



*NATIONAL WETLAND MITIGATION  
BANKING STUDY  
The Early Mitigation Banks:  
A Follow-up Review*

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**WORKING PAPER**

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## EXECUTIVE SUMMARY

In 1992, the Corps of Engineers' Institute for Water Resources conducted a detailed case study survey collecting information on 22 pioneer wetland mitigation banks in the nation. The case studies demonstrated the wide range of characteristics of wetland mitigation banks in existence, including various classes of wetlands, sponsorship (both public and private), mitigation objectives, institutional arrangements, implementation plan, and long-term maintenance and monitoring. Evaluation of the case study banks revealed that at least one-third of these mitigation banks were experiencing some technical and/or administrative deficiencies. As a follow-up, this report examines the status of the mitigation banks originally reported as operating unsuccessfully and takes an in-depth review at the various technical and administrative deficiencies these mitigation banks experienced. In 1996, interviews were conducted with sponsors and resource and regulatory agency representatives to assess the current status of these eight mitigation banks.

The majority of these "problem" mitigation banks appear to be currently functioning according to the original goals. A number of the successes may be attributed to the additional time which has allowed these mitigation banks to progress towards success. In other cases, the sponsor has taken corrective measures which have led to functional progress observed.

Several important lessons may be learned from the follow-up survey findings. These lessons may be important to those establishing or regulating mitigation banks in the future. The lessons commonly observed are as follows:

### Technical Lessons:

- C Proper site selection and baseline evaluation in terms of substrate characterization, long-term groundwater data, and elevation measurements is critical to ecological success.
- C Success criteria should be ecologically defensible and measurable.
- C Contingency plans should be enforceable.
- C Monitoring provisions should be enforceable.

### Administrative Lessons:

- C An enforceable banking instrument which clearly defines roles and responsibilities of parties and appropriate uses of the bank is necessary.
- C Market demands for the specific type of mitigation bank should be evaluated (by the sponsor).

It is important to note that the mitigation banks reviewed in this report were established before any formal Federal policy on the establishment, use, and operation of mitigation banks had been developed. In November of 1995, the Federal agencies issued final guidelines which address many of these and other issues pertaining to mitigation.



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The National Wetland Mitigation Banking Study is being conducted within the IWR Policy and Special Studies Division, whose chief is Eugene Z. Stakhiv. The National Study have benefited from Dr. Stakhiv's review and guidance throughout the course of the ongoing effort. Kyle E. Schilling is the Director of IWR.

This report was prepared by Fari Tabatabai, Los Angeles District of the Corps, and Robert Brumbaugh, Manager of the National Study. In addition to those individuals listed at the end of this report who were interviewed and/or provided bank-specific information for this evaluation, thanks are extended to the following:

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This document is considered a resource for the overall WMBDS and for those interested in the early mitigation banks in operation prior to development of the Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks (1995). This document will not be published as a final report.



## I. INTRODUCTION

National Wetland Mitigation Banking Study (hereafter referred to as National Study) was conducted by the U.S. Army Corps of Engineers Institute for Water Resources (IWR) under the authority of Section 307(d) of the Water Resources Development Act of 1990 (WRDA '90). In 1992, as part of the National Study, IWR conducted detailed case studies of approximately one-half of the population of the then existing mitigation banks in the nation. The results of those case studies are presented in the National Study Report entitled "Wetland Mitigation Banking: Resource Document" (IWR Report 94-WMB-2). The current report is prepared as a follow-up survey on the status of the eight case study mitigation banks that were experiencing technical deficiencies during the implementation phase. This report describes the overall progress of mitigation effort and management status rather than quantitative assessment of success. The term "success" in this report is defined as meeting the stated goals of the mitigation bank and does not necessarily involve specific determination of ecological success. A qualitative or quantitative field evaluation was not conducted by the authors. Interviews were conducted in 1996 with regulatory and resource agency personnel and project sponsors who have conducted the most recent field evaluation to determine the current status of the bank.

Some of those banks deemed "successful" in the 1992 case studies also experienced problems. For example, the Minnesota Department of Transportation Bank Program experienced negative balances in the first few years throughout much of the multi-site system. However, by the time the National Study began, those problems had been resolved. In another example, the Company Swamp Bank in North Carolina experienced credit accounting problems. While permitted wetland losses were authorized by the Corps, the bank's "books" had not been officially debited as of 1992 due to the fact that signatories had not yet signed any debiting forms as required by the terms of the bank's Memorandum of Understanding. However, this problem was small given the large size (i.e., credit base) of the bank relative to the small size of the debits.



## II. BACKGROUND

In 1992 the Corps of Engineers' Institute for Water Resources conducted a comprehensive survey of 22 mitigation banks in the nation, about one-half of the banks in operation at that time. Of these 22 mitigation banks, many appeared to be successful in terms of meeting their apparent goals. However, at least eight had experienced difficulties achieving their goals at the time of the survey, and consequently were selected for this follow-up survey. This report reviews the current status of the eight "problem" mitigation banks. The basic characteristics of these banks are presented in Table 1. A map showing the case study bank locations is presented in Figure 1.

The banks that are the focus of this study are located throughout the nation, represent various methods of establishment (creation, restoration, enhancement, and preservation), and consist of various classes of wetlands. These mitigation banks vary in age (4-15 years), as well as size (6 acres - 7,014 acres). The 1992 survey showed these eight banks were either operating at a deficit or withdrawal of credits had been suspended. Problems experienced by these mitigation banks include technical and/or administrative deficiencies. Administrative deficiencies include inadequate account statements which keep track of credits and debits of the bank. Technical problems include inadequate hydrological design, poor grading, and inadequate substrate. In some cases, unforeseen natural events, such as regional drought, had caused the mitigation bank to fail meet its ecological objective.

Sufficient time has elapsed since the case studies were conducted, to warrant a reevaluation of these banks to gain valuable lessons regarding establishing and operating mitigation banks. Therefore, the specific tasks of this investigation were to examine the issues associated with implementation of each selected bank, investigate corrective measures undertaken to remedy deficiencies, and determine whether the bank, as a management tool, has been instrumental in assuring achievement of mitigation objectives.

