Final Report

The North Carolina Ecosystem Enhancement Program: Managing The Future

Watershed-Based Planning,
Functional Assessment of Loss Mitigation,
and Continuing Research

Report and Recommendations to the
North Carolina Department of Transportation

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16. Abstract

Chartered in 2001 the North Carolina Ecosystem Enhancement Program (EEP) is well into implementation. It represents a new national model for providing mitigation for environmental impacts. The numerous national awards that EEP has received are validation that this new approach is an important step forward in balancing infrastructure needs in a growing economy with protection and enhancement of natural resources that are essential to North Carolina's quality of life. EEP has reached a milestone in its implementation, and the North Carolina Department of Transportation (NCDOT) along with its EEP partners, the North Carolina Department of Environment and Natural Resources (NCDENR) and the United States Corps of Engineers-Wilmington District (ACOE), requested the preparation of this report. The purpose of this report is to document briefly the history of the EEP, to summarize the regulatory environment that it operates within, to identify some of the emerging issues and directions it faces, and to make recommendations on next steps the EEP can take to continue to advance this new approach to mitigation.

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Introduction

Chartered in 2001 the Ecosystem Enhancement Program (EEP) is well into implementation. It represents a new national model for providing mitigation for environmental impacts. The numerous national awards that EEP has received are validation that this new approach is an important step forward in balancing infrastructure needs in a growing economy with protection and enhancement of natural resources that are essential to North Carolina's quality of life.

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The North Carolina Ecosystem Enhancement Program

Background

The first North Carolina interagency approach toward dealing with mitigation for environmental impacts because of transportation projects dates back to a 1998 two-party memorandum of understanding between the NC Department of Environment and Natural Resources (NCDENR) and the U.S. Army Corps of Engineers (USACE). The 1998 MOU was an effort to help alleviate crippling time delays associated with transportation projects in the state's 17 river basins containing 54 cataloguing units. It was created as an opportunity for an in-lieu-fee mitigation program (the Wetlands Restoration Program, or the WRP) to serve as a less time-consuming alternative to the NCDOT in-house on-site mitigation program. By early 2001 approximately 55 percent of the NCDOT transportation projects were still being delayed due to issues associated with compensatory mitigation.

During mid 2001 an interagency group of nearly 20 individuals (NCDOT, NCDENR, USACE, FHWA, and four other partnering resource agencies) met and agreed to sponsor a permitting process improvement exercise. During the course of their facilitated workshops they came to an agreement that compensatory mitigation issues dwarfed everything on the table for discussion and deferred the mitigation issues to an improvement process of its very own (Memorandum, May 2001). Key issues contributing to North Carolina's problematic mitigation picture were:

1) Lack of defined mitigation processes and poor synchronization with the planning/permitting process.
2) No clear definition of roles and responsibilities.
3) Difficulty in identifying, obtaining, and improving mitigation sites.
4) No clear definition of successful mitigation or shared environmental standards.
5) Disconnect between mitigation science and the regulatory requirements.

Birth of the Ecosystem Enhancement Program

Later in 2001 a second interagency group of nearly 20 individuals (NCDOT, NCDENR, USACE, FHWA, and eight other partnering resource agencies spun off from the earlier group, some repeaters), working in three facilitated workshops, began development of what would later evolve in 2003 as the Ecosystem Enhancement Program (EEP) (Mitigation Process, January 2002). The memorandum of agreement (MOA) hammered out by a team from NCDOT, NCDENR, and USACE and signed in July 2003 merged and transitioned the formerly NCDENR-housed WRP and the NCDOT in-house mitigation programs into one formal, comprehensive, and expanded initiative of advanced mitigation to offset impacts to waters and wetlands due to transportation projects with the assessment, restoration, creation, preservation, and enhancement of natural resources in North Carolina.

