIONS

The background material provided in previous sections serves as a departure point for discussions as efforts to interpret and apply the improvement standard move forward. Following are the types of questions that might be considered. They are associated with the definition, interpretation, and application of the resource improvement standard.

1. At what scale is the resource improvement standard appropriately applied?
   a. At what *spatial* scale is the resource improvement standard appropriately applied (e.g., site specific, lake-wide, basin-wide)?
   b. At what *time* scale is the resource improvement standard appropriately applied (e.g., 10 years, 50 years, etc.)?
2. What options are available for measuring improvement under the application of the resource improvement standard?
3. To what extent, if any, should mitigation be a consideration in the application of the resource improvement standard?
4. How should cumulative impacts be considered in the application of the resource improvement standard?

7.4.2 SUMMARY OF RESOURCE IMPROVEMENT STANDARD WORKSHOP

These key questions were posed to participants during a half-day workshop on July 31, 2002 in Chicago to generate ideas of how to implement a resource improvement standard. No consensus was reached on most of the issues raised during the workshop. Participants included members of the Annex Working Group, the Project Management team and Stakeholder Advisory Council, and the Great Lakes Protection Fund, and Observers. A list of participants and the workshop agenda are included in Appendix Y. The responses to these questions raised during the workshop discussion, and submitted in writing by attendees, are summarized below.

1. At what scale is the resource improvement standard appropriately applied?

a. At what *spatial* scale is the resource improvement standard appropriately applied (e.g., site specific, lake-wide, basin-wide)?

Diverse opinions were expressed on this issue. Some argued that improvements should be located as closely as possible to new withdrawals, especially for withdrawals from aquifers, streams, and rivers, while others pointed out that the requirement to avoid adverse impacts may make a spatial link between withdrawal and improvement unnecessary. The importance of flexibility in location was

also expressed, based on the need to find suitable land to accomplish effective improvements. It was also argued that the scale of an improvement should be consistent with our ability to measure that improvement, relative to a baseline condition. Some argued that this consideration points to local rather than basin- or lake-wide improvements, in part because of the great technical difficulty of forecasting baseline Great Lakes ecosystem health on a decadal scale.

On a different spatial issue, a concern about differences between in-basin and external uses was discussed. Legally, the proposed requirements might convey ownership rights to parties outside the Great Lakes Basin, making Great Lakes waters an ordinary commodity with an established price. Related issues of riparian law were raised in connection with a proposal to withdraw water and restore Lake Superior coastline.

b. At what *time* scale is the resource improvement standard appropriately applied (e.g., 10 years, 50 years, etc.)?

It was pointed out that restoration projects take time to produce ecosystem benefits, so that there could be a lag between initiation of a new withdrawal and effective resource improvement. Reactions to this idea were diverse: some argued that improvements should be undertaken in advance of new withdrawals, while others pointed out that delays in approval for needed withdrawals could reduce the attractiveness of the Great Lakes Basin to business.

On the length of the time horizon, some argued that any improvements should be sustainable indefinitely, while others proposed an augmented flow of services over time as the appropriate standard. A temporal match between improvements and the productive life of water-withdrawing capital was also proposed.

The role of changes in hydrological conditions over time was also raised: both the value of water to users and the functional value of ecosystem improvements may vary, as conditions change from drought to wet weather.

2. What options are available for measuring improvement under the application of the resource improvement standard?

It was pointed out that U.S. and Canadian national, provincial, and state governments already are monitoring Great Lakes ecosystem health, and that these efforts could be used to measure improvements, and that assessment tools are also available or under development, including some being initiated by the Great Lakes Protection Fund to support resource improvement decisionmaking It was also pointed out that the need to measure improvements is related to the explicitness of the Annex requirements, and will be less if Annex guidance is flexible.

Discussion also focused on measurement of improvements using environmental currencies, including dollar values. Some participants expressed interest in a trust fund, which could be used to finance improvement projects. Currencies, such as acres of wetlands or dollar values of services provided, were argued to lend simplicity to an improvement standard, but also to be imperfect measures of the true functional value of a resource improvement. Concerns raised with dollar valuation of improvements included the following: the "selling" of Great Lakes water; facilitating its export outside of the basin; its commodification; uncertainties in quantifying nonhuman services; and the possibility that of services delivered may not be commensurate with their dollar price tag.

3. To what extent, if any, should mitigation be a consideration in the application of the resource improvement standard?

Issues of potential adverse and beneficial impacts of water uses were discussed, along with the relationship of improvements to those impacts. It was pointed out that adverse impacts are not allowed under the Annex, so that policy examples that match improvements to adverse impacts may

not be appropriate prototypes. (A similar point was made for cumulative adverse impacts in the discussion of question 4: if they are not allowed under the Annex, then the relevance of measuring or mitigating them is questionable.) There was wide, although not universal, agreement that mitigation of harm caused by new withdrawals should not be part of the improvement standard. Withdrawal of groundwater in amounts much less than its potential yield was given as an example of a withdrawal without adverse impact.

