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16. Abstract

An increasing number of Texas Department of Transportation (TxDOT) projects are requiring mitigation of wetland impacts. Many of these sites are very small, which can be very difficult and expensive to develop with no real assurance of success. There is considerable statewide concern and nationally documented evidence that, even using the best available knowledge and care, many mitigation efforts are relatively unsuccessful. Several other states have already adopted alternatives to in-kind wetland mitigation such as commercial banking, inter-agency agreements, in lieu fee, and so forth. This project examines the wetland mitigation efforts and needs of TxDOT, the regulatory framework that governs wetland mitigation in the state, evaluates alternatives to in-kind mitigation, and develops alternatives and a strategy for implementation of alternatives to current practice.

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TxDOT WETLAND MITIGATION ALTERNATIVES: OPTIONS AND PROCEDURES FOR IN-KIND MITIGATION

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Texas Department of Transportation
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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. The researcher in charge was Mike Teal, Registered Landscape Architect (Texas, # 1955).

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TABLE OF CONTENTS

Page

List of Figures ..... **ix**
List of Tables ..... **x**
CHAPTER 1: INTRODUCTION **1**
Objectives 2
History of Wetland Loss and Protection 2
Defining Wetlands 3
Mitigation Options, Alternatives and Issues 4
Mitigation Options 4
Wetland Mitigation Alternatives and Implementation Decisions 6
Issues Specific to Transportation in Texas 9
Summary of TxDOT-Specific Issues 11
CHAPTER 2: WETLAND MITIGATION POLICY AND STATUTES **13**
Federal Law and Policy 13
Section 404 of the Clean Water Act 13
Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines (MOA) 13
Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (Banking Guidance, 60FR58605) 14
Transportation Equity Act for the 21st Century (TEA-21) 14
Federal Guidance on the Use of In-Lieu Fee Arrangements 14
Federal Highway Administration Regulations 15
Corps Regulatory Guidance Letter (RGL 02-2), Guidance on Compensatory Mitigation Projects 15
Federal Guidance on TEA-21 Preference Mitigation Banking 15
State Law and Policy 16
Clean Water Act Section 401(a)(1) 16
Natural Resources Code §221.021 17
Transportation Code §201.6061 (2001) 17
Chapter 14 of the Parks and Wildlife Code (2001) 17
Issues and Opportunities 17
CHAPTER 3: LITERATURE REVIEW AND ASSESSMENT OF CURRENT STATE PRACTICES **19**
Literature Review 19
Review Process 19
State and Federal Transportation Research Projects 20
Wetland Mitigation Program Evaluation 20
Comparative Review of Wetland Mitigation Practices 21
Mitigation of Ecological Impacts: A Synthesis of Highway Practice 22
Evaluation of Wetland Mitigation Measures 23
Alternatives to On-Site Mitigation: Regulatory Guidelines, Research, and Practices 23
CRS Report for Congress: "Wetland Mitigation Banking: Status and Prospects II" 24

General Accounting Office: Assessments Needed to Determine Effectiveness of In-Lieu-Fee Mitigation 25
National Wetlands Mitigation Action Plan 25
Guidelines for Selecting Compensatory Wetlands Mitigation Options 26
Wetlands Mitigation for Highway Impacts: A Nationwide Survey of State Practices 26
Planning and Operation Guidelines for Mitigation Banking for Wetland Impacts 26
Assessment of State Practices 27
Process 27
Arizona Department of Transportation (ADOT) 28
Arkansas Highway and Transportation Department (AHTD) 28
California Department of Transportation (Caltrans) 29
Florida Department of Transportation (FDOT) 29
Iowa Department of Transportation (IDOT) 30
Kentucky Transportation Cabinet (KYTC) 30
Louisiana Department of Transportation and Development (La DOTD) 31
Washington State Department of Transportation (WSDOT) 31
Wetland Mitigation within the Texas Department of Transportation 32
Departmental Organization and Staffing 32
Mitigation Practices 33
CHAPTER 4: CASE STUDIES 35
Field Analysis Methodology 35
Data Collection 37
Results 37
Chapter 5: RECOMMENDED ALTERNATIVES TO IN-KIND WETLAND MITIGATION 39
Comparison of Mitigation Alternatives 39
On-Site (Project-Specific) Mitigation 39
Banking (In-House) 40
Banking (Third-party) 41
In-Lieu-Fees 41
Partnering 41
Process for Selecting Appropriate Mitigation Alternatives 42
Organizational Options 43
WET (Wetland Expert Team) Organization Options 47
Disciplines Involved in WETeams. 48
Conclusion **49**
REFERENCES 51

LIST OF FIGURES

Page

Figure 1: Watersheds of Texas 10
Figure 2: The Vegetation Types of Texas. 1984. Texas Department of Parks and Wildlife..... 11

LIST OF TABLES

Page

Table 1: Types of Wetlands in Texas 9

CHAPTER 1:
INTRODUCTION

According to Section 404 of the 1977 Clean Water Act (CWA), all activities involving the discharge of dredge or fill material into navigable waters of the United States, including their associated wetlands, must be approved and permitted by the U.S. Army Corps of Engineers (Corps). The difficulties surrounding the successful implementation of a wetland mitigation project have been increasingly noted in the literature (Kruczynski, 1989) but until relatively recently little progress has occurred at a national level to increase the relative successes of wetland mitigation projects. After independent reports by both the General Accounting Office and the Committee on Mitigating Wetland Losses, Board on Environmental studies and Toxicology, water Science and Technology Board, National Research Council (both published in 2001), which criticized the effectiveness of compensatory wetland mitigation, the Environmental Protection Agency (EPA) and the Corps are now working together on a National Wetlands Mitigation Action Plan to address the failures of compensatory wetland mitigation. Some of the targeted actions include adequately addressing performance standards, improving accountability, integrating mitigation into a watershed approach, and implementing a cohesive database to help keep track of mitigation sites. This recent trend toward a more organized approach to wetland mitigation may signal a new era of more effective compensatory wetland mitigation.

The Texas Department of Transportation (TxDOT) recognizes the need for an assessment of the current practice of wetland mitigation alternatives across the country as well as a departmental assessment of TxDOT's wetland mitigation program so that the department can more effectively make decisions regarding the future of wetland mitigation at TxDOT. The issue of wetland mitigation within TxDOT is unlikely to disappear. According to the 2001 population projections compiled by the Texas State Data Center and the Office of the State Demographer, the Texas population could grow from the current population of 21 million people to over 35 million people by the year 2040 (http://txsdc.tamu.edu/tpepp/2001_txpopprj_txtotnum.php). As a larger human population attempts to thrive within a framework of finite resources, the issue of wetland mitigation will continue to play an important role in Texas environmental protection. TxDOT activities frequently impact wetlands which are subject to Army Corps regulation, but at times the wetland mitigation projects fail to perform up to TxDOT expectations. As the Texas

Department of Transportation continues to work to meet the transportation needs for an ever-growing state population, the department will inevitably be required to avoid, minimize or mitigate impacts to jurisdictional wetlands within Texas.

OBJECTIVES

This report provides wetland mitigation recommendations so that TxDOT can better plan for future wetland impacts. These recommendations grew from the analysis of the various wetland mitigation options available, through the assessment of other state transportation department practices and through the assessment of past TxDOT wetland mitigation projects. The specific tasks associated with this project include:

- review of current literature and assessment of current practice,
- develop case study evaluations of selected wetland mitigation sites,
- review of authorities, policies and procedures,
- develop a portfolio of background reference materials,
- develop a strategy for gaining approval of selected alternatives to in-kind mitigation,
- draft guidance document for selection of alternatives to in-kind wetland mitigation, and
- reports.

HISTORY OF WETLAND LOSS AND PROTECTION

According to estimates provided by the National Wetlands Inventory, between 1780 and 1989 Texas has lost approximately 52 percent of its wetlands, a statistic that closely resembles the national loss of 51 percent of wetlands within the 48 conterminous states (Mitch and Gosselink, 2000). A majority of this wetland loss occurred prior to society's realization of the importance of wetlands. However, wetland loss continues to be a problem at a national level, despite the goal of "no net loss of wetlands" adopted by the first Bush administration and affirmed by each administration thereafter. Ecologists now understand that wetlands can provide vital ecological functions through the improvement of water quality, by flood abatement and by groundwater recharge as well as by increasing biodiversity within an ecosystem. Wetlands also have significant impacts on economic factors including tourism dollars generated from birding

and hunting as well as the importance of wetlands in providing nursery habitat for species important to the fish and shellfish industry.

DEFINING WETLANDS

The Corps oversees through Section 404 of the CWA, only wetlands that are associated with jurisdictional waters of the United States. Many states have additional statutes that protect wetlands that are not considered jurisdictional, but Texas thus far has not adopted additional regulating statutes. As defined by 33 CFR Part 328.3, "*Waters of the United States*" are:

1) all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide;

2) all interstate waters including interstate wetlands;

3) all other waters such as interstate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could effect interstate or foreign commerce including any such waters:

    i. which are or could be used by interstate or foreign travelers for recreational or other purposes; or

    ii. from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

    iii. which are used or could be used for industrial purposes by industries in interstate commerce;

4) all impoundments of waters otherwise defined as waters of the United States under the definition;

5) tributaries of waters identified in paragraphs 1-4 of this section;

6) the territorial seas;

7) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section;

8) Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with the EPA.

Not all wetlands are created equal. Within the state of Texas there are many different types of wetlands, including estuarine wetlands, saltwater marshes, non-tidally influenced freshwater marshes, wet meadows, wet prairies and playa lakes (see Fig. 1). Therefore, it is often difficult to determine whether to consider a given area of land as a wetland or not. Scientists, wildlife organizations and governmental offices may define wetlands differently, but the definition that is most often relevant to TxDOT activities is the one provided by the United States Army Corps of Engineers. The Corps defines a wetland as:

> *"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

According to the Corps of Engineers Wetlands Delineation Manual (1987) there are three ecological factors that determine whether a given area of land can be considered a wetland. These three factors are 1) hydric soils, 2) hydric vegetation and 3) wetland hydrology. Any wetland, no matter the type, has these characteristics. A further description of soils, vegetation and hydrology will be discussed in the field study methodology.

