REPORT ON THE EFFECTIVENESS OF PERMITTED MITIGATION

Prepared by

Florida Department of Environmental Regulation
Pursuant to Section 403.918(2)(b), Florida Statutes

Submitted to
Lawton Chiles, Governor
Gwen Margolis, President of the Senate
T. K. Wetherell, Speaker of the House of Representatives

March 5, 1991

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

In 1990, the Florida Legislature instructed the Department of Environmental Regulation to assess the use and effectiveness of mitigation in Wetland Resource Regulation permitting. The study was to determine the acres of wetlands permitted to be created or enhanced, to evaluate the effectiveness of permitted mitigation, and to identify needs for improvement. This is the report.

From January 1, 1985 through December 6, 1990 the Department issued 1,262 permits that included creation, enhancement, or preservation of wetlands. The permits authorized the loss of 3,305.42 acres of wetlands, and required that 3,344.9 acres be created, 7,300.9 acres be enhanced, and 7,587.54 acres be preserved.

To evaluate the effectiveness of creating wetlands as mitigation, the Department examined 119 wetland creation sites required by 63 permits.

Sites included freshwater herbaceous and forested wetlands, and tidal herbaceous and mangrove wetlands. Each was evaluated for compliance with the requirements of the permit and whether the wetland created at the site was ecologically successful.

The study found a high rate of noncompliance. Only four of the 63 permits reviewed for the study were found to be in full compliance with the mitigation requirements of the permit. Noncompliance ranged from minor non-submittal of reports to major deviations from the permitted mitigation design.

In addition, separate reviews by Department District Offices and others indicate that in about 34 percent of permits no mitigation has been attempted although wetland losses had occurred.

Ecological success was defined as whether the site is, or appears likely to become, a functional wetland of the intended type of mitigation wetland.

The ecological success rate of mitigation in permits reviewed for this study, at sites where the mitigation was actually built, was 27 percent. Freshwater permits with a 12 percent success rate, were less successful than permits for tidal wetlands, where the success rate was 45 percent. In some cases it appeared that success rates could be improved by simple remedial measures, and in general, the tidal permits appeared more likely to achieve success through corrective measures than the freshwater permits.

The study resulted in several recommendations for legislative improvements and improvements in Department policy or rulemaking.

Recommendations for the Legislature

- Grant the program the authority to assess compliance fees when permits are issued.
- Grant the authority to the Wetland Resource Regulation program to assess administrative fines for noncompliance with permit conditions that require documents to be submitted.
- Approve 17 additional positions requested in the 1991/1992 budget for wetland resource compliance and enforcement, as well as an additional environmental specialist to assist with the staff work.
- Implement a step pay raise system within the environmental specialist series to retain qualified, experienced personnel.

Recommended Improvements in DER Policy or Rules

- The primary focus of the wetland resource regulation program must be on <u>avoiding</u> wetlands and minimizing the effects of permitted activities on wetlands
- After all attempts to avoid or minimize wetland impacts have occurred, and the applicant has proposed mitigation, the Department should consider mitigation options in the following sequence:
  - enhancement of degraded wetlands, or restoration of historic wetlands,
  - preservation of other wetlands in conjunction with other forms of mitigation, and finally,
  - wetland creation.

  Creation should <u>only</u> be accepted if review of the creation proposal indicates that it includes features to ensure that it will be successful. In all cases, if the proposed mitigation does not provide reasonable assurance that the wetlands losses can be offset, the project should be denied.

- Permits that authorize wetland creation as mitigation should only be authorized for freshwater systems when the applicant has substantiated what the future range of water table elevation will be at the creation site. In all instances when tidal and freshwater creation is authorized as mitigation, the permits must require that the wetlands be constructed before, or concurrently with, the authorized impacts. The applicant is clearly responsible for the ultimate long-term success of the mitigation.

- Basin black mangroves are unique systems for which successful wetland creation technology does not exist. These fragile and critical systems should not be permitted for destruction unless the required wetland creation is completed and is determined to be successful or clearly trending toward success before the destruction occurs.

- Guidelines should be developed that outline the circumstances under which enhancement of wetlands alone is not adequate to offset wetland losses.

- Preservation of other wetlands as mitigation should only be used in conjunction with wetland enhancement, restoration, and creation.

- Mitigation proposals should not be accepted that would eliminate other habitats (wetland or upland) unless the habitat would be destroyed as part of the project or is a disturbed or non-functional system.

- The compliance record of an applicant should be considered as part of the decision to issue or deny permits. Past noncompliance should be grounds for possible denial.

- All mitigation sites should be placed in a conservation easement.

INTRODUCTION

The Henderson Wetlands Act, passed in 1984, requires the Department of Environmental Regulation to consider mitigation proposed by the applicant as the Department decides whether to issue or deny a wetland resource (dredge and fill) permit. Mitigation is defined here as the creation, enhancement, or preservation of wetlands to help offset wetlands that may be damaged or destroyed by a permitted project.

The Department has been issuing wetland resource permits that include creation of wetlands as a permit condition since 1979. Many of those issued before the Henderson Act were associated with restoration after mining. Other early wetland creation projects were to restore tidal wetlands.

Mitigation is intended to offset the biological and other functions that are lost when natural wetlands are destroyed. **For mitigation to be effective, projects that create or enhance wetlands must become self-sustaining wetland systems that will replace the lost functions of the natural wetlands.**

Under the wetland resource regulation program, mitigation has been aimed primarily at creation and enhancement of wetlands. However, preservation of natural wetlands also plays an important role--normally as part of a mitigation package that also includes wetland creation or enhancement.

Since creation of wetlands has been the primary type of mitigation employed in wetland resource regulation to date, initial emphasis on wetland mitigation success and compliance has focused on these projects.

Approximately half of the standard form permits issued since 1984 have included some form of mitigation, but the percentage of short form (smaller, or minor) permits that include mitigation varies among the Department's District offices--ranging from under 5 percent to near 90 percent of the permits issued. The wide range is caused primarily by differences between the Districts in the amount of wetlands and the percentage of projects permitted in Outstanding Florida Waters (which require a stricter permitting test).

In 1990, in an attempt to assess the use and effectiveness of mitigation in wetland resource regulation, the Florida Legislature directed the Department to conduct a study (paragraph 403.918(2)(b), Florida Statutes) to:

- Indicate the acreage of wetlands statewide permitted to be created or enhanced;
- Analyze a representative number of different types of mitigation sites, indicating;
  - the effectiveness of each type;
  - the reasons observed for success or failure;
  - any legislation needed to improve the permitting, compliance and enforcement process to protect the state's wetlands, including proposed sources of funds.

Overall Rate of Success

The study focused on whether mitigation has been successful. Separate reviews have shown that for a large number of projects, the required mitigation simply was not done.

The Department's Central Florida Office inspected 24 permits in late 1990. In six, none of the required mitigation had been built. The South Florida District inspected 10 permits in the summer of 1989. In two of these permit areas none of the mitigation had been built. The Southwest Florida Aquatic Preserves office of the Department of Natural Resources inspected 43 Department of Environmental Regulation permits in late 1989, and at 18 none of the required mitigation had been built. The Vero Beach office of the U.S. Fish and Wildlife Service inspected 20 Corps of Engineers and Department permits in early 1990, and found seven where there had been no mitigation.

Substantial percentages of required mitigation projects have not been built or started. In significant numbers of other projects, mitigation has been only partially built.