The majority of the selected case study mitigation banks, it should be noted, were established without involvement of the Corps. This is significant because it means that, in many cases, legal or regulatory means to bring about compliance with the responsibilities stated in the banking instrument were absent. Subsequent to the establishment of these mitigation banks, the Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks was issued, stipulating an active role for the Corps in establishment, use, and operation of mitigation banks. The Federal Guidance not only sets forth a unified interagency policy on establishment, use and operation of mitigation banks, but also defines the rules and responsibilities of the parties involved in implementing mitigation banks. In addition, many of these banks were established and used prior to 1990, when mitigation was not a standard practice under the Section 404 Regulatory program, therefore there was little precedent for these banks.

**Table 1. Summary of Mitigation Bank Profiles**

<b>Bank (Location)</b>	<b>Bank Instrument</b>	<b>Sponsor</b>	<b>Date of Establishment</b>	<b>Size (acre)</b>	<b>Method of Credit Production</b>	<b>Wetland Class</b>	<b>Problem</b>	<b>Crediting &amp; Debiting Methodology</b>
Astoria Airport, Oregon	MOA	Oregon DSL	1987	33	Restoration	Brackish Persistent Emergent Marsh/ Palustrine scrub shrub/ Alder forest/ Freshwater Channels	Technical	ODSL Relative Value System
Bracut Marsh California	MOU (no Corps) DOA permit	California Coastal Conservancy & California Coastal Commission	1981	6	Restoration	Tidal Marsh	Technical	Acreage
Fina LaTerre Louisiana	MOA (no Corps)	Fina Oil Co.	1985	7,014	Preservation Enhancement	Fresh Water Marsh	Technical & Administrative	BPJ based on HEP
Idaho DOT, Idaho East Marsh Acequia Old Beaver	MOA (general for Idaho)	Idaho TD	1989-1990	150	Restoration	Scrub/shrub and Palustrine emergent marsh	Technical & Natural	HEP
				21	Creation	Scrub/shrub and Palustrine emergent marsh	Technical & Natural	
				42	Enhancement	Scrub/shrub and Palustrine emergent marsh	Administrative	
Louisiana DOT	Verbal Agreement	Louisiana DOTD	1981	2,944	Enhancement Preservation	Bottomland Hardwood	Administrative	HEP & later area
Naval Amphibious California	MOU (no Corps) DOA permit	US Navy	1990	7.03	Creation	Eelgrass bed	Technical	Acreage
Pridgen Flats No. Carolina	MOA (no Corps)	North Carolina DOT	1992	127.3	Restoration	Pocosin	Technical	Acreage 2:1
Washoe Lake Nevada	MOA (no Corps)	Nevada DOT	1988	88.5	Creation Enhancement	Palustrine Emergent/ Persistent open water	Technical	1.5:1



Figure 2. Location of Case Study Banks



### III. SURVEY METHOD

A standard questionnaire was designed to evaluate the current status of the selected banks relative to their conditions four years prior--when the case studies were originally conducted. The basic outline of the questionnaire is presented in the Appendix.

Since the mitigation banks surveyed in this study had technical and/or administrative difficulties, and because the various parties involved may have had different views on the condition of a bank, responses to the questionnaire were sought from different points of views for each mitigation bank. Individuals contacted for each of the mitigation banks are listed in the Appendix and included the appropriate Corps district Project Manager as well as staff of the resource agency involved in the establishment, monitoring, and/or maintenance of the mitigation bank. In addition to the questionnaire, telephone interviews were conducted to fill gaps in the available data for certain mitigation banks.

The information obtained from questionnaires and telephone surveys were used to evaluate the current status of mitigation banks and to:

- C Document status of remediation;
- C Update the credit balance;
- C Evaluate establishment of specific goals for the bank (i.e., success or performance criteria);
- C Determine long-term ability to manage, protect, and manipulate wetlands;
- C Evaluate maintenance and monitoring provisions;
- C Determine Corps' involvement;
- C Determine existence of contingency plans;
- C Determine status of the overall management of the mitigation bank;
- C Evaluate managing entities' role in success of mitigation banking efforts;
- C Determine if the bank has been instrumental in the goal of no net loss of wetland acreage; and
- C Determine if other benefits have been gained from establishment of the mitigation bank



## IV. SURVEY RESULTS

### ASTORIA AIRPORT MITIGATION BANK

**Sponsor:** Oregon Division of State Lands (ODSL)

**Banking Instrument:** Memorandum of Agreement (MOA), 1987

**Problem:** The restoration of a tidal salt marsh from a currently upland site with small areas of freshwater marsh was not successful mainly as a result of poor grading (baseline topography was not accurate). In addition to the inaccurate elevation measurements, remnants of the old dike continue to prevent tidal circulation. The restoration, involving breach and excavation of dikes resulted in creation of additional freshwater wetlands rather than the planned brackish marsh. The Memorandum of Agreement for establishment of the Astoria Airport Mitigation Bank does not document or identify either the responsibilities of the sponsor or the detailed contingency actions. However, the sponsor did take remedial action immediately after construction when it became apparent that the necessary inundation was not occurring—the excavated tidal channels were deepened and widened and new channels were created, but saltwater intrusion remained limited and freshwater wetlands continued to form.

**Corrective Action:** Although corrective action is still needed, the ODSL is not planning to conduct any such action.

**Success Criteria:** The goal was to create tidal marsh habitat. No additional success criteria or performance standards were established.

**Crediting and Debiting Update:** Of the initial 33 acres (70 credits) that were deemed to be available upon completion of the initial restoration activities, 4.4 acres (10.6 credits) have been debited. The debit was authorized to the Port of Astoria in recognition of their deed transfer for bank property to ODSL. Additional debiting is not planned.

**Status:** Inactive

**Future Actions:** In 1992, the five-year interagency review took place and recommendations were made for corrective actions. The recommendations involved comprehensive measures to restore tidal flushing. However, there are no plans to implement the corrective measures due to lack of demand for estuarine intertidal and subtidal wetlands for mitigation. Since tidal salt marsh has not been restored, the site will not be used as mitigation for impacts to this class of wetlands.

