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16. Abstract The objective of this research project is to assess current mitigation policies and practices in comparison to resource agency objectives, and identify mitigation strategies and priorities that provide greater cost-benefit potential and implementation speed through strategic inter-resource agency planning. Mitigation for various actions associated with transportation development has been part of the process for decades. Although the science, practice, and technology may have advanced during this time, many of the processes and practices are rooted in traditional rules and regulations that require mitigation. The objective for this project is to assess mitigation policies and practices as a whole—looking at both the current and future of mitigation efforts in the transportation development process. This report summarizes activities conducted in the first year of the project.					
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**MAXIMIZING MITIGATION BENEFITS - MAKING A DIFFERENCE
WITH STRATEGIC INTER-RESOURCE AGENCY PLANNING: YEAR
ONE TECHNICAL REPORT**

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). 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 FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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TABLE OF CONTENTS

	Page
List of Figures	viii
List of Tables	ix
Introduction	1
Outreach Highlights.....	1
Case Study Highlights.....	2
Chapter 1: Subtask 2.1. Review Current Mitigation Practices, Processes, and Programs	5
NCHRP/SHRP 2.....	5
FHWA Eco-Logical Program.....	8
Grant Recipients of FHWA Eco-Logical Program.....	11
Sample State Practices.....	22
Background	37
Resource Agency Management Plans.....	43
Mitigation.....	54
Chapter 2: Subtask 2.2. Review of Regulatory and TxDOT Framework	59
Overarching Framework Laws and Policies.....	59
Texas Statewide Long-Range Transportation Plan.....	60
Project Development Process and Mitigation.....	62
National Historic Preservation Act of 1966.....	64
Endangered Species Act (ESA).....	65
Cultural and Environmental Impacts.....	65
Mitigation Definitions.....	66
TxDOT and Resource Agencies Agreements.....	69
Chapter 3: Stakeholder Outreach	73
Outreach Summary.....	73
Right of Way Division (ROW).....	73
Transportation Planning and Programming Division (TPP).....	75
Environmental Division (ENV).....	77
Mitigation Cost Review.....	79
Bibliography	89
References	93

LIST OF FIGURES

	Page
Figure 1. H-GAC Methodology for Development of Eco-Logical.....	16
Figure 2. Publicly Accessible Eco-Logical Interface.	17
Figure 3. H-GAC Time and Cost Estimates for Development of Eco-Logical.	18
Figure 4. LLELA Location.	25
Figure 5. FDOT Efficient Transportation Decision Making Process.	28
Figure 6. State-Issued Mitigation Banks in Florida. Source: Florida DEP.....	30
Figure 7. The Maryland Watershed Resources Registry Public Interface.....	33
Figure 8. Maryland’s Watershed Resources Registry Output.	34
Figure 9. Maryland Watershed Resource Registry - Potential Cost Savings.	35
Figure 10. EEP Biennial Budget: 2012-2014	38
Figure 11. Stream, Wetland and Riparian Buffer Fees	41
Figure 12. Nutrient Offset Fee per Pound ⁶	41
Figure 13. Reasons Stakeholders Choose EEP In-Lieu Fee Program	42
Figure 14. TxDOT Project Development Process.	63
Figure 15. General ROW Parcel Acquisition Process for Mitigation or In-Lieu Fee.....	74
Figure 16. Histogram and Cumulative Frequency of Payments for Mitigation Parcels (Excluding Highest Value).	80
Figure 17. Annual Amount of Payments for Mitigation Parcels.	81
Figure 18. Annual Number of Mitigation Parcels Acquired.....	82
Figure 19. Average Cost per Mitigation Parcel by Year.	82
Figure 20. Annual Number of Mitigation Parcels Acquired by Expense Type.....	83
Figure 21. TxDOT Regions.	84
Figure 22. Amount of Mitigation Funds Expended by TxDOT Region.....	84
Figure 23. Percentage of Total Mitigation Funds Expended (Red) and Number of Parcels Acquired (Blue), by TxDOT Region.	85
Figure 24. Number of Mitigation Parcels Acquired in Region by Expense Type.	85
Figure 25. Amount of Mitigation Funds Expended by TxDOT District.	86
Figure 26. Percentage of Total Mitigation Funds Expended (Red) and Number of Parcels Acquired (Blue), by TxDOT Region.	86
Figure 27. Number of Mitigation Parcels Acquired at District by Expense Type.....	87

LIST OF TABLES

	Page
Table 1. FHWA’s 2007 Eco-Logical Grant Program.....	10
Table 2. Dallas–Fort Worth Regional Transportation Mitigation Initiatives.	15
Table 3. TSSWB-Sponsored Watershed Protection Plans.....	44
Table 4. TCEQ Sponsored Watershed Protection Plans.....	46
Table 5. Third-Party Sponsored Water Protection Plans.....	48
Table 6. Agencies that Administer Statewide Watershed Protection Plans.....	49
Table 7. SLTRP Chapter 8.....	61

INTRODUCTION

This report presents the first year summary for *Maximizing Mitigation Benefits—Making a Difference with Strategic Inter-Resource Agency Planning*. The first year involved the following tasks generally described below:

- *Review Current Mitigation Practices and Regulatory/TxDOT Framework (Task 2)*. This task reviewed current and relevant practices, processes, and programs on mitigation and evaluated the regulatory/TxDOT framework. These practices were updated and expanded in follow-up interviews with stakeholders and in mitigation case studies (described below).
- *Stakeholder and Resource Agency Outreach and Interviews (Task 3)*. This task sought out key stakeholders and partners in the transportation development process for input on mitigation practices and is reported in [Chapter 3](#).
- *Mitigation Case Studies (Task 4)*. This task collected more detailed project level data on examples identified in the initial review task. The additional information, strategies, and practices were added case studies in [Chapters 1 and 2](#).

OUTREACH HIGHLIGHTS

Based on outreach and interviews with TxDOT and other agencies, researchers observed the following:

- TxDOT enjoys good relations with most resource agencies and state partners. Continued benefits from inter-agency coordination with federal resource agencies could be improved with regularly scheduled meetings with key agencies such as the U.S. Army Corp of Engineers (USACE).
- Mitigation tracking on a statewide basis is difficult. TxDOT would benefit from creating the ability to measure and manage mitigation on a regional and statewide basis. Existing management systems, such as the Environmental Compliance and Oversight System (ECOS) could be enhanced to have more robust Environmental Permits and Commitments (EPIC) and mitigation tracking.
- Metropolitan planning organizations (MPOs) provide an important potential resource and partner for regional mitigation coordination efforts. Example successful practices are occurring in North Texas between North Central Texas of Governments (NCTCOG), North Texas Tollway Authority (NTTA), USACE, and local jurisdiction to coordinate 404 and 408 mitigation and permitting for transportation projects. Additionally, regional toll revenues (RTR funds) are being used to fund positions at the USACE to expedite regulatory permitting, reviews and coordination.
- TxDOT has benefited from funding positions at resource agencies to advance and expedite environmental reviews, permitting, and coordination for TxDOT projects. Other state DOTs and MPOs that have funded positions have also experienced significant time savings.

CASE STUDY HIGHLIGHTS

Task 3–*Mitigation Case Studies* collected more detailed project-level information on the case studies identified during the initial scan of mitigation practices. From these more in-depth reviews the following observations were noted.

- FHWA awarded a grant to NCTCOG to follow up on the initial Eco-Logical program completed in 2011. This new phase is the *SHRP2 Lead Adopter Incentive Implementation Assistance* that will make the next step in implementing Eco-Logical for the North Texas region. The project is scheduled to begin in summer 2013 and conclude in fall 2015. One of the tasks will apply NCTCOG’s Regional Environmental Framework (REF) to a pilot corridor feasibility study. The TTI research will continue to monitor and partner with NCTCOG staff on this implementation project.
- An evaluation of 143 California mitigation projects from 1991 to 2001 revealed that the “percent met” of permit requirements was approximately 73 percent, with 42 percent having permit compliance of 90 percent or better. In addition to assessing compliance over a ten-year period, the California researchers reported conclusions and recommendations based on the mitigation evaluation, including:
 - Information management, databases, and archiving need improving.
 - Mitigation project tracking needs improving.
 - Improvements to permit information clarity are needed (permit tables and description).
 - Coordination with other agencies is needed—consider developing integrated permits.
 - Improved environmental information is needed on the front end of the project delivery process. Under the current process, state DOTs retrieve environmental data from a variety of sources and then assess environmental impacts and constraints. A central data clearinghouse—similar to those that MPOs developed in the Eco-Logical grants—could improve assessment processes and mitigation outcomes.
 - Mitigation and environmental processes are generally project-focused, so applying Transportation for Communities—Advancing Projects through Partnerships (TCAPP) and *Integrated Environmental Framework (IEF)* is difficult for partners to separate the planning scale from a project scale.
 - Maintaining institutional relationships and knowledge is difficult with turnover at partner agencies. Regular meetings help maintain the knowledge base and institutional memory.
 - Success is dependent on good data and good data is not readily available for good decision making. Mitigation tracking data improvements are needed to make informed decisions.
 - Coordination with, and changing expectations from, cooperating agencies is a continuing challenge. Use agreements and meetings to address mid-course and 11th hour changes in agency requirements and expectations.
 - Risk aversion is a big driver for regulatory agencies and reluctance to change to avoid setting precedents with respect to agreed-upon standards and subsequently being

perceived as not administering regulations as required. Scope creep, based on a lack of explicit rules and responsibilities, creates problems.