Based on results of the study, 27 percent of the required mitigation projects could be successful--12 percent of the freshwater permits and 45 percent of the salt water permits. The rate of success would be higher--rising to 40 percent, 29 percent, and 52 percent respectively--if simple remedial measures were implemented.

This document reports the results of the Department of Environmental Regulation study.

ACREAGE ESTIMATES

METHODS

Method of tracking wetlands permits- The Department uses its Ground water Management System to track the acres of wetlands which are lost, created, enhanced and preserved under the permitting program. All wetland resource permits are entered into this system. However, many of the permits with entries in the creation, enhancement, and preservation acreage categories reflect mitigation imposed under requirements of other agencies, and wetlands created and enhanced as part of environmental restoration projects.

Methods used for this Report- For a statewide estimate of the acres of wetlands permitted to be created or enhanced, all entries in the Ground Water Management System which list acres created, enhanced, or preserved between January 1, 1985 and December 6, 1990, were selected for analysis. Projects that involved creation, enhancement, or preservation of more than 500 acres were examined individually to remove the large-scale public works restoration projects or others that did not involve Department mitigation under the wetland resource regulation program.

RESULTS

The acres lost, created, enhanced, and preserved are shown in Table 1, Figures 1 and 2.

Of the 1,262 permits, 988 were indicated to have permanent wetland losses totaling 3,305.42 acres.

As mitigation for these losses:

- 837 permits required the creation of 3,344.90 acres of wetlands
- 425 permits required enhancement of 7,300.90 acres of wetlands
- 370 permits required 7,587.54 acres of wetlands to be preserved from development.

WETLAND CREATION

METHODS

Any evaluation of mitigation requires a field inspection of the mitigation wetlands which have been built, along with review of the proposed mitigation design, the permitted mitigation plans, and the conditions included in the permits.

The constraints of time required that this study focus only on standard form mitigation projects permitted in the Bureau of Wetland Resource Management in Tallahassee. These projects involve the largest effects on waters of the State and include large amounts of required mitigation. However, information from routine short form permit compliance inspections, where available, is included in the discussion in the section on results.

Inspection sites for the constructed wetlands were chosen based on whether some or all of the mitigation included in a permit had been built. As many as could be visited within the available time--from April to November 1990--were inspected.

A total of 119 mitigation sites required by 63 permits were inspected. They included 26 forested wetland sites, 34 freshwater herbaceous wetland sites, 55 mangrove sites, and 11 salt marsh sites. (Seven sites contained both herbaceous and forested components.)

Each detailed site visit included three evaluations;

- Adherence to the permitted design (site dimensions, elevations, soil treatments, plantings, and other requirements of the permit)--permit compliance,
- The apparent ecological success of the mitigation as implemented, and
- Whether the mitigation site is within the wetland resource jurisdiction of the Department.

Factors considered in the ecological analyses included water quality and habitat, and the presence of desirable or nuisance or exotic vegetation. Related abiotic factors, such as soils, hydrologic regime, and topography, also were evaluated. (An example of the field assessment forms used for each inspection is included as Appendix B.)

Finally, the Department evaluated the adequacy of the permit documents, including the clarity and completeness of drawings depicting the proposed mitigation site, specific conditions relating to the construction and planting requirements of the site, adequacy of success criteria for evaluating the created wetland, and whether periodic reporting of status, maintenance, or monitoring for success was required.

RESULTS AND DISCUSSION

Because of their intrinsic differences, freshwater and tidal sites are discussed separately. Tables 2 and 3 summarize the field summary sheets for the major factors which were analyzed. (Copies of field summary sheets for each site are available upon request.)

Freshwater Systems

A total of 34 permits were reviewed that required creation of freshwater wetlands, including 20 permits that included forested wetlands (at 26 sites), and 17 permits that included herbaceous wetlands (34 sites). (Some permits included as many as ten sites, and five of the 34 permits required creation of both forested and herbaceous wetland.)

Permit compliance - Of the 34 permits, one was in complete compliance with all of the permit mitigation requirements (Table 2). The remaining 33 permits were out of compliance to some extent--ranging from non-submittal of reports to major deviations from permitted design. By focusing only on permit requirements that are important to the likelihood of the success of mitigation (Table 2), the total compliance rises to three of the 34 permits.

Types of Noncompliance

Topographic noncompliance--constructing all or part of the creation site at elevations different than those specified in the permit--was found in 22 of the 34 permits. This noncompliance ranged from truncation of the

transition zone between the created wetland and the upland, to construction of the wetland several feet higher or lower than the permit required. Three sites showed positive trends toward ecologic success. In these cases, the in-field construction change was probably an improvement on the permitted design. The remaining 19 permits were either too new to effectively evaluate or were not successful.

Configurational noncompliance--changes in the permitted site configuration--was observed in ten of the 34 permits. In some cases these changes were made to preserve stands of upland trees for habitat reasons. These types of decisions implemented in the field are not detrimental, as long as the acreage of the mitigation site is not reduced and the changed configuration does not negatively affect some aspect of the wetland's functions. There rarely were drawings of record of the constructed topography available to verify any changes in acreage used for mitigation. Nor were configurational changes commonly brought to the attention of the Department office that issued the permit, but were discovered during the course of compliance inspections.

Soils noncompliance--noncompliance with the mucking requirements--was observed in eight of the 34 permits. This form of noncompliance included not using any muck, using less muck than was required, and using muck that included seeds of nuisance species of plants when the permit specifically required otherwise. Lack of adequate muck, or exposure of rock or clay hardpan, prevented successful establishment of vegetation and wetland soils at several sites. In some sites where the required 6 inches of muck had been placed, the muck, laid over hard substrate, was not deep enough to allow many plant species to thrive. Aquatic vegetation and vegetation that requires little root space were seen at the inundated sites in these cases. It was not possible to evaluate whether the dry sites had been mucked, because any muck would have oxidized and disappeared.

Vegetation noncompliance--complete lack of the required plantings or a significant alteration in the vegetation planted compared to that which was approved--was found in 19 of the 34 permits. Permits often provide a list of species to be used and then either specify that all of the species are to be used, a specific proportion of the species are to be used, or do not specify which species should be used. This report considered a permittee in noncompliance when either of the first two instances were violated.

Noncompliance relating to the elevation of the connection between the created and natural wetland--an unapproved alteration of the permitted wetland outfall invert elevation that was detrimental to the wetland--was observed in five of the permits. This refers to instances where the controlling elevation of the wetland was altered.

For example, in one case, the wetland was designed to receive treated stormwater from a stormwater lake. The permit required that the stormwater lake be maintained at an elevation above the mitigation wetland so water could overflow into the mitigation wetland. The stormwater lake appeared to have been built in compliance with the permit plans. However, a notch in the lake's secondary overflow was chiseled by hand, diverting water away from the mitigation site. As a result, the mitigation wetland received substantially less water from the stormwater lake than contemplated in the original design.

Success Criteria - Success criteria were met in two of the 34 permits (Table 2). By implementing simple remedial actions, such as control of nuisance and exotic species and construction of connecting flowways, another eight permits could become successful. The remaining 24 permits either would require earthwork and replanting to become successful, or are unlikely ever to be successful because of poor design. The most common reason for neither meeting nor trending toward success, was the presence of upland vegetation caused by inappropriate hydrology and a lack of hydric soils.