**Benefits:** Establishment of the mitigation bank resulted in transfer of the land to the ODSL. The ODSL will manage the site as wildlife habitat in perpetuity, therefore, the site will be preserved as such. Although brackish marsh was not created, pockets of freshwater marsh created following the restoration effort make the site ecologically valuable. It is plausible that the MOA could be revised and credits sold for in-kind impacts to freshwater wetlands. However, the need for such a revision is currently not apparent. Additionally, it should be noted that the bank wetlands were planned as part of the 1983 CREST Mitigation Plan for the Columbia River Estuary. Although there has likely been net loss of brackish marsh (4.4 acres and functions), creation and restoration of the freshwater marsh may constitute an overall net gain of wetlands in general (approximately 29 acres).

## BRACUT MARSH

**Sponsor:** The California Coastal Conservancy and the California Coastal Commission

**Bank Instrument:** Memorandum of Understanding (MOU), 1981

**Problem:** Restoration of this tidal marsh has been unsuccessful due to unsuitable substrate, incompatible adjacent land use, and inadequate tidal flushing resulting from incorrect baseline elevation measurement. The Bracut marsh was established to compensate for losses of small degraded wetlands which would not have normally required mitigation as per Federal jurisdiction. Individual wetland losses mitigated at Bracut Marsh averaged 0.4 acres (the largest was 1.15 acres). Only one was a requirement of a Corps permit. No financial mechanism was in place to recover cost of contingency, remedial, and monitoring actions. Only 38% of total project cost was recouped by the Coastal Conservancy from sales of credits.

**Corrective Action:** In 1988, a biological survey was completed which made recommendations for corrective actions. During 1988, Phase I of the restoration work was completed—planting to buffer the marsh from incompatible adjacent land use. A vegetation survey was conducted in 1991 which showed that the site was performing better than the pre-restoration (pre-bank) condition. By 1991, two rare plant species had colonized the marsh, although plant species diversity was low. In 1992-1993, the Community Action Agency, which took charge of the enhancement of the marsh, had made the decision to enhance the biological diversity by improving the compacted soil and further by breaching the levee. The Phase II levee breach was expected to negatively impact the rare plant species, therefore, a seed bank was collected to be used as stock following the levee breach. The elevation at portions of the site was lowered and tidal channels were excavated. In September 1994, a vegetation survey showed that the rare plants had not recolonized and there had not been significant additional recruitment of other native tidal marsh species, even though the area of tidal pools had increased on the site. Currently, the project site consists of tidal pools/marsh, freshwater/brackish wetlands, a wetland upland transition zone, mudflats, and uplands (Figure 2).

### **Crediting and Debiting**

**Update:** Of the total of six acres, four acres have been debited (11 projects including one Corps permitted project). The last debiting was in 1990.

**Status:** Inactive

**Future Actions:** None

**Benefits:** The Bracut Marsh mitigation bank was used to mitigate for impacts to small degraded “pocket” marshes surrounded by development. Projects which used the Bracut Marsh for mitigation would not otherwise have been required to mitigate due to the small size of their impacts. Establishment of the mitigation bank has led to considerable habitat improvements over the pre-bank conditions. Also, the site is preserved in perpetuity as per the bank MOU.



**Figure 2.** Tidal wetlands, Bracut Marsh Mitigation Bank, September 1996

## FINA LATERRE

**Sponsor:** Fina LaTerre, Inc., a subsidiary of Fina Oil and Chemical Company

**Banking Instrument:** Memorandum of Agreement, 1984

**Problem:** The project consisted of construction of levees and weirs to manage water levels and reduce salinity for the purpose of enhancing estuarine fish and wildlife habitats and reversing or retarding conversion of the site to open water. While actions partially achieved their objectives, the 1990 survey showed fewer than expected credits for wildlife and estuarine fisheries habitats. Recommendations were for structural and operational modifications. As a result of less than expected improvements in the estuarine fisheries' habitat, adjustments to the originally projected estuarine fisheries credits are being considered.

**Corrective Action:** An interagency inspection of the bank was conducted in 1994. In January of 1995, recommendations were made to modify a water control structure, and, as of this writing, the modifications had not been implemented, although they are expected in early 1997.

**Success Criteria:** Predicted Average Annual Habitat Units (AAHU) for Wildlife and Estuarine Fish.

**Crediting and Debiting Update:** In light of the habitat improvement, the Corps has recognized the mitigation bank and authorized debiting the bank in the past two to three years. The currency for measurement of credits is in form of AAHU for wildlife and estuarine fish. The latest accounting (in 1994) submitted by the FWS is summarized as follows:

<u>Measured Credits (AAHU)</u>		<u>Estimated Debits (AAHU)</u>		<u>Balance (AAHU)</u>	
Wildlife	Estuarine Fish	Wildlife	Estuarine Fish	Wildlife	Estuarine Fish
50,433	38,690	20,613	4,887	29,820	33,803

**Status:** Active

**Future Actions:** There are tentative plans to change the HEP evaluation as an assessment methodology. According to the regulatory and resource agencies, implementation of HEP for determination of debits is administratively burdensome. There are also plans to avoid using the credits for estuarine fisheries' habitat. The task of maintaining the crediting and debiting records has been ponderous for the FWS due to the lack of agency resources. In the future, mitigation bank sponsors would be responsible for maintaining and submitting accurate up-to-date records of bank transactions to the responsible agency(ies).

**Benefits:** The goal of the project was to mitigate for impacts to wetlands by delaying the inevitable conversion of Palustrine marsh to open water. The project has been successful in enhancing and preserving the Palustrine marsh. The estuarine marsh, however, has not been as productive as it was envisioned in the original plans. Implementation of the water control structure is expected to further improve the estuarine fish habitat.

## IDAHO DEPARTMENT OF TRANSPORTATION MITIGATION BANK

The Idaho Department of Transportation Mitigation Bank consists of 3 separate parcels—the East Marsh (Mudlake), Acequia, and Old Beaver.