- Using a business case and business approaches to change does not resonate with regulatory agencies that are using mission-oriented approaches. Eco-Logical cases offer more promise to improvements in relations with resource agencies.
- Tracking annual mitigation/compliance costs is not precise. Such costs are not separated as a part of doing business. Monitoring is also controversial in terms of investment and outcome, and return on investment.
- State DOT Eco-Logical/TCAPP pilot projects revealed that large decentralized organizations like state DOTs led to decision making authority spread across multiple offices.

CHAPTER 1: SUBTASK 2.1. REVIEW CURRENT MITIGATION PRACTICES, PROCESSES, AND PROGRAMS

The permitting process under federal and state legislation constitutes a major component of the project development and delivery process for transportation projects. Over \$3.3 billion is spent annually on compensatory mitigation under the Clean Water Act (CWA) and Endangered Species Act programs (1), so significant incentives exist to maximize the conservation and economic outcomes of transportation-induced aquatic resource, and endangered species habitat offsets (2). In response, a variety of efforts have been developed to identify, evaluate, and select mitigation strategies and programs. Case studies and analyses of implemented mitigation efforts are also becoming available to ground-truth and benchmark such efforts.

Transportation agencies do their best to avoid and minimize any impacts to the environment, but some impacts are unavoidable. Compensatory mitigation is used to offset these unavoidable impacts to the environment. It involves the restoration, establishment, enhancement, and/or preservation of the environment, including threatened or endangered species and/or their habitats (3).

The body of literature on mitigation practices is vast since the regulatory framework requirements has matured and widened in scope over the years. For Task 2, the research team has focused on identifying and assessing the most relevant and implementable processes from federal and state resources. A review of the results of the SHRP 2 and Eco-Logical reports is emphasized at this time given their scope and relevance to current and near-future practice. The research team also focused on innovations in the mitigation arena to identify and assess the most relevant practices to the TxDOT project development process, and to stay aware of ongoing advancements.

NCHRP/SHRP 2

The research team reviewed the most relevant research products from the National Cooperative Highway Research Program (NCHRP) and the Strategic Highway Research Program (SHRP). The NCHRP was created in 1962 as a means to conduct research in acute problem areas affecting highway planning, design, construction, operation, and maintenance nationwide. The Transportation Research Board (TRB) of the National Academies, sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO), and in cooperation with the Federal Highway Administration (FHWA), administers the NCHRP.

Congress authorized the Strategic Highway Research Program (SHRP 2) to address some of the most pressing needs related to the nation's highway system. These programs are divided into four research focus areas: safety, renewal, reliability, and capacity. The TRB of the National Academies, under a Memorandum of Understanding with the FHWA and the AASHTO, administers the SHRP 2.

NCHRP

NCHRP Project 25-25 supports improvements to analytical methods, decision support tools, procedures, and techniques employed by practitioners to support statewide and metropolitan transportation planning, programming, and development. A variety of tasks within Project 25-25 relate to mitigation, including the following:

- Task 75–Nationwide Evaluation of Transfer of Compensatory Wetland Creation Sites for Transportation Projects to Private Conservation Organizations or Government Conservation Agencies (4). The objective of this research was to collect and review information from state DOTs and prepare a report. The report would document those processes and procedures proven successful in transferring responsibility (ownership and/or long-term management and maintenance) for mitigation (stream and wetland) and conservation (based on the Endangered Species Act) sites to private conservation organizations or government conservation agencies.
- Task 67–Optimizing Conservation and Improving Mitigation Cost/Benefit (2). Report details noted below.
- Task 10–Alternative Mitigation Strategies/Early Mitigation: Streamlining and Achieving Net Benefits for the Natural Environment (5). The objective of this study was to identify alternative methodologies for accomplishing early mitigation/conservation and addressing both DOT and resource agency needs.

NCHRP Synthesis 302 *Mitigation of Ecological Impacts*, published in 2002, provides an overview of:

- Then-current transportation agency practices.
- Recent literature findings.
- Research regarding environmental impact mitigation measures; and monitoring and evaluating information for aquatic environments and related habitats, including wetlands, streams, and riparian corridors.

The definitions and framework of this publication are from the FHWA final rule on *Mitigation of Impacts to Wetlands and Natural Habitats* (23 CFR Part 777). For this report, the term “ecological impact mitigation” defines efforts to offset the loss or impairment of functions and values of natural habitats due to department of transportation (DOT) activities, and envelopes a range of activities that DOTs pursued or considered.

NCHRP Synthesis 302 summarizes information on:

- The types of ecological impacts that highway projects incurred and the methodologies used to assess these impacts.
- Procedures to determine mitigation and monitoring needs.
- Types of mitigation implemented for different impacts and how mitigated sites are monitored, evaluated for success or failure, and cost.

The synthesis also provides:

- An overview of the regulatory framework regarding mitigation actions, and discussion of ecological impact assessments.
- Details on ecological mitigation assessments, mitigation costs, and transportation agency case studies.

A key finding of Synthesis 302 is how transportation agencies seek additional flexibility in their approaches, allowing for out-of-kind and alternative forms of mitigation. Some of the DOTs tactics included:

- Easier access to wetland mitigation banks.
- Use of in-lieu fees.
- Consolidated mitigation projects.
- Mitigation credit for combinations of mitigation approaches (restoration, creation, enhancement, and preservation).
- Compensatory mitigation credit for improving or providing wildlife underpasses/overpasses and fish passage devices (6).

The report also notes that although some DOTs are using these arrangements, many are not because of funding or regulatory restrictions. These approaches reflect a general viewpoint of transportation agencies to remove themselves from the long-term commitments and costs that wetland and habitat mitigation projects require.

NCHRP 25-25 (Task 67): *A Practitioner's Handbook: Optimizing Conservation and Improving Mitigation Through the Use of Progressive Approaches* provides a systematic view of ecosystems and the economic benefits and cost savings associated with progressive approaches to the Clean Water Act or Endangered Species Act compensatory mitigation. This work compares the benefits and savings of a progressive approach to that of traditional mitigation approaches. The handbook highlights several empirical examples of transferable tools, models, and frameworks used for innovative compensatory mitigation in use throughout the United States. Emphasis is placed on landscape or a watershed analysis of ecosystem functions, as well as progressive approaches that include the valuation of ecosystem services that compensatory mitigation provided. The handbook includes tangible steps for transportation agencies, policy makers, and the research community to facilitate and implement progressive mitigation programs. The handbook also categorizes compensatory mitigation strategies as traditional, midway, or progressive.

Traditional approaches to compensatory mitigation are those that allow a permit applicant or the entity conducting compensatory mitigation (e.g., a mitigation bank) to propose compensation sites on a project-by-project basis, usually based on best professional judgment and with little or no analysis of landscape or watershed functional needs. Mitigation sites selected using traditional approaches to compensatory mitigation are generally chosen opportunistically to minimize costs to the permittee, rather than maximize environmental outcomes.

Midway approaches are those using some means of evaluation of landscape setting, but do not include holistic watershed- or landscape-scale planning. Examples of these approaches generally undertake single-priority analysis, such as watershed plans that assess a single aquatic resource function or service. The midway category incorporates the use of qualitative mitigation guidelines to describe the types of compensation projects resource agencies prefer, and decision-making frameworks on the selection of appropriate locations for compensation projects. However, neither use detailed analyses of watershed nor landscape needs to select compensatory mitigation sites.

Progressive approaches to compensatory mitigation seek to use a strategic, analytic approach to compensation site design and selection that rely on a robust analysis of proposed compensatory mitigation using a suite of data on the watershed/landscape. These approaches—whether applied through a mitigation or conservation bank, in-lieu fee program, or another compensatory mitigation mechanism—seek to characterize a watershed/ecosystem’s functional needs in order to design mitigation projects that will improve the overall condition of a hydrologic or ecological unit. These holistic planning approaches consider multiple ecosystem functions or services. In the case of watershed planning, they address the entire suite of aquatic resource functions or services, such as landscape planning efforts to address the habitat needs of multiple species. These watershed- or landscape-scale evaluations allow permittees to move beyond project-by-project compensatory mitigation site selection.

SHRP2 C06(A) Integration of Conservation, Highway Planning and Environmental Permitting Using Outcome-Based Ecosystem Approach

Federal, state, and local resource agencies have widely accepted and increasingly practiced ecosystem approaches to environmental conservation. From a highway perspective, the FHWA document *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects* provides conceptual groundwork for integrated conservation plans and mitigation activities that transcend individual agency jurisdictional boundaries and encourages an outcome-based ecosystem approach to conservation. However, *Eco-Logical* stops short of providing the tools to implement the principles.

SHRP 2 projects C06A (Integration of Conservation, Highway Planning, and Environmental Permitting Using an Outcome-Based Ecosystem Approach) and C06B (Integration of Conservation, Highway Planning, and Environmental Permitting Through Development of an Outcome-Based Ecosystem-Scale Approach and Corresponding Credit System) are intended to provide the tools needed to implement the ecological approach.