MITIGATION OPTIONS, ALTERNATIVES AND ISSUES

Mitigation Options

Under Section 404 rules, impacts to jurisdictional wetlands must be avoided if possible. If avoidance is not possible, impacts must be minimized to the extent possible. The Section 404 permitting process must mitigate all unavoidable impacts. Although on-site mitigation has been preferred historically by regulators, under certain circumstances off-site mitigation may be considered. All off-site mitigation should occur within the same geographical service area as the impacts, generally the United States Geological Survey (USGS) watershed. The Corps Regulatory Guidance Letter 02-2 defines several mitigation types:

1) **Establishment (Creation):** The manipulation of the physical, chemical, or biological characteristics present to develop a wetland on an upland or deepwater site, where a wetland did not previously exist. Establishment results in a gain in wetland acres.

2) **Restoration:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into:
    a. **Re-establishment:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former wetland. Re-establishment results in rebuilding a former wetland and results in a gain in wetland acres.
    b. **Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

3) **Enhancement:** The manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality improvement, flood water retention, or wildlife habitat. Enhancement results in a change in wetland function(s) and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres. This term includes activities commonly associated with enhancement, management, manipulation, and directed alteration.

4) **Protection/Maintenance (Preservation):** The removal of a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. This term includes the purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term preservation. Preservation does not result in a gain of wetland acres and will be used only in exceptional circumstances.

Restoration is often the preferred mitigation alternative because research has shown that restoration efforts are more likely to succeed than the other mitigation options (Marble and Riva, 2002). Creation, while much more difficult to complete successfully, would theoretically add to the total number of wetland acres and is, therefore, often preferred over enhancement or protection. All mitigation sites are subject to a monitoring period (generally five to ten years) which should be described within the Section 404 permit. After the monitoring period is complete, regulators must then determine if all parameters specified within the permit have been met. If all parameters have not been met then regulators may decide to require additional mitigation. Time extensions may be necessary to complete all additional mitigation requirements.

Wetland Mitigation Alternatives and Implementation Decisions

In addition to deciding upon mitigation types, mitigation planners must consider available alternatives to on-site mitigation as well. These alternatives include either the creation of a mitigation bank, purchasing credits at a commercial bank or paying in-lieu-fees. Also included in this section is the topic of forming partnerships with other agencies or organizations and the use of consultants to handle wetland mitigation planning. The decision to form partnerships with other agencies or to employ contractors to handle mitigation work is important to consider; however, they are not typically considered a mitigation alternative.

On-Site Mitigation

On-site mitigation, also referred to as project-specific mitigation, refers to mitigation that is provided for one project located as near to the disturbed wetland as possible. Despite the growing use of mitigation alternatives, on-site mitigation is the form most often preferred by DOTs (Marble and Riva, 2001). Reasons for this preference can be attributed to a widespread lack of available alternative options and a historical preference for locating mitigation sites as near to the disturbed site as possible (Kruczynski, 1990). On-site mitigation is thought to be best able to protect the actual type of habitat lost as well as to more effectively preserve the ecological functioning of an entire watershed than off-site mitigation where differences may exist in the soils, vegetation and hydrology from the impacted wetland. On-site mitigation may be the most practical and cost-effective when considering the time necessary to formulate banking instruments or to locate appropriate third-party mitigation partners.

Off-Site Mitigation

When no appropriate site can be located near the impacted wetland, off-site mitigation can be considered. The mitigation options available for off-site mitigation (creation, restoration, enhancement, preservation) are the same as for on-site mitigation, or other alternatives such as mitigation banking or in-lieu-fees may be considered if it is determined that an alternative mitigation would most benefit the watershed as a whole. Off-site mitigation must occur within the same geographic service area or watershed as the impact.

Mitigation Banking

Mitigation banking, where multiple impacts are combined into one mitigation site often prior to the impacts, is the preferred alternative for projects funded by the Federal Highway Administration (FHWA) under the Transportation Equity Act for the 21st Century (TEA-21). According to the legislation enabling mitigation banks (Federal Register; Volume 60, Number 228) mitigation banking is defined as:

> *" …wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial. It typically involves the consolidation of small, fragmented wetland mitigation projects into one large contiguous site."*

Single-client banking, where the bank is developed for the client by the client (Marble and Riva, 2001) has been used when impacts to wetlands are known in advance of the impacts so that one mitigation site combines all known impacts. Reasons for choosing this option include the reduction of overall mitigation costs and an increase in the likelihood of success of the mitigation project. Mitigation banks can also help improve the effectiveness of compensatory mitigation because impacts are mitigated prior to the impact.

Purchasing credits at a third-party bank, one that was not created for the client by the client, can be considered so long as the bank is located within the impacted watershed. Research has shown that regulators have been reluctant to use this form of mitigation because of a widespread belief that developers and private homeowners who do not have the means to mitigate wetlands on their own should use third-party banks (Marble and Riva, 2001). However, several DOTs, including TxDOT, have been successful at using third-party banks in recent years. Louisiana DOT, for example, now uses third-party mitigation banks almost exclusively (personal communication) and the transportation departments of Arkansas and Minnesota, to name only two, both have extensive mitigation banking programs for transportation impacts. While TxDOT continues to use on-site mitigation for most wetland impacts, there are three wetland mitigation banks available exclusively to TxDOT.

In-Lieu-Fees

While slowly gaining in use, in-lieu-fees are the most underused mitigation option available to transportation departments. According to guidance issued by the Galveston Corps of Engineers office issued in May 2000, on-site mitigation must always be considered first. In-lieu-fee proposals will be considered only when on-site mitigation is not considered "feasible, or ecologically desirable" (Galveston Corps of Engineers, 2000). All in-lieu-fee proposals must include a complete mitigation plan including monitoring parameters as well as the agreed upon fee paid to the in-lieu-fee operator approved by regulators within the permit application. As with all mitigation options, in-lieu-fee mitigation should be in-kind and occur within the same geographical region or watershed as the impacts.

One obstacle to the use of in-lieu-fees is the lack of procedural frameworks for their use. An example of such a framework can be seen in the Memorandum of Agreement (MOA) between the Louisville District of the Corps of Engineers and the Kentucky Department of Fish and Wildlife Resources (KDFWR) which recognizes a trust fund within the KDFWR that was set up to receive in-lieu-fees for unavoidable impacts that cannot be mitigated on-site. A key element of this MOA is the establishing a mitigation review team that performs yearly reviews of ongoing and completed projects. The Corps chairs the team and the other members include representatives from state and federal governmental agencies. The in-lieu-fees provide funding necessary for restoration projects overseen by the KDFWR.

Partnering

If no appropriate mitigation site can be located adjacent to the impacted wetland then land must be located as near to the mitigation site as possible. In these instances, it is often beneficial for transportation departments to partner with other agencies, whether they be private conservation organizations, governmental agencies or private land owners. There are many benefits from forming partnerships for mitigation projects. Many times there is available land owned by state or federal governments within the same watershed. Positive relationships formed between the transportation department and those agencies will often lead to successful mitigation sites that benefit both agencies. Because maintenance costs are always an important factor for every transportation project, locating mitigation sites on land that will be maintained by other agencies is one positive benefit to forming partnerships. Agencies that partner with TxDOT will

benefit from the addition of a wetland on their land and many times the wetland will be available for enjoyment by the public.

ISSUES SPECIFIC TO TRANSPORTATION IN TEXAS

Many of Texas' wetland mitigation issues and concerns are also national problems; however there are many issues that are specific to our state. Texas is the largest state in the 48 conterminous states and has the fifth largest acreage of wetlands nationwide (Dahl, 2000). Due in part to its large size, Texas is very diverse ecologically and has a large number of types of wetlands (see Table 1). From playas in the panhandle to freshwater marshes along the Trinity River, from cypress swamps near the Louisiana border to tidal salt marshes along the gulf, Texas is home to a diversity of wetlands types. An agency such as the transportation department, which serves the entire state, must be prepared to mitigate every kind of wetland that is impacted and must possess knowledge of the general characteristics of each kind of wetland.

Table 1: Types of Wetlands in Texas (Mitch and Gosselink, 2000).

BOTTOMLAND	Lowland among streams and rivers, usually on alluvial floodplains, that is periodically flooded. When forested, it is called a bottomland hardwood forest in the southeastern and eastern United States.
MANGROVE	Subtropical and tropical coastal ecosystem dominated by halophytic (salt-loving) trees, shrubs, and other plants growing in brackish to saline tidal waters. The word "mangrove" also refers to the dozens of tree and shrub species that dominate mangrove wetlands.
MARSH	A frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.
PLAYA	An arid- to semiarid-region wetland that has distinct wet and dry seasons. Term used in the southwest United States for marsh-like ponds similar to potholes, but with a different geologic origin.
SALT MARSH	A halophytic (salt-loving) grassland on alluvial sediments bordering saline water bodies where water level fluctuates either tidally or non-tidally.
TIDAL FRESHWATER MARSH	Marsh along rivers and estuaries close enough to the coastline to experience significant tides by non-saline water. Vegetation is often similar to non-tidal freshwater marshes.
WET MEADOW	Grassland with waterlogged soil near the surface not without standing water for most of the year.
WET PRAIRIE	Similar to a marsh, but with water levels usually intermediate between a marsh and a wet meadow.

In addition to the diversity of wetland types, there are 210 USGS watersheds within Texas (see Figure 1), according to the EPA. The multitude of watersheds makes the organization of any effective mitigation banking program very difficult. The transportation departments of smaller states can easily target the watersheds that are most likely to be impacted. The Kentucky

Transportation Cabinet, for example, was able to setup mitigation banks within all of the watersheds that are likely to require wetland mitigation and is, therefore, able to use mitigation banks for all wetland mitigation needs. In Texas only a few watersheds have private mitigation banks within them, decreasing the opportunity to make use of a potentially important mitigation option (Figure 1).