It was jointly decided that the entire mitigation effort would be housed in the NC Department of Environment and Natural Resources and specified as such in the MOA. The management team of the EEP came in part from NCDOT and in part from NCDENR. There was a second and separate memorandum of understanding between the state NCDOT and NCDENR to deal with business functions with which the federal USACE chose not to be involved. There is an upper management-level Policy Group comprising the leadership from NCDOT and NCDENR to deal with policy and major administrative issues of the EEP and to ensure the progressive future of EEP. In addition, the tri-party MOA established the Assessment Group (now known as the Program Assessment and Consistency Group, PACG), consisting of federal and state regulatory agencies. The role of the PACG is to review policy issues with EEP management and to contribute to the evaluation of program accomplishments and shortfalls. There is also a Liaison Council composed of non-governmental mitigation stakeholders that is informed of key EEP activities and provides feedback to the program.

Transition to the Ecosystem Enhancement Program

The multi-agency endorsement of the EEP created a two-year transition period of accelerated mitigation in order to get a strong wetland, stream, and buffer restoration and enhancement program in place. The transition period allowed for all mitigation requirements of transportation projects to be temporarily met with approved wetland and stream preservation mitigation credits. After the transition period, half of the preservation credit placeholders would have to be replaced with approved restoration mitigation credits. The replaced preservation mitigation credits could then be rolled over to be used again at a later date. Progress on the development of EEP and meeting of the short- and long-term mitigation needs of the NCDOT was reported quarterly to the NCDOT during the two-year transition.

NCDOT and NCDENR leadership met weekly during the two-year transition period to deliberate on the following:

1) Management and committee program oversight structure for NCDOT, NCDENR, USACE, and other federal and state resource agencies.
2) Broad structural, management and operational issues.
3) Staffing needs (sources and configurations).

4) Specific mechanics for pre-EEP and EEP mitigation asset merging and tracking.

5) Process for credit assignment by project of pre-EEP and EEP assets.

6) Creating and managing a multi-million-dollar, high-quality resource preservation agenda.

7) Process for calculating/quantifying accurate NCDOT mitigation credit needs based upon projects delineated in a volatile seven-year Transportation Improvement Program document.

8) Formal solicitation processes for restoration, enhancement, and preservation asset acquisition.

9) Creating on-going effective interagency communications between NCDOT and NCDENR.

10) Involvement of private for profit bankers, non-profit land trusts, and other conservation organizations in the EEP process.

11) Managing the multi-million-dollar cash flow requiring quarterly status reports to NCDOT.

12) Managing a credible public relations process for a very complicated, expensive, publicly financed concept.

13) The resolution of policy issues and unanticipated issues created by the change.

"Going Live" with the Ecosystem Enhancement Program

At the conclusion of its two-year transition period in July 2005, the EEP owned on a fee simple or conservation easement basis over 15,000 acres of wetlands under restoration and nearly 950,000 feet of freshwater streams under restoration. In addition, over 8,000 acres of high-quality wetlands and over one million feet of high-quality streams had been permanently preserved by fee simple or conservation easement purchases. All WRP assets were consolidated under the EEP. Former full-delivery contract sites of the NCDOT with non-debited assets were transferred to the EEP and became available for debit by EEP.

All acquired mitigation assets are recorded and accounted for by 8-digit hydrologic unit codes (HUC) within a watershed-based planning regimen. The cost of specific mitigation credits are billed to transportation projects in need of mitigation credits from the asset pool being created by the EEP. Over 97 percent of the wetland and stream credits have been assigned to the projects from acquired assets in the same watershed impacted by the respective transportation projects. There are at least three, and potentially as many as five, asset-short HUCs in North Carolina where alternate arrangements are being pursued with the NCDENR, USACE, and other resource agencies.

Recognized Benefits Accrued through the Ecosystem Enhancement Program

Recognized benefits to date of having established the EEP in North Carolina include the following: (1) advanced mitigation efforts through EEP has removed mitigation from the critical path of the permitting process; (2) compensatory mitigation projects and assets are moved years ahead of the construction years; (3) multiple project impacts addressed in a comprehensive

manner generate more comprehensive treatment of watershed needs; (4) transportation project delays are eliminated due to elimination of mitigation needs [no project delay in North Carolina since July 2003]; (5) ecological effects of mitigation are dramatically improved due to multi-agency approach [improving water quality, habitat protection, complements endangered species programs]; (6) environmental stewardship at NCDOT is enhanced; and (7) establishment of the PACG created a framework for structured, open dialogue on mitigation issues in North Carolina.