FHWA ECO-LOGICAL PROGRAM

FHWA developed the Eco-Logical program in liaison with seven other agencies as a vision for an infrastructure development process that endorses ecosystem-based mitigation through integrating plans and data across agency and disciplinary boundaries. From its inception,

Eco-Logical emphasizes interagency collaboration to create infrastructure projects in ways that are more sensitive to terrestrial and aquatic habitats. In addition to FHWA, the Eco-Logical signatory agencies are:

- Bureau of Land Management.
- National Oceanic and Atmospheric Administration National Marine Fisheries Service.
- National Park Service.
- U.S. Army Corps of Engineers.
- U.S. Department of Agriculture Forest Service.
- U.S. Environmental Protection Agency.
- U.S. Fish and Wildlife Service.

The Eco-Logical effort encourages federal, state, tribal, and local partners involved in infrastructure planning, design, review, and construction to use flexibility in regulatory processes. The *Framework for Integrated Planning* includes an eight-step process for interagency planning program:

- Build and Strengthen Collaborative Partnerships.
- Identify Management Plans.
- Integrate Plans.
- Assess Transportation Effects.
- Establish and Prioritize Opportunities.
- Document Agreements.
- Design Projects Consistent with Regional Ecosystem Framework.
- Balance Predictability and Adaptive Management.

The SHRP 2 project C06A–*Guide to the Integrated Ecological Framework* further refined the steps as follows:

1. Build and Strengthen Collaborative Partnerships; Develop a Vision.
 - Characterize Resource Status.
 - Create the Regional Ecosystem Framework.
 - Assess Land Use and Transportation Effects.
 - Establish and Prioritize Ecological Actions, Restoration/Conservation Sites.
 - Develop Crediting Strategy.
 - Develop Programmatic Consultation/Agreements.
 - Implement Agreements and Adaptive Management.
 - Monitor and Update Regional Integrated Plan/Ecosystem Framework.

As noted in [Table 1](#), FHWA’s 2007 Eco-Logical grant program provided support to 15 projects that implemented the principles outlined in the Eco-Logical report. Grant recipients were from state and local DOTs, state resource agencies, metropolitan planning organizations, local governments, non-governmental organizations, and one university.

Table 1. FHWA’s 2007 Eco-Logical Grant Program.

STATE	PROJECT TITLE
Arkansas, Louisiana, New Mexico, Texas, and Oklahoma	A Regional Ecological Assessment Protocol (REAP) for the South Central United States (7)
Colorado	Developing a Regional Ecosystem Framework for Terrestrial and Aquatic Resources along the I-70 Corridor, Colorado: An Eco-Logical Field Test
Illinois	Sustainable Infrastructure Standards for Urban Ecology
Illinois	Regional Transportation, Ecosystem, & Land Use Integration Plan
Missouri	An Eco-Logical Approach to Transportation Planning in the Kansas City Region
New Hampshire	Creating Tools to Support Integrated Transportation and Resource Planning in New Hampshire
New York	Opportunities for Highway Programs to Remediate Natural Resource Concerns in New York
North Carolina	Linking Lands and Communities in the Land-of-Sky Region of Western North Carolina
North Carolina	Integration of North Carolina’s Conservation and Transportation Planning
Oregon	Using the Eco-Logical Approach to Develop and Implement Conservation and Mitigation Priorities for Oregon
Texas	Central Texas Greenprint for Growth—A Tool for Balancing Sustainable Conservation Goals with the Infrastructure Needs of our Rapidly Urbanizing Region
Texas	Developing a Regional Decision Support System for the Houston–Galveston Region
Texas	North Central Texas Regional Ecological Framework
Utah	Blueprint Jordan River, A Lake-to-Lake Vision
Virginia	Integrating Green Infrastructure and Transportation Planning

Researchers reviewed the selected Eco-Logical grant recipient programs from Texas and across the country summarized below.

GRANT RECIPIENTS OF FHWA ECO-LOGICAL PROGRAM

North Central Texas Regional Ecological Framework–NCTCOG (Completed 06/2011, 37 months) (8, 9)

North Central Texas Regional Ecological Framework–NCTCOG (2011) (10,11)

Using funding from the Eco-Logical program, the North Central Texas Council of Governments established a *Regional Ecosystem Framework* (REF), an advance planning tool for infrastructure projects and ecosystem based mitigation, based on a vision of desired future conditions that integrate ecological, economic, and social factors. The REF helps agencies to assess environmental impacts of proposed infrastructure projects and enhances multi-agency understanding of critical resource-protection areas. NCTCOG was able to do this by overlaying the individual plans of local, state, and federal agencies and determine how different pieces of data worked together. The project also analyzed resource-agency management plans and GIS data to assess potential effects on watersheds.

NCTCOG used the regional data to develop 10 base maps and one composite map of resource priorities by watershed, and developed an REF user guide to introduce the public to the watershed concept, which was finalized in 2011. The project also produced a technical overview document to help other COGs replicate the process. The guide focuses primarily on watershed information with some guidance on applications for transportation infrastructure. Regional resource agencies—including the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), and the Texas Parks and Wildlife Department (TPWD)—provided feedback that was used to refine different criteria in the REF methodology and the environmental policies included in the Metropolitan Transportation Plan (MTP).

The REF is the “umbrella” framework for a variety of regional initiatives, such as:

- Watershed protection for water supply reservoirs in North Texas.
- “Greenprinting” two clusters of sub-watersheds in the region.
- Watershed roundtable meetings.
- Watershed Connections flyers.
- Enhancement of environmental considerations in the transportation planning process.

The Eco-Logical program was on hold since its completion in 2011. However, with a recent grant from FHWA through the SHRP 2 Implementation Assistance program, NCTCOG intends to launch a pilot program to incorporate the data set into corridor planning and identify data gaps prior to the National Environmental Policy Act (NEPA) process. Currently, NCTCOG is formalizing the internal process for utilizing the REF and putting ecological parameters in a context that is useful for decision making in the region. In the future, NCTCOG hopes the data set will be used to develop a regional program for avoiding impacts and selecting strategic mitigation sites for transportation projects and intends to develop an online version of the user guide and the final data set to increase accessibility to the public and organizations throughout the region.

USACE and NCTCOG Agreement (2011)

In 2008, the Regional Transportation Commission (RTC) approved the release of \$500,000 to hire USACE staff to expedite the permitting of transportation projects in the region. NCTCOG signed an agreement with USACE in October 2008 and a USACE staff member was selected to work on permitting. There were two main permitting priorities:

- The Trinity Parkway toll road, Trinity River Corridor Plan, and complementary projects.
- CDA projects are their regional transportation priority projects.

Several partners were also involved in this agreement, including TxDOT Dallas and Fort Worth districts, NTTA, Union Pacific Railroad, and the City of Dallas.

This Memorandum of Agreement (MOA) led to the development of a *Regional General Permit* (RGP) to expedite 404 permits during the 408 permit process, which saves 2–3 months on the overall permitting process. Also, permit verification is issued within four days of receiving a completed application for modification to the project. For example, the SH 114/DFW Connector added three additional projects to be reviewed; the process was completed in eight days and kept the project on its timeline. Also, coordination for the Santa Fe Trestle Trail led to minor changes in the project, which resulted in the issuance of a Nationwide Permit (NWP). This saved three months of processing time and 1.75 acres of mitigation.

This agreement has been successful in many ways, including:

- A reduction in mitigation requirements.
- A reduction of impact to aquatic environment.
- A reduction of time for permit decisions.
- The elimination of unnecessary permits.

Out of 54 listed projects, 29 permits have been issued; all partner agencies have been highly satisfied with this MOA, and all performance measures have exceeded expectations for the second year. Although an exact dollar amount on time savings cannot be established, in many cases the permitting time was greatly reduced. Also, NCTCOG estimates the return on mitigation credit savings to be between 15–88 percent.

Expediting Transportation Projects: USACE 404 Agreement and Regional Mitigation Banks (July 2011)

In 2011, NCTCOG wished to fund a new agreement with USACE through 2016 and develop potential regional mitigation banks to expedite transportation projects and support conservations of vital regional ecosystems. NCTCOG requested \$1.45M in RTR funds for a new 404 permit/Regional Mitigation Bank project to continue an existing agreement with USACE and develop Regional Mitigation banks. This request involved two transfers: transferring \$1.45M STP-MM funds from Trinity Parkway and expediting the 408 permit project to the IH 35E/Dickerson Parkway project and transferring \$1.45M RTR funds from the IH 35E/Dickerson Parkway project to the new 404 Permit/Regional Mitigation Bank program project. The request also directed staff to administratively amend the 2011–2014 Transportation Improvement Program to add/change these projects.

Section 214 List (July 2013)

This NCTCOG's most recent listing of projects that USACE staff should work on under the Section 214 Agreement with USACE. It has a tab for "Finalized Actions" under the program and "2011 MOA," which are the projects USACE is currently working on and that have not yet been finalized. There are details for each of the projects listed. The details include general information such as:

- Permit number.
- Project name.
- Submitting agency.
- County.
- Primary point of contact.
- Control-Section-Job (CSJ) number.
- Expected letting date.

It also includes specific application details, such as:

- The date application modification is predicted.
- The date the application was submitted and completed.
- The date the permit decision is expected.
- The projected USACE decision.
- The actual date the permit was finalized.
- The date Record of Interest (ROD)/Finding of No Significant Impact (FONSI) approval is expected.
- The type of permit required (404, 10, NW RGP IP LOP, 408).
- Any comments.