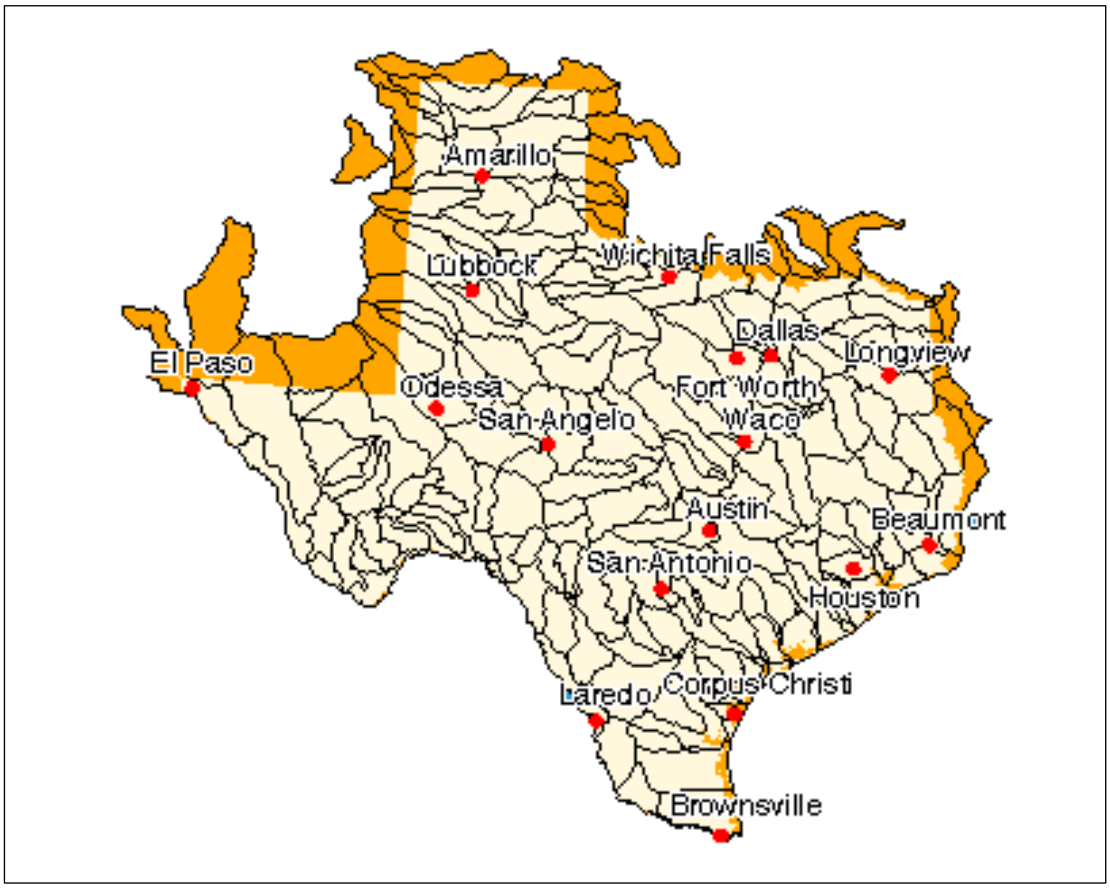

Figure 1: Watersheds of Texas.

Texas also has a diversity of ecological zones and vegetation types (Figure 2) and, therefore, it would be difficult for a centralized wetland staff to maintain the level of expertise necessary for wetland mitigation planning for all of Texas.

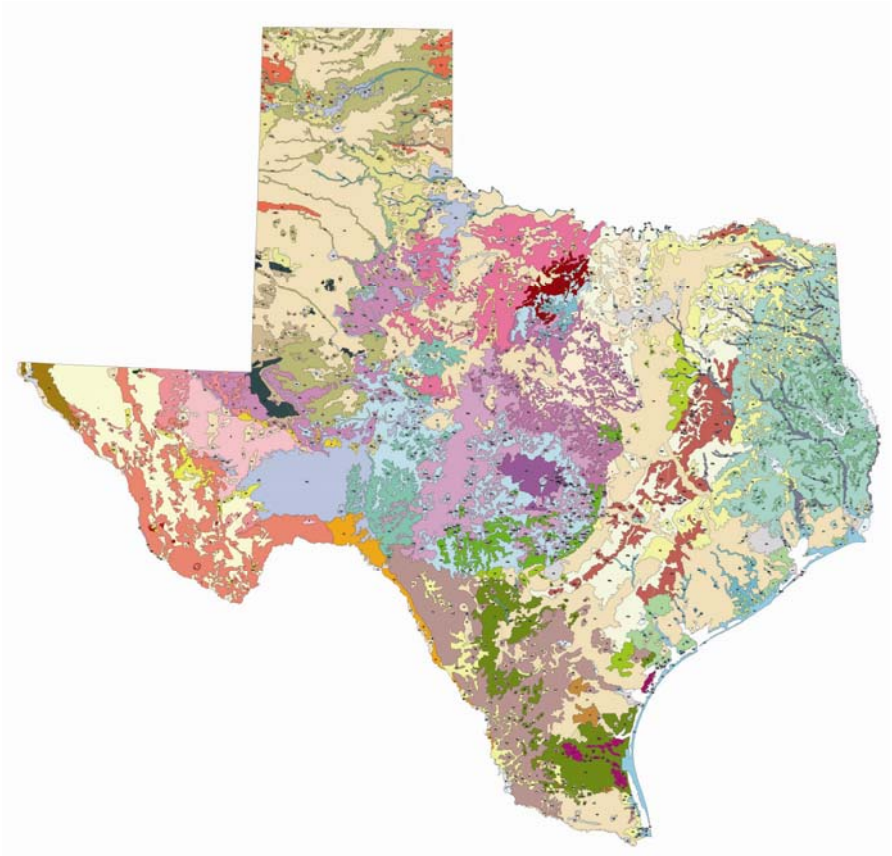

Figure 2: Vegetation Types of Texas.

Additional complexities to wetland mitigation specific to TxDOT include the twenty-five transportation districts within TxDOT that coordinate with the Environmental Division for all environmental impacts and the four Corps of Engineers districts within the state of Texas (Albuquerque, Fort Worth, Galveston and Tulsa). Additionally, it is often difficult to locate land within the TxDOT right-of-way (ROW) that is suitable for wetland mitigation because regulators' concern that later transportation needs will impact the land in the future. Therefore, it is often necessary to locate land out of the ROW to ensure holding mitigation sites in perpetuity.

Summary of TxDOT-Specific Issues

The following summarizes wetlands concerns in Texas:

- diversity of types of wetlands,
- diversity of ecological zones within Texas,
- Texas' 210 watersheds,
- TxDOT's 25 districts,

- four Corps of Engineers Districts within 2 Regional Divisions,
- scarcity of private mitigation banks throughout the state, and
- difficulties locating suitable mitigation sites within TxDOT ROW.

CHAPTER 2:
WETLAND MITIGATION POLICY AND STATUTES

FEDERAL LAW AND POLICY

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act is the federal law limiting the discharge of dredge or fill material into the navigable waters of the United States. Because of an historic precedent dating from the 1899 Rivers and Harbors Act, the U.S. Army Corps of Engineers was granted oversight of the Section 404 permitting process. All rule-making activities and regulatory oversight was granted to the newly formed Environmental Protection Agency which has the authority to override any Corps decision. However, EPA intervention is relatively rare and in most circumstances the EPA respects the Corps' decision regarding specific permits. In addition to the Corps and the EPA, the U.S. Fish and Wildlife Service, an agency of the Department of the Interior must receive copies of Section 404 permits that would include additional recommendations on avoiding, minimizing, or mitigating wetland losses. Unlike the EPA, the USFW cannot override a Corps decision. Additional oversight from the National Marine Fisheries Service, a part of the National Oceanic and Atmospheric Administration (NOAA) under the Department of Commerce, when the situation involves tidally influenced wetlands. The National Resources Conservation Service (NRCS), under the Department of Agriculture, was given administration of the Swampbuster program and must be notified when wetlands involve agricultural lands.

Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines (MOA)

The EPA and the Corps clarified mitigation policies and allowed for the possibility of off-site mitigation so long as it was "undertaken in the same geographic area if practicable (i.e., in close proximity and, to the extent possible, the same watershed)." This MOA establishes that mitigation banking may be an acceptable form of compensatory mitigation.

Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (Banking Guidance, 60FR58605)

Known as the Banking Guidance, this letter published by the Corps, EPA, NRCS, USFW and NOAA explains in more detail federal policy regarding mitigation banks. According to the banking guidance: "In general, use of a mitigation bank to compensate for minor aquatic resource impacts (*e.g., numerous small impacts associated with linear projects* [emphasis added]; impacts authorized under nationwide permits) is preferable to on-site mitigation. Mitigation banks should be used when there exists 'no practicable opportunity of on-site compensation or when use of a bank is environmentally preferable to on-site compensation'." Permittees may use mitigation credits from a bank with an established Mitigation Banking Review Team. Generally banks should function in advance of project impacts.

Transportation Equity Act for the 21st Century (TEA-21)

Due to the linear nature of transportation projects, the liklihood of causing numerous, small impacts within a geographic region creates mitigtation issues specific to transportation projects. TEA-21 established the preference for mitigation banking for compensatory mitigation requirements resulting from impacts caused by federally funded highway projects.

Excerpt from TEA-21:

> *"With respect to participation in a natural habitat or wetland mitigation effort related to a project funded under this title that has an impact that occurs within the service area of a mitigation bank,* ***preference shall be given, to the maximum extent practicable, to the use of the mitigation bank****…"* [emphasis added]

Federal Guidance on the Use of In-Lieu-Fee Arrangements

The ILF guidance letter describes the use of in-lieu-fee mitigation. In-lieu-fee mitigation allows permittees to provide funds to an in-lieu-fee sponsor instead of completing project-specific mitigation or purchasing credits at a mitigation bank. The guidance says: "Where on-site mitigation is not available, practicable, or determined to be less environmentally desirable, use of a mitigation bank is preferable to in-lieu-fee mitigation where permitted impacts are within the service area of a mitigation bank approved to sell mitigation credits, and those credits are

available." Banking is the preferred alternative because the wetland has already been established and the bank has already been approved.

Federal Highway Administration Regulations

These regulations describe the eligibility requirements for the use of natural habitat and mitigation banks. Preference for mitigation banks shall be given where:

- the wetland impact occurs within the service area of an existing mitigation bank,
- the bank contains sufficient credits to offset the impact,
- the bank used has been approved as adhering to the Federal Guidance for the Establishment, Use and Operation of Mitigtion banks, and
- selection of the eligibility preference is "in accordance with all applicable Federal laws, including regulations."

Corps Regulatory Guidance Letter (RGL 02-2), Guidance on Compensatory Mitigation Projects

This guidance letter emphasizes the watershed-based approach to solving mitigation problems. The ecological needs of the watershed should be considered when determining the most preferable wetland mitigation option. All mitigation options, including restoration, enhancement, creation and preservation, may be considered, as well as off-site alternatives such as banking or in-lieu-fees, so long as the proposed mitigation is considered the most ecologically beneficial.