There was no quick, silver bullet solution in North Carolina. It has been nearly five years since the first facilitated discussion. Perceived contributors to the current success of the EEP seem simple, but they required honest and constant attention. Some features of the program's success include the following:

1) Development of shared goals at the very beginning and committing to those shared goals in signed interagency agreements.

2) Coordinating and merging of work plans in writing.

3) Infusion of integrity into the process.

4) Trust building among the agencies committed to the process.

5) Embracing effectiveness, efficiencies, and, above all, accountability by agencies for their actions and results.

During the transition period a critical task was the development of EEP'S planning, operations, monitoring, and research capacities to meet the short and long-term needs of the NCDOT and other mitigation credit customers. The Research Section has promoted the examination of critical factors facing the EEP related to the lack of clear definition of successful mitigation or shared environmental standards and some persistent disconnects between mitigation science and the regulatory requirements. The Research Section successes and additional recommendations as to existing research needs at the EEP should receive continued attention.

The Evolving National Mitigation Policy Framework

Several federal interagency documents have addressed the matter of compensatory mitigation in the context of the Clean Water Act and the National Environmental Policy Act, including a 1990 memorandum of agreement on determining mitigation between the Department of the Army and the Environmental Protection Agency (EPA). There was a 1995 federal guidance on use of mitigation banks, signed by the U.S. departments of the Army, Interior, Agriculture, Commerce, and the EPA. There was also a multi-agency guidance on in-lieu-fee arrangements in 2000. All of these documents have been important in the development of the national policy on mitigation, but a few will be highlighted in this document.

The Hydrogeomorphic Approach – An Exploration of Functional Loss

In 1997 *The National Action Plan to Implement the Hydogeomorphic Approach to Assessing Wetland Functions* was jointly released by the U.S. departments of Defense, Transportation, Agriculture, Interior, and the Environmental Protection Agency. It represented a new strategy that the federal government planned to follow to implement the hydrogeomorphic approach for assessing wetland functions through the development of an extensive collection of national and regional guidebooks. The Waterways Experiment Station of the U.S. Army Corps of Engineers developed the hydrogeomorphic methodology and has carried the lead in the development of the guidebooks (CFR, June 20, 1997).

The hydrogeomorphic approach (HGM) is a procedure for measuring the capacity of a wetland to perform environmental functions. The primary goal of the HGM approach is to provide a standard tool for consistently assessing wetland functions in a diversity of wetland types in the United States. The approach involves the classification of wetlands based upon ecological characteristics, the use of reference wetlands to establish the potential range of functioning within a wetland classification (ranging from relatively undisturbed to significantly degraded conditions), and the use of a relative index of functions calibrated to reference wetlands to asses the degree of wetland functions. The HGM approach is not envisioned by its proponents to replace, to preclude, nor to supersede the Section 404(b)(1) provision for wetland delineation, sequencing process, or public review (CFR, June 20, 1997).

Three major considerations go into the definition of wetlands into a set of national wetland classifications. The three ecological considerations are (1) landscape setting (land form and position of the wetland in the landscape, (2) water source (precipitation, floodwater, ground water), and (3) hydrodynamics (level of energy in water movement and the direction the water moves on the land. After initial investigation of the matter, seven national classifications evolved (1) riverine, (2) depressional, (3) slope, (4) flats with mineral soils, (5) flats with organic soils, (6) estuarine fringe, and (7) lacustrine fringe (Smith and Klimas, April 2002).

To allow for the significant inter-regional and intra-regional variability in the nation, subclasses sprang from the seven major classifications. Subclasses allowed for a smaller, regional scale of examination of the functional assessment question. Some of the distinguishing characterizations permitting approaching wetland functions on a regional geography are (1) geomorphic setting, (2) water resources, (3) hydrodynamics, (4) vegetation, and (5) soil types (Smith and Klimas, April 2002).