SHRP 2 Implementing Eco-Logical Implementation Assistance

NCTCOG has been awarded a grant from FHWA to follow up on the initial Eco-Logical program completed in 2011. This new phase is the *SHRP2 Lead Adopter Incentive Implementation Assistance* that will make the next step in implementing Eco-Logical for the North Texas region. The project is scheduled to begin in summer 2013 and conclude in the fall 2015. The seven tasks are summarized below.

- Task 1 task includes:
 - Updating the regional ecosystem framework (REF).
 - Identifying regional focus areas.
 - Re-engaging resource agencies.
 - Developing a sub-watershed map and mitigation/enhancement area map.
 - Creating a list of key sub-watersheds for future ecological investment.

- Task 2 will apply REF to a pilot corridor feasibility study. The goal is to determine the feasibility of using the REF as a tool for addressing conservation needs and potential mitigation strategies.
- Task 3 will implement a pilot program referred to as the shared value mitigation (SVM). NCTCOG will consult with resource and transportation partner agencies, and will actively seek participation and input from environmental Non-Governmental Organizations (NGOs).
- Tasks 4 and 5 will create an interactive REF and SVM website that will function as a one-stop shop for REF data and updates, regional mitigation program outcomes, and process documentation for project evaluations. This will include a mapping component that is user-friendly and compiles data and information for each sub-watershed when clicked on. This site will be publicly available and have a password-protected version for partners participating in the SVM.
- Task 6 will use \$50,000 from the project budget as seed money to pay for the entire cost or portions of the cost of the first few projects piloted from the SVM Program. NCTCOG will consult with resource and transportation partner agencies, and will actively seek participation and input from environmental NGOs to develop the SVM program.
- Task 7 will be an ongoing effort to meet the administrative requirements of this project, including:
 - General project coordination with FHWA Headquarters and the Division Office.
 - Grant administration activities.
 - Participation in conference calls with FHWA.
 - Conducting presentations about the project.
 - Travel costs.
 - Development of required reporting.
 - A final report summarizing the outcomes and lessons learned from this project.

Table 2 provides a summary of the Dallas- Fort Worth area’s regional mitigation efforts.

Table 2. Dallas–Fort Worth Regional Transportation Mitigation Initiatives.

	Shared-Value Mitigation	Eco-Logical Framework
Mitigation Scale	Project ^a	Sub-watershed ^b
Mitigation Implementation	Environmental Clearance Phase	Planning Phase
Result	Mitigation project implemented	Advance planning tool for infrastructure projects and ecosystem-based mitigation
Objective	Fund priority mitigation projects selected from the Resource Agency’s Strategic Plan, which are located within the NCTCOG Region	Implement an ecosystem approach to: Mitigate the effects of infrastructure projects, avoid and minimize impacts to vital resources by identifying impacts during planning phase using up-to-date data
Resource Agency Benefit and Outcomes	Compensatory Mitigation Projects that support the Agency’s Strategic Plan goals are funded, implemented, monitored, and have funds for maintenance and/or remedial action	Align policies and programs to achieve goals for both transportation and resource agencies, which informs long-term planning and ecosystem priorities; supporting advanced mitigation efforts
Needs from Resource Agency	Regional compensatory mitigation projects, as selected/adapted from pertinent agency strategic plan	Coordination resulting in partnering agreement and data updates
Update Frequency	Continuous	Continuous
Legally Enforceable Commitments	Enforced through RODs, FONSI, and Permits	None
Revenue Stream	Compensatory mitigation funds result from NEPA/permit commitments	Federal/State/Local Grants
Initiative Lead	NCTCOG Transportation Streamlined Project Delivery	NCTCOG Transportation Plan Team
Contact	Christopher Anderson, Program Manager, CAnderson@NCTCOG.org Kimberly Kendrick, Transportation Planner III, KKendrick@NCTCOG.org	Tamara Cook, Principal Transportation Planner, TCook@NCTCOG.org

a–Mitigation project would occur within the 16-county region of the NCTCOG: Collin, Dallas, Denton, Ellis, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise.

b–NCTCOG Planning Area encompasses the 21 Regional Watersheds of the Metropolitan Planning Area (MPA), 12 counties: Collin, Dallas, Denton, Ellis, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise.

Regional Decision-Support System for the Houston–Galveston Region (H-GAC) (12,13)

The Houston–Galveston Area Council (H-GAC) used a tool, called Eco-Logical (modeled on the concepts presented in the Federal Highway Administration framework with the same name) that is designed to address a regional need to balance growth with natural resources conservation. To develop their tool, the H-GAC organized an Eco-Logical Advisory Committee (EAC) to guide in the development of the tool. The EAC was comprised of federal and state environmental resource agencies, and other conservation organizations. The tool manifests as an in-depth Geographic Information System (GIS) database that is accessible both in-house and publicly through an online portal. It enables the identification of sensitive natural resources in the H-GAC region so that environmental concerns that project development had created can be understood early on in the process. In turn, the project prioritization process can be tailored to

work with sensitive environments and respond to the needs of the natural resources as well as growth and development.

According to a webinar that the H-GAC's chief GIS specialists presented, Eco-Logical is designed to achieve three goals:

- Provide a decision support system for regional planning.
- Allow for an inventory of high value environmental resources.
- Act as a data clearinghouse for organizations and the public.

Their methodology for creating Eco-Logical is presented in [Figure 1](#). The Houston-Galveston Area Council's Eco-Logical tool is an excellent example of what can be accomplished through staff efforts executed on a regional scale (through the EAC) and represents the type of tool that is necessary to plan for transportation development while acknowledging regional impacts.

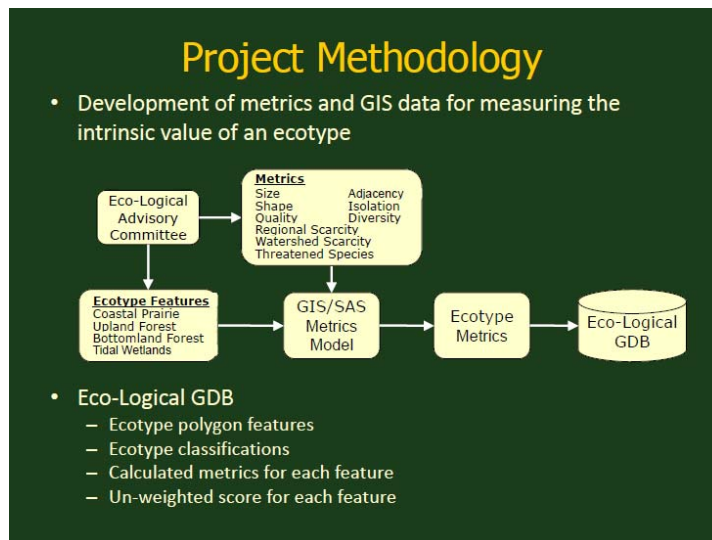


Figure 1. H-GAC Methodology for Development of Eco-Logical.

Through the Eco-Logical system, the H-GAC was able to map all pertinent resources in its jurisdiction and publish a web-based, interactive tool in June 2010 (see [Figure 2](#)). The tool has over 12,000 mapped features that transportation planners can use to evaluate the potential impacts of proposed projects.

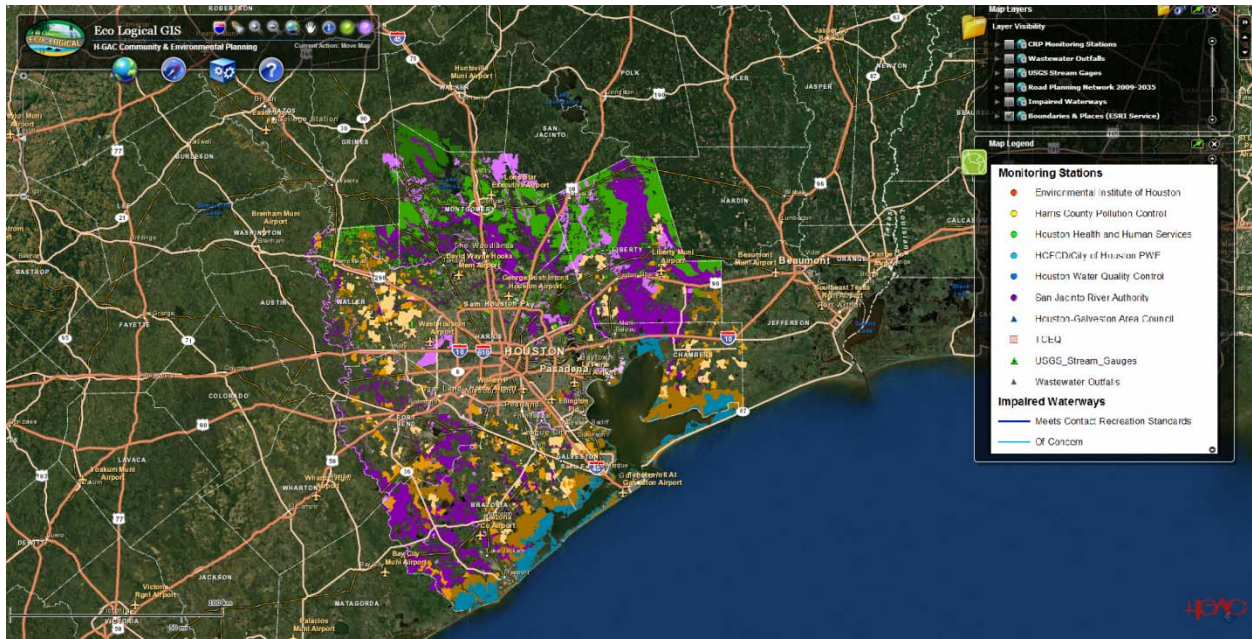


Figure 2. Publicly Accessible Eco-Logical Interface.

