Conceptualizing Mitigation Performance Standards

The National Mitigation Action Plan, an interagency response to criticisms of the country's approach to compensating for authorized wetland losses, aims to develop a federal guidance on compensatory mitigation performance standards in 2005. Here, members of the action plan workgroup discuss the fundamentals of defining and employing such standards.

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For nearly 20 years, scientists and resource professionals from environmental organizations, academic institutions, state and federal agencies, and private organizations have questioned whether most compensatory mitigation projects, especially wetland restoration and creation efforts, are effective at replacing the acreage or functions of permitted losses (e.g., NRC 1992, Race 1985, Race and Fonseca 1996). Recent national (NRC 2001, GAO 2001, GAO 2002) and regional evaluations (Sudol 1996, Balzano et al. 2002, Gallihugh 1998, Johnson et al. 2000) have documented the shortcomings of many current compensatory mitigation efforts. The critical nature of these reviews has drawn particular concern because the practice of compensatory mitigation, including wetland mitigation banking, has become increasingly popular over the past decade.

In 1998, the U.S. Army Corps of Engineers and the Environmental Protection Agency charged the National Academy of Sciences with examining the effectiveness of wetland compensatory mitigation in the United States. The resulting report, issued by the National Research Council in 2001, was a thorough, critical, and constructive evaluation of compensatory mitigation programs. The council reported that although there is insufficient compensatory mitigation data from which to draw firm conclusions concerning losses of wetland acres and function, the body of scientific literature on this issue suggests that federally required mitigation projects often are not undertaken or fail to satisfy permit requirements. The committee was "not convinced that the goal of no net loss for permitted wetlands is being met for wetland functions." The report identified significant problems with recent wetland mitigation efforts, including:

- Failure to construct or complete required mitigation projects;
- Failure to satisfy permit conditions;
- Failure of mitigation projects to offset the losses of area or functions in the affected wetland resources; and
- Lack of legal and financial mechanisms to ensure that mitigation projects are completed and receive long-term protection.

The council concluded that the performance expectations in federal wetland permits issued under section 404 of the Clean Water Act are often unclear, and that permit compliance is not assured. It suggested that mitigation effectiveness could be improved if permits established clear mitigation goals with measurable performance standards.

Mitigation Action Plan

In response to this and other critiques of wetland mitigation (e.g., GAO 2001, Race and Fonseca 1996), an interagency team consisting of the Corps, the Environmental Protection Agency, and the Departments of Interior (Fish and Wildlife Service), Agriculture (Natural Resource Conservation Service), Commerce (National Marine Fisheries Service), and Transportation (Federal Highway Administration) developed the National Mitigation Action Plan in 2002. This plan is not a new approach to compensatory mitigation, but an effort to systematically improve the ecological performance of wetland compensatory mitigation by incorporating scientific evaluations, scientific literature, and the experience of mitigation stakeholders, including regulators, resource professionals, scientists, mitigation practitioners, and the regulated public, into federal mitigation standards and guidance. The plan presents 17 specific tasks for improving mitigation effectiveness.

Need for Mitigation Performance Standards

One of the tasks specified by the National Mitigation Action Plan is the development of guidance for wetland mitigation performance standards. This task is a response to the National Resource Council's 2001 finding that compliance requirements for evaluating the

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ecological performance of mitigation sites are often inadequate. Specifically, the council expressed concern that:

- Many permits lack mitigation performance standards.
- Many "performance standards" given in permits are observable actions rather than measurable outcomes, e.g., requirements for prescribed burning, rather than measurements of post-burn plant species composition and distribution. Some management tasks that are commonly and often incorrectly referred to as performance standards may not result in desirable environmental outcomes. For example, prescribed burning may be considered ecologically unsuccessful if the desired plants die, the fire is not hot enough, or the burn is conducted during the wrong season—yet a standard that merely requires burning would be considered met once the burn is completed.
- Standards often require a site to provide ecosystem functions similar to those provided by a reference wetland, but don't identify specific functions to be provided.
- Permits often call for measurement of only one site parameter, usually a metric assessing vegetation type or cover. However, vegetative conditions alone may not reflect the overall viability of a mitigation site.