While the HGM approach generally provides a comprehensive set of standards for examination of wetland functions, and is also adaptable to a spectrum of regulatory, planning, management, and educational situations, it is still evolving and not yet considered an industry standard. Some states, due to various geographic, temporal, and economic factors, have opted to use or are in the process of developing other functional assessment methodologies. The science continues to advance on this topic, and the EEP has remained proactive in doing research and developing processes that will help the program develop efficient and scientifically sound tools that improve the identification and assessment of functions associated with impacts. The contributions to date made by NCDOT and others toward this end is a valuable part of environmental stewardship in North Carolina.

The National Wetlands Mitigation Action Plan – A Watershed Context

In 2002 the *National Wetlands Mitigation Action Plan* was released as part of several stakeholder group meetings and in response to a number of earlier evaluations and reports offering critical views of the results of national mitigation policy implementation. Two notables among the critiques were the evaluation presented by the National Academies of Sciences' National Research Council (wetlands program evaluation) and the report from the General Accounting Office on the in-lieu-fee mitigation program.

These two (and other) reports highlighted a number of shortcomings of the ongoing mitigation efforts and recommended a number of policy and programmatic adjustments for federal agencies, state agencies, and others involved in mitigation. Focal points of the challenges to the accepted practices were whether there was actually a "no-net-loss" effect of the existing mitigation program and who was accountable for success or failure of mitigation actions.

The *National Wetlands Mitigation Action Plan* clarified a recommitment to "no-net-loss" and tried to make clear who was responsible for the success of mitigation projects. The *National Wetlands Mitigation Action Plan* specified the federal intentions to advance on the concept of integrating compensatory mitigation into a watershed context. There was an initiation of clarification of the relative environmental desirability of on-site or off-site mitigation and in-kind or out-of-kind mitigation. Vegetated buffers became an issue for clarification in the mitigation field. A need for clarification of the proper usage of preservation for compensatory mitigation was addressed in the plan. Finding an alternative to wetland mitigation sites and more adequately mitigating for stream impacts surfaced as issues for future clarification. As a result of the *National Wetlands Mitigation Action Plan* work began to determine the effectiveness of using biological indicators and functional assessment for evaluating mitigation performance.

The *Plan* committed the federal partners to lead in the development of performance standards in order to more consistently monitor the management and performance of mitigation sites in a watershed context. A shared mitigation database, reporting standards, and other management improvement tools were also commitments outlined in the *Plan* (NWMAP, 2002).

2002 Regulatory Guidance Letter – Watersheds and Ecosystems

Coincidental with the release of the *National Wetland Mitigation Action Plan* was the release of the U.S. Army Corps of Engineers' regulatory guidance letter of December 24, 2002. The letter would prove to be a significant document for over three years in guiding federal policy and the management of mitigation activities in the country. It did not modify existing mitigation policies, regulation, or guidance of the day. It began with an affirmation that the U.S. Army Corps of Engineers district offices would "use watershed and ecosystem approaches when determining compensatory mitigation requirements, consider the resource needs of the watersheds where impacts will occur, and also consider the resource needs of neighboring watersheds" (RGL, 2002).

Corps districts were instructed to rely on a watershed approach and encouraged to increase their reliance on functional assessment methods. They were granted the authority to use a functional assessment approach to describe impacts and determine appropriate mitigation on a case-by-case basis. Functional replacement was recognized as a more accurate application of the "no-net-loss" objective. Wetland and stream losses were left open to a functional replacement methodology. Wetland acres and stream feet were identified as appropriate surrogate measures in the absence of reliable functional loss or replacement data (RGL, 2002).

Establishment or creation of wetland or stream resources, restoration (re-establishment or rehabilitation) of wetland or stream resources, enhancement of wetland or stream resources, and protection (preservation) of resources were defined in the context of the "no-net-loss" provision. Appropriate uses of on-site and off-site mitigation were defined. In-kind and out-of-kind mitigation options were explained. Establishment and maintenance of buffers and the inclusion of riparian areas as accepted mitigation activities were outlined in the letter (RGL, 2002).