Since completing the project, the H-GAC has developed several mechanisms to promote use of the tool within the region, including:

- A brochure designed to educate local governments.
- A website (<http://www.h-gac.com/community/environmental-stewardship/eco-logical/default.aspx>) that includes tutorials for using the tool and a glossary of terms.
- An iPhone-accessible version of the tool (<http://www.h-gac.com/community/gis/mobile-gis.aspx>).

In 2011, the H-GAC received a grant from the National Association of Regional Councils to conduct additional outreach that has resulted in numerous webinars, a brochure, and a poster. It is estimated that the development of Eco-Logical took over 1,400 hours and cost more than \$20,000. Figure 3 shows a more detailed breakdown of estimated costs.



Figure 3. H-GAC Time and Cost Estimates for Development of Eco-Logical.

The H-GAC continues to use Eco-Logical in regional transportation activities. Its staff works to educate MPO board members on the tool’s purpose and benefits so that it can be effectively used and included as a required component of the 2040 Regional Transportation Plan. They have also incorporated the tool in the Regional Sustainable Development Plan, which is part of a Department of Housing and Urban Development Sustainable Communities Grant. Additionally, the H-GAC staff is planning to use a methodology that The Conservation Fund (TCF) is developing to show the monetary benefits of ecological processes used during regional transportation planning. It is expected that evidence of monetary benefits as well as more formal integration of the tool in general transportation planning activities will increase the use of the tool among local governments. Inspired by Eco-Logical, TCF is applying the project’s methodology to six counties outside of the H-GAC’s boundaries, funded by local and regional foundations, to support green infrastructure planning and further contribute to the Regional Sustainable Development Plan.

Central Texas Greenprint for Growth: A Tool for Balancing Sustainable Conservation Goals with the Infrastructure Needs of Our Rapidly Urbanizing Region–CAPCOG (Completed 05/2010, 24 months) (14, 15, 16)

The Capital Area Council of Governments (CAPCOG) was awarded an Eco-Logical grant in May 2008 with one goal in mind: to create a Greenprint for the region to help agencies plan for future growth. The Central Texas Greenprint for Growth plan aimed to protect:

- Water quality.
- Ecological, cultural, and recreational resources.
- Farm and ranch land.
- Scenic corridors.

The process combined stakeholder input about conservation goals and priorities with mapping and modeling technology to produce graphic illustrations showing opportunity areas for conservation.

The Greenprint for Growth project had many accomplishments. The CAPCOG included three additional counties in the final report and maps, and integrated data into a GIS model prioritizing conservation opportunities. Additionally, the priorities from the Greenprint for Growth plan were included in the Bastrop County Comprehensive Transportation Plan and provided information for the selection of conservation easements and mitigation lands in Travis and Hays Counties.

Local and county governments and academia participated in the Greenprint development process. The CAPCOG partnered with the Trust for Public Land, which conducted outreach activities for municipalities, and as a result improved its relationships with local governments and promoted its maps and reports. Travis County is incorporating its Greenprint plan into its comprehensive plan.

The CAPCOG regularly follows up with county government stakeholders to encourage the use of the Greenprint plan in infrastructure development and land-use planning. The CAPCOG staff has made presentations on the project at various conferences and plans to improve availability of the Greenprint for wider use among local governments. The CAPCOG staff will also continue working with the MPO board and transportation planning staff in the Austin–Round Rock area to integrate Greenprint data and opportunity areas into the regional long-range transportation planning and project delivery processes.

Integration of North Carolina’s Conservation and Transportation Planning (Completed 04/2010, 25 months) (17, 18)

The North Carolina Department of Environment and Natural Resources (NCDENR) was awarded an Eco-Logical grant in 2010 to produce a conservation plan for North Carolina that included wildlife-habitat and vegetation data to improve the integration of conservation data into the transportation-planning process. State and regional planning agencies can use the data to develop their long-range planning.

The grant project enhanced the state wildlife action plan by providing data on upland and non-riparian wetland habitats. The project also allowed the cultural resource features to be digitized to demonstrate the latter’s role within North Carolina’s ecosystems. The project team integrated the data into a conservation-planning tool, One NC Naturally, which is available online to the public.

The Conservation Planning Tool (CPT) (18) identifies, evaluates, and prioritizes important natural resources required to maintain healthy and sustainable ecosystems statewide, including assessments and maps about:

- Biodiversity/wildlife habitat.
- Forestry lands.
- Farmland.

- Open space and conservation lands.
- Marine/estuarine areas.
- Water services.

This planning tool illustrates the locations and conservation values of significant natural resources throughout North Carolina. Local governments, state agencies, regional councils of governments, funding programs, and conservation organizations have applied this tool to support land use, conservation, mitigation, and transportation planning, and decision making.

Using the Eco-Logical Approach to Develop and Implement Conservation and Mitigation Priorities for Oregon (19)

The Oregon State University (OSU) was awarded an Eco-Logical grant in 2008 intended to:

- Build upon the wildlife and habitat conservation strategy that the Oregon Department of Fish and Wildlife had developed.
- Identify Oregon's conservation priority areas, and then consolidate data from each area into an online Regional Ecosystem Framework tool.

This REF helps agencies throughout Oregon coordinate mitigation and conservation plans with transportation projects. Several state and federal agencies, including the EPA, have adopted the OSU's methodology to identify and implement wetland mitigation sites. The University also developed a wetlands database based on REF data for the Oregon Department of State Lands, determined wildlife area to avoid during bridge projects and developed an endangered species map for the U.S. Fisheries and Wildlife Service using the REF tool.

The OSU successfully completed a pilot study in the Willamette Valley region, where two MPOs used the REF to inform their planning activities, but found it difficult to replicate the same approach in other areas of the state due to varying interpretations of acceptable levels of avoidance. One key finding of the pilot studies is that identifying a small number of avoidance priorities in a large area may hinder the completion of mitigation projects because decision makers prefer to have options for selecting a project. The University is updating the REF with ranked mitigation priorities throughout Oregon in response to this finding, which will allow transportation planners to identify a range of mitigation priorities while emphasizing the most critical opportunities.

In addition to the Eco-Logical report and grant program, the FHWA *Eco-Logical Successes* newsletter highlights signatory agencies' strategic environmental programs, projects, and efforts that share the vision set forth in the Eco-Logical report. Beginning in January 2011, three editions of *Eco-Logical Successes* have been published on the Eco-Logical website that focus on the signatory agency's strategic environmental programs, projects, and efforts that are either directly related to or share the Eco-Logical vision. A key aspect of the Successes program is identifying program goals, contact information, and a list of other strategic initiatives being undertaken, as well as potential joint projects and opportunities for collaboration.

As noted in the September 2012 *Eco-Logical Successes* update, the FHWA continues to pursue activities to make operational the Eco-Logical approach. This work focuses on creating practical tools and delivering training to support agencies that are implementing the Eco-Logical approach. In collaboration with the TRB and AASHTO, the FHWA is currently developing an implementation plan for the *Integrated Eco-Logical Framework (IEF)*. The *IEF* is a step-by-step process that guides natural resource and transportation practitioners in developing conservation and restoration priorities, and integrating such information into transportation and land use planning processes. The *IEF* implementation plan will include:

- Goals and objectives.
- A tactical action plan and budget.
- Roles and responsibilities of key players.
- Marketing and communication strategies.

Also noted in the September 2012 *Eco-Logical Successes* update, the FHWA is developing an Eco-Logical Benefit Assessment Framework to analyze the benefits and costs associated with applying the Eco-Logical approach. This framework will help agencies understand the potential time and resource savings of using the Eco-Logical approach for transportation and mitigation planning and project delivery as compared to a traditional approach to transportation delivery.

The FHWA is also developing a unified Eco-Logical training strategy to help achieve implementation of the Eco-Logical approach as standard practice among transportation and environmental practitioners. As a first step in developing the strategy, the FHWA is coordinating with key stakeholders to understand the current conditions and needs among transportation, regulatory, and resource agencies. The training strategy will use the stakeholders' input to define audiences, delivery methods, and training content to be delivered on a national scale.

The FHWA has also conducted 14 Eco-Logical webinars between October 2010 and December 2012 as a way to foster cooperative learning. The webinars with the most direct connection to mitigation include:

- Watershed Approaches for Mitigation and Transportation Planning: Innovative Programs from FHWA's Resource Agency Partners (November 2011) (20). Presenters from federal resource and regulatory agencies highlighted programs that use a watershed approach to implement Eco-Logical principles. The presentations included methods for:
 - Assessing watershed health.
 - Prioritizing watersheds for conservation and restoration.
 - Using watershed approach in integrated planning.
- Mitigation Banking, Conservation Banking, and In-Lieu Fee Programs: Mitigation Options Using the Eco-Logical Approach (September 2011) (21). Speakers described programs and case studies related to conservation and mitigation banking, and in-lieu fees, which are tools that help implement the Eco-Logical approach.