Federal Guidance on TEA-21 Preference for Mitigation Banking

The EPA, Department of the Army, and the Department of Transportation published this guidance letter which summarizes federal policies relevant to compensatory mitigation (all of which this section describes), as well as provides a summary of factors for consideration when determining the suitability of banking as compensatory mitigation for TEA-21 projects. A two-step process should be used in considering factors relevant to the TEA-21 mitigation banking preference. The first step evaluates whether banking will suitably compensate for the impacts and the second step addresses the circumstances where there is more than one suitable method for compensating for unavoidable impacts, comparable to an approved bank. According to the FHWA guidance letter, mitigation banks are preferable to on-site mitigation when the

compensation is for "numerous, small aquatic resource impacts associated with linear projects such as highways."

TEA-21 requires that federal agencies work together to streamline environmental review of transportation projects. The objective of this provision is to allow state and federal agencies to adequately consider alternatives and the cumulative environmental impacts. The guidance recommends early coordination on the development of mitigation plans during the National Environmental Policy Act (NEPA) stage of environmental review of transportation projects (when drafting environmental impact statements) so that mitigation plans can occur well in advance of the impacts. The guidance letter further encourages localized agreements with regional and district offices of all agencies to promote early coordination for the development of mitigation plans and to identify priorities for each region.

STATE LAW AND POLICY

While many states have passed laws forbidding certain mitigation alternatives, Texas statutes allow both mitigation banking and in-lieu-fees for compensatory mitigation by TxDOT. The Texas Commission on Environmental Quality (TCEQ) must certify all Section 404 permit applications prior to their approval.

Clean Water Act §401(a)(1)

Section 401 of the Clean Water Act (1977) requires states to issue certificates to any applicant for a federal permit for activities which may result in any discharge into navigable waters of the United States that those activities will comply with applicable provisions of 33 United States Code §1341 which deals with water pollution prevention and control. Section 401 also provides that the state shall establish procedures for public notice or, if appropriate, public hearings, in the case of all applications for certification. Texas Administrative Code details this certification process in Chapter 279 of Title 30 (§§279.1-279.13). Under §279 TCEQ was granted the right to grant or deny certification for any activity which may affect water quality standards. Guidance for meeting 401 requirements for certification, including Best Management Practices, can be found at the TCEQ website: (http://www.tnrcc.state.tx.us/permitting/waterperm/wqstand/401cert.html).

Natural Resources Code §221.021

This natural resources code establishes the right of any state agency to "take any necessary and reasonable action to comply with a federal requirement to establish or maintain a mitigation bank." Included in the list of actions within the statute is "purchasing, selling, or contracting to purchase or sell a mitigation credit in a mitigation bank."

Transportation Code §201.6061

This transportation code allows the transportation department to use in-lieu-fees for compensatory mitigation. According to the statute, "If authorized by the applicable regulatory authority, the (transportation) department may pay a fee to an appropriate public agency or private entity in lieu of acquiring or agreeing to manage property for the mitigation of an adverse environmental impact that is a direct result of a state highway improvement project."

Chapter 14 of the Parks and Wildlife Code

In addition to oversight from the TCEQ, the Texas Parks and Wildlife and the Texas Land Office were given the task of conserving state-owned coastal wetlands under this code (2001). These agencies have the authority to monitor and enforce the no overall net loss policy of state-owned coastal wetlands and must be consulted for advice during the drafting of mitigation plans affecting those wetlands.

ISSUES AND OPPORTUNITIES

The review of literature and current wetland mitigation policies and state practices has raised several key issues when considering mitigation alternatives. These issues include the:

- role of formalized partnerships and/or agreements with other agencies and organizations to ensure mitigation will meet watershed-level ecological needs,
- historical preference by regulators for on-site mitigation,
- recent emphasis on ecological needs of the watershed,
- role of a centralized decision-making department in forming long-term mitigation goals,
- need to locate mitigation banks in the same service area of impacts (usually the USGS watershed),

- need to maintain mitigation sites in perpetuity,
- method to weigh costs/benefits with the likelihood of success for each mitigation option, and
- departmental ability to sufficiently review work completed by mitigation consultants.

In addition to the issues raised from the analysis thus far, several opportunities exsist within TxDOT and the wetland mitigation community. These opportunities include:

- TEA-21 emphasis on mitigation banking and environmental streamlining,
- examples of previous, successfully implemented partnerships with other agencies for individual wetland mitigation projects,
- hands-on experience and expertise of district environmental staff throughout TxDOT, and
- examples of other states' successful implementation of wetland mitigation alternatives.

CHAPTER 3: LITERATURE REVIEW AND ASSESSMENT OF CURRENT STATE PRACTICES

LITERATURE REVIEW

Review Process

Due to the vast quantity of research detailing the various aspects of wetlands and wetland mitigation, researchers first narrowed the literature review to a select number of topics pertinent to this research project.

Summary of Critical Issues

Ample evidence suggests that the Section 404 permitting process has not adequately addressed the national loss of wetlands for various reasons. Brown and Lant (1999) suggest that mitigation banks might result in a net loss of 21,328 acres of wetlands nationally because many of them are used for preservation and enhancement instead of creation or restoration. Allen and Feddema (1996) found that there was a net loss of 3.14 ha of wetlands in a specific region of Southern California throughout a two-year period. Campbell et al. (2002) found that created wetlands in Pennsylvania had different soil properties than natural wetlands, vegetation species richness and total cover were lower in created wetlands and vegetation had a greater proportion of upland species in created wetlands than in naturally occurring wetlands. Brown and Veneman (2001) found that a majority of constructed wetlands in Massachusetts were smaller than required and did not produce the desired wetland type. Shafer and Streever (2000) found that constructed salt marshes from dredged material in Texas were significantly different from naturally occurring salt marshes in terms of number of ponds and flooded depressions and relative exposure to waves. These studies all highlight the difficulties inherent in attempting to recreate a naturally occurring system. Many different solutions have been proposed to help alleviate some of the problems faced by created or restored wetland mitigation sites. Three topics often discussed include more time and effort spent during the design process (Mitch and Wilson, 1996), improved performance standards (success criteria) detailed within the permit (Kruczynski, 1989; Breaux and Serefiddin, 1999; Zedler and Callaway, 2000) and better assessment techniques to determine the overall success of the mitigation site (Kusler, 2003).

State and Federal Transportation Research Projects

Because transportation departments are responsible for a large percentage of all impacts to wetlands, there have been several studies of various aspects of the wetland mitigation programs of transportation departments. The following section discusses some of these reports.

Wetland Mitigation Program Evaluation

In a two-phase study, Rheinhardt and Brinson (2000) evaluated the effectiveness of the North Carolina Department of Transportation's (NCDOT) compensatory mitigation program by comparing them with reference sites where available. Phase I evaluated 71 mitigation parcels within 49 mitigation sites using a combination of NCDOT monitoring information and site visits to determine the similarity of soils at mitigation sites to natural wetlands, the overall success of the vegetation at mitigation sites, if the site appeared to be on a trajectory to be ecologically successful, if the site met all conditions within the permit and if the type of mitigation was appropriate for the associated impacts. Of the 71 sites, 26 were judged to be either ecologically successful or on trajectories to become ecologically successful; 9 sites were ecologically unsuccessful; 19 sites were preservation sites and were automatically judged successful and the remaining sites either lacked sufficient data or were too young to assess ecological success. They also discovered that, regarding restoration projects, many of the sites were not designed to restore the site to historical conditions with respect to vegetation composition; for example, many of the trees on the planting plan were not representative of the type of species that would naturally occur in those areas. Wetland creation was most likely to fail, perhaps due to the massive redistribution of soil in order to reach the underlying water table or saturated zone. Even when establishing hydrology, the soils were often too nutrient poor to allow vegetation to thrive. Based on their findings, the researchers established a list of strengths and weaknesses of NCDOT's mitigation program and then developed a list of recommendations. Some of their recommendations included alteration of success criteria to account for vegetation variability, improved monitoring, more standardized monitoring, choosing plants that are more representative of the naturally occurring wetland species. They also recommended purchasing more riverine sites and their associated buffer zones in order to more effectively help downstream water quality.

Phase II of this study involved the in-depth examination of five NCDOT compensatory wetland mitigation sites. The overall research objective was to provide information to help NCDOT and regulatory agencies develop a framework to improve NCDOT's compensatory mitigation program and to improve communication between NCDOT and the regulatory agencies. Their recommendations include:

- alter NCDOT's current definition of various types of compensatory mitigation to be more compatible with scientific understanding of ecosystems,
- revise success criteria to ensure that the hydrologic regime of the mitigation sites represents the historical hydrologic regime,
- use reference wetland sites in the design and assessment of mitigation sites,
- study restoration sites for longer periods to improve future restoration projects,
- use more innovative means to restore lost functions of a wetland,
- avoid impacting or trying to restore wetland classes that are difficult to restore (those with high organic content), and
- attempt more stream restoration.

Comparative Review of Wetland Mitigation Practices

A study conducted by the Department of Landscape Architecture and Environmental Planning at Utah State University (Johnson et al., 2001) examined various state transportation departments' wetland mitigation practices including mitigation evaluation, monitoring, maintenance, inventory, staffing and funding. The research methods included a literature review, a questionnaire and a telephone survey to determine the current wetland mitigation practices across the country. In addition, the report features a helpful chapter summarizing all the conclusions gleaned from the research and literature review. Based on the completed and returned questionnaires they received, they found that the most common causes of mitigation failure (those appearing on over 50 percent of the questionnaires) included:

- inexperienced contractors,
- poor mitigation site selection,
- inadequate pre-construction orientation of contractor-to-wetland related issues,
- inadequate wetland-related education/experience of DOT construction inspectors,
- insufficient funding for mitigation wetland maintenance,

- insufficient time allocated to the supervision of wetland construction and planting,
- poor maintenance, and
- incompatible mitigation site and objectives.

The researchers listed their general conclusions and then compiled a list of the eight elements that contribute to a high level of success. These elements included the following:

- good communication, best achieved through use of checklists and meetings;
- involvement of an interdisciplinary team through all mitigation phases;
- integration of activities in wetland mitigation (e.g. maintenance and monitoring can be integrated into one activity instead of keeping the activities independent);
- proper mitigation site selection;
- experience and trained individuals involved in wetland mitigation;
- consistency of methods and strategies (guidelines and checklists for evaluation, construction, monitoring, maintenance and inventory);
- flexibility of methods and strategies (each site will have specific difficulties and characteristics); and
- proper planning and follow-through.