Ecological Success - Herbaceous wetlands usually are constructed by scraping uplands down to the water table and applying a thick layer of muck taken from the wetland to be eliminated by the project. However, when the site to be eliminated is covered by nuisance and exotic plants, other organic material or muck is used and the site is planted with nursery stock. Careful supervision of construction to ensure that the wetland floor is excavated to the water table and that the muck used does not contain nuisance or exotic species--combined with periodic maintenance of nuisance and exotic species--should provide reasonable assurance that a successful herbaceous wetland can be created.

Forested wetlands usually are constructed by scraping uplands down to the water table, applying a thick layer of muck from the wetland to be eliminated, and planting sapling trees. Careful supervision of construction to ensure that the wetland floor is excavated to the water

table and that the muck used does not contain nuisance or exotic species--combined with periodic maintenance of nuisance and exotic species--should guarantee creation of a successful forested wetland. However, because of the time required for a mature forested wetland to develop, it remains unclear whether forested wetlands can be created.

Ecological success, as used here, means that the wetland site is or seems likely to become a functional wetland of the intended mitigation wetland type--based on vegetation, soils, hydrology, and faunal usage. Of the 34 permits reviewed (Table 2), one attained ecological success, three showed positive trends toward success, more time will be required before four other sites can be fairly evaluated, and the remaining 26 probably will not be ecologically successful. Six of the 26 might become successful if simple remedial actions are undertaken. Therefore, in the best case, 14 of 34 permits either are successful, or possibly could be made successful with some small additional effort.

Contrary to expectations, there was no difference between forested wetlands and herbaceous wetlands in the ecological success category. Experts have thought that herbaceous wetlands would be easier to create than forested wetlands, but for the two types examined in this study, the proportion of "successful", "trending to success", "too soon to evaluate", and "unsuccessful" mitigation did not differ. It appears that creation of freshwater wetlands of either type is more difficult than had been believed.

The problems associated with topography, configuration, jurisdictional connections, plantings, and nuisance and exotic species control are surmountable if the site has an appropriate hydrologic regime. However, hydrology is often beyond the control of the permittee. Where the elevation of the water table is not controlled, or where mitigation is constructed at a distance from natural wetlands,
the likelihood for building a functional wetland is low. Even where hydrology appears to be controlled, results are not always predictable. In one case with controlled ground water elevations, a sink developed which drained the site.

Critical factors for ecological success - For creation of freshwater herbaceous and forested wetlands, the following four factors are critical in assuring a high likelihood of success.

- Constructing the wetland floor at the proper elevation relative to the ground water table is the most difficult and critical factor. Of the 34 permits, 16 had problems with the water table (Table 2).

Several factors must be considered in designing the mitigation wetland floor: proximity to natural wetlands, size of the contributing watershed, and variation of the normal wet and dry cycles within and among years. The likelihood that the water table will be intercepted is greatest when the wetland is designed to be adjacent to other wetlands. However, if the existing wetlands are overdrained by ditches, canals, or wellfields, building a contiguous mitigation wetland probably will result in failure.

If the natural wetland only goes through a natural cycle of drawdown, the likelihood of success is much greater--although if drought occurs during establishment, the time to success will be longer. Two extreme examples observed during site inspections were sites with water tables several feet below the design floor elevation of the wetland because of drought. Unfortunately, dry conditions during the establishment phase may jeopardize the success of mitigation, and require expensive remedial measures later. Many permits issued in the mid to late 1980s were affected by drought, and many mitigation projects probably are being designed during the current drought cycle with wetland elevations set at the long-term low ground water levels. These sites may become inundated when water level returns to normal, unless the design anticipates this contingency.

- There must be a hydrologic connection between the mitigation wetland and other waters of the State to ensure that the wetland is within Department wetland resource regulation jurisdiction and functions as a water of the State. Of the 34 permits, 15 had jurisdictional wetlands, eight sites were partially jurisdictional, nine were non-jurisdictional wetlands, and two needed a more thorough review of jurisdictional status (Table 2). Department District Office reviews support this general observation for short form mitigation sites.

In mitigation wetlands that are located away from natural wetlands and connected by an overflow feature, the connection is an integral part of the design. Paradoxically, however, when sites are built next to a natural wetland, a functional hydrologic connection often does not exist because the extreme landward edge of the natural wetland is left undisturbed--creating a topographic separation between the systems. This separation eventually can become a narrow strip of uplands between the

natural and mitigation wetlands--unless it is corrected with connecting flowways between the mitigation and natural wetlands, a technique which has been successful at some sites and could be used at others.

- The topography and configuration of the wetland should coincide with the permit requirements to yield the required wetland acreage. In 25 permits, the wetland topography, or configuration, was out of compliance with permit requirements (Table 2). Noncompliance usually was either construction deeper than the permitted design in an attempt to intercept a drawn-down water table; too brief a transition from uplands to the deepest point in the wetlands, resulting in little shallow wetland area; or alteration of the site configuration to preserve forested uplands.

In the first case, if the water table recovers, the site will be too wet and will not support the desired vegetation. In the second case, the shallow transition and moderate depth zones of wetlands are eliminated or reduced, while in the third case, islands or peninsulas of forested uplands are left as habitat oases--resulting in less wetland acreage than required by the permit.

- Regular maintenance of the wetland to reduce exotic and nuisance plants during its establishment is crucial. Control of nuisance or exotic plants was implemented in 14 of the permits. In six, the control was required by the permit. In the remaining eight, the control was not required but was undertaken as part of best management practices to help achieve success. Control was required by an additional six permits, but was not implemented. The control of nuisance and exotic plants remained a problem in 26 cases.

Active maintenance in the early stages is especially critical. If the problem species can be kept in low numbers from the start, the desirable plants should be able to spread easily, leaving little space for the undesirables.

Some permittees have used an elaborate series of chemical controls to good effect. Others misjudged the application rates and killed desirable vegetation as well. In any case, the dead vegetation should be removed from the system rather than being allowed to remain and decay. Cutting of cattail leaves about 18 inches from their bases during the coldest time of year was effective at one site. None of the plants survived. Another effective control method is frequent hand removal of undesirable species,

but this is labor intensive. It was used successfully at a prison site by having prisoners do the work, but probably is not practical for large sites, unless there is a similar large, cheap labor supply.

Tidal Systems

In salt water, this report considers two types of systems-- salt marshes and mangrove forest--required by a total of 29 permits. Eleven salt marshes, located in northern and central Florida, required in seven permits were evaluated, ranging from 0.79 to 26.6 acres. In south Florida, 55 mangrove sites, required by 24 permits were evaluated. (Two permits included both marsh and forest sites.) Mangrove sites ranged from 0.01 to 23.0 acres and from 2 months to 8 years in age--with a median age of 9 months at the time of inspection.

Permit compliance - Of the 29 permits evaluated, three were in compliance with all of the permitted mitigation requirements (Table 3). The remaining 26 had sites that were out of compliance to some extent, ranging from non-submittal of reports to major deviations from permitted design.

Types of Noncompliance

Topographic noncompliance appeared to occur in 16 sites. Seven of those may have been in compliance, but it was difficult to determine from field inspections, especially when no drawings of record were available (most sites).

Only six permits required drawings of record to verify that elevations and grading were completed according to permit requirements. However, only two drawings of record had been submitted. In several cases, the grade was too steep, which may have been partially a consequence of erosion by waves.

Only three permits had configuration or acreage noncompliance. Size and configuration of the mitigation sites was generally in compliance with permit requirements.