- Intersections between Eco-Logical and FHWA’s Planning and Environment Linkages (PEL) Programs to Improve Environmental Outcomes (April 2011) (22). This webinar included presentations on the topics linking Eco-Logical and the FHWA’s PEL program.
- Using Eco-Logical to Identify Priorities for Conservation and Mitigation (March 2011) (23). Three Eco-Logical grant recipients presented tools that help transportation practitioners and resource agencies to identify ecosystem priorities and related mitigation projects in their States and regions.

FHWA reports that 2013 Eco-Logical webinars will focus on implementing each step in the *Integrated Ecological Framework*, a tool designed to help transportation and resource agencies work together to integrate transportation and ecological decision making.

SAMPLE STATE PRACTICES

Heard Natural Science Museum and Wildlife Sanctuary, North Texas

In-lieu fee agreements are conducted in accordance with the Memoranda of Understanding MOU between TxDOT and TPWD under provision (4)(A)(ii), and with TAC Title 43 Part 1 Chapter 2, which addresses compensatory mitigation for non-regulatory habitat. One recent example project in Collin County is providing a fee-in-lieu payment to the Heard Natural Science Museum and Wildlife Sanctuary in Collin County, Texas for approximately 24 acres of upland habitat impacts caused by the impacts from US 75 and approximately one acre of riparian habitat from the Stacy Road project. The compensatory mitigation will involve wetlands and prairie restoration, as well as forest reconstruction and restoration. The TxDOT Right of Way (ROW) division establishes a ROW CSJ in order to make payments to the Heard Museum.

Mitigation for FM 2499, North Texas

FM 2499 (Segment IV) is a 4.7-mile, four-lane divided, non-controlled access, new location, urban arterial that extends the existing FM 2499 north terminus and travels through or abuts the city of Highland Village, the town of Copper Canyon, an unincorporated portion of Denton County, the town of Corinth, and U. S. Army Corps of Engineers (USACE) land and water associated with the Poindexter and Hickory Creek Branches of Lewisville Lake.

FM 2499 project resulted in compensatory mitigation for the unavoidable impacts at the USACE land and waters. The benefactor of this mitigation is the Lake Lewisville Environmental Learning Area (LLELA).

Lewisville Lake Environmental Learning Area (LLELA) (24)

The LLELA was created in the early 1990s when the U.S. Army Corps of Engineers, in partnership with several state and local agencies, founded a consortium to manage nearly 2,000 acres below Lewisville dam. Today the LLELA consortium includes the USACE, the University of North Texas (UNT), the University of Texas at Arlington (UTA), Texas A&M University, the

city of Lewisville, and the Lewisville Independent School District. With funding support from the FM 2499 mitigation, TxDOT has helped the LLELA to advance its mission to preserve and restore our native ecosystems, and to provide and promote environmental education and scientific research.

The LLELA contains a variety of habitats, including prairies, bottomland hardwood forests, wetlands, and cross timbers forest. With such habitat diversity, there is a profusion of wildlife. Mammals such as bobcats, white-tailed deer, and mink can be found, along with birds such as wild turkeys, painted buntings, and dozens of waterfowl species. The LLELA is dotted with sloughs, wetlands, creeks, and dry channels, the landscape features originally wrought by the Elm Fork and its tributaries during flood events. Rainwater and flooding keep these areas filled, providing areas where one can find wood ducks and other waterfowl, as well as many turtles, wading birds, and amphibians.

The FM 2499 mitigation directed to the LLELA provides a model for future mitigation, whereby mitigation funds are leveraged with an expert management staff, thousands of volunteers and sweat equity, and an educational laboratory for students of all ages. The original mitigation plan called for approximately 62 acres of reforestation, 15 acres of grassland restoration, and 38 acres of emergent wetlands. Funding to accomplish the mitigation exceeds \$300,000, which is integrated into LLELA's five-year management plan.

In 2005, a USACE environmental assessment on the effects of the construction of Farm to Market Road (FM) 2499 from FM 407 to FM 2181 in Denton County, and its supplemental assessment in 2007, resulted in a Finding of No Significant Impact (FONSI), assuming that an unavoidable loss of approximately 27 acres of wetlands could be adequately mitigated. To expedite the project, Denton County requested the highest mitigation ratio, 6:1, which also allowed out-of-kind mitigation (i.e., restoration of grasslands and woodlands in lieu of only allowing wetland restoration). The USACE 6:1 in-lieu analysis required mitigation efforts to be applied to approximately 51 acres of wetlands, 22 acres of grasslands and 88 acres of woodlands (totaling approximately 161 acres). Based on the USACE analysis of the Consumer Price Index, the mitigation was valued at nearly \$484,000, or an in-lieu fee of just under \$18,000 per acre of wetlands lost caused by the FM 2499 project.

Mitigation Efforts

Aquatic Ecosystem Restoration. The LLELA has been utilizing the in-lieu fees from the FM 2499 project for mitigation actions since 2007. For example, in 2011 aquatic restoration activities included hydrologic alterations to increase the residence time of water released from Lewisville Lake in their Bittern Marsh wetland system as well as native wetland species plantings within the Bittern Marsh. Education and outreach, one aspect of comprehensive ecosystem restoration, was to utilize Master Naturalists and members of the Fort Worth and Dallas Fly Fishers Clubs to improve fisheries habitat with the plantings so that these stakeholders could better understand how adverse impacts of projects can be mitigated. Ultimately, these efforts directly benefit the groups.

Forest Restoration. FM 2499 in-lieu fees have also been used for forest restoration. For example, efforts to eradicate the Chinese privet (an invasive plant species) from forested areas have continued, using primarily mechanical removal. Where privet was cleared, native forest species—such as inland sea oats that had been cultivated at the LLELA nursery—were transplanted at strategic locations in their bottomland forests. Thick stands of native grasses now grow at the bottom of first-order streams, eliminating most of the erosion that had been occurring after rain events. Part of the forest restoration efforts also included:

- Collecting walnuts, pecans, and acorns of several native hard-mast tree species.
- Germinating those seeds in the LLELA nursery.
- Replanting the seedlings in areas of degraded forest habitat.

In addition to woody plants being transplanted at LLELA, local stakeholders from within the DFW area have provided several species of rare perennial native forest forbs, such as trout lilies, that were then transplanted in appropriate locations at LLELA.

Prairie Restoration. LLELA has been restoring native prairies within LLELA with various activities including bison herd rotational grazing—depending on extent and duration of droughts—as well as burning and mowing to encourage the emergence and continuity of both tall grass and short grass species. Efforts during 2011 included controlling brush and woody vegetation on former upland grassland sites and replacement of exotic herbaceous plants with native prairie species. This improved native diversity and enhanced ecological functioning help control the upland mesquite savannahs, which had become a more closed canopy system over the past century due to the elimination of fire and grazing. Prairie restoration efforts included control of exotic grasses, forbs, and woody species using mechanical, chemical, and prescribed burning interventions. Restoration efforts also included maintenance of a native seed bank through plant rescue projects and seed harvests from Denton and surrounding counties in north central Texas.

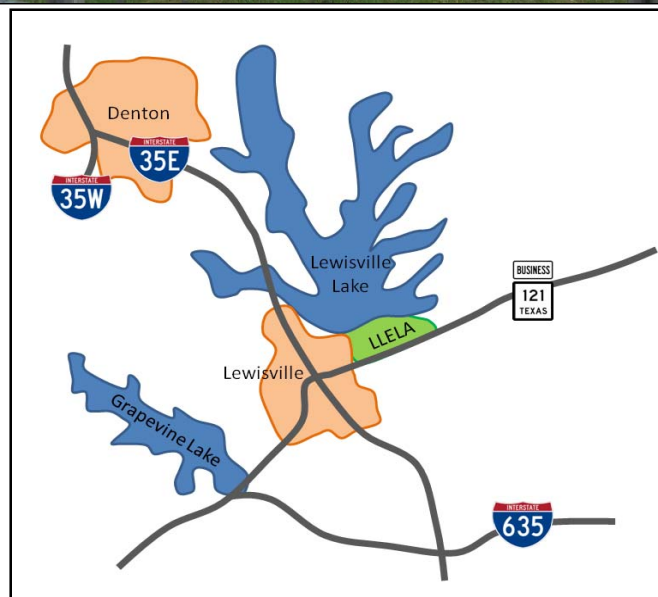


Figure 4. LLELA Location.

TxDOT Mitigation Banks.

TxDOT has financed a total of three multi-project wetland mitigation banks, located primarily in the eastern and coastal regions of the state (25). The Anderson Tract and Blue Elbow Swamp banks operate under independent memoranda of agreement that involve USACE, USFWS, EPA, TPWD, and TxDOT. The Coastal Bottomlands bank operates under a separate, mitigation banking instrument that the State’s MBRT had developed and approved.

Anderson Tract (2,242 Acres; 2,200 Credits Approved) USFWS Priority 1 Site

A highly diverse wetland complex of riverine habitats, including oxbow lakes and many bottomland forest communities, located in the Tyler District in Smith County, adjacent to Little Sandy National Wildlife Refuge.

Blue Elbow Swamp (3,343 Acres; 2,841 Credits Approved)

A “national priority wetland” that comprises a complex of habitats, including young to mature Cypress-Water Tupelo bottomland forest, isolated pine-oak upland, emergent marsh, and open water. Location is in the Beaumont District in Orange County.