**Sponsor:** The Idaho Transportation Department (ITD)

**Banking Instrument:** Memorandum of Agreement for operating procedures, 1988, and a separate Memorandum of Understanding for management responsibilities

### East Marsh (Mudlake)

**Problem:** Restoration of seasonal Palustrine emergent/scrub shrub wetlands involved installation of pumps at existing wells, construction of levees, rehabilitation of culverts and headgates to control water movement and levels. The unsuccessful restoration activities have been attributed to structural deficiencies of water control structures, regional drought, poor site selection, and excessive pumping of groundwater by adjacent landowners which lowered the water table. The number of credits obtained by the ITD were to be proportional to the financial contributions made by the ITD to the Idaho Department of Fish and Game (IDFG) for restoration work. The IDFG was responsible for restoration activities including the first year flooding of the 150-acre bank area, which was unsuccessful. The ITD has completed the work according to the initial plans and agreements, however, it has not incurred land acquisition costs since the land has been in IDFG ownership. The ITD has contributed to the initial engineering and planning costs incurred by the IDFG. The site currently supports upland grasses and may be suitable for duck nesting. In 1995, due to overflow of the river, wetland vegetation developed in portions of the site. It is anticipated that sporadic establishment of wetland vegetation will occur on-site depending on the frequency of river overflow.

**Corrective Action:** None

**Success Criteria:** No specific success criteria were established for the East Marsh mitigation bank. The goal stated in the management MOU was the enhancement of waterfowl habitat.

**Crediting and Debiting Update:** The East Marsh bank was established as a condition of categorical exclusion for construction of Interstate-15 which impacted 16 acres of wetlands. Following establishment of the mitigation bank, no credits have been withdrawn. The total debited amount is 16 acres withdrawn prior to the establishment of the bank. Thus, the bank has a balance of -16 acres.

**Status:** Inactive

**Future Actions:** Implementation of corrective measures involves obtaining water rights from adjacent landowners. However, this will not be possible within the next five years. The existing MOA states that credits will be used by the ITD for project impacts located in the same watershed as the Mudlake mitigation bank (Camas Creek drainage basin). As potential future ITD projects are not located in the Camas Creek drainage basin, the need for future mitigation in this drainage basin is minimal.

**Benefits:** The East Marsh bank is part of a 342-acre degraded wetland area which has always been in the ownership of the IDFG. The success of the restoration activities in the East Marsh mitigation bank was of concern to the agencies during the initial bank establishment because of their awareness of drought conditions. At this point, benefits associated with the East Marsh bank appear to be minimal. It is unlikely that under current conditions the East Marsh mitigation bank will be used by the ITD.

### **Acequia**

**Problem:** The 21-acre Acequia parcel was created as part of a gravel pit reclamation. Construction activities included creation of a stream channel with rock drop structures and a small rock dam to divert water from an adjacent irrigation ditch to the newly created wetlands, and installation of a 24-inch outfall culvert connecting the site to the Snake River. The areas of created wetlands are smaller than the expected design due to grading design errors, improper design of the intake structures, water stagnation problems leading to limited vegetation development, severe regional drought conditions, and uncontrolled public use.

**Corrective Action:** No corrective actions have been taken since initial construction of the mitigation bank and there are no plans for implementation of any future corrective actions.

**Success Criteria:** No specific success criteria were established for the Acequia mitigation bank.

**Crediting and Debiting Update:** The number of available credits was not established and no credits have been withdrawn from the bank.

**Status:** Inactive upon creation of a Palustrine emergent marsh. Since the wetlands have not been successfully created, the status of the bank is essentially on-hold.

**Future Actions:** No future remedial actions are planned.

**Benefits:** Not much at this time.

### **Old Beaver**

**Problem:** Establishment of the Old Beaver bank involved purchase and enhancement of a 42-acre parcel of grazing land. The enhancement work required fencing of the parcel to prevent cattle grazing. The site has developed into a mosaic of freshwater marsh, riparian, and upland habitats. The difficulties associated with this mitigation bank are administrative in nature, including failure to determine available credits.

**Corrective Action:** No technical corrective actions are necessary for the Old Beaver site. Administrative issues such as determination of specific success criteria, future maintenance responsibilities, and monitoring of the site will need to be resolved through an interagency agreement.

**Success Criteria:** No specific success criteria were established for the Old Beaver mitigation bank.

**Crediting and Debiting Update:** No determination of the accrued credits in the Old Beaver mitigation bank has been made. Since its establishment, no credits have been withdrawn.

**Status:** Active

**Future Actions:** There are no plans to determine the available credits in the Old Beaver mitigation bank. The ITD may have the need to use the bank to compensate for its project impacts in the near future.

**LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (LDOTD)  
MITIGATION BANK**

**Sponsor:** LDOTD

**Banking Instrument:** No formal agreement

**Problem:** A verbal agreement (1981) between the FWS, LDOTD, and Louisiana Department of Wildlife and Fish (LDWF) was entered into in order to allow 11 parcels of land totaling approximately 3,000 acres to be used for impacts from LDOTD activities. The land was purchased and transferred to the LDWF. Sixty-four AAHU (of 296) represent the credits for land purchase (based on assumption that approximately 15% of the bank would have been converted to agriculture if not acquired and placed in public ownership). The site was to be fenced to prevent cattle grazing, however, this was delayed because lands had not yet been surveyed and because LDWF was attempting to consolidate lands into larger parcels through land swaps. Until 1992, fencing had not occurred and disputes were pending. This caused a disagreement on the total number of credits available for use by LDOTD. In addition, responsibilities for the management of funds were in dispute.

**Corrective Actions:** Since 1992, parcels have been fenced and cattle grazing excluded. All parcels are currently being managed as part of LDWF's Little River Wildlife Management Area. The management and maintenance funds are provided by LDWF.

**Success Criteria:** None

**Crediting and Debiting Update:** The Corps does not recognize the bank's unused credits. However, the LDOTD considers some credits still available.