Mitigation of existing harm was also discussed. It was pointed out that this is a category of improvement explicitly identified under the Annex, that it should include in-kind improvements, and that it would be less likely to be construed as commerce than mitigation of potential impacts of new withdrawals. Several dangers to be avoided were also identified, however: new users getting double credit for mitigation that would be required even without the improvement standard; and the resource improvement standard being used as a tool to prohibit water use or extort desired outcomes from users

Others argued that potential adverse impacts could be mitigated as the first step in any new withdrawal, and that any additional ecosystem enhancements would then constitute the required improvements. If this approach is accepted, it was argued, there remains a challenge of achieving fairness in scaling improvements for different applicants having different circumstances.

Beneficial aspects of municipal and agricultural water uses were mentioned, and it was pointed out that human civilization is a part of the Great Lakes ecosystem, along with wildlife. Human benefits to Great Lakes users was pointed out as a potential discriminator between in-basin and external users, and it was argued that the intent of the Annex is to restrict consumptive use of diversions outside the basin. Others argued that benefits that are important to human society, even within the Great Lakes Basin, are not necessarily improvements to waters and water-related resources, as specified in the Annex.

4. **How should cumulative impacts be considered in the application of the resource improvement standard?**

   Both spatial and temporal aspects of this issue were discussed. These included the simultaneous contributions of each upstream user to downstream conditions, and the ultimate cumulative impact of successive users in a single location. Both human use and ecosystem impacts were discussed. A National Environmental Policy Act definition of cumulative impact was suggested as a precedent: "incremental, when added to past, present, and reasonably foreseeable future impacts." Specific examples were discussed in which it would be technically challenging to estimate these cumulative impacts, lending uncertainty to implementation of an improvement standard. One implementation method that was proposed was to estimate the cumulative impact of a combination of many withdrawals, including a margin of safety to account for uncertainty, and then attribute fractions of that potential impact to individual users according to their incremental withdrawals.

7.5. FINDINGS AND RECOMMENDATIONS

7.5.1 FINDINGS

Successful implementation of the Great Lakes Charter Annex will, in large part, be determined by the development and application of a new decisionmaking standard for water withdrawal proposals, as called for in Directive #3 of the Annex. Key issues associated with standard development include: the definition and interpretation of Directive #3 terminology; operationalyzing the four associated principles; and addressing application issues including assigning a spatial/temporal scale and accommodating prospective cumulative impacts.

The case study analyses and resource improvement workshop were the primary tools used to research development and application of a resource improvement standard. The case studies mostly provide examples of mitigation that have relevance, but not direct application, to the development of a resource improvement standard. None of the case studies provides a model for exclusive application to the Annex's resource improvement standard, but several case studies have elements of resource improvement that have been interpreted and applied in many settings. The workshop focused on four key questions and generated several ideas related to the definition, interpretation, and application of the resource improvement standard.

Given the potential range of water withdrawal scenarios in the Great Lakes basin, the resource improvement standard (and associated process) must be specific enough to provide scientifically sound guidance, yet flexible enough to accommodate the inherent uniqueness of individual proposals. A point that was brought out through the research effort is that because the Annex decisionmaking standard will require "no significant adverse individual or cumulative impacts," the term "mitigation," as used in the Annex's "definition" section, pertains only to resource improvement measures that mitigate impacts of existing withdrawals, not the prospective impacts of the proposed withdrawal.

Resource improvement measures should all be directed toward a common end point, or goal, and should work from a common baseline for measurement. Specification of the goals, objectives, and baseline conditions should be developed within a state and province-based "Great Lakes Restoration Plan." Spatial and temporal parameters should be applied to the selection of prospective resource improvement measures so that benefits occur in the vicinity of the proposed withdrawal and during the lifetime of the proposed withdrawal.

A fundamental component of application of a resource improvement standard is the ability to measure an improvement. Therefore, consideration must be given to both the design of an appropriate methodology, and the data, information and resource requirements to support it. Data and information need to be collected on current and prospective ecological conditions to measure the effectiveness of resource improvement measures. One part of measuring resource improvement is selection of an environmental currency that will be used to measure the amount of resource improvement that withdrawal applicants provide. A possible approach is to charge fees for water withdrawal proposals that could be used in a "Great Lakes Trust Fund" to pursue resource improvement activities that augment current state, provincial and regional agency activities. This approach raises concerns that water resources will be commodified. Use of ecological indicators may be another viable environmental currency.

7.5.2 RECOMMENDATIONS

1. Develop the following in the interest of identifying data, information and evaluation requirements for water withdrawal assessments: a) precise definitions for terms in Directive #3 of the Annex; b) guidance on the application of spatial and temporal dimensions of "resource improvement"; and c) a science-based evaluation methodology that presents acceptable procedures for assessing withdrawal proposals (from individual and cumulative standpoints) in the interest of measuring the "improvements" associated with the attendant conservation, enhancement or restoration activity. Many of the same data and knowledge base needs identified in Chapter 6 for assessisng significance of resource impacts are also needed for assessing resource improvements.
2. Provide additional attention to the case study approach to resource improvement standard application. Ongoing work on a suite of projects supported by the Great Lakes Protection Fund should be carefully reviewed and augmented, as needed, by additional "scenarios testing" that leads to efficient and cost-effective methodologies for implementing the resource improvement standard.

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