Coastal Bottomlands (3,552 Acres; 1,522 Credits Approved)

A bottomland hardwood forest that includes willow swamp within the ecosystem of the Gulf Coast prairies and marshes, and within seven miles of the Peach Point Wildlife Management Area and San Bernard National Wildlife Refuge. Location is in the Houston District in Brazoria County, and includes buffer area uplands with 500-year-old live oak trees with a diameter breast height (dbh) in excess of 200 inches. Also includes Endangered Species Act (ESA) compensation for bald eagle habitat in the form of nesting and foraging areas.

California RAMP (26)

Regional advance mitigation planning (RAMP) incorporates both a regional geographic component and an advance time frame. The regional component allows state and federal agencies to consider the environmental impacts of planned infrastructure projects at once. The advance time frame will identify regional mitigation opportunities that will satisfy anticipated mitigation requirements early in the project planning and environmental review process, *before* the projects are in the final stages of approval. The goal is for natural resource agencies and infrastructure agencies to work together and estimate mitigation needs early in the projects’ timelines, avoiding permitting and regulatory delays, and allowing public mitigation dollars to stretch further.

This innovative approach differs from the way many infrastructure projects are typically funded and implemented, wherein the agencies engage in project-by-project mitigation, usually near the end of a project’s environmental review, with insufficient consideration of regional or statewide conservation priorities. Although this type of mitigation is still a valid approach, permitting delays can occur when appropriate mitigation measures cannot be easily identified and agreed upon, and the cost of mitigation often increases between the time the project is planned and funded and the time mitigation land is acquired. As a result, infrastructure agencies end up paying top dollar to satisfy mitigation requirements. Project-by-project mitigation also often overlooks regional conservation needs and ecosystem-scale impacts to sensitive species and habitat, thereby missing critical opportunities for efficient, reliable, and biologically relevant

mitigation. Additionally, the opportunity for greater benefits to water and air quality and public health are lost.

Evaluation of California Mitigation Projects

This project evaluated compliance and wetland condition of compensatory wetland mitigation projects associated with Clean Water Act Section 401 Water Quality Certifications throughout California. The California researchers reviewed and performed field evaluations for 143 permit files from 1991–2002 distributed across the 12 Water Board regions and sub-regions of the state and found that permittees largely followed permit requirements, but approximately one-third to one-fourth did not (27).

The average percent-met score was 73 percent. Forty-six percent of the files fully complied with all permit conditions. The average compliance score based on mitigation plan requirements (a proxy for all agency requirements) was slightly lower than the 401 compliance scores (81 percent vs. 84 percent). Only 16 percent of the files fully complied with all mitigation plan conditions; however, 42 percent had scores of 90 percent or greater.

The reports present detailed conclusions and recommendations based on the mitigation evaluation, including:

- Improving mitigation requirements:
 - Permit conditions should ensure complete compensation for the full suite of wetland functions and services lost.
 - Ensure that mitigation projects compensate for losses in water quality (pollution) improvement services.
 - Improve accounting of the habitat types lost and gained.
 - Mitigation projects should have appropriate landscape context.
 - Offsite mitigation should be within the same catchment, or at least the same watershed.
- Information management recommendations:
 - Improvements to database.
 - Improve permit archiving.
 - Improve tracking the progress of mitigation projects.
 - Improve permit clarity.
- Coordination with other agencies:
 - Improve incorporation of final permit information into Water Board files.
 - Consider developing an integrated permit.

Florida Efficient Transportation Decision Making

The Florida Department of Transportation (FDOT) implemented a process called Efficient Transportation Decision Making (ETDM) shown in [Figure 5](#) below, that frames the environmental process within the planning and project development phases. Central to this

process are district-level environmental technical advisory teams (ETATs), which provide coordination services throughout the entire project development process, including transportation planning and programming, schematic development, and design. FDOT uses the ETDM process for all new capacity projects, including Categorical Exclusion (CE), Environmental Assessment (EA), and Environmental Impact Statement (EIS) projects.

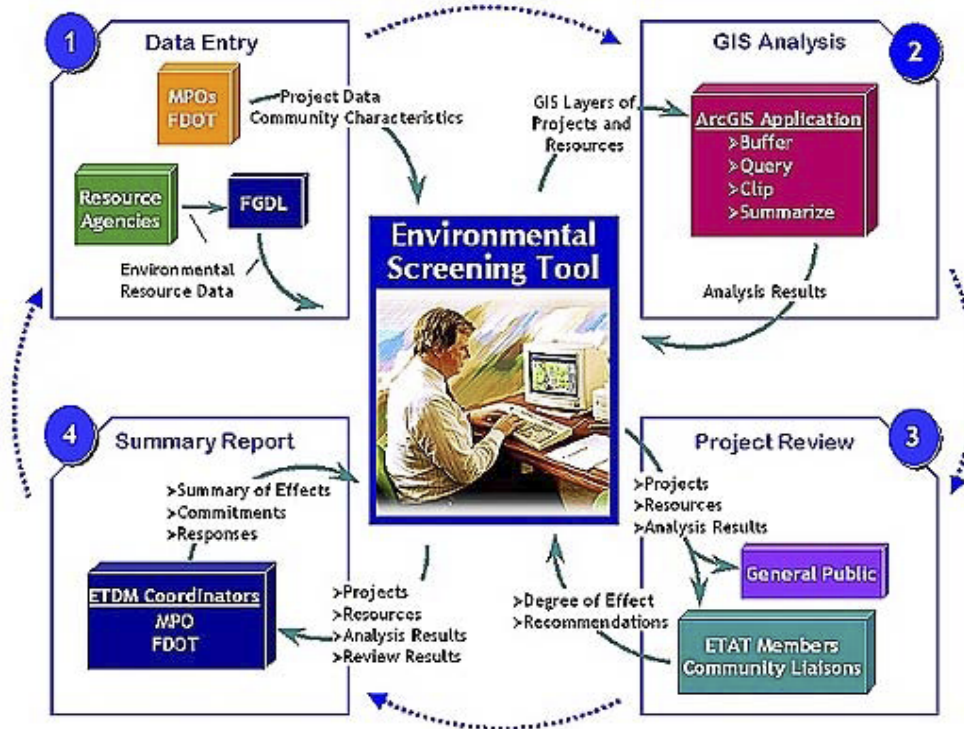


Figure 5. FDOT Efficient Transportation Decision Making Process.

FDOT has reported several benefits resulting from the ETDM process implementation, including the following:

- Improved agency coordination and consultation that fosters a team approach to the identification of solutions, while minimizing contention about the need for transportation projects.
- Improved transportation planning that increases awareness about potential negative project environmental impacts, which has resulted in modification and even project withdrawals, while enabling better environmental mitigation cost estimates.
- Focused evaluations during project development that enables the identification of key project issues before the start of the preliminary design phase, the development of better scopes of services, better staff and resource allocations, and time and cost savings.
- Improved dispute resolution process through the early identification of issues, which eliminates the need for unnecessary evaluations of project alternatives that are not consistent with protection plans.

- Less costly environmental studies and documentation as a result of early feedback from environmental stakeholders, leading sometimes to changes in the required environmental class of action (e.g., Programmatic CE (PCE) versus CE).
- Shortened project delivery through better coordination among ETAT members (in one case, the traditional project development process duration was reduced from the originally expected 18–24 months to 15 weeks).
- Better access to information.

FDOT historically conducted mitigation for wetland impacts associated with roadway construction on a project-by-project basis. In 1996, the State Legislature created the FDOT Mitigation Program (28) because mitigation would be more effective with regional, long-range mitigation planning rather than on a project-by-project basis. The state’s water management districts administer this program, and these are responsible for developing an annual a mitigation plan with input from various federal and state regulatory and resource agencies, including representatives for public and private mitigation banks. Each year, FDOT provides an inventory of anticipated construction-related wetland impacts and updated information for previously identified transportation projects. Based on the impact information that the FDOT provided, mitigation options are matched to road improvement projects to satisfy state and federal permitting requirements for offsetting wetland.

Mitigation projects established through the FDOT Mitigation Program focus on activities of the water management districts and the Department of Environmental Protection such as Surface Water Improvement and Management (SWIM) projects, land acquisition, and control of invasive and exotic plants. To date, there are 37 mitigation projects that have been established through the FDOT Mitigation Program, of which 15 are SWIM projects, six contain a land acquisition element, and 14 contain an invasive and exotic plant control element.

Mitigation Banking

The Florida Department of Environmental Protection and water management districts throughout the state operate an extensive network of mitigation banks (29) (see Figure 6). The Uniform Mitigation Assessment Method (UMAM) is a standardized procedure used to assess mitigation banks established after February 2004. UMAM was developed to fulfill a state mandate and is used to determine how much mitigation is needed to offset impacts to wetlands and to award or deduct mitigation bank credits. The UMAM (30) evaluates:

- The current condition.
- Hydrologic connection.
- Uniqueness.
- Location.
- Fish and wildlife utilization.
- Time lag.
- Mitigation risk of a particular area.