Twelve sites were found with vegetation noncompliance-- ranging from lack of planting to not using transplants from the impact site as required by the permit. Exotic species did not appear to be a problem.

Success criteria - Success criteria appeared to have been met in four of the 29 permits (Table 3). Implementation of simple remedial actions--

such as installing or improving wave barriers and construction of connecting flowways--probably would lead to success in another three permits. Twenty-one permit sites were not successful or were too new to judge. One permit did not include success criteria.

Ecological Success - Salt marshes usually are constructed by scraping uplands adjacent to existing salt marsh down to appropriate elevations with respect to tidal amplitude, then planting with nursery stock. The construction should be carefully supervised to ensure that the planted system will have the proper tidal range. If the site has good flushing, there usually is no problem with invasion of exotic or nuisance species because of their intolerance for saline water, but there can be problems with exotics in the more landward areas that have less flushing. The newly planted vegetation needs protection from waves, especially in areas with heavy boat traffic.

Mangrove wetlands usually are constructed by scraping uplands adjacent to existing mangrove systems down to appropriate elevations with respect to tidal amplitude, then planting with mangrove seedlings or propagules. In some cases, a nurse crop of Spartina alterniflora (smooth cordgrass) is planted, which helps reduce local wave energy and induces the trapping of mangrove propagules from adjacent systems. Mangrove seedlings need protection from waves, especially in areas with heavy boat traffic. Careful supervision of construction to ensure that the planted system will have a proper tidal range and that wave barriers are adequately constructed are critical to the success of the mitigation. In brackish areas, there is usually no problem with invasion of exotic or nuisance species.

Ecological success, as used here, is when the wetland site is or seems likely to become a functional wetland of the target mitigation wetland type--based on vegetation, soils, hydrology and faunal usage. Of the 29 permits evaluated (Table 3), four were ecologically successful, nine showed trends toward success, six require more time before success can be evaluated, and the remaining ten were not successful. At least three of those should become successful after simple remedial action.

An important difference between noncompliance and poor initial success at tidal sites versus freshwater sites, seems to be that the problems are more readily solvable at the tidal sites because of the predictability of water levels based on tides-- except where the site has

such poor water quality or heavy wave and wind erosion that success was compromised from the start.

Critical Factors for Ecologic Success - For moderate to high energy salt marsh and mangrove wetlands--the types evaluated for this report--three factors appear to be critical in assuring a high likelihood of success:

- Constructing the wetland at the proper elevations relative to tidal amplitude, and matching the relative elevations of adjacent salt marsh vegetation (as appropriate) are the most critical features of design and implementation for tidal wetlands. Because the tidal amplitude varies around the state, the range of elevations in adjacent wetlands should be matched for each vegetation zone to be constructed.
- Proper erosion control must be provided. Many sites were in areas of high to moderate wave energy which are subject to severe erosion unless the energy is controlled. Riprap or rubble wave barriers were commonly used at the waterward edge of tidal mitigation sites to provide protection against erosive wave energy. These barriers often were too small to provide adequate wave protection in areas with boat traffic, where wakes vary dramatically.
- Adequate tidal flushing must be provided. Of the 29 permits, five were having problems with tidal flushing (Table 3). This problem can be worsened by freshwater flow at the landward edge which encourages the establishment of exotic species--something that was observed in inspections performed by Department district offices. The best way to ensure adequate flushing is to include tidal channels that simulate natural patterns and depths. However, in one case, the channels that were designed to be about 2 feet deep were constructed about 6 feet deep, allowing boat wakes into the interior and causing erosion. Normally, where inadequate flushing is a problem, flushing channels can be enlarged or added to the site at relatively low cost or effort.

Permit Evaluation

General - Permit conditions and permit drawings describe the permittee's responsibilities in carrying out a wetland resource project in waters of the State. The adequacy of these documents affects how well the permitted work is done and the ability of the Department to ensure compliance. Adequacy, as used here, refers to thoroughness and clarity. Permit conditions should detail each step that must be adhered to while constructing the project. Requirements that are not addressed in a permit are not enforceable.

Conditions should include the agreed-upon elements of the mitigation plan--including planting, soils and substrate, schedule, monitoring, reporting, drawings of record of the topography, long-term agreements, conservation easements, maintenance, and periodic district inspections. They may be included in specific conditions in the permit or as attachments to the permit.

Certain types of information are best addressed in permit drawings--site location, configuration, and topography. Other information that can be shown is depths of soil amendments or muck layers, and planting plan layouts.

In only 16 of the total 63 permits reviewed in this study were the specific conditions judged to be adequate and readily enforceable.

Major Observed Problems

Success criteria - The most common reason a permit was considered to have inadequate specific conditions was due to inadequate success criteria. These also are the most likely factor to lead to major enforcement problems related to mitigation. The criteria which were used to judge whether a mitigation site was successful or not varied among permits. In early permits, mitigation success criteria often were vague and sometimes did not even specify that the vegetation must consist of wetland species. Later permits began to include success criteria that specified wetland vegetation. It has become apparent now that even more obvious points need to be included in success criteria--such as requirements that the area be within the Department's wetland resource regulation jurisdiction, and that the mitigation be built in accordance with the permit. Even when some other specific conditions are vague,

success criteria should be comprehensive enough that the goal of the mitigation is apparent and not subject to misinterpretation.

The specific conditions for mitigation in freshwater forested wetlands improved significantly in 1988 over previous years. Examples of older and recent success criteria for forested wetlands are shown in Appendix C. Five of the six 1988 freshwater forested wetlands permits reviewed were judged to have adequate specific conditions.

For mangrove mitigation, permit conditions have improved since 1987. Still, only three of the 11 permits issued in 1988 and 1989 were deemed to have completely adequate success criteria. In particular, success criteria did not specify that the vegetation be tidal system vegetation, but specified "wetland vegetation". These criteria could be interpreted to mean that a site is successful if vegetated completely by freshwater species, although it was never the intent of the permit.

The most frequently used success criterion for mangrove sites required 80 percent survival of mangrove seedlings after two years. However, this criterion differed somewhat among permits, ranging from 75 percent to 85 percent survival, and 2 to 6 years for survival, depending upon the permits. Another commonly used success criterion was that plant cover be 80 percent and consist of listed wetland species, but this criterion varied to include a requirement of 75 percent cover or that coverage consist of only mangroves.

Several criticisms can be made of these success criteria. Survival of planted seedlings, as required by the survival criterion, probably can not be reliably estimated since planted seedlings are never distinguished from naturally recruited seedlings. Furthermore, the permits probably never intended that survival (according to its usual definition) be measured, since replanted or naturally recruited seedlings are explicitly included in the survival percentage by some permits. Thus, an 80 percent survival criterion can be interpreted to mean that the density of planted seedlings must be maintained at 80 percent of their original level--regardless of whether seedlings were planted, replanted, or naturally recruited.

Density in itself may not be a good success criterion in these systems, since densities can be easily increased temporarily by planting, seeding, or natural recruitment, and may not reflect the likely long-term success of the site. Sites with high densities of mangrove seedlings may

not be regenerating into mangrove forests, but may nonetheless be judged successful. On the other hand, since natural density normally declines with increasing plant size, it is possible that sites with low densities of large mangrove seedlings and saplings may be judged unsuccessful, even though good site development may be occurring.