Mitigation of Ecological Impacts: A Synthesis of Highway Practice

Samanns (2002) discussed various issues related to mitigating for ecological impacts. Issues discussed in the report include:

- the regulatory framework impacting ecological mitigation,
- a description of the various methods used to assess ecological impacts,
- the assessment of mitigation projects, and
- the costs of mitigation.

The report also describes four case studies of mitigation projects in New Jersey, California, North Carolina, and New York. The report discusses the widespread inconsistencies within departments and regulators of the assessment methodologies and decision-making. "Professional judgment" is often used in the place of standardized assessment techniques. The report also includes a compendium of sample agency documents such as mitigation checklists,

departmental guidance documents, memorandum of understanding's between transportation departments and regulatory agencies, etc.

Evaluation of Wetland Mitigation Measures

An older report (Crabtree et al., 1992) sponsored by the Federal Highway Administration evaluated wetland mitigation efforts in several state transportation departments. Seventeen mitigation projects in fourteen states were examined and compared with naturally occurring control wetlands. The researchers discovered that the success of the mitigation was less a function of mitigation type (i.e., restoration, creation, and enhancement) than the adequacy of planning, design elements, and implementation and follow-through.

Alternatives to On-Site Mitigation: Regulatory Guidelines, Research, and Practices

Regulatory Guidance Letters

The United States Army Corps of Engineers periodically publishes guidance letters intended to clarify various issues related to wetland mitigation. In recent years there have been two of these guidance letters (RGL 01-1 and RGL 02-2). The first RGL, dated October 31, 2001, provides "direction concerning factors that affect compensatory mitigation success in a variety of contexts." The letter also adopts definitions developed for use in accounting for the various types of mitigation used, including the terms "credit" and "debit." Mitigation, according to the guidance letter, should be based on a consideration of regional aquatic resource requirements, and should take an ecosystem approach to the formulation of compensatory mitigation projects. The letter notes that mitigation, including a mix of habitats (open water, wetlands and adjacent uplands), is generally more ecologically sustainable. The guidance letter further details the following components for a compensatory mitigation plan:

- baseline information,
- goals of the mitigation,
- mitigation work plan,
- success criteria,
- monitoring plan,
- contingency plan,
- site protection,

- financial assurances, and
- responsible party for long-term maintenance.

Other guidance topics included in the letter were: locating sites for mitigation projects, the use of off-site versus on-site mitigation, agency roles and coordination, public review and comment, the role of the permit applicant, the party responsible for project success, management and protection of the mitigation sites, monitoring requirements and remedial action.

The second regulatory guidance letter (RGL 02-2) published December 24, 2002, does not modify existing mitigation policies, regulations, or guidance, but supersedes RGL 01-1. RGL 02-2 further emphasizes the watershed approach to mitigation in order to clarify and support the national "no net loss" of wetlands policy. They specify that watersheds will be identified using the USGS hydrologic unit codes. The letter gives further guidance regarding buffer zones, stream mitigation, functional assessment of mitigation, and functional replacement of wetlands. Regarding mitigation alternatives, however, the guidance simply states "Permit applicants may propose the use of mitigation banks, in-lieu-fee arrangements, or separate activity-specific projects."

CRS Report for Congress: "Wetland Mitigation Banking: Status and Prospects II"

The Congressional Research Service (CRS) published a report in 1997 detailing the status and prospects of mitigation banking. The report states that "mitigation banking is intended to help resolve contentious situations where growth and development pressures conflict with wetland protection efforts." Further, most of the early operating banks were used by departments of transportation or highways and were primarily managed by the states. Participation in banking by both sponsors and clients is expanding rapidly, especially for commercial banks. At the time, little activity concerned with the watershed approach to mitigation planning at the regulatory level occurred; however, the report mentioned that banking has its greatest potential for success when part of a watershed-based mitigation plan, which may be difficult for banks serving linear highway projects that pass through multiple landscapes or watersheds.

General Accounting Office: Assessments Needed to Determine Effectiveness of In-Lieu-Fee Mitigation

In 2001, the General Accounting Office published a report to Congressional requesters discussing issues raised by the in-lieu-fee mitigation alternative. The objects of the study were to determine the extent to which the in-lieu-fee option has been used to mitigate impacts, the extent to which in-lieu-fees have achieved the intended purpose of mitigation impacts, and whether in-lieu-fee organizations compete with mitigation banks for business. After interviewing Corps districts, the report concluded that the benefits of in-lieu-fees provide developers with a less cumbersome and timelier mitigation option which also allows Corps districts to operate more efficiently. However, the EPA, FWS and NOAA officials and mitigation bankers raised many concerns, including whether in-lieu-fees are being spent in a timely manner, and whether the Corps can adequately monitor such arrangements. Whether or not in-lieu-fee arrangements have achieved the purpose of mitigating adverse impacts to wetlands was uncertain due to inconclusive evidence. At the time the report was published in-lieu-fee arrangements in Texas consisted of one in the Fort Worth Corps District and four in the Galveston Corps District, but none of those were for transportation projects.

National Wetlands Mitigation Action Plan

Noting the often-publicized failures of the national goal of "no net loss" of wetlands, the EPA and the Corps combined efforts to devise a National Wetlands Mitigation Action Plan (2002). Three of the themes guiding the plan are described below:

- working to provide a "consistent voice" on compensatory mitigation,
- focusing guidance to achieve ecologically meaningful compensatory mitigation, and
- emphasizing accountability, monitoring, and follow-through in evaluating compensatory mitigation.

The plan includes a goal to work with the Federal Highway Administration to develop guidance clarifying the TEA-21 preference for mitigation banking.

Guidelines for Selecting Compensatory Wetlands Mitigation Options

Marble and Riva (2002) discuss the factors influencing successes of both project-specific and consolidated mitigation projects, as well as the key obstacles to the effective use of consolidated mitigation. Their report includes a detailed examination of banking instruments including a discussion of monitoring requirements, long-term management of banks, the use of mitigation banks, wetland preservation and banking and the addition of wetland buffers to increase the number of credits within a bank. The report also highlights case studies of eight state transportation department mitigation programs: California, Florida, Louisiana, Maine, North Carolina, Pennsylvania, Washington and Wisconsin. With the passage of TEA-21, there is a record level of funding for transportation projects, and therefore, the number of transportation-related impacts to wetlands will increase in the future. The report concludes that more states should be able to enjoy more mitigation options rather than on-site mitigation (project-specific mitigation) through more planning, staff experience and regulatory support. The authors discuss four tasks aimed at more effectively utilizing all mitigation options, including:

- presentation of mitigation options at annual meetings and conferences,
- training workshops,
- coordination with other transportation research entities, and
- development of a web-based information center for mitigation options.

Wetlands Mitigation for Highway Impacts: A Nationwide Survey of State Practices

Hinojos et al. (1999) put together a compendium of wetland mitigation practices for state transportation departments. Information regarding the organization of the departments, the approximate number of mitigation sites and types of mitigation preferred by the departments are presented on a state-by-state basis. Unfortunately, there was no overall results section summarizing general results. However, the information presented in the report is useful if questions arise concerning specific transportation departments.

Planning and Operation Guidelines for Mitigation Banking for Wetland Impacts

One problem often faced by transportation department staff is that there is little understanding of or training in the procedures needed to incorporate mitigation alternatives into existing mitigation programs (Samanns 2002). To gain an understanding of mitigation banking

practices, Weems and Canter (1995) surveyed 19 existing and 20 proposed wetland banks. The survey recipients answered questions relative to eight planning or operational issues including bank goals, site selection, bank operator, policies for credit establishment and usage, preferred wetland development options, criteria for bank usage, long-term management plans, and construction and maintenance requirements. Based on the surveys, the researchers compiled ten guidelines which are paraphrased below:

- wetland banks should increase the efficiency of the permitting process,
- construction should occur prior to impacts,
- the operator of the bank should be the developer as well as a combination of resource agencies,
- banking credits/debits should be based on established methods, such as the method proposed by the U.S. Fish and Wildlife Service,
- the preferred order of mitigation option is restoration, enhancement, creation or preservation,
- projects eligible for bank use must have proven that avoidance or minimization are not possible and that on-site mitigation is not feasible,
- long-term funding for the bank should be guaranteed through trust funds or other such accounts,
- best management practices should be used throughout the construction of the bank,
- monitoring should be conducted annually for at least 10 years after construction, and
- bank account statements should be sent semiannually to bank users.

ASSESSMENT OF STATE PRACTICES

Process

The intention of this section is to describe some of the wetland mitigation practices of interest that have been implemented by other state transportation departments. This section is not intended to be an exhaustive compendium of all state practices, but rather it is intended to highlight the practices of a select group of state transportation departments whose mitigation programs may be of interest to TxDOT. The specific transportation departments were chosen after examining information taken from literature, departmental websites and from direct phone

conversations with transportation department employees responsible for wetland mitigation. Particular note was given to the favored mitigation options and alternatives, to departmental organization and to environmental streamlining or partnerships.

Arizona Department of Transportation (ADOT)

Arizona, in consultation with the Arizona Game and Fish Department (AGFD) and the Corps, recently began an in-lieu-fee program with various conservancy organizations for 404 and wildlife habitat conservation. All pertinent entities agree that, in certain instances, mitigation funds can be better utilized away from the highway than on-site. Therefore, ADOT, AGFD, and the Corps devised an in-lieu-fee system that allows funneling funds to projects that are most beneficial for the area. The conservancy organizations who have received funds thus far include the Nature Conservancy, the Center for Native and Urban Wildlife/McDowell Sonoran Land Trust, and the Desert Foothills Land Trust. ADOT and AGFD work together to locate restoration projects in the near vicinity or the same watershed as the impacts, as well as locate conservancy groups that are working to protect, restore or enhance habitat in the area. After locating a suitable project the fee is determined. Not all projects are suitable for in-lieu-fee mitigation. ADOT uses a costs-benefits analysis, as well as examining the on-site mitigation options before deciding which mitigation projects are best handled through in-lieu-fees.