**Status:** Closed. According to the Corps, no credits remain in the bank.

**Future Actions:** The LDWF will continue to manage the parcels as its Wildlife Management Area for habitat improvement and timber production.

**Benefits:** The LDOTD transferred the title of land to the LDWF for wildlife management. The LDOTD would not have been required by the Corps to mitigate its impacts prior to 1990. The mitigation was implemented in advance of impacts. The resulting benefit is enhancement and preservation of approximately 3,000 acres of wildlife habitat in 11 separate parcels.

## NAVAL AMPHIBIOUS BASE EELGRASS MITIGATION BANK

**Sponsor:** Department of the Navy

**Banking Instrument:** Memorandum of Understanding, 1986

**Problem:** Initially, 5.8 acres of eelgrass bed were to be created. However, during the creation of the eelgrass beds in February 1990, the adjacent 6.2 acres of eelgrass were damaged by the deposit of dredged material. Due to inadequate design, establishment of the eelgrass bed was initially unsuccessful and the bank operated at a deficit for one year. The mitigation bank was debited prior to the end of 4-year monitoring period despite the provisions of the MOU.

**Corrective Action:** The MOU called for the Navy to provide funding to the National Marine Fisheries Service (NMFS) for conducting monitoring of the site. Following implementation of the project, the Navy did not take any corrective actions to remediate the eelgrass mitigation bank. However, after the first year, the eelgrass beds started to show improvements. The adjacent eelgrass bed also restored itself naturally.

**Success Criteria:** The success criteria were defined as follows:  
Mean Shoot Density > 75% of the Reference Site = 100% Success  
Mean Shoot Density 50%-75% of the Reference Site = 50% Success

**Crediting and Debiting Update:** The five-year monitoring results show that the coverage of eelgrass has extended beyond the original bank area. Consequently, NMFS approved availability of an additional 1.23 acres of credits. As of January 1996, the available credit balance was 2.83 acres.

**Status:** Active

**Future Actions:** The last survey conducted by NMFS in 1995 shows healthy, self-sustainable eelgrass growth in the mitigation bank area. The Navy and NMFS are proposing implementation of a new MOA with the involvement of the Corps for future operation of the mitigation bank. There are no plans to perform additional site visits of the area, however, NMFS periodically revisits and assesses existing eelgrass beds.

**Benefits:** Implementation of this project caused short-term temporal loss of the eelgrass habitat. In the longer term, success has been achieved and improvement in wetland functions and acreage extended beyond the designated project site.

## PRIDGEN FLATS

**Sponsor:** North Carolina Department of Transportation (NCDOT)

**Banking Instrument:** Memorandum of Understanding, 1992

**Problem:** The goal of the project was to restore Pocosin wetlands previously drained for agricultural purposes. Pocosin wetlands (Palustrine broad-leaved evergreen scrub/shrub—a sparse needle-leaved evergreen forested overstory may be present) are defined as saturated or seasonally flooded/saturated freshwater wetlands, characterized by acid water chemistry and highly organic soils. Initial restoration efforts included placement of flashboard risers, and removal of tile drains and culverts. Additional drains were discovered throughout the site following the initial construction activities. The initial monitoring determined inadequate progress towards achieving success. However, credits were withdrawn from the bank prior to successful establishment of the Pocosin wetlands. Of the initially projected 127.3 acres (credits), 116.6 credits were withdrawn.

**Corrective Action:** Construction activities were completed according to the provisions of the MOU. However, in February of 1993, the FWS recommended corrective measures which included revision of the restoration and monitoring plan to include additional tile drain removal, erosion prevention measures, and control burns and planting on 42.3 acres of the site. These measures were implemented.

**Success Criteria:** The success criteria are specified in the Restoration and Monitoring Plan (Plan), which is incorporated into the MOU. The Plan states the determination of success is to be based upon the acceptable survival rate of vegetation. The criteria are as follows: (1) for the planted area, 80% survival of container plants and 50% for seedlings including planted and natural succession of desirable species; and (2) for seeded and natural succession areas, stem density equal to that planted in the planted area. The Plan also states that measurement of ground water levels using 10 monitoring wells will verify the effectiveness of hydrologic restoration activities.

**Crediting and Debiting Update:** No credits have been withdrawn since the original withdrawal of 116.6 credits. Projects were mitigated at a 2:1 ratio according to the provisions of the MOU. The FWS is responsible for maintaining an account statement for the bank. According to the latest statement, 10.7 credits remain in the bank.

**Status:** The 127.3 acres of the mitigation bank land were deeded to the FWS. The NCDOT is responsible for repairing damaged structures for 20 years and paying for maintenance during the initial five years. The bank is considered to be active and progressing successfully toward the goal of establishing Pocosin wetlands. However, no monitoring reports have been completed and, therefore, no success criteria determination has been done. The North Carolina Division of the FHWA examined Pridgen Flats in July 1994 as part of a state-wide review of highway construction and found the following:<sup>1</sup>

- (1) One of the two sites met wetlands criteria as per the 1987 manual;
- (2) The site had an appearance of early field succession—from sparse to thick;
- (3) Wetland pocosin hydrology had not been restored;
- (4) Hydrology modeling should have been done; the ditch should be filled not just plugged; and,
- (5) 80% success criteria not met.

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<sup>1</sup>Federal Highway Administration, North Carolina Division, April 1995, “Process Review on: Compensatory Wetland Mitigation Associated with Highway Construction in North Carolina.”

**Future Actions:** An interagency team will conduct a five-year review of the site in 1997 at which time the FWS will assume the long-term maintenance cost and management responsibilities. Future actions at the site are expected to be routine maintenance activities.

**Benefits:** Projects were mitigated at a 2:1 ratio. The U.S. FWS originally had a conservation easement of 348.3 acres, which included the 127.3 acres of the mitigation bank land, subsequently the bank land has been deeded to the U.S. FWS.