Mitigation banks and in-lieu-fee arrangements were specifically allowed as optional alternatives to first-party mitigation activity. Timing requirements were addressed with a general expectation for mitigation construction to occur concurrently with the realization of authorized project environmental impacts. Planning and sequencing of mitigation activities were extensively addressed in the letter (RGL, 2002).

The evolution of federal mitigation policy and regulation toward a watershed perspective and a concern for functional losses in the environment reflected an acknowledgement of the connection among landscape components. Land use, water use, water quality, habitat, and other issues were moving out of the channeled action of earlier years into a perspective of connectivity in a national system of watersheds. This new environmental paradigm would generate new ways of thinking about environmental impacts and the most effective way to mitigate for those impacts.

2006 Federal Proposed Rules for Compensatory Mitigation

During March 2006 the Environmental Protection Agency, U.S. Department of Defense, and U.S. Army Corps of Engineers jointly issued *Proposed Rules for Compensatory Mitigation for Losses of Aquatic Resources* in the *Federal Register*. The revisions were proposed for three noted reasons: (1) to establish performance standards and criteria for use of permittee-responsible compensatory mitigation for activities authorized by the Corps of Engineers; (2) to

improve the quality and success of compensatory mitigation projects; and (3) to account for regional variations in aquatic resource types, functions, and values, and apply equivalent standards to each type of compensatory mitigation. The earlier-mentioned National Research Council recommendations were considered in preparation of the proposed rules. The major thrust of the new regulations was to evolve compensatory mitigation to a watershed-based platform and to strengthen the extent and quality of watershed planning as a basis for assessing functional losses from environmental impacts and the resulting selection of mitigation sites – and, the introductory commentary notes that the proposed rules apply to both wetland and stream restoration mitigation activities.

> The watershed approach uses a landscape perspective that places primary emphasis on site selection, through consideration of landscape attributes that will help provide the desired aquatic resource types and ensure they are self-sustaining. The watershed approach also considers how other landscape elements (e.g., other natural resources and developments) interact with compensatory mitigation project sites and affect the functions they are intended to provide. (CFR, March 28, 2006)

There are specific comments regarding the compilation of watershed planning documents and compensatory mitigation activities being completed in the context of those planning documents.

A second major issue in the proposed rules affecting the future of the Ecosystem Enhancement program is the matter of functional assessment. Where practicable, use of an appropriate functional assessment methodology (e.g., hydrogeomorphic or other mutually agreed-upon approach to wetlands functional assessment) is required to assess and describe the aquatic resource types that will be restored, created, enhanced, and/or preserved (CFR, March 28, 2006).

Another important shift in policy occurs in that in-lieu-fee mitigation programs have five years to comply with the same standards as mitigation banks.

Headed in the Right Direction with the NC EEP

Watershed Planning Base

There was a growing commitment to watershed-based planning in North Carolina that predated the creation of the Ecosystem Enhancement Program. Much thought and work had been applied to the concept through the Wetland Restoration Program, an organization that has blended into the EEP during the prescribed transition period of the EEP. Work has been continued by the EEP, and approximately $6 million per year has been budgeted to expand watershed planning activities. Such planning maximizes the value of the investment made with mitigation dollars. Three groups were established to develop more formalized and scientific approaches to watershed planning and mitigation planning and implementation. Combined, their work will establish the basis of future watershed planning and mitigation activities.

Wetlands Needs Assessment Team (WNAT)

The Watershed Needs Assessment Team (WNAT) worked for two years developing methods of watershed assessment for the Ecosystem Enhancement Program. There was broad agreement among its interagency membership that identification and implementation of compensatory mitigation projects through a watershed approach was a positive course of action.

The results of their work generated two valuable methodologies for watershed assessment and planning in North Carolina. They were to essentially build on one another. The first level of assessment is referred to as a screening methodology. It involves a comparative analysis of the 14-digit hydrologic units within an eight-digit cataloguing unit in order to stratify the hydrologic units for a more detailed assessment and management plan development. This screening methodology displays a heavy reliance on GIS for evaluation of watershed attributes and to identify major problems in the unit. There is a prescribed, step-by-step action plan for the completion of the screening methodology (NCDENR, WNAT, October 2003).