Arkansas Highway and Transportation Department (AHTD)

A statewide multi-agency wetland MOA allows AHTD to use banking for all wetland mitigation projects. Restoration is the most preferred form of mitigation banking because it is most likely to succeed. Currently the planning and design of the banks are handled in-house, but legislation passed that enables the state of Arkansas to be the sole mitigation bank provider, and therefore the transportation department will eventually purchase all credits through the state. Therefore, it is unlikely that the in-lieu-fee option will be pursued in the future.

Partnerships with other institutions are useful for AHTD when locating land adjacent to or on state or federal property. In these instances maintenance can be relinquished to the other institution after the requisite monitoring period.

Five individuals within the environmental department with backgrounds in wildlife biology or a related field are responsible for all conceptual wetland designs. These individuals consult with engineers if needed, and subcontractors implement the design. Because of the large

number of mitigation banks AHTD uses, an additional employee is responsible for writing banking instruments.

The Corps, the AHTD, and the FHWA entered into a cooperative agreement related to interagency funding for the Department of the Army permit process on federal-aid highway projects. The AHTD agreed to fund one Corps point of contact in the Corps' Little Rock District to be dedicated to the permitting of transportation projects. This agreement allows AHTD to acquire all necessary permits occurring throughout the state of Arkansas through one Corps office rather than working through three Corps offices.

California Department of Transportation (Caltrans)

California is most similar to Texas in size and diversity of ecological zones. Similarly, the organization of the Caltrans wetland mitigation program is also similar to TxDOT. Because of California's large size, most of the wetland mitigation design and planning is delegated to the districts. There is some belief that Caltrans' mitigation decentralized mitigation program has caused it to be slow at pursuing consolidated mitigation options (Marble and Riva, 2002). Because no form of mitigation is preferred, districts are encouraged to seek out the best mitigation solution on a case-by-case basis based on a myriad of variables such as cost, time and science. While Caltrans has constructed mitigation banks in the past, the department has at times encountered difficulties using all of the credits of the constructed banks in a timely manner and is, therefore, reluctant to pursue this option. In-lieu-fees are used if allowed for small impacts because of the higher rate of failure for small sites; however, regulators are often reluctant to allow this option. The formation of partnerships with local park districts and conservancy organizations is implemented occasionally; however, the time-consuming process of relinquishing ownership of land to another organization can often be cost-prohibitive.

District level designers and landscape architects usually handle wetland mitigation planning and design in-house, and consult with experts if necessary.

Florida Department of Transportation (FDOT)

FDOT's wetland mitigation program has the progressive goal of no net loss of wetland function which goes a step further than simply no net loss of wetland area. Because of research reports that were critical of project-specific mitigation in Florida, the state legislature passed the Florida Environmental Reorganization Act which supported the use of banking and in-lieu-fees

as well as granted oversight of the permit process to the state Department of Environmental Protection and five Water Management Districts (WMDs). Other legislation passed in 1996 (Senate Bill 1986) directed the WMDs to more effectively address the region's needs regarding transportation-related wetland mitigation. FDOT must forecast its mitigation needs for each WMD by May of each year and set aside funds in an escrow account to pay the WMDs for the mitigation provided. Marble and Riva (2002) present a more in-depth discussion of FDOT's mitigation.

Iowa Department of Transportation (IDOT)

IDOT has been unsuccessful using banking and only rarely uses in-lieu-fees. Because of the lack of mitigation alternatives, the environmental division handles a majority of mitigation projects on-site (within the watershed). IDOT's environmental division regularly partners with a variety of organizations, including the Iowa Department of Natural Resources and local conservation groups.

Wetland planning and design is handled at the division level. In order to help fund the new Environmental Division, IDOT received an EPA wetlands protection grant which helped centralize the mitigation staff as well as partially fund a project which tracks all mitigation sites on a Geographical Information Systems (GIS) database. A design team consisting of two environmental engineers, one hydrologist and one wetland manager is responsible for the planning and design of each mitigation project. This team works closely with the district offices throughout the design process, especially during the site selection process. The site selection process involves first examining locations on-site, preferably within the ROW. If no feasible site is located on-site within the ROW then the environmental division contacts local biologists, the NRCS office or local conservation groups for available land options. Keeping mitigation planning and design in-house rather than hiring subcontractors to complete the work has resulted in cost-savings benefits as well as the ability to have more control in the implementation of the project.

Kentucky Transportation Cabinet (KYTC)

KYTC began a mitigation banking program in the early 1990s and currently only uses wetland banking for all wetland mitigation. The lack of private banks in the state of Kentucky was the principal driving force behind KYTC's wetland banking program. Banking is feasible in

Kentucky because of the relatively small number (around a dozen) of watersheds that are likely to face wetland impacts. KYTC uses the team approach to the design of their wetlands. Despite the existence of an MOA between the corresponding Corps districts and the Kentucky Department of Fish and Wildlife Resources (KDFWR), which establishes the ability to receive in-lieu-fees for mitigation purposes, KYTC has not pursued the in-lieu-fee option. However, in-lieu-fees have been utilized extensively in stream restoration and the in-lieu-fee option may be pursued in the future for wetland mitigation when all the credits have been used in the already established wetland mitigation banks. Districts do not currently have the staff or the expertise for wetland design and, therefore, all planning and design is handled within the environmental division. Team members including water and terrestrial biologists and design engineers are responsible for designing and planning the wetland banks. Occasionally consultants employing landscape architects are hired for design work.

Recently the KYTC and the Kentucky Department of Fish and Wildlife Resources (KDFWR) entered into a mitigation property transfer agreement whereby the KYTC can choose to transfer ownership of successfully completed mitigation sites over to the KDFWR and continue to receive mitigation credits for the property.

Louisiana Department of Transportation and Development (La DOTD)

Due to the number of mitigation banks within the state of Louisiana and a small environmental staff, La DOTD uses commercial mitigation banking exclusively. All wetland planning is performed at the division level with little input from the districts.

Washington State Department of Transportation (WSDOT)

In the past, regulatory agencies have been reluctant to approve wetland mitigation projects that were not on-site and in-kind in the state of Washington. In-lieu-fees have not been used by WSDOT thus far. Because mitigation banks have been approved for WSDOT only recently, on-site mitigation continues to be an important mitigation option for WSDOT. Currently, only one wetland bank has been approved and another bank is pending approval. Three other mitigation banks are still in the planning phase. The approved mitigation bank resulted from collaborating with the NRCS, which paid for a majority of the land purchase fee necessary to preserve a stream. WSDOT will be responsible for maintaining the land.

Two team members, one landscape architect and one wetlands biologist, are responsible for working together to first devise a conceptual design to be submitted with the wetland mitigation permit. WSDOT also boasts a highly organized mitigation monitoring program.

The state of Washington passed the Permit Streamlining Bill (ESB 6188-TPEAC) in 2001 which helped bolster WSDOT's effort to create liaison staff positions at various permitting agencies. Currently WSDOT has several liaisons at the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the U.S. NOAA Fisheries Service, state wildlife and ecology agencies, and the Washington State Tribal Organizations. These staff members coordinate with WSDOT to facilitate watershed-based mitigation and the one-stop permitting program. Additionally, in 1994, WSDOT entered into the *Washington State Department of Transportation Wetland Compensation Bank Program Memorandum of Agreement* with state and federal wetland regulatory agencies. This MOA provides principles and procedures for establishing, implementing, and maintaining WSDOT wetland mitigation banks. This MOA was driven by the emphasis that WSDOT placed on advanced wetland mitigation.

WETLAND MITIGATION WITHIN THE TEXAS DEPARTMENT OF TRANSPORTATION

Departmental Organization and Staffing

TxDOT districts handle wetland mitigation individually with additional help available from TxDOT's Environmental Division. Districts are responsible for all the permitting, planning, monitoring and maintenance of each mitigation project. The district environmental staff members involved in wetland mitigation in TxDOT generally have educational backgrounds in wildlife biology or related fields, but specific training in wetlands, design or hydrology is not required. Recently, TxDOT offered supplementary training specific to wetland design and encouraged district environmental staff to attend. However, such training is not mandatory and, therefore, not all appropriate staff were able to take advantage of such training. Because of the variation in the wetlands experience of the staff across the state, many districts often decide that it is best to outsource the design and planning of wetland mitigation projects to outside contractors.

Mitigation Practices

The ability of a TxDOT district to utilize mitigation alternatives varies widely across the state. Because of the regulatory requirement to locate mitigation projects within or as near to the impacted watershed as possible, many transportation mitigation projects are unable to utilize the private wetland banks within Texas. The wetland banks in Texas tend to be concentrated within a few regions of Texas and, are therefore, inappropriate as mitigation options for most areas within Texas. Additionally, the necessary relationships are difficult to explore with other agencies for the establishment of in-lieu-fee agreements since wetland mitigation is decentralized across the state. Any partnership that seeks to streamline environmental mitigation or strives to meet the mitigation needs of a watershed must be carried out at the division level. However, while individual districts are unable to instigate any wide-sweeping MOAs with other agencies or organizations, some districts have been successful at working with local conservation organizations or government agencies for individual projects. See Chapter 3 for a more in-depth discussion on the steps taken by individual TxDOT districts to implement partnerships.

CHAPTER 4:
CASE STUDIES

Various TxDOT wetland mitigation sites were chosen for a more in-depth, case-study analysis so that distinct regional characteristics and mitigation practices throughout TxDOT could be understood more thoroughly. Researchers included the Bryan, Corpus Christi, Dallas, Laredo, Lufkin, Paris and Yoakum districts in the case study. Researchers visited each site at least once and, in several instances the sites were visited twice. Permit information was obtained from the districts or the Environmental Division prior to the site visits. Generally, the first site visit consisted of staff interviews and a general walk-around of the site in order to gather pertinent historical background information of the project and to determine what issues or concerns, if any, that the district faced regarding section 404 wetland mitigation. The second site visit consisted of a field site examination, which included a wetland delineation to determine whether or not the site was functioning as a wetland. Because the Dallas District was in the process of procuring mitigation monitoring reports from a consultant when the study was conducted, the information obtained by the consultant was used instead of site visits for the mitigation projects within the Dallas District.