The use of a percent cover criterion can also be criticized. Percent cover can be very hard to measure, and estimates are subjective. It is not clear whether both living and dead plant material should be included in percent cover estimates. Furthermore, many plant communities never achieve 75-85 percent cover as measured as a vertical projection of the ground covered. Thus, these sites would never meet this criterion.

In summary, neither survival (interpreted here as density) or cover will be a clear indication whether a site is successfully developing into a mangrove forest. The newer criteria that require it to be evident that the target mitigation type is developing on the site should ensure greater success. A combination of an appropriate cover requirement, along with the use of a reference wetland, as discussed below, may be the most appropriate success criteria.

Use of reference waters (or wetlands) is important. The purpose of mitigation is to offset the lost functions of natural wetlands. To address this requirement, the earliest mitigation policy required type-for-type replacement of wetlands. The Mitigation Rule, Rule 17-312 Part III, F.A.C. (Appendix D) states that type-for-type replacement is normally the appropriate course of action, unless the system to be lost is degraded. In the case of degraded wetlands, the type of wetland present in the past becomes the appropriate type.

The use of a reference wetland is appropriate when the mitigation is to create or enhance a wetland and there is not enough information available that adequately describes the intended mitigation type. The purpose of the reference wetland is to ensure that the mitigation wetland is enough similar to a natural wetland of the target type to be deemed successful.

Reference wetlands were not used in early mitigation permits, rather, generic type descriptions--such as "forested wetland" were used. Recent permits include reference wetlands requirements and target wetland descriptions in the success criteria to create more enforceable permits.

Lack of Topographic Information - Permit drawings generally are enforceable because they depict specific, scaled information. However, one type of problem encountered with drawings is the failure to require a topographic plan view of the mitigation area in the permit so topography must be determined from cross-sectional drawings. The problem occurs when there are too few sections to adequately describe the site. In these cases it may be difficult to require corrective action, even though the constructed topography was unlikely to lead to success.

A requirement for a post-construction topographic survey of the creation site should be required for every permit. To effectively use this method of compliance, the drawings of record must be received immediately after construction, and immediate compliance reviews must be made to ensure that the permit has been complied with.

Inadequate Control of Nuisance and Exotic Species - Control of nuisance and exotic species is handled in two ways--with herbicides and hand-removal. Permit conditions must require that nuisance and exotic species be controlled during the establishment of the mitigation wetland. Unfortunately, compliance with these conditions was low (six out of 12 permits).

Protection from Erosion - Protection from wave action is an important factor influencing the ability of Spartina alterniflora plants and mangrove seedlings to establish at a site. A quarter of the tidal system permits evaluated did not require riprap or wave barriers waterward of planted vegetation. (Protection from waves was not necessary at two sites because of their location and configuration.) One permit did not require wave barriers, but the permittee constructed them anyway.

Of the 12 permits that required protection from waves, five had inadequate wave barriers or insufficient riprap. At one, wave attenuating devices scarcely dampened waves from boat traffic on the adjacent Intercoastal Waterway. Other sites that bordered on the waterway were likewise inadequately protected by riprap.

Most permits seem to require inadequate wave protection. This inadequacy may stem primarily from underestimating the wave energy on some water bodies, especially the heavily used Intercoastal Waterway. In the future, permittees should be required to document or measure the wave energy of the water body adjacent to a mitigation site. This information

should ensure that the wave protection design is adequate to allow good plant survival and growth.

Preservation of Mitigation Sites - Long-term preservation of mitigation sites should be a high priority. Five of the reviewed permits included mitigation for destruction of former mitigation sites. In the case of forested systems, mature forests may never develop as replacement for destroyed forest if higher priority is not given to protecting mitigation sites from further disturbance.

Inappropriate Mitigation Sites - In at least 10 of the reviewed permits, established mangrove trees or functional upland forested habitats were destroyed to construct the mitigation site. When there are relict wetlands at a proposed mitigation site, a conscious decision should be made regarding the value of the existing system and whether it is an appropriate site for mitigation. In the case of proposed mitigation that would destroy functional upland habitat, the proposal should not be approved unless the habitat would be destroyed for other reasons as well. Only disturbed uplands, including pasture, should be converted to wetlands as mitigation so that the mitigation does not destroy functional habitat.

Responsibility for Success - Half of the permits reviewed made no provisions for the permittee to be responsible for the success of the mitigation site after the permit had expired. Since most permits have not yet expired, problems with responsibility have rarely arisen. All permits should clearly state that the permittee is responsible for the success of the mitigation site even after the permit expires. Recent permits are more likely to require that long-term agreements be signed before the permit expires.

Department District Information

Several dozen mitigation compliance inspections were performed by Department District staff in the summer and fall of 1990. While these inspections were somewhat less exhaustive than others reported here, most of the observations were in general agreement with the findings of the main study. For all types of wetlands, about half of the permits were judged to be written well enough for enforcement purposes; more than half were adjacent to natural wetlands (which contributed to the likelihood of success); and half had topographic problems. For freshwater sites, about half were not jurisdictional or were only partially jurisdictional; about

two thirds had problems with nuisance and exotic species or lack of approved plantings. About half were not successful, while slightly more than a third were too new to assess for success and 15 percent were successful. For tidal sites about half had problems with erosion or flushing (most of these were deemed to be correctable with remedial action) and a quarter were not successful, another quarter were too young to assess, and half were successful.

The District inspections included basin black mangrove creation sites, a type of system not examined in this study. Basic black mangrove forests are found in depressional areas which are separated from open water by a natural berm that limits tidal flushing. The lack of tidal flushing, combined with freshwater drainage into the system, promotes the development of a soil profile that is unique to these systems. The district findings indicate that success in creating this particular type of system is low and further study is necessary.

WETLAND ENHANCEMENT

Although the major focus of this study was on wetland creation as mitigation, wetland enhancement also plays an important role in wetland resource mitigation and should be the subject of further study.

Wetland enhancement is the improvement of natural, jurisdictional wetlands. It usually consists of removal of exotic and nuisance plants, or the restoration of natural hydroperiods or tidal flushing. Allowed enhancement-to-loss ratios range from 5:1 to 20:1. High ratios are appropriate because enhancement addresses only functional losses, not acreage losses. It is the improvement in wetland quality and function that should offset much of the functional loss in the long term. In general, the Department encourages the enhancement of wetlands when an applicant proposes to damage wetlands that are known to take a longer time to successfully establish--such as forested systems.

Removal of exotic species, such as Melaleuca and Brazilian pepper, as enhancement, has been used most often in permits in central and southern Florida. This usually consists of removal of the offending species by hand or by application of herbicides, and generally takes a few years to become successful, because of the need to eradicate new plants that recruit from the seed left in the soil and from root stocks after the initial removal.

Sometimes the permit requires a buffer zone around the site to reduce the influx of new seeds.

Removal of exotic species can be extremely beneficial because of the degradation they cause in native wetlands. Unfortunately, the basic cause of the problem is rarely addressed. Native systems are invaded by exotic vegetation when the natural system is thrown out of ecologic balance by a change in the abiotic system. Overdrainage is the primary cause of the imbalance in native wetland communities in Florida.

Dominance by nuisance species in Florida wetlands also can be caused by loss of naturally fluctuating water levels in the system because of impoundment. The removal of nuisance species and remedial action to restore water level fluctuations should effectively restore the integrity of the system. It also may be necessary in some cases to plant native vegetation to speed up recovery of the system.