The second methodology deals directly with answering three basic questions in the watershed area:

1) Where are we today? What is the current set of conditions of the watershed area under further examination?
2) Where do we want to be? What is an acceptable set of conditions for the watershed area under study?
3) What are the steps necessary to get from where we are to where we want to be?

In the context of the second assessment methodology, major watershed functional areas are defined for three areas of concern: water quality, hydrology, and habitat. Major water quality functions include elemental cycling and spiraling, removal and transport functions, retention functions, and thermal regulation. Major hydrology functions include subsurface water storage, moderation of groundwater flow or discharge, surface flow or discharge, dynamic surface water storage, and long-term surface water storage. Major habitat functions include maintaining characteristic plant distribution and abundance, maintaining characteristic animal distribution and abundance, and physical habitat characteristics.

There was a grouping of watershed needs into three major categories: watersheds in need of preservation, watersheds in need of preservation and restoration, and watersheds in need of restoration. The cost estimates for a watershed assessment ranged between $200,000 and $400,000, depending on size and potential difficulties faced in specific watersheds. Because of the degree of assessment, the time involved and the expense, it has been recommended that the second assessment methodology should occur at the 14-digit hydrologic unit scale, with allowances for flexibility when a different scale seemed warranted.

Functional Assessment Methodologies

EEP has been associated with two other interagency groups engaged in the examination of the state-of-the-science of functional assessment and how it might be applied in North Carolina. Their work has been focused on how EEP might use functional assessment of environmental loss in its future mitigation efforts. Some of the objectives of the move to functional assessment methodologies are (1) to apply existing functional assessment methods in local watershed planning, (2) to refine existing and evolving assessment methods to increase their applicability across eco-regions, and (3) to identify the strategies and policy framework needed to move from conventional measures of project success to functional measures. A functional assessment of loss methodology will eventually replace conventional mitigation methodologies for defining success in site selection and credit determinations currently used by the EEP. The two pieces of work focused upon wetlands assessments and stream assessment. The wetlands group has issued a draft report of its work. The stream group has not completed a report and is still working on several issues.

North Carolina Wetland Assessment Method (NCWAM)
Wetland Functional Assessment Team (WFAT)

The Wetland Functional Assessment Team (WFAT) has prepared a draft user manual capturing the work of an interagency team that has been going on for many months. The document is an attempt to provide the public and private sector parties involved with compensatory mitigation with an accurate, consistent, rapid, observational, and scientifically-based method to determine the level of function of wetlands relative to the reference condition for each general wetland type identified within North Carolina. The NCWAM does not replace more comprehensive methodologies where actual field measurements might be necessary (NCWAM, March 2006). But it does attempt to define 16 wetland types in North Carolina and establish three general functional ratings for the types of wetlands identified. The 16 general wetland types identified in the report follow:

1) Bottomland Hardwoods Forests
2) Riverine Swamp Forest
3) Headwater Wetland
4) Floodplain Pool
5) Pocosin
6) Hardwood Flat
7) Pine Flat
8) Pine Savannah
9) Small-Basin Wetland
10) Non-Riverine Swamp Forest
11) Mountain Bog
12) Seep
13) Non-Tidal Freshwater Marsh
14) Tidal Freshwater Marsh
15) Salt/Brackish Marsh
16) Estuarine Woody Wetland

Other groups have defined classifications of North Carolina wetland areas numbering up to 59 types listed by the NC Natural Heritage Program. The NCWAM report defines each type designated in the report.

In addition to consistency of effort and collection of comparable data, an objective of the NCWAM was to create a rapid field information collection process of functional assessment that would take approximately 15 minutes. Combined with GIS data, photographs, background experience, and site familiarity, a field assessment form allows a wetland assessor to perform a functional assessment rating of wetland sites around the state.