## WASHOE LAKE MITIGATION BANK

**Sponsor:** Nevada Department of Transportation (NDOT)

**Banking Instrument:** MOA, 1988

**Problem:** The water source was not adequate for providing wetland hydrology to the mitigation bank. During the drought year of 1992, the adjacent lake which provided water to the site was dry, though nearby natural wetlands suffered less severely than the Washoe wetlands. Subsequently, the Corps requested the NDOT to secure additional water sources.

**Corrective Actions:** The sponsor is attempting to obtain additional water sources (groundwater and surface water) for the site, though, as of this writing none has been secured. The Corps' 1994 survey showed hydrology of the site had improved from the 1992 survey, and the habitat functions of the mitigation bank site had also improved. Although no quantitative compliance inspections have been conducted by the Corps or the resource agencies since the 1994 survey, site visits by resource agencies report the site functioning as stated in the monitoring report (Figure 3). The improvements are the result of succeeding wet years and not the result of the sponsor's actions.

**Success Criteria:** The goal of the mitigation bank is to provide wildlife habitat. Success criteria included 80% aquatic vegetation cover, use by migratory birds, and utilization by waterfowl and shore birds.

**Crediting and Debiting Update:** The number of credits and debits has not changed since the 1992 survey. The number of credits remaining at the site is 4.7 acres (obligated) of created wetlands and 55.4 acres of enhanced wetlands.

**Status:** Suspended. Withdrawal of credits from the bank is currently on hold pending the securing of additional water sources.

**Future Action:** Currently, the mitigation bank is functioning



**Figure 3.** Shallow water and emergent wetland, Washoe Wetland Mitigation Bank, November 1996. Looking at west from easternmost edge of bank (photograph courtesy of Stephanie Wilson, EPA).

according to the success criteria, however, the site is susceptible to failure unless additional sources of water are secured. The NDOT is planning to pursue expansion of the bank to 269 acres following the securing of additional water rights. Upon supply of additional water to the site, the Corps will consider participating in a banking agreement.

**Benefits:** Despite the difficulties in establishing wetlands, habitat functions have improved and the sponsor is attempting to secure additional water rights. Sponsor's proposal to expand the mitigation bank and the regulatory agencies' willingness to participate indicate apparent improvements of mitigation bank conditions.

## V. SUMMARY OF RESULTS AND CONCLUSION

A follow-up study of selected wetland mitigation banks studied in 1992 was conducted to pursue their progression and more importantly, reaffirm the lessons learned from this group of mitigation banks. Eight mitigation banks were selected for this follow-up study which exhibited various types of deficiencies. Of these eight mitigation banks studied in this survey, five appear to have successfully progressed toward achieving the goal initially established for these banks. These mitigation banks are the Naval Amphibious Eelgrass mitigation bank, Fina LaTerre, Washoe Lake, Louisiana Department of Transportation, and the Old Beaver parcel of the ITD mitigation bank. Moreover, Astoria, Bracut, and Pridgen Flats mitigation banks all have resulted in the establishment of some wetland acreage, although not necessarily in accordance with the original plans.

As reported in the 1992 case study report, establishment of the Naval Amphibious Eelgrass mitigation bank was not only unsuccessful in establishing eelgrass beds, but also had resulted in damage to the adjacent eelgrass beds. As of 1995, however, the eelgrass survey conducted by the National Marine Fisheries Service (NMFS) showed that not only had the adjacent eelgrass beds recovered but also that, in terms of eelgrass coverage area, the mitigation bank was performing successfully. The sponsor (Navy) is consequently proposing to expand the extent of the mitigation bank to include approximately an additional two acres. The extension of bank area is proposed to be accomplished through an interagency agreement which includes the Corps as a signatory to the bank. The improvements at the Naval Amphibious Eelgrass mitigation bank are mainly attributed to time, as they have occurred without additional measures by the sponsor and the eelgrass beds appear to be self-sustaining.

The second successful case is the Fina LaTerre mitigation bank, where a 7,014-acre parcel was to be preserved and enhanced for 25 years. The sponsor (Fina Oil company) has implemented changes to the water control structures as recommended by the interagency review committee to enhance the ability to manage water levels and to provide suitable habitat for estuarine organisms. In consideration of actual habitat improvements and the sponsor's willingness to implement recommended measures to achieve the initially projected improvement, the Corps has accepted use of available credits from this mitigation bank within the last two to three years. Although habitat for estuarine fishes has not improved, the regulatory agencies are considering use of mitigation credits for non-estuarine fisheries' habitat.

The Washoe Lake mitigation bank experienced severe drought during its first years of establishment. Although natural wetlands in the region also suffered from the drought during those years, the Washoe Lake mitigation bank suffered more severely. However, routine surveys conducted by the Corps and EPA show the site has considerably improved since the end of the drought. However, additional sources of water are needed for its sustainment. The Corps will not accept bank credits for mitigation for Section 404 permits until an additional water source is available and a banking instrument with the Corps as a signatory is in existence. The Sponsor has secured water rights and is in the process of supplying water to the site. In addition, once the water source is supplied, the sponsor (NDOT) will propose additional areas to be included as credits in the bank.

The Louisiana Department of Transportation and Development mitigation bank is one of the earliest mitigation banks. This mitigation bank is currently being managed by the Louisiana Department of Wildlife and Fisheries (LDWF) for habitat improvement and timber harvesting. Although the majority of credits have been withdrawn by the LDOTD, none of the withdrawals were a Corps permit requirement since prior to the 1990 Corps and EPA Mitigation MOA, the Corps New Orleans District did not require mitigation for impacts to waters of the United States. The LDOTD transferred the deed of the land to LDWF, who has responsibility for its management. The Corps and the FWS do not view the LDOTD mitigation site as an operational mitigation bank and all credits are considered withdrawn. The LDWF is managing the site as part of the Little River Wildlife Management Area.