FIELD ANALYSIS METHODOLOGY

Researchers gathered soils information, aerial photography, and the mitigation site plan prior to the visit. The sites were delineated following the routine determination described in the 1987 Corps of Engineers Wetland Delineation Manual, which states an area can be considered a wetland if it meets three criteria regarding soils, vegetation, and hydrology. Because the wetlands included in this report were "man-induced," they can be considered "atypical situations." In created wetlands, the soils may not have had sufficient time to develop hydric characteristics. If no hydric soil characteristics were noted, but the site had wetland hydrology and vegetation, then the site could still be considered a wetland.

1. Hydric Soils. There are two main categories of hydric soils: organic soils (Histosols) and hydric mineral soils. The study soils fall under the category of non-sandy mineral soils. National, state, or local soil lists all contain hydric soil information. If the soils mapped at the project site are listed as hydric, there is a strong possibility that there are hydric soils present.

However, field observations are necessary to determine whether or not hydric soils actually exist. Field indicators for non-sandy hydric mineral soils include:

- the presence of an organic layer near the surface of the soil (histic epipedon),
- saturated soil conditions,
- reducing soil conditions,
- soils that have a low chroma or are gleyed,
- the presence of bright mottles, and
- iron or manganese concretions.

2. Hydric Vegetation. The regionally published List of Plant Species That Occur in Wetlands includes hydric vegetation. Texas lies within Region Six. Plants are given an indicator status based upon how probable it is that they occur in wetland areas. The seven indicator categories are:

OBL Obligate (>99 percent probability of occurrence within wetlands)

FACW Facultative Wetland (greater than 67 percent to 99 percent probability of occurrence in wetlands)

FAC Facultative (33 percent to 67 percent probability of occurrence in wetlands)

FACU Facultative Upland (1 percent to less than 33 percent probability of occurrence in wetlands)

UPL Obligate Upland (less than 1 percent probability of occurrence in wetlands)

NA The species has been reviewed, but the Interagency Review Panel has not reached an agreement as to its indicator status.

NI No indicator status recorded; insufficient information available

In addition to the indicator categories listed above, the modifiers + and – are sometimes applied to the FAC, FACU and FACW indicator status categories to indicate tendencies of wetland occurrence. Greater than 50 percent of all recorded vegetation at a given location must be listed as FAC, FACW or OBL.

3. Wetland Hydrology. Sites have wetland hydrology when they are periodically inundated or the soils remain saturated for a significant period of time, generally two continuous weeks, throughout the growing season. Wetland hydrology field indicators include:

- drainage patterns,
- drift lines,
- sediment deposition,
- water marks,
- saturated soils, or
- visual observation of inundation.

Data Collection

Transects were established and data were gathered along the transect based on the size of the site. At each data collection point the dominant species of trees, shrubs, herbs and vines were noted. A soil pit was dug at each point and we observed the soil composition, texture, color, chroma, odor and the presence or absence of saturation. The presence or absence of wetland hydrology was also noted at each data collection point. After collecting all data, the wetland was delineated using pink surveyor's flags to indicate the wetland edge. A TxDOT intern, Mario Mata, then mapped the site using a Trimble global positioning system (GPS) unit in order to obtain the correct area of the site. If including additional requirements in the permit, such as vegetation requirements for example, researchers briefly noted the extent to which these requirements had been met and other specific problems or issues, such as significant erosion or the presence of invasive species.

Results

The purpose of the field visits was to gain a general understanding of the wetland mitigation program at TxDOT in order to help develop a set of recommendations for the program. Therefore, the results discussed in this section do not specifically pertain to any one project.

There were several sites with positive elements as well as several sites where concerns were noted. One of the positive elements included the formation of partnerships with other state agencies such as Texas Parks and Wildlife and Texas Department of Corrections. These projects

allowed TxDOT to use state-owned land for wetland mitigation and will continue to be maintained by the state agency for use of either the public or their employees. Other projects were wisely situated adjacent to rivers that experience regular flooding regimes and have ultimately resulted in larger than anticipated wetland acreage. While TxDOT should be commended for their successful mitigation efforts, there is room for improvement regarding the overall wetland mitigation program.

Generally, the concerns noted at the TxDOT mitigation sites are similar to those found at a national level. The smaller mitigation sites, particularly those under one acre, were most likely to encounter the most serious problems, while the larger projects were most likely to encounter fewer problems. The most serious problems noted during the field visits included:

- mitigation site was too small,
- hydric vegetation failed to establish,
- mitigation sites that were built in locations with inappropriate hydrology,
- mitigation sites that may not be protected from effects of cattle grazing,
- mitigation sites not constructed on a timely basis,
- higher than permitted mortality rate for planted vegetation, and
- vegetation planting not corresponding to permitted planting plan.

While it is always difficult to recreate nature, it is possible to examine the above concerns in order to learn from them. Some of the causes of the problems noted during the field visits include:

- poor choice of location of mitigation project,
- failure to act quickly enough when problems were first noted,
- failure to receive written approval from regulators regarding changes to mitigation plans,
- inability to effectively assess the recommendations of paid consultants,
- failure to adequately maintain and irrigate plantings,
- failure to prevent sedimentation resulting from serious erosion of sideslopes,
- construction crew did not build project as directed in the plan, and
- inadequate oversight of mitigation plans resulting in construction of a project that was too small.

CHAPTER 5: RECOMMENDED ALTERNATIVES TO IN-KIND WETLAND MITIGATION

COMPARISON OF MITIGATION ALTERNATIVES

Texas comprises over a quarter of a million square miles of diverse habitats and ecosystems. This diversity leads to a disparity within the types of mitigation alternatives available within different regions of Texas. Future impacts to wetlands are more probable in the eastern portion of the state and along the Gulf Coast where the climate is more mesic and the population is denser. Because of this difference in climatology, most of the established mitigation banks are concentrated in a few areas of Texas and are unavailable to the remainder of the state.

Many state transportation departments have centralized departments dedicated to environmental mitigation projects, where staff gain experience needed to plan wetland mitigation projects, conduct standardized monitoring of mitigation sites, and forge necessary relationships with other organizations and agencies to enable successful partnerships. Texas' size coupled with the decentralized organizational structure of wetland mitigation staff makes this task more difficult to achieve than it would be in smaller states with fewer watersheds to manage. In areas where impacts to wetlands are rare, there is little incentive to provide staff with extra training. Therefore, historically TxDOT favored on-site mitigation because it is outwardly the simplest form of mitigation to plan. Unfortunately, on-site mitigation is often fraught with problems, as discussed previously in this report.

On-Site (Project-Specific) Mitigation

In areas of Texas where impacts to wetlands are relatively rare, and therefore, the other mitigation alternatives are not available, on-site mitigation, also called project specific mitigation, can be a cost-effective, ecologically beneficial option, provided sufficient planning occurs. Regulators generally prefer on-site mitigation because it is more likely to replace lost ecological functions. TxDOT can continue to utilize this option effectively if staff members are adequately trained and have the budgetary resources to effectively plan for such mitigation. The main concern with on-site mitigation, in particular where impacts to wetlands are relatively rare, is the lack of experience dealing with wetland mitigation. When TxDOT staff lack experience, they hire consultants to handle the mitigation planning and design work. However, little

evidence suggest consultants are more successful than in-house designers. Environmental staff ought to take care when hiring consultants that they have adequate knowledge and understanding of the particular issues associated with each project. At a minimum, staff should understand wetland mitigation issues well enough to determine the qualifications of consultants. One option is to use more experienced staff from other areas of Texas to aid districts that are not as familiar with wetland mitigation planning and design.

Banking (In-House)

According to TEA-21, banking is the preferred mitigation alternative for transportation projects. Many states have successfully implemented banking programs by examining future transportation needs and pinpointing the watersheds where impacts will likely occur. In-house banking, which occurs when the transportation department is responsible for formulating the banking instrument and overseeing the planning and construction of the mitigation bank, can be implemented in concert with the NEPA process of environmental impact statements. Mitigation usually occurs prior to the impacts, thereby reducing the loss of ecological functions. Keeping mitigation banking in-house is often beneficial because the transportation department will control where the bank is located and the terms of the bank which are detailed in the banking instrument. The department can locate the areas of greatest need and establish a bank in those areas. In-house banks are dedicated only to transportation projects and are not available for use by other individuals or organizations. Another benefit to banking is that it is possible to ensure that the mitigation projects receive adequate funding because there has been advanced planning that takes mitigation into account.

One disadvantage to in-house mitigation banking programs is that they typically require significant time to develop. Marble and Riva (2002) suggest two to three years should be sufficient to approve a banking instrument. Few studies have been published that address whether or not mitigation banking is a cost-effective mitigation option. Another difficulty with banks results from the Corps' historical preference for on-site mitigation. This preference for on-site banking, coupled with the language of TEA-21 that favors mitigation banking, is a confusing issue that begs for further clarification. Any transportation mitigation banking program must work closely with regulators to ensure that the mitigation bank can be used for future transportation impacts within the bank's described service area.

Banking (Third-Party)

Purchasing credits at a private mitigation bank is only an option when no practicable alternative can be found on-site and when a private bank already exists within the watershed. While outwardly this seems like the simplest option, the lack of mitigation banks within Texas prevents use. The need to demonstrate that on-site mitigation is not practicable is another obstacle to effectively utilizing this mitigation option.

In-Lieu-Fees

While many staff members interviewed throughout the compilation of this report expressed an interest in this option, in-lieu-fee arrangements are actually the most difficult forms of alternative mitigation to implement. Many Corps districts have been very reluctant to allow in-lieu-fee arrangements. Very few state transportation departments have had successful in-lieu-fee programs. However, those that have taken the significant time and planning necessary to implement such arrangements (Arizona DOT, Kentucky Transportation Board, Florida DOT) have had a great deal of success utilizing in-lieu-fee programs and the up-front planning has paid off in the future streamlining of mitigation projects. The difficulty with in-lieu-fees arises from the need to reach consensus with regulators and the other agencies involved that would receive the fee as to the conditions of the arrangements. Successful in-lieu-fee arrangements are possible, but they generally involve significant input and oversight from the state wildlife departments.

Partnering

Forming partnerships with other wildlife agencies and organizations, while technically not a mitigation alternative, deserves consideration. Such arrangements have benefits for both partners. TxDOT can receive aid in locating desirable land on which to situate mitigation projects, and typically can turn maintenance over to the other organization after completing the monitoring period. In turn, the other organizations receive money for land acquisition and maintenance, as well as the addition of a wetland area to the site. Agencies and organizations that have partnered with TxDOT include the Texas Parks and Wildlife Department and the Nature Conservancy.