North Carolina Wetland Assessment Method (NCWAM)
Stream Functional Assessment Team (SFAT)

Although the Stream Functional Assessment Team (SFAT) report has not been completed, the proposed analytical and field work exercises have been structured around the three major functional areas mentioned earlier: water quality, hydrology, and habitat.

Water quality analysis will focus on recent weather, seasonal factors, channel flow factors, presence of dozens of species of aquatic life, buffer situations, pollutant discharges, and stream shading factors. Hydrology analysis will focus on streamside area attenuation, floodplain issues, buffer issues, stream stem density, microtopography, and stream stability/instability. Habitat analysis will focus on roots in stream bank, buffer characteristics, channel flow, presence of dozens of species of aquatic life, riffle/run substrate embeddedness, sediment deposits in pools, flow obstructions, streamside vegetation, stream areas signs of wildlife, and adjacent wetland characteristics.

The EEP Research Section

The Research Section is responsible for assuring that EEP's development is based on the best scientific information available. The purpose and goals of this section were defined early:

1) To improve project success.
2) To reduce maintenance and overall costs by increasing the understanding of the applicability and limitations of various mitigation restoration methods.
3) To improve the ability to measure and demonstrate success at both the individual project level and the larger watershed scale.
4) To improve monitoring and reduce monitoring costs.
5) To provide quantitative and qualitative measures of effectiveness of evolving mitigation strategies at watershed scales.
6) To contribute to the advancement of restoration ecology and the technical practice of wetland and stream restoration.

This section has initiated a number of specific programs or activities to help implement these goals. They have established a list of prioritized strategic research needs and initiated targeted projects to address the issue of restoration methodologies. As the science of mitigation advances, a comprehensive research program is essential to EEP's future success.

One of the challenges that EEP faces is developing and maintaining a database containing quantitative and qualitative information on pertinent natural communities. The identification and understanding of these natural communities will aid in the structuring of properly targeted mitigation projects and will lay the foundation for meaningful evaluation of mitigation successes and failures.

Carolina Vegetation Survey

The Carolina Vegetation Survey is a voluntary, multi-institutional collaborative founded to document and disseminate information on the composition and condition of natural vegetation in North and South Carolina. Purposes of the group are to inventory biodiversity, monitor environmental impacts, and assess conservation measures. The CVS is based at the University of North Carolina (Chapel Hill) in the curriculum of Ecology. The program is overseen by a team from four institutions, including UNC-Chapel Hill, North Carolina State University, The North Carolina Natural Heritage Program (NC Department of Environment and Natural Resources), and The Herbarium of the North Carolina Botanical Garden (UNC-CH).

Coupling the CVS and the EEP will provide for a more comprehensive coverage and investigation of the diversity and variation of natural communities across North Carolina. It will offer the EEP a greater opportunity to have access to natural communities of interest to the program. The EEP/CVS arrangement offers the possibility of a broader, larger compatible digitized database on natural communities with easy submission and easy reporting capabilities. Better analysis and reporting will assist the EEP in targeting restoration mitigation to most appropriate locations and site conditions.

Catchment Area Studies

Catchment area studies are done to demonstrate the effects of mitigation restoration projects on water quality, habitat, and hydrology at larger watershed scales in order to achieve watershed improvement goals. They help in the understanding of spatial relationships among small-scale restoration areas and larger-scale catchments. Catchment area studies demonstrate watershed-scale improvements resulting from alternative mitigation strategies and help build acceptance of alternative mitigation strategies.

Catchment area studies underway in North Carolina through the EEP are the Purlear Stream Restoration Project in Wilkes County, Cow Swamp in Pitt County and nearby counties, Ripshin Creek in Ashe County, and Sandy Mush Creek in Buncombe and Madison Counties.

Understanding how ecosystems respond to disturbances is critical to any attempt to maximize the impact and value of the EEP. Good science must be used in the program to protect, manage, and restore vital ecosystem functions on which human life depends. The state's rapid urbanization and the significant alteration of land use in North Carolina are contributing to the degradation of our streams. There is a need to understand the impact of the increasing anthropogenic influences on streams and wetlands and how different scale ecosystems handle similar disturbances. Work currently underway will aid the EEP in appropriately targeting resources to maximize environmental return from mitigation investments.

