Environmental Assessment and Risk Analysis Element

Research Project Summary

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Creating Indicators of Wetland Status (Quantity and Quality): Freshwater Wetland Mitigation in New Jersey

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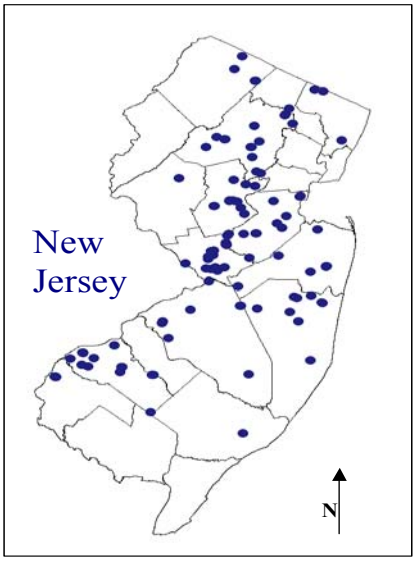
Abstract

This study was initiated to determine the extent to which approved freshwater wetland mitigation sites had been constructed in terms of area achieved; concurrence with approved plans; and relative quality of constructed wetlands. In addition to these indicators of current conditions, this research developed a standard rapid assessment method that can be used to monitor New Jersey's wetland mitigation trends into the future. The study also enhanced NJDEP's Mitigation Database by establishing a geographic information system application. A peer review committee consisting of leading wetland scientists from academic institutions, government and non-governmental organizations, and the private sector provided guidance and oversight throughout the study.

Introduction

Approximately 15% of New Jersey's land is freshwater wetlands, while 4% is tidal wetlands. Wetlands are critical natural resources because they perform a suite of important functions including: improvement of water quality through nutrient cycling; flood attenuation; groundwater recharge; prevention of shoreline erosion; critical habitat for a great diversity of plant and animal species; as well as providing aesthetic and recreational opportunities. It has been estimated that New Jersey lost 39% of its wetlands between the 1870s and 1970s and perhaps 20% between the 1950s and 1970s. The importance of tidal and freshwater wetlands was recognized when the New Jersey Legislature enacted the New Jersey Wetlands Act of 1970 and the New Jersey Freshwater Wetlands Protection Act of 1987 (considered to be one of the most stringent wetland laws in the United States). These state statutes provide additional protection beyond federal law by regulating more than dredge and fill activities, as well as providing protection in buffer areas for freshwater wetlands.



Study site location map

Yet, as the most densely populated state in the country, experiencing a population increase of approximately 1% annually over the last 10 years, New Jersey's wetland resources are subject to increasing stress. Recent data for New Jersey show a loss of approximately 1,755 acres of wetlands per year between 1986 and 1995, a period of time before the Freshwater Wetlands Protection Act had become fully operative. Even after that period, the implementation of the Act has still allowed for the disturbance of approximately 150 acres of freshwater wetlands per year. Recognizing their importance, as well as these challenging trends, NJDEP has established a strategic planning goal for wetlands: *"improve quality and function and achieve a net increase by 2005. Explore innovative techniques for creation, enhancement and maintenance of New Jersey wetlands."*

Techniques to mitigate the loss of wetlands from permitted activities include wetland creation, enhancement, restoration, preservation and banking. This research project summary describes research that was specifically developed to measure progress toward the wetlands strategic planning goal with respect to mitigating wetland losses at freshwater sites. Freshwater sites were chosen as the study focus because these are the wetlands types with the most acreage in New Jersey, yet least studied in terms of mitigation. The research provides a standardized protocol to measure the quantity of wetlands constructed, compliance with approved plans and a means to evaluate the potential of the constructed wetland to evolve to a mature, functional system. In addition, a revised data management system was developed which enhanced NJDEP's mitigation database with a Geographic Information System.