PROCESS FOR SELECTING APPROPRIATE MITIGATION ALTERNATIVES

The process for selecting the appropriate mitigation alternative depends upon how much up-front planning has occurred prior to the need for wetland mitigation. However, there are general steps to take when determining the appropriate mitigation alternative for transportation projects.

Step One: Avoidance.

Have all steps been taken to avoid impacts to the wetland? The less expensive mitigation alternative is to avoid the need for mitigation.

Step Two: Determine the appropriateness of on-site mitigation.

- Based on the size of the mitigation project and the likelihood for future transportation needs, is there any appropriate land available within the TxDOT right-of-way near the project site?
- If land is available, is the land connected hydrologically within the landscape? Is the land located near a wetland? Will the site be subjected to regular flooding regimes?
- Is the land likely to be needed for future transportation use? Can the site be maintained in perpetuity?
- Would the watershed benefit from the replacement of the existing habitat with a wetland habitat? It is often not desirable to create a wetland within an existing hardwood forest.
- Is the site protected from upstream activities? Is the site likely to be damaged by future development or agriculture run-off?

Step Three: Available alternatives within the watershed.

Banking

- Does an in-house wetland bank exist within the impacted watershed?
- Is the wetland bank the same kind as the wetland that was impacted?
- If no in-house-bank exists, are wetland impacts likely to occur within the watershed in the future?
- If not, are commercial banks available?

In-Lieu-Fees

- Does an in-lieu-fee program exist within the watershed that has been approved by regulators?
- If yes, what wildlife organizations exist within the area that would be willing to accept fees for the creation of a wetland? What are the most important ecological needs within the watershed?
- If no in-lieu-fee programs have been agreed upon by regulators, is there a need to explore this option based on the likelihood of future wetland impacts?

Step Four: Off-site project-specific mitigation.

- If no alternatives are available within the watershed and on-site mitigation is not likely to be ecologically beneficial, land must be located off-site but within the same watershed for mitigation.
- Does TxDOT or another state agency own land located near an existing wetland, river or other water body? What are the most important ecological needs within the watershed?

Step Five: Partnerships.

Once the most appropriate mitigation alternative has been chosen, TxDOT should explore the possibility of forming partnerships.

- Does the state wildlife department have a need for wetland area within the watershed?
- Do land owners within the watershed desire to donate land to a trust?
- Do wildlife agencies have projects within the watershed that would benefit from a mitigation site?

Organizational Options

A consistent difference between those states with environmental mitigation programs that emphasize alternative wetland mitigation processes such as banking or in-lieu-fee arrangements is the organization of the environmental section of the transportation department. Due to the size

of the state of Texas, district staff conducts much of the mitigation planning with some oversight from the Environmental Division. Because of the decentralized nature of the mitigation process in Texas, it is difficult to contain the knowledge and experience of the district environmental staff within an easily accessed location. It is further difficult to imagine the successful implementation of any alternative mitigation effort when experienced staff are scattered throughout the state.

Many of the state transportation departments having successful alternative mitigation efforts employ one centralized mitigation team that handles the entire permitting process. While this scenario is the obvious choice for transportation departments of smaller states, a centralized environmental mitigation team would encounter challenges within the much larger and diverse state of Texas. The research team has identified six organizational options that warrant consideration. A description of these options follows.

Option 1: Change nothing.

While there were many positive aspects of TxDOT's wetland mitigation program, the concerns that were discovered during the field visits are likely to recur if no changes take place. This option is not recommended.

Option 2: Always pay a consultant to handle all wetland mitigation projects.

It is a fallacy to expect that consultants always have more experience designing and building wetland mitigation projects than environmental staff. Consultants, while sometimes necessary, should only be utilized when TxDOT staff are adequately knowledgeable to oversee the work performed by the consultants. Often times the Consultant is awarded a planning project and then distances itself from TxDOT dealings until the project is completed. This process is typical of most consultant awarded projects, not just wetland mitigation. As long as the consultant is qualified, TxDOT should end up with a successful project, however, it is preferred that the TxDOT staff also has the expertise to oversee the consultant. Therefore, TxDOT should consider the following when planning to use a consultant:

- Consultants may have more training, resources, knowledge. TxDOT staff may not have the time to devote to mitigation planning.
- TxDOT is still liable to ensure the success of wetland.
- Consultants may not have the expertise that they claim to have.

- TxDOT staff must possess an adequate understanding of wetland issues to ensure that consultants perform to a high standard.

Option 3: Provide more training to staff.

Most TxDOT Environmental staff have obtained a bachelors degree, and sometimes an advanced degree, in a field that qualifies them to operate in the ENV arena. However, often times they are not specialized in the area of wetland mitigation to the extent needed to oversee or develop a mitigation plan. There are not an abundance of outside opportunities or programs directed at wetland mitigation training, therefore on the job training and case studies are commonly the accepted methods. Outside training is expensive and might not be feasible to the entire staff, but key positions could benefit greatly, as would collateral staff that would receive the trickle-down effect. TxDOT should consider the following with regards to training staff:

- more knowledge and training will help staff recognize issues before they arise,
- more general understanding of wetland issues amongst key staff members may raise the success rate of all mitigation projects,
- training must be mandatory and on-going for new staff, and
- districts may resist training due to cost and time considerations.

Option 4: Implement standardized monitoring for all mitigation projects.

Even in the event that the organizational structure of the wetland mitigation process stays the same, the program as a whole would benefit from a standardized monitoring system. A system that analyzes what measures have been taken and gives feedback on the results of those measures would help insure that mistakes don't repeatedly occur, and successful methods could be reapplied. Ideally, this monitoring system would encompass the entire TxDOT mitigation program, but at a minimum, a system within the individual districts would allow them to better manage their own mitigation process. TxDOT should consider the following related to standardized monitoring:

- TxDOT will be better able to keep track of all wetlands across the state.
- The possibility exists that standardized monitoring reports are not taken seriously.
- It may be difficult to ensure that districts conduct monitoring correctly and in a timely manner.

Option 5: Provide more oversight from the Environmental Affairs Division.

The decentralized nature of the mitigation process makes exchange of information a difficult and uncommon occurrence between TxDOT Districts. The Division Level Environmental personnel are not currently set up to act as liaisons between the district Environmental coordinators in regards to individual project information. District level coordinators and division level personnel are often only in contact to exchange information on the status of a project, not the process that has, or is, taking place. A central source for information and guidance at the division level would require specialized knowledge and adequate time, but would be a valuable asset to the district level coordinators who are developing the mitigation plan. This division level source would also be a logical facilitator of a standardized monitoring program (mentioned in Option 4) that would provide feedback to the districts. With this in place, TxDOT would benefit from the following:

- more effort will be put forth throughout the agency to ensure the success of mitigation projects, and
- the Environmental Affairs Division will be able to track all successes and concerns and learn from past experiences.

Option 6: Wetland teams handle all wetland mitigation work (Wetland Expert Team - WET).

Interdisciplinary teams with experts from various fields related to environmental regulation may be able to more effectively plan, design, and implement wetland mitigation projects, as well as establish the procedures for implementing mitigation alternatives with state and federal regulators and nature conservation organizations. Therefore, this option would provide the following:

- TxDOT can ensure that key specialists are communicating with each other.
- More people have a stake in ensuring a successful mitigation effort.
- One or two people in each district do not shoulder the burden.
- This effort may save money in the long run (see Corpus Christi million dollar 1/3 acre wetland).
- Staff will be better able to decide what mitigation options are available for specific projects and whether or not consultants will be necessary.

- The organization of the teams may be difficult to implement and may eventually require addition of more staff.

Because the centralized handling of wetland mitigation will help ensure that mitigation efforts are adequately planned for, monitored and tracked in a standardized manner, Option 6 is preferred. The main difficulty with this option concerns the implementation of such an organization that would be able to effectively handle all mitigation throughout Texas. Three subcategories of Option 6 were identified below.

WET (Wetland Expert Team) Organization Options

A WETeam approach allows more eyes and expertise to be involved with each project, therefore increasing the possibility that all of the issues will be addressed. This would prevent the chances of creating a poorly performing project that becomes a financial drain to the district. The WETeam would be more aware of its capabilities from the onset and would be less likely to back into an undesirable situation.

WETeams would also add stability to the mitigation infrastructure and relationships/agreements established with the regulatory organizations and partners. Employee turnover would not have as drastic of an effect on a team effort as it would on a project controlled by an individual. The operational methods would remain in place from project to project regardless of the makeup of the WETeam. The WETeam organizational options are:

Option 6a: Teams organized at ENV level (one centralized location).

- One department is easier to manage.
- Concentrated resources may be more cost effective.
- It may be difficult to get necessary experts all in one location.
- It will require knowledge to create wetlands all around the state.
- It may be difficult to coordinate with local land-owners/environmental groups from one location

Option 6b: Teams organized at district level.

- Local staff will be better able to coordinate with local environmental groups and may have more knowledge of available land resources and a relationship with specific Corps regulators.

- It may prove difficult to coordinate between districts.
- Districts may not have necessary resources in terms of staff.

Option 6c: Teams organized at regional level.

- This organization maximizes levels of expertise and local knowledge.
- This option provides the ability to pin-point key locations around the state that experience more mitigation projects.
- Experts already have regionally specific knowledge regarding the natural conditions of a region and have already established relationships with environmental organizations and regulators.
- Staff may welcome the opportunity to work with colleagues from different disciplines.
- Team members may need to be gleaned from different districts (e.g., hydrologist from one district works with vegetation expert from another.)
- This may be a challenge to coordinate and organize.

Disciplines Involved in WETeams

Many disciplines may be encompassed with one staff member. Every project may not need every specialist. Specialists that could contribute to wetland mitigation efforts include:

- landscape architect
- hydrologist
- civil engineer
- structural engineer
- botanist/horticulturist
- ecologist
- wildlife biologist
- environmental policy specialist
- soils expert, and
- attorney.

CONCLUSION

Ultimately it is up to TxDOT to determine the exact operational framework within which it is best suited to function with respect to wetland mitigation. The Assessment of State Practices shows that the states with the most successful wetland mitigation programs have departments dedicated to the cause, and/or the organizational infrastructure in place that allows it to satisfy the needs of the regulatory entity. These states have committed the resources and developed the relationships needed to establish a successful wetland mitigation program. TxDOT has now taken measures to propel its already budding program to the next level of accomplishment.

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