Conclusions and Recommendations

There are a number of directions, initiatives, or actions outlined in this report that are working for the betterment of North Carolina's natural environment and the welfare of the North Carolina Department of Transportation. These directions, initiatives, and actions are embedded in over a decade of federal and state government thinking and program development about compensatory mitigation and watershed planning and management. The concepts have moved from scientific curiosities in the late 1980s and early 1990s to become major planks of federal environmental policy and regulation.

North Carolina and a small number of other states have operated on the cutting edge of these environmental policy and regulatory changes for most of the past decade. North Carolina has seen especially significant advancements on environmental preservation and restoration and major improvements in the movement of transportation projects through the evolving environmental review process currently in place in the nation and state. The benefits of striving to understand and operating within the environmental regulatory framework should be becoming more obvious each program year.

The collaborative features of the North Carolina environmental review process are especially beneficial for the North Carolina Department of Transportation. When weighed against the estimated financial costs, NCDOT Board concerns, and the local public outcry related to project delay, the price for a continuing collaborative environmental review framework in North Carolina reflects favorably and will be a small part of future costs for the North Carolina Department of Transportation and can only generate good results for the Department and the state.

The recommendations for the North Carolina Department of Transportation based upon the findings contained in this report are as follows:

- Support the development of a North Carolina Geographic Information System that provides the data layers necessary for cost-effective watershed assessment and planning activities. The benefits for the NCDOT will be cost reduction and better location in the development of future mitigation sites. The impacts of compensatory mitigation outlays by NCDOT are maximized for the department in the long run.

- Support DENR and the EEP in their efforts to finance the initiatives being developed by the Wetlands Needs Assessment Team. The investment in this work refines the technical work behind the development of successful mitigation. Successful mitigation is the only type of compensatory mitigation that meets the Clean Water Act regulations applied to the NCDOT.

- Support the work being done by the Wetlands Functional Assessment Team and the Stream Functional Assessment Team. These are two of the most important groups addressing the future of mitigation in North Carolina. Their work is laying the foundation for streamlining all mitigation development in North Carolina. They demonstrate a firm understanding of what future compensatory mitigation will involve.

- Continue to support the Research Section of the Ecosystem Enhancement Program. The collaborative relationships being built by this group with the University of North Carolina System will mean the creation of the highest quality mitigation sites, which should improve the mitigation credit ratios for the NCDOT in the future, thereby contributing to lowering NCDOT costs for compensatory mitigation.

- Keep all sectors of the NCDOT informed of the intent of the Department to support these initiatives. It is critical that all organizational units at NCDOT understand that these initiatives represent a significant financial asset for the department that will reduce both project development and compensatory mitigation costs.

- Constantly reassess the meshing of the NCDOT compensatory mitigation program and the evolving federal rules and regulations in order to stay ahead of the compensatory mitigation curve and to influence the formulation of future rules and regulations. The environmental work being performed by the North Carolina Department of Transportation and the North Carolina Department of Environment and Natural Resources is currently serving as a national model on these issues because to date the collaborative group has read the signals well.

- Support the establishment and the development of a science panel to review the product of these various task force groups with the intent of setting the highest, most consistent scientific standard for compensatory mitigation and maximizing NCDOT return on investments for compensatory mitigation purchases. The second phase of this project will provide recommendations for the composition and structure of this science panel.

In the past NCDOT has spent as much as $80 million per year for compensatory mitigation. This considerable investment should represent the very highest quality mitigation to assure that the natural environment is held harmless, and potentially improved, by this investment of public funds. NCDOT's environmental stewardship ethic, transportation project delivery with environmental excellence, is advanced by EEP's comprehensive approach to watershed-based mitigation. Implementing these recommendations will help assure that North Carolina has both the environmental quality and transportation excellence that are so important to the state's long-term economic vitality and quality of life.

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