The Idaho State Highway Department banks have experienced the extremes in terms of the level of success. Two of the three sites—East Marsh and Acequia—are considered unanimously as failures in achieving their goals. No remedial efforts are planned. The Acequia site was not used to mitigate for any project impacts while the East Marsh site was established as a condition for categorical exclusion for impacts to sixteen acres of wetlands, resulting in net loss of sixteen acres of wetlands. The third Idaho DOT site—Old Beaver—which involved fencing to exclude cattle grazing and removal of flow obstructions, is progressing towards the wetland goal. The site has not been used for mitigation to date and the accrued credits remain in the bank. The Mudlake bank is not a self-sustaining bank and was rendered a complete failure during the regional drought in the late 1980's and early 1990's when concurrent excessive pumping of groundwater by the landowners lowered the water table. The Acequia site was also a non-self-sustaining created wetland.

The Pridgen Flats mitigation bank was established in 1992 by the NCDOT to mitigate for impacts from transportation projects. The goal of this mitigation bank was restoration of Pocosin wetlands by removal of tile drains and planting of Pocosin vegetation. The 1993 interagency site visit confirmed availability of 127.3 acres of credits and made recommendations for removal of additional tile drains and site preparation including planting of 42.3 acres. The FWS manages this site as part of the Roehn Oak National Wildlife Refuge. Due to inadequate baseline condition evaluation, lack of ecologically defensible and measurable goals, and absence of monitoring data, the success of the site as a broad-leaved evergreen pocosin wetland is difficult to assess. The NCDOT has the responsibility of monitoring the Pridgen Flats mitigation bank, however, no formal monitoring has been conducted since corrective actions were completed. A July 1994 field review by the North Carolina Division, FHWA, found the success criteria had not yet been met. One of the issues making the determination of success difficult is insufficient information on this type of pocosin wetlands which complicates measurement of the attainable goals of the project. The Roehn Oak Wildlife Refuge has plans for monitoring the site to evaluate its success as compared to this class of natural pocosin wetlands.

The goal of the Astoria Airport mitigation bank was to restore tidal flushing to the mitigation bank site. Despite efforts to restore a brackish marsh, the site has developed into a freshwater marsh. Although the site has the potential to be used as a freshwater mitigation bank, there are no plans by the sponsor or the regulatory or resource agency to do so. Additional efforts to restore estuarine wetlands are not planned due to a lack of demand for estuarine wetland for mitigation. The Astoria Airport Mitigation Bank may be interpreted as questionable success where, due to incorrect project design, out-of-kind wetlands developed. At this time, there is no apparent demand for tidal salt marsh mitigation in the geographic service area of this mitigation bank. There has been a net loss in acreage and functions of tidal salt marsh for the initial five acres debited from this mitigation bank. Although Astoria is not considered a successful mitigation bank, by creating five acres of freshwater wetlands, the bank has contributed to a net gain in wetlands overall.

The Bracut Marsh is also one of earliest mitigation banks in the nation. The Bracut Marsh was established in 1981, at which time the Corps did not require mitigation. The purpose of the mitigation bank was to compensate for impacts from California Coastal Commission permits which normally would not have been mitigated, if not for existence of a mitigation site. Although Bracut Marsh has resulted in establishment of approximately six acres of tidal marsh/pools, freshwater/brackish wetlands, mudflats, and wetland/upland transition zone, it has not successfully restored a tidal marsh as was envisioned. One of the managing entities attributes the improvements that have occurred at the Bracut Marsh to time, rather than enhancement activities. An important factor to consider when evaluating the insufficiencies of Bracut Marsh is that the mitigation bank was established when the science of restoration was still in its infancy. Since that time, the state of restoration science has considerably improved such that among the first initial considerations for site selection now are evaluation of existing substrate, elevation measurements, and adjacent land use.

A summary of the total credits and debits at each of the bank studied is presented in Table 2. The Pridgen Flats, Astoria Airport, and Bracut Marsh mitigation banks were assumed to have resulted in net loss of acreage of wetlands due to questionable performance of these banks.

**Table 2. Summary of Credits and Debits**

<b>Mitigation Bank</b>	<b>Total Debits (acres or habitat Units)</b>	<b>Total Mitigated (acres)</b>	<b>Mitigation Ratio</b>	<b>Type of Aquatic Resource Gained or Lost</b>
Astoria Airport	5 acres	0 acre	1:1	Brackish Marsh
Bracut Marsh	4.3 acres	~6.0 acres	1:1 (avg.)	Tidal Marsh
Fina LaTerre	20,613 HU Wildlife 4,887 Estuarine Fish	20,613 HU Wildlife 4,887 Estuarine Fish	1:1	Palustrine Emergent Marsh
Idaho DOT: East Marsh	16 acres	0 acre	1:1 (HEP)	Palustrine Emergent Marsh
Acequia	0 acre	0 acre	1:1 (HEP)	Palustrine Emergent Marsh
Old Beaver	0 acre	42 acre	1:1 (HEP)	Palustrine Emergent Marsh
Louisiana DOTD		3,000 acres	1:1	Bottomland Hardwood
Naval Amphibious	4.41 acres	7.0 acres	1:1	Shallow Subtidal
Pridgen Flats	116.6 acres	127.3 acres	2:1	Pocosin Wetlands
Washoe Lake	19 acres	27.9 acres	1.5:1	Palustrine (Emergent/ Persistent & Open Water)

### **Lessons: Reaffirmed**

The most common technical problem continuing to be faced by the case study banks appears to be assurance of adequate hydrology. Riparian wetland mitigation projects particularly face this problem. A wetland project that requires an artificial hydrology mechanism, i.e., it is not self-sustaining, especially presents an obstacle for success. In the semi-arid and arid west, assurance of access to water, i.e., water rights, appears to be necessary for successfully creating or restoring palustrine wetlands.