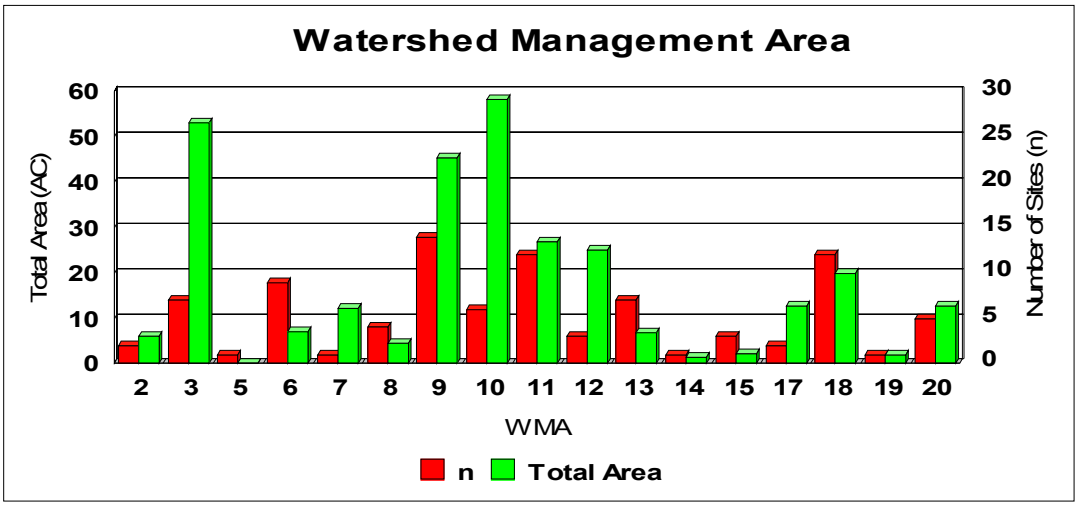
Methods

Field evaluation was conducted for 90 freshwater wetland mitigation sites (out of 171 approved freshwater wetland mitigation projects in NJDEP's database at time of study commencement) that were distributed throughout 17 of New Jersey's 20 Watershed Management Areas (WMAs). Study sites included a total of 326 acres of proposed wetland mitigation area and ranged in size from 0.08 to 41.20 acres, with an average proposed size of 3.62 acres. Forested (PFO) and emergent (PEM) wetlands were the most common type of freshwater wetland proposed, accounting for 41% and 33% of total proposed freshwater wetland mitigation area, respectively. Sixty-four percent of the sites, representing 60% of the total area evaluated, were greater than 5 years old.

Wetland Area Achieved was determined for 85 mitigation sites and calculated based upon the results of a wetland delineation performed following the procedure in the *1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. Delineation methodology included observation of hydrology, soil, and vegetation characteristics of wetland and upland communities. Five sites were eliminated from this evaluation because mitigation site boundaries distinct from pre-existing wetlands could not be readily discerned in the field. A visual estimate of wetland community type (i.e., forested, scrub/shrub, emergent, State open water) was made during delineation and recorded as percent of total wetland area. Wetland Area Achieved was expressed in terms of total acreage achieved based on the area delineated in the field using a Global Positioning System (GPS) unit.

Concurrence was determined for 88 mitigation sites and consisted of a field inspection to verify and measure the extent to which the constructed mitigation site conforms to and is consistent with NJDEP-approved mitigation plans. Concurrence evaluations could not be performed on two of the study sites due to insufficient plan information in the mitigation files. Scoring was based upon visual estimates of several variables that could be readily observed in the field: grading; hydrology; soil; vegetation cover; vegetation survival; and design. Raw scores for each variable were expressed as a percent from 0-100 representing the relative degree to which the constructed mitigation site was consistent with approved plans and specifications. A weighting factor was assigned to differentiate the relative importance of each variable to the final score. Observations were made to identify specific corrective action necessary to comply with approved plans and specifications, as well as improve status of the mitigation site.

Relative quality was determined using a Wetland Mitigation Quality Assessment (WMQA) tool developed through this research and determined for 74 mitigation sites. The WMQA was only applied to areas delineated as jurisdictional wetlands. A relative wetland quality value (rating scale of 0 to 3) was based on the presence or absence of readily observed field indicators of the following variables: hydrology; soils; wildlife suitability; vegetation; site characteristics; and landscape features. The variables were considered representative of the relative probability that the mitigation site would develop into a natural wetland system and provide desirable wetland functions over time. A weighting factor was



Number of Sites and Total Area in Each Watershed Management Area

assigned to differentiate the relative importance of each variable to the final score.

All field data were collected using a Trimble Pathfinder Pro XRS© GPS unit. All field observations were recorded on standardized data forms. Photographs were taken at every site.

Results

The average percent freshwater wetland area achieved was 45%, indicating that approximately 0.45 acre of wetland**s** was achieved for each acre of mitigation proposed. The range of wetland area achieved was 0 to 140%; six sites achieved more than 100% of proposed acreage while 16 sites failed to achieve any wetlands. On average, 92% of proposed emergent wetland acreage was achieved, while 1% percent of proposed forested wetland acreage was achieved. Open water acreage was achieved almost three times in excess of that proposed.