The final type of enhancement routinely addressed in wetland resource permits is restoration of hydroperiod in systems in which subsidence of the hydric soils is evident. Enhancement of this type generally takes the form of reflooding overdrained wetlands and is normally done by installing an adjustable weir and gradually raising the water level in the wetland, giving the plant community time to readjust physiologically to hydric conditions. Sometimes water can be directed to an altered system from a stormwater or wastewater treatment system to restore the hydroperiod of an overdrained wetland.

Only two enhancement projects were reviewed for this study. One involved removal of exotics and replanting with native vegetation. Only a token effort at carrying out the permitted requirements was made. The other, involved stopping routine mowing of the wetland and allowing the vegetation community to recover. The mowing has been discontinued, but the vegetation that returned is comprised of upland species. Either the site was never sufficiently wet to support wetland species or the site is being overdrained by the newly constructed, adjacent wetland. More sites will be evaluated in 1991 to further assess the effectiveness of wetland enhancement as mitigation.

WETLAND PRESERVATION

The permits reviewed that include a preservation category include permits that required preservation of natural wetlands and preservation of mitigation areas. Because preservation does not affect wetland acreage or function, it is usually used to address concerns over cumulative effects. The Department policy on wetlands preservation was promulgated by former Secretary Twachtmann in June 1988 (Appendix E).

The Department historically only accepted preservation of wetlands, as opposed to uplands, as part of a mitigation package. This was because the Department only has regulatory authority over wetlands, and acceptance of uplands for preservation was either considered an expansion of authority or was not considered to offset the loss of wetlands. More recently, the Department has accepted uplands as part of a wetlands-uplands habitat complex. This makes sense from a habitat standpoint because most species use both types of systems, and an upland buffer can protect the habitat values provided by the wetland.

NEEDS AND RECOMMENDATIONS

This study has identified several aspects of the wetland resource regulation program that should be addressed to improve the effectiveness of the use of mitigation, especially the high rate of noncompliance.

Recommendations to improve the program are divided into three groups--recommendations for the Legislature, recommendations for Department policy or rulemaking, and those that can be implemented within the current program with additional guidance and training for staff.

RECOMMENDATIONS FOR THE LEGISLATURE

• **Compliance Fees.** To ensure effective enforcement of permits, as much or more time is spent on the compliance phase as in the permitting phase. To supplement funding of permit compliance, compliance fees should be authorized for projects that require mitigation or other long-term monitoring.

Recommendation: The authority to assess compliance fees at the time a permit is issued should be authorized for the wetland resource regulation program.

• **Administrative fines.** The degree of noncompliance seen in this study was very high. A common problem with wetland resource regulation compliance is late or non-submittal of required monitoring reports, drawings of record, conservation easements, long term mitigation agreements and other documents. Unlike other Department programs, the wetland resource regulation program has no authority to assess administrative fines for failure to submit required reports and documents. Administrative fines for this type of noncompliance would provide the permittee with an incentive to submit required compliance information as well as provide additional funding to support the compliance and enforcement program.

Recommendation: The authority to assess administrative fines for noncompliance with permit conditions requiring document submittals should be provided to the wetland resource regulation program.

• **Increased enforcement, compliance and mitigation staffing levels.** This study indicates a very high rate of noncompliance for permits that require mitigation. The Department has submitted a request to the 1991 Legislature

for 17 environmental specialist positions for wetland resource regulation compliance and enforcement. In addition, the Department has asked the 1991 Legislature to fund one Environmental Specialist II position per year for the next two years to help the Environmental Specialist III position devoted to development, coordination and training related to the Department's mitigation rule and policies.

Recommendation: The budget request for 17 compliance and enforcement staff positions and an additional environmental specialist position for mitigation support should be granted to improve the effectiveness of the wetland resource regulation program.

• **Employee retention.** The pay scale of the environmental specialist series which staffs the wetland resource regulation program, has not kept up with industry salaries. For employees in the wetland resource regulation program to receive pay increases commensurate with their experience they must seek promotions or leave the agency. The federal government civil service system can provide step increases within pay grades to retain qualified, experienced personnel. The state system does not have this ability, and as a result suffers from chronic turnover, reducing the effectiveness of the program.

Recommendation: A step pay raise system should be instituted to provide program professionals with regular, incremental raises above base pay.

RECOMMENDATIONS FOR AGENCY POLICY AND RULEMAKING

• The primary focus of the wetland resource regulation program must be on avoiding wetlands and minimizing the effects of permitted activities on wetlands.

• Mitigation sequence. After all attempts to avoid or minimize wetlands impacts have occurred, and the applicant has proposed mitigation, the Department shall consider mitigation options in the following sequence:

- enhancement of degraded wetlands, or restoration of historic wetlands,

- preservation of other wetlands in conjunction with other forms of mitigation, and finally,
- wetland creation.

Creation should only be accepted if review of the creation proposal indicates that it includes features to insure its success. In all cases, if the proposed mitigation does not provide reasonable assurance that wetlands losses can be offset, the project should be denied.

- Creation of wetlands. Permits that authorize wetland creation as mitigation should only be authorized for freshwater systems when the applicant has substantiated what the future range of water table elevations will be at the creation site. When tidal and freshwater wetland creation are authorized as mitigation, the permits must require that the wetlands be constructed before, or concurrently with, the authorized impacts. Enhancement of wetlands, where determined to be feasible to offset the loss, should be preferred over creation. The applicant is clearly responsible for the ultimate long-term success of the mitigation.

- Basin black mangroves. Basin black mangroves are unique systems for which successful wetland creation technology does not exist. These fragile and critical systems should not be permitted for destruction unless the required wetland creation is completed and is determined to be successful or clearly trending toward success before the destruction occurs.

- Enhancement of wetlands. Guidelines should be developed that outline the circumstances under which enhancement of wetlands alone is not adequate to offset wetland losses.

- Preservation of other wetlands. Preservation of other wetlands as mitigation should only be used in conjunction with wetland enhancement, restoration, and creation.

- Inappropriate mitiation sites. Mitigation proposals should not be accepted that would eliminate other habitats (wetland or upland) unless the habitat would be destroyed as part of the project or is a disturbed or non-functional system.

- Compliance track record. The compliance record of an applicant should be considered as part of the decision to issue or deny permits. Past noncompliance should be grounds for possible denial.

- Protection of mitigation sites. All mitigation sites will be placed in a conservation easement.

RECOMMENDATIONS FOR PROGRAM IMPROVEMENT

- Increased attention should be given to the soil characteristics of the proposed mitigation sites, to ensure that the mitigation will offset the wetland to be lost.

- Care should be given in the evaluation of mitigation proposals to ensure that natural vegetation zonation typical of the target mitigation type is not lost in the created wetland.

- When removal of exotic species is included as part of a mitigation proposal, increased attention should be given to addressing and correcting the ecological imbalance that is allowing the invasion of exotic species.

- All permits that include creation of wetlands should include strict requirements for the control of nuisance and exotic species during the establishment of the mitigation.

- Wetland mitigation sites should be designed to provide adequate protection from wave energy and erosion.

- The Department should place high priority on funding research designed to answer questions about mitigation.

- Increased guidance should be provided to wetland resource regulation staff to ensure that permit documents maximize the likelihood for successful mitigation and allow enforcement of the intent of the permit.

- Implementation of a central tracking system for compliance, enforcement and information management should be an immediate priority.

- The training for wetland resource regulation personnel should be expanded.

- Increased access to word processing should be made available to wetland resource regulation staff to increase their efficiency.