Characteristics of this subset of mitigation banks as they relate to success criteria, monitoring, contingency plans, and self-sustainability are summarized in Table 3. Determination of success for many of the case study banks is especially difficult because bank plans often lack ecologically defensible and measurable success criteria. The difficulty in assessing the contribution of individual banks to the nation's wetland goals impinges on the difficulty of designing and enforcing any necessary remedial actions. Most of the case study bank sponsors undertook remedial actions in good faith or at least in recognition that, otherwise, further use of this bank or other banks would likely be precluded by regulators. The incentive to produce a successful wetland project is also influenced by the relatively high visibility of the project (as compared to individual on-site or even off-site wetland replacement projects) to the public and to the regulatory and other oversight resource agencies. The review also

demonstrates that the monitoring period should be carefully tailored to the local environmental conditions. A mechanism to revise the monitoring requirements should also be considered during bank planning. These technical and administrative deficiencies of the mitigation banks re-examined are summarized below:

Technical Problems:

- C Inadequate hydrology due to improper site selection
- C Inadequate baseline evaluation in terms of substrate characterization, long-term groundwater data, and elevation measurements
- C Lack of ecologically defensible and measurable success criteria
- C Lack of enforceable contingency plans
- C Lack of enforceable monitoring provisions

Administrative Problems:

- C Enforceable banking instrument which clearly defines roles and responsibilities of parties and appropriate uses of the bank
- C Evaluation of market demands for specific type of mitigation banks

The review of these case study banks demonstrates that much has been learned on mitigation and mitigation banking since the early days of restoration. The Federal Interagency Guidance, which has clearly defined the roles of the bank sponsors, regulatory and resource agencies, and other technical guidance being developed as part of National Mitigation Banking Study, should assist in reducing the probabilities of failure for future mitigation banks.

**Table 3. Summary of Bank Characteristics**

<b>Mitigation Bank</b>	<b>Success Criteria (Y/N)</b>	<b>Monitoring Provision in Banking Instrument</b>	<b>Site Monitored (Y/N)</b>	<b>Contingency Plans</b>	<b>Contingency Plan Implemented (Y/N)</b>	<b>Self Sustaining (Y/N)</b>	<b>Other Benefits</b>
Astoria Airport	N	Y	Y	Y	N**	Y (as freshwater wetlands)	Land Preserved
Bracut Marsh	N	Y	N	N	Y	*	Land Preserved
Fina LaTerre	Y (Predicted HEP Spp.)	Y	Y	Y	Y	N	Land Preserved for 70 years (as designed)
Idaho DOT Mudlake	N	Y	N	N	N	*	---
Acequia	N	Y	N	N	N	*	---
Old Beaver	N	Y	Y	N	N	Y	Land Preserved
Louisiana DOTD	N	N	N	N	N	Y	Land Preserved
Naval Amphibious	Y (% Veg.)	Y	Y	Y	N	Y	Land Preserved
Pridgen Flats	Y (% Veg.)	Y	Y	Y	Y	*	Land Preserved
Washoe Lake	Y (Waterfowl habitat)	Y	Y	Y	Y	N	---

\* Indicates unsuccessful efforts

\*\* Effort to remediate unsuccessful



## APPENDIX

### List of Contacts

#### **Astoria Airport Mitigation Bank**

Corps of Engineers, Jim Goudzwaard  
Oregon Division of State Lands, Ken Bierly

#### **Bracut Marsh Mitigation Landbank**

Corps of Engineers, Molly Martindale  
State Coastal Conservancy, Mark Wheatly  
Botanica, Annie Eicher

#### **Fina LaTerre Mitigation Bank**

Corps of Engineers, John Reddoch  
Fina LaTerre, Inc., John Woodard  
Fish and Wildlife Service, Patti Holland

#### **Idaho Transportation Department Wetland Mitigation Bank**

Corps of Engineers, Ray Kagel  
Corps of Engineers, Greg Martinez  
Idaho Department of Fish and Game, Tom Meader  
EPA, John Olson  
Idaho DOT, Bob Humphrey  
Idaho DOT, Charles Rountree

#### **Louisiana Department of Transportation Mitigation Bank**

Corps of Engineers, John Reddoch  
Louisiana DOT, Michele Deshotels  
Louisiana Department of Wildlife and Fish, Maurice (Blue) Watson

#### **Naval Amphibious Base Eelgrass Mitigation Bank**

EPA, Elizabeth White  
Corps of Engineers, David Zoutendyck  
National Marine Fisheries Service, Bob Hoffman

#### **North Carolina Department of Transportation - Pridgen Flats**

Corps of Engineers, Ernie Jenke  
Fish and Wildlife Service, Howard Hall  
Fish and Wildlife Service (Roehn Oak Wildlife Refuge), Janis Allen

#### **Washoe Lake State Park Mitigation Area**

Corps of Engineers, Mike Finin  
Corps of Engineers, Nancy Kang  
EPA, Stephanie Wilson  
The Nevada DOT, Gray Zunino

## Standard Questionnaire

### Administrative:

1. Has the banking instrument been modified, or a new banking instrument written since 1992 when the IWR National Wetland Mitigation Banking Study (NWMBS) case studies were conducted? If yes, what elements have been changed?
2. What has been the Corps involvement in the bank since 1992? a. Compliance inspection b. permitting
3. If the bank is for commercial use, has the price of credits been revised to reflect the cost of any contingency actions or corrective measures?
4. Who is the managing entity?
5. Was withdrawal of credits ever suspended?

### Technical:

1. Has the problem been resolved? If yes, explain in detail any corrective measures since 1992. Describe in detail any changes in the ecological conditions of the bank since corrective measures.
2. Current status of credits and debits:
  - a. Number of credits?
  - b. Number of debits?
  - c. What are the class and size of the permitted wetland losses since 1992?
  - d. What were the exchange ratios for these debits?
3. Has there been a functional assessment of the bank since 1992?
4. Were success criteria or performance standards established? Were they met?
5. Is there any remediation work planned for the future? Describe.
6. Were there any contingency plans in the mitigation bank's original plans? If not, are there any now?
7. Can some of the technical problems be solved administratively (e.g., development of different types of wetlands or increased monitoring requirements)?
8. Has the bank become self-sustaining? If not, is it expected to ever become self-sustaining?
9. Have the credits available in the bank been adjusted? Or the crediting and debiting ratio?
10. Describe future plans for the mitigation bank. a. Administrative b. Technical
11. Lessons learned?
12. Are there any other conflicting views regarding the bank success and/or status? What are those views? (Please provide name, association, and phone number).