The Corps' *Regulatory Guidance Letter 02–2* (2002), issued in response to the council's report, encourages Corps districts to incorporate written and clear performance standards in the special conditions attached to permits or the mitigation plans required by permits. However, districts still lack direction on *how* those clear standards should be constructed.

Accordingly, the interagency workgroup charged with executing the tasks in the action plan is drafting federal guidance for the development of clear and enforceable performance standards. Workgroup members are reviewing existing research on the evaluation of mitigation performance; a survey of scientific research concerning performance standards has already been completed and is available on the plan's website, http://www.mitigationactionplan.gov. The workgroup also will use feedback from the public and regulators to inform the guidance, and is presently working with regional field staff and stakeholders to review existing information concerning mitigation in different regions and for different wetland types.

Nature of Mitigation Performance Standards for Ecological Success

Most experts agree that wetland mitigation projects should be evaluated based on how well they achieve specific goals, structures, and functions. This achievement can be evaluated in many different ways. Standards can be stated in terms of regulatory jurisdiction, requiring that a mitigation project satisfy specific criteria, such as the presence of hydric soils, wetland hydrology, or hydrophytic vegetation (Environmental Laboratory 1987). Standards can also be stated in terms of requirements to establish a particular wetland community, such as a *Spartina patens*-dominated high marsh, or to provide specific functions, such as offering overwintering habitat for salmon. Performance standards can be phased such that different standards apply as a site develops or matures, allowing managers and regulators to evaluate its progression toward stated goals and functions. Some standards may evaluate the development of mitigation site characteristics or functions by comparing these attributes to those in reference wetlands or in populations of naturally occurring wetlands (e.g., NRC 2001, Streever 1999, Diefenderfer et al. 2003). There are three general types of standards that can be used to ensure ecological achievement at a site: administrative, ecological performance, and adaptive management based.

Organizing mitigation performance standards into administrative, ecological performance, and adaptive management standards may help regulators develop more comprehensive mitigation performance criteria.

Administrative Standards

Administrative standards address the well-documented problems of uninitiated, incomplete, or unprotected mitigation sites (Race and Fonseca 1996, NRC 2001). These standards ensure that a mitigation site is constructed according to plan, protected, and maintained. Administrative standards may include financial assurances such as performance bonds, letters of credit, or escrow accounts; these funds may be later used to correct problems with a site's physical and ecological performance. Financial assurances such as endowments or trusts are often used to fund long-term management and maintenance of mitigation sites.

Administrative standards also include as-built surveys, which can be used to determine whether work has been conducted according to the mitigation plan; legal or real estate instruments such as deed restrictions or conservation easements that may be

used to protect mitigation sites from future disturbance; and maintenance or management requirements. While many may not consider these provisions true performance standards, and while they may not be structural or functional components of a mitigation project, they are observable, enforceable, and necessary to ensure the basic integrity of a mitigation site.

Ecological Performance Standards

Ecological performance standards evaluate environmental improvements at a mitigation site. These measures are a way to examine the structure, function, and community development trajectory of the site (Morgan and Short 2002, Zedler and Callaway 1999). Ecological performance standards account for spatial and temporal scales, baseline site conditions, and the potential resilience of the site to future disturbances, such as flood, drought, or herbivory (Diefenderfer et al. 2003, Kentula 2000).

Structural metrics describe and specify goals concerning the form, extent, and basic physical characteristics of a mitigation site, such as size, landscape position, wetland classification, hydrologic regime, vegetative community, soils, stream morphology, and fauna. It is important to ensure that the hydrology and related physical parameters of a mitigation site are correctly designed and implemented, because remediation may not be possible (Sudol and Ambrose 2002).

Community development or functional performance standards include explicit descriptions of the intended ecological objectives for the mitigation site, such as the establishment of bottomland hardwoods or habitat for neotropical migratory birds, or primary productivity objectives; these standards also should specify measures for evaluating attainment of the objectives. Those measures can be simple, such as bankfull depth, annual standing crop, and foliage height diversity, or more complex and composite measures that evaluate community composition, diversity, or function. Examples of composite measures include floristic quality assessments, habitat suitability and functional capacity indices, and various indices of biotic integrity.