- Submittal of drawings of record of the constructed mitigation site, including a topographic survey, should be included as a condition of all permits requiring wetland creation.

FUNDING SOURCES

Operating Funds - Currently, the wetland resource regulation program depends on General Revenue to provide most of its operating budget. The recent budgetary problems have emphasized the need for the Department to replace its dependence upon general revenue with a more stable source. The Division of Water Management currently generates approximately $1,000,000 annually through its permit fees. A revised permit fee rule is in progress that will generate an additional $1.5 million for a total of $2.5 million. The approximate shortfall will be $850,000 per year.

As recommended, compliance fees and administrative fines should be authorized to further support the wetland resource regulation program. In addition, increased permit fees and operating fees could be considered to help provide a self-supporting program. The Department will continue to analyze these measures.

Grants are available from a variety of sources such as Environmental Protection Agency, National Oceanographic and Atmospheric Administration, and Florida Institute for Phosphate Research. Use of these funds for research on mitigation should be explored to maximum extent possible.

Table 1: ACRES OF PERMITTED MITIGATION

Interval	Lost	Created	Enhanced	Preserved
1985 (Sample Size=64)				
Total	110.94	92.08	376.58	227.69
Mean	1.73	1.44	5.88	3.56
Median	0.15	0.10	1.40	0.37
Range	0.00-30.12	0.00-37.80	0.00-371.00	0.00-86.59
1986 (Sample Size=253)				
Total	345.35	374.68	1051.45	1635.07
Mean	1.36	1.48	4.16	6.46
Median	0.33	0.25	0.50	1.31
Range	0.00-58.00	0.00-55.00	0.00-201.00	0.00-326.50
1987 (Sample Size=274)				
Total	940.00	438.06	3445.97	1294.37
Mean	3.43	1.60	12.58	4.72
Median	0.39	0.38	0.35	2.67
Range	0.00-410.00	0.00-49.10	0.00-2000.00	0.00-345.10
1988 (Sample Size=264)				
Total	473.86	499.79	1286.97	2398.97
Mean	1.79	1.89	4.87	9.09
Median	0.40	0.51	0.40	5.00
Range	0.00-44.00	0.00-49.00	0.00-442.00	0.00-370.00
1989 (Sample Size=213)				
Total	430.86	1332.28	559.66	1370.60
Mean	2.02	6.25	2.63	6.43
Median	0.27	0.56	0.60	1.50
Range	0.00-74.00	0.00-420.70	0.00-244.50	0.00-248.00
1990* (Sample Size=190)				
Total	1004.39	608.01	580.27	660.84
Mean	5.18	3.13	2.99	3.41
Median	0.22	0.55	0.44	2.00
Range	0.00-490.13	0.00-220.00	0.00-90.00	0.00-199.00
Overall (Sample Size=1262)				
Total	3305.42	3344.90	7300.90	7587.54
Mean	2.62	2.65	5.79	6.01
Median =	0.31	0.66	0.90	2.94
Range =	0.00-490.13	0.00-420.70	0.00-2000.00	0.00-370.00

*January 1, 1990 through December 6, 1990.

Table 2: FRESHWATER MITIGATION SITES

Permit Number	Year Issued	Dredge/Fill Complete	Mitigation Complete [1]	# Sites Inspected	Spec. Cond Adequate	Compliance Full/Impt [2]	Success Criteria met [3]	Jurisdictional Mitigation	Ecological Success [4]	Forested vs. Herbaceous	Problems with Water Table [5]
581088709	1986	No	No	1	No	No/CV	No	Yes	No	Forested	No
291164909	1986	Yes	Yes (?)	1	No	No/T?	No	?	Too Soon	Forested	Yes
291105259	1986	Yes	Yes	1	No	Yes/Yes	No	No	No	Forested	Yes
291149449	1986	Yes	Yes	1	No	No/TS?V	NR	Yes	No	Forested	No
480992159	1986	Yes	Yes	1	No	No/TCV	NR	?	No	Forested	No
481352309	1987	Yes	Yes	1	No	No/TCV	No	Yes	No	Forested	No
411232979	1987	No	No	1	No	No/Yes	No	Yes	Pos. Tr.	Forested	No
511285659	1987	Yes	Yes	2	No	No/T	No	No	No	Forested	Yes
501268889	1987	Yes	No	2	No	No/V	No	Yes	No	Forested[6]	Yes
371373939	1988	Yes	Yes	1	Yes	No/TS	NR	No	No	Forested	Yes
161317359	1988	Yes	Yes	1	Yes	No/TSV	No	No	No	Forested	No
161389029	1988	Yes	No	4	Yes	No/TCV	NR	Partial	No	Forested	No
361366329	1988	Yes	Yes	1	No	No/TCV	No	No	No	Forested	Yes
581484829	1988	Yes	Yes	1	Yes	No/S	NR	Partial	No	Forested	Yes
291275009	1988	Yes?	Yes	2	Yes	No/TW	No	Partial	No	Forested	No
591150034	1986	Yes	Yes	1	No	No/T	Yes	Yes	No	Both	No
481033389	1986	Yes	Yes	1	Yes	No/TCV	No	Partial	No	Both	Yes
131310519	1987	Yes	Yes	1	No	No/T	No	Yes	Too Soon	Both	No
511304269	1987	Yes	Yes	1	No	No/Yes	No	Partial	No	Both	Yes
481462339	1988	Yes	No	1	No	No/TC	No	Partial	No	Both	Yes
480612939	1984	Yes	Yes	3	No	No/V	No	Partial	Too Soon	Herbaceous	Yes
581062279	1985	Yes	Yes	1	No	No/T	Yes	Yes	Yes	Herbaceous	No
580970349	1985	Yes	Yes	1	Yes	No/TSVW	No	Yes	No	Herbaceous	No
501065679	1986	Yes	Yes	10	No	No/TV?	No	Yes	No	Herbaceous	Yes
481230519	1986	Yes	Yes	2	Yes	No/TV	No	Partial	No	Herbaceous	No
511074049	1986	Yes	Yes	1	No	No/T	No	No	Pos. Tr.	Herbaceous	Yes
511279939	1987	No	No	4	No	No/TCSVW	No	Yes	No	Herbaceous	No
061289489	1987	Yes	No	1	No	No/CV	No	Yes	No	Herbaceous	No
581262979	1987	Yes	Yes	2	Yes	No/V	NR	Yes	Too Soon	Herbaceous	No
411343109	1987	Yes	Yes	1	Yes	No/TS?	No	Yes	No	Herbaceous	No
22,261384139	1988	Yes	Yes	1	No	No/V	NR	Yes	No	Herbaceous	No
511446039	1989	Yes	No	2	No	No/T	NR	No	Pos. Tr.	Herbaceous	No
411268563	1987	Yes	Yes	1	No	No/CSVW	No	No	No	Can't tell[7]	Yes
411345313	1987	Yes	Yes	1	No	No/VW	No	No	No	Can't tell	Yes

1 Construction of entire or all mitigation area(s)

2. Full = complete compliance with all requirements. Imp. = compliance with feature important for mitigation success, T (topography), C (configuration), S (soil), V (vegetation), W (wetland invert).