The Concurrence Evaluation indicated that, on average, sites concur with 48% of the designs and specifications in permit plans. Concurrence Evaluation scores ranged from 0 to 100%. Corrective actions identified through the concurrence evaluation included: regrading consistent with permit plans at 84% of the sites (partially accounting for low concurrence with permit plan hydrology); application of supplemental topsoil at 47% of the sites; and replanting at 84% of the sites to conform with permit plans.

Average WMQA index score was 0.51 out of a maximum possible score of 1, finding that freshwater wetland creation sites, on average, met half the criteria that would indicate they have the potential to function as natural wetlands over time. WMQA scores ranged from 0.25 to 0.83. Low scores for hydrology, the variable weighted highest in the WMQA based upon independent judgment of 15 wetland scientists in New Jersey surveyed for this research, were found to result from extremes in water conditions — either too much or too little. In both cases, it appeared as if low hydrology scores resulted from inappropriate or inadequate sources of hydrology or established grades that were inconsistent with the hydrologic regime of the site. In areas where the mitigation site exhibited favorable hydrology and soil conditions, natural recruitment of desirable wetland vegetation was generally observed. Establishment of invasive species or persistent grasses was evident on numerous sites and in some instances precluded the establishment of desirable wetland plants.

A compensation ratio (mitigation proposed/mitigation achieved to wetland losses in a single permit action) in excess of 1:1 is required to attain a net increase in wetland area. Examination of compensation ratios based on the 90 study sites revealed that for each acre of impact to wetlands approved by NJDEP, on average 1.80 acres of compensatory mitigation were required. The actual ratio of acres of mitigation wetlands achieved to those impacted for the 75 mitigation sites, for which sufficient information was available to determine ratios, was calculated to be 0.78:1. On average, for each acre of impact to wetlands approved by NJDEP, 0.78 acres were actually achieved through mitigation, a net loss of 22%.

Compensation ratios can be examined by wetland type to determine replacement of ecological value lost from permitted disturbances. When analyzed by type of wetland compensation, emergent wetlands (n = 14 sites) were the only types where mitigation exceeded impacts (average compensation ratio of 1.29:1); this was still below the approved compensation ratio of 1.85:1. Forested wetlands achieved an average compensation ratio of 0.01:1 (n = 31 sites). These results suggest that for the two most commonly permitted freshwater mitigation wetlands (forested and emergent), New Jersey has achieved a net increase of emergent wetlands but not forested wetlands.

Several other analytical applications of the data were explored: analysis by New Jersey Watershed Management Area (WMA); site size; site age; and source of hydrology. Site age did not correlate with the study indicators. Other analyses suggested possible relationships with study indicators (watershed-based local conditions and site size); however, small sample sizes limit the ability to confirm these possibilities and further research would be needed to explore these hypotheses. More sites greater than one acre in size would be needed to further examine the influence of site size on mitigation outcome.

The data were analyzed to determine effect of hydrologic source on project indicators. Although Wetland Area Achieved remained relatively constant among sources of hydrology, stream diversion resulted in the highest average score of 61%, well above the mean value of 45% when all sites are combined. Stormwater-driven wetlands scored substantially lower for the WMQA Index values than wetlands with other hydrologic sources. Stormwater-driven mitigation wetlands were also found to be more likely to have in excess of 50% cover of nuisance and invasive vegetation than mitigation wetlands driven by other sources of hydrology.

Recommendations

NJDEP could facilitate NEPPS goals for wetland resources and improve future mitigation projects through several mechanisms. Continued focus should be on avoiding impacts to wetlands and minimizing the effects of permitted activities on wetlands. Refinement and standardization of permitting, mitigation planning, monitoring and maintenance, and compliance inspections/enforcement of mitigation sites should continue. Some of these issues have been addressed in the recently adopted revisions to the New Jersey Freshwater Wetland Protection Act Rules that specifically outline the performance and pre-construction requirements for wetland mitigation proposal submissions. Increased resources should be devoted to implementation, oversight and tracking of mitigation projects once they have been approved by NJDEP. Tracking of approved mitigation projects should include an up-to-date, well-maintained data management system for filing and retaining monitoring reports and other administrative documents. Research on

New Jersey's wetlands resources should continue and the results provided to regulatory staff.

Conclusions

Based on a subset of 90 New Jersey freshwater wetland mitigation sites, NJDEP has not yet met its goal to improve wetland quality and function and achieve a net increase. Emergent and open water wetland projects were more likely to succeed than forested wetland projects. Some high quality wetlands of all proposed mitigation types, however, were observed during the course of this study. These successful projects provide evidence that wetland creation is possible for all community types given the level of knowledge currently available.

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