At this point, there is no single best approach for evaluating mitigation site performance with ecological performance standards. Most approaches rely on comparisons with reference areas but define these areas in slightly different ways. Some compare mitigation sites and reference areas using empirical assessments of soil structure, hydroperiod, plant community composition, and other characteristics (e.g., Clewell 1999, Stolt et al. 2000). Others compare a mitigation site's performance of specific functions, such as carbon sequestration or flood storage, to the performance of reference areas (e.g., Diefenderfer et al. 2003). Some examine the development of community functions, such as trophic structure or biological guilds, in restoration sites (e.g., Tanner et al. 2002). Some researchers have constructed developmental trajectories or performance curves for mitigation sites to estimate the sites' replacement of specific wetland functions, such as primary productivity or carbon sequestration (e.g., Zedler and Callaway 1999, Kentula 2000, Morgan and Short 2002). Their research suggests that the development of some functions in mitigation sites does not follow a smooth or linear pathway, and that many mitigation sites may not provide functions similar to reference wetlands within the 5–10 year monitoring period typically required for mitigation sites. These different approaches to evaluating mitigation sites and defining and using reference areas should be considered further in the development of the performance standards guidance.

Adaptive Management Standards

Adaptive management standards address the uncertainties and risks associated with mitigation (Thom 2000). The practice of restoring or creating aquatic resources, including wetlands, is still in its infancy, and sometimes requires as much art as science. These natural systems are complex and dynamic, and our ability to predict their responses or development is limited. Some might argue that restoring or creating aquatic resources should not be attempted until the components and long-term functions of these systems are understood. However, this stance is unrealistic. Regulatory agencies do not have the luxury of waiting for better, more refined knowledge of aquatic systems, although this understanding certainly must be pursued. Permit issuance will continue, and regulators must find ways to increase the likelihood of sustainable and successful mitigation. This is the challenge of adaptive management—to learn from successes and failures and apply those lessons to permits and any future policy development.

Adaptive management of a mitigation site might follow these steps:

1. Develop administrative and ecological performance standards for the mitigation site; these will predict the outcome of mitigation activities.
2. Monitor the mitigation site.
3. Compare the analysis of the monitoring data to the ecological performance standards.
4. Determine whether the site is progressing toward the intended community or functions; if the site is not progressing appropriately, determine whether corrective action is necessary, and, if so, of what type.
5. Implement the corrective action as necessary.

Clearly, one of the principal tools in adaptive management of mitigation sites is monitoring. Ongoing assessment informs an iterative feedback process that can result in the modification of administrative standards or ecological performance standards to meet changing site needs. Continued monitoring can evaluate the effectiveness of the original mitigation activities (step 1), and can inform the prescription (step 4) and implementation (step 5) of any necessary corrective action. Essentially, the results of each treatment and response are incorporated into future actions, and a permittee's mitigation plan is revised to reflect the new information (e.g., Kentula 2000, Diefenderfer 2003). This process may actually encourage experimentation and innovation in mitigation efforts.

Determining whether corrective actions are needed and then implementing those actions is central to adaptive management. Financial assurances are one mechanism for ensuring that permittees implement necessary corrective actions. However, other techniques can also be compelling, including using logic and persuasion; offering incentives, such as removal or suspension of some previously required monitoring provisions; releasing additional mitigation credits; suspending mitigation credits; or as a last resort, suspending or revoking permits, levying administrative penalties, or even pursuing litigation.

Future Guidance

Any meaningful performance standards guidance must consider the constraints, including costs, associated with developing and implementing standards. Monitoring compliance with performance standards should not be expensive or complex. One way to reduce costs is to use indicators of specific wetland functions, rather than measuring actual functions. Direct measurement of some wetland functions or processes, such as primary productivity or denitrification, can be expensive, time consuming, or difficult; however, in many cases, indicators that are related to specific functions or processes can be used more cost effectively (Morgan and Short 2002).

Organizing mitigation performance standards into administrative, ecological performance, and adaptive management standards may help regulators develop more comprehensive mitigation performance criteria that ensure a mitigation site is constructed, maintained, and protected; evaluated in terms of its intended functions; and managed such that those desired functions are attained. The National Mitigation Action Plan workgroup expects to complete guidance on the development of mitigation performance standards by the end of 2005. This guidance, together with recent actions by the Corps, including development of district mitigation guidelines that incorporate many of the National Research Council's recommendations, will help improve compensatory mitigation success. ■

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