3. Yes, No, Need simple remedial action before assessment (NR)

4. Successful, positive trend to success, unsuccessful, too soon to tell

5. Water table much lower than predicted during design and permitting phases

6. Enhancement site.

7. "Can't tell" designation refers to conflicting permit requiremer

Table 3: T . MITIGATION SITES

Permit Number	Year Issued	Dredge/Fill Complete	Mitigation Complete [1]	# Sites Inspected	Spec. Cond Adequate	Compliance Full/Impt [2]	Success Criteria met [3]	Ecological Success [4]	Problems with Wind, Wave Erosion	Problems w/ Flushing	Mangrove vs. Marsh
521008489	1986	Yes	Yes	1	No	?Yes/Yes?	Yes	Yes	No	No	Marsh
551288789	1987	Yes	Yes	1	Yes	No/T	No	No	No	No	Marsh
521366499	1988	Yes	Yes	1	No	No/Yes	Yes	Yes	No	No	Marsh
521546319	1989	Yes	Yes	2*	Yes	No/TVO	No	No	No	No	Marsh
161249929	1989	Yes	Yes	2	No	No/C	No	Pos. Tr.	Yes	No	Marsh
520797109	1985	No	Yes	3	No	No/TVO	No	No	No	No	Both
411065669	1987	Yes	Yes	2	No	Yes?/T?V?	No	Pos. Tr.	No	No	Both
50-25-3391	1981	No	Yes	6	No	No/Yes	No	Pos. Tr.	Yes	No	Mangrove
430520289	1983	Yes	Yes	2	No	No/T	No	Pos. Tr.	No	Yes	Mangrove
360580719	1983	Yes	Yes	1	No	No/T?V	No	No	Yes	No	Mangrove
361015149	1985	Yes	Yes	1	No	No/T?C	NR	No	Yes	No	Mangrove
131215179	1987	Yes	Yes	1	No	No/Yes	No	Too Soon	No	No	Mangrove
060924019	1987	Yes?	Yes	7	Yes	No/T	No	Too Soon	Yes	No	Mangrove
411239879	1987	Yes	Yes	2	No	No/TV?	NR	Pos. Tr.	No	Yes	Mangrove
521051789	1987	Yes	Yes	1	No	No/TV	N/A	No	Yes	No	Mangrove
411395519	1988	Yes	Yes	1	No	Yes/Yes	No	No	No	Yes	Mangrove
411352329	1988	Yes	Yes	1	Yes	No/T?O	No	Pos. Tr.	No	Yes	Mangrove
061374779	1988	Yes	Yes	2	No	No/V	No	Pos. Tr.	No	No	Mangrove
131226599	1988	Yes	Yes	1	No	No/Yes	No	Pos. Tr.	Yes	No	Mangrove
501237339	1988	Yes	Yes	1	No	No?/V?	Yes	Yes	No	No	Mangrove
501392389	1988	Yes	Yes	1	Yes	No/Yes	No	Too Soon	No	No	Mangrove
501384029	1988	Yes	Yes	3	No	No/Yes?	No	Too Soon	Yes	No	Mangrove
361392379	1988	No	No	3	No	No/T?V	No	Too Soon	No	No	Mangrove
061434959	1988	Yes	Yes	9	No	No/TV	No	No	Yes	No	Mangrove
501433899	1988	Yes	Yes	3	No	No/TO	NR	No	Yes	No	Mangrove
061478409	1988	Yes	Yes	1	Yes	No/V	No	Pos. Tr.	No	No	Mangrove
111257589	1989	Yes	Yes	1	No	No/T?V	No	No	No	Yes	Mangrove
501513529	1989	Yes	Yes	1	No	No/T?C?	No	Too Soon	No	No	Mangrove
501578049	1989	Yes	Yes	1	No	No/Yes	Yes	Yes	No	No	Mangrove

1 Construction of entire or all mitigation area(s)

2. Full = complete compliance with all requirements. Imp. = compliance with feature important for mitigation success, T (topography), C (configuration), V (vegetation), O (other)

3. Yes, No, Need simple remedial action before assessment (NR)

4. Successful, positive trend to success, unsuccessful, too soon to tell

* includes one creation and one enhancement site

FIGURE 1. TOTAL ACRES OF PERMITTED MITIGATION
JANUARY 1, 1985 – DECEMBER 6, 1990

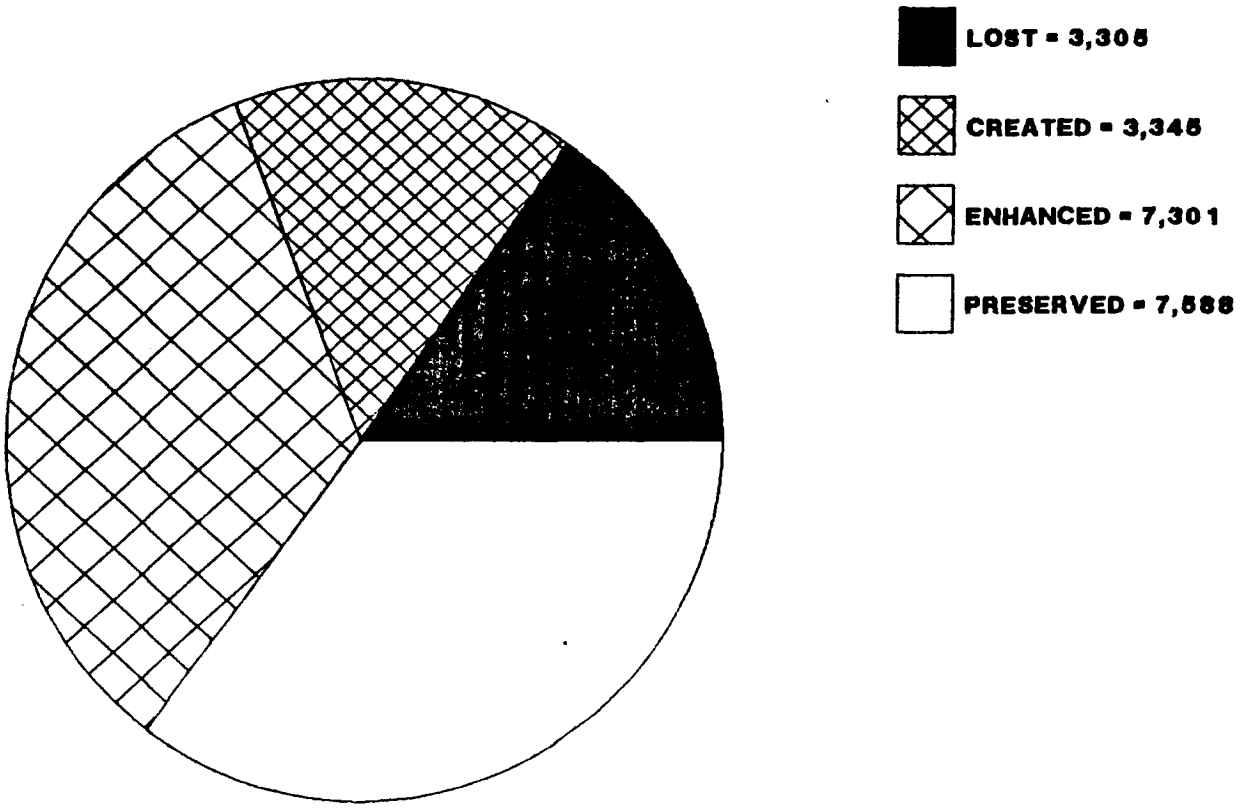

FIGURE 2. ACRES OF PERMITTED MITIGATION BY YEAR