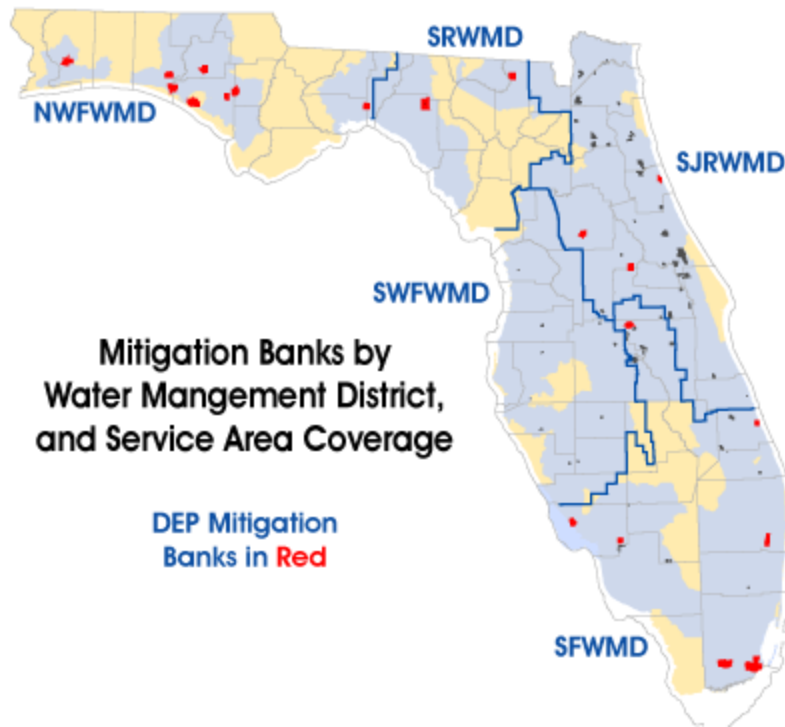


Figure 6. State-Issued Mitigation Banks in Florida. Source: [Florida DEP.](#)

Regional Offsite Mitigation Areas (ROMA)(31)

Regional Offsite Mitigation Areas (ROMAs) are environmental enhancement projects serving as mitigation for multiple impact projects. Applicants pay money to the ROMA sponsor (the Florida Department of Environmental Protection, a water management district, or local government), and the collected funds are used toward implementation of the larger mitigation project. Payments received for a ROMA project may be used only for that project, and no other purpose. ROMAs that serve as mitigation for more than five permits or 35 acres of impact are operated under a memorandum of agreement (MOA), similar to a mitigation bank permit established by State statutes.

Florida Wetland Restoration Information Center (32)

The Florida Department of Environmental Protection developed the Florida Wetland Restoration Information Center (FWRIC), a web portal used to facilitate restoration of wetlands and their associated uplands. The FWRIC has several sections, including the Florida Ecological Restoration Inventory (FERI), a restoration library with:

- Mitigation guidebooks.
- Training courses.
- Expert directories.

- The restoration policy and programs that review state wetland management programs and policies.
- Case studies for restoration projects.

Current and proposed ecological restoration projects within Florida are compiled in the FERI (33). The Florida Department of Environmental Protection maintains the inventory, with contributions from many organizations. Each project in the inventory typically includes:

- Project name.
- Description of the project.
- Applicable categories, benefits, needs, and habitats.
- Acreage estimate, cost estimate.
- Geographic information systems (GIS) data.

This information assists agencies and practitioners during restoration planning and implementation. This database is intended to minimize overlapping research and maximize data availability, and greatly assist the concerned parties in decision-making and enforcement activities. The inventory includes:

- Wetland restoration.
- Upland natural community restoration.
- Exotic species removal.
- Cultural and historic resource management.
- Ecological protection projects.

Florida Forever (34)

Florida Forever is Florida's conservation and recreation lands acquisition program, used for conserving natural resources and the state's natural and cultural heritage. Since the program began in 2001, the program has acquired more than 683,000 acres of land with \$2.87 billion and protected thousands of acres. These include:

- Strategic habitat conservation areas.
- Rare species habitats.
- Ecological greenways.
- Natural floodplains.
- Fragile coastlines.
- Groundwater recharge areas.
- Sustainable forest lands.
- Under-represented natural communities.

Maryland's Conservation Efforts and the Watershed Resource Registry

The State of Maryland has committed to multiple environmental remediation and mitigation planning efforts over the past decade. Much of this work revolves around statewide planning for lowering the state's overall impact on climate with specific focus on reductions in greenhouse gas (GHG) emission.

In April 2007, Executive Order 01.01.2007.07 created Maryland's Climate Change Commission. The commission's central responsibility is to create and update the *Maryland Climate Action Plan* (the plan) to prepare the state for the impacts of climate change while establishing goals and strategies to ameliorate the potentially negative effects.

In 2009, Governor O'Malley further expanded the state's efforts to understand and combat its contributions to climate change by signing the Maryland Greenhouse Gas Emissions Reduction Act of 2009 (the act). The act requires GHG emissions to be reduced by 25 percent (from 2006 levels) by the year 2020. Because of its broad scope, the act has resulted in multiple statewide efforts to plan for reductions in GHG—both the Maryland Department of Transportation (MDOT) and the Maryland Department of the Environment (MDE) have developed related plans.

The MDOT has established a methodology for determining a baseline GHG inventory and released the *Maryland Climate Action Plan Draft 2012 Implementation Plan* (the MDOT plan), which focuses on strategies for reduction of GHG (35). The MDE's plan—*Maryland's Plan to Reduce Greenhouse Gas Emissions* (the MDE plan)—includes 65 programs developed to reduce emissions. MDOT is responsible for 14 of these programs (36).

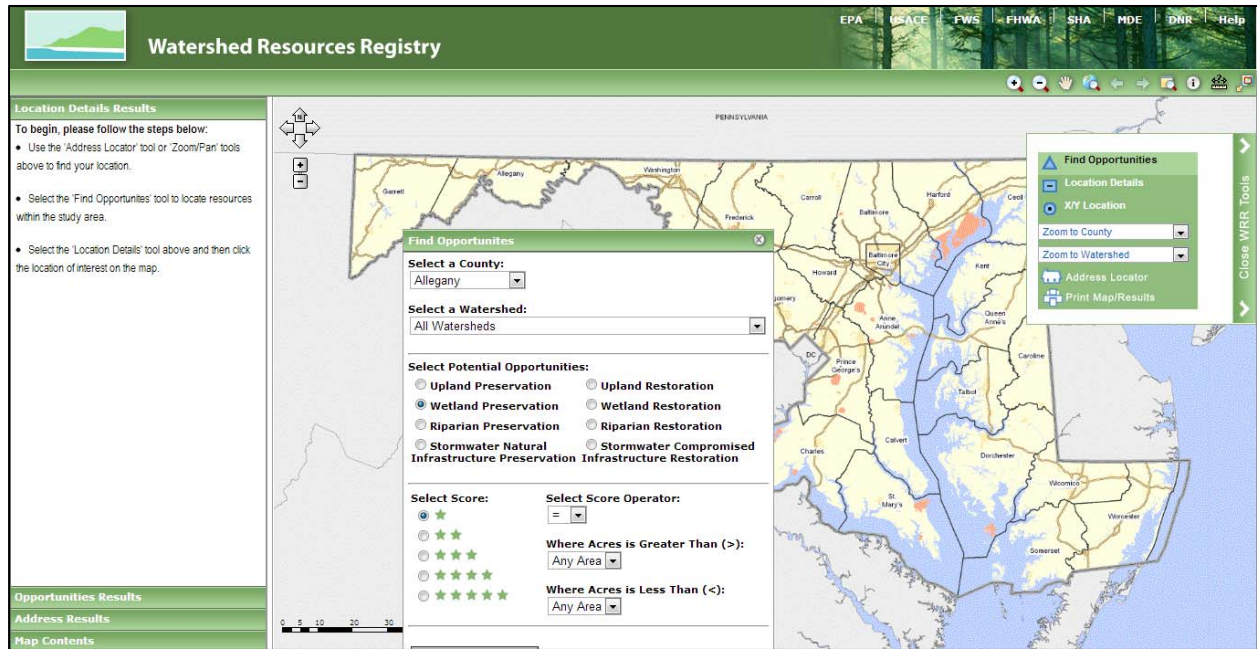
The standalone plans that MDOT and MDE offered do not offer mitigation strategies of relevant depth or scope. Instead, a separate tool designed to “identify preferred locations for conservation and restoration” statewide complements these plans. This tool, the Maryland Watershed Resources Registry (the registry), was developed by both agencies along with the Baltimore Army Corps of Engineers District, United States Environmental Protection Agency Region 3, and a variety of resource and transportation agencies across the state (37, 38). The Registry was released in the fall of 2012 after an initial pilot project in southern Maryland. According to the registry's website (39), it is:

A comprehensive mapping tool & replicable framework that:

- *Integrates regulatory and non-regulatory programs.*
- *Guides resource planners.*
- *Conserves program resources.*
- *Highlights for multiple environmental benefits.*
- *Maximizes watershed benefits.*
- *Is transparent and predictable.*

The registry further describes itself as such: The Maryland Watershed Resources Registry “integrates multiple programs from the CWA [Clean Water Act], and moves mitigation efforts away from a stovepipe approach, towards a comprehensive watershed view. [It also includes] collaboration between regulatory and non-regulatory agencies.” Figure 7 depicts the

registry’s public interface and shows some of the available options that can be accessed when researching potential restoration opportunity sites.



Source: (40)

Figure 7. The Maryland Watershed Resources Registry Public Interface.

The Strategic Highway Research Program 2 briefly discusses the registry in the appendices to their guide to the *FHWA Integrated Ecological Framework* (37). The registry’s capabilities are outlined in detail and include the following (paraphrased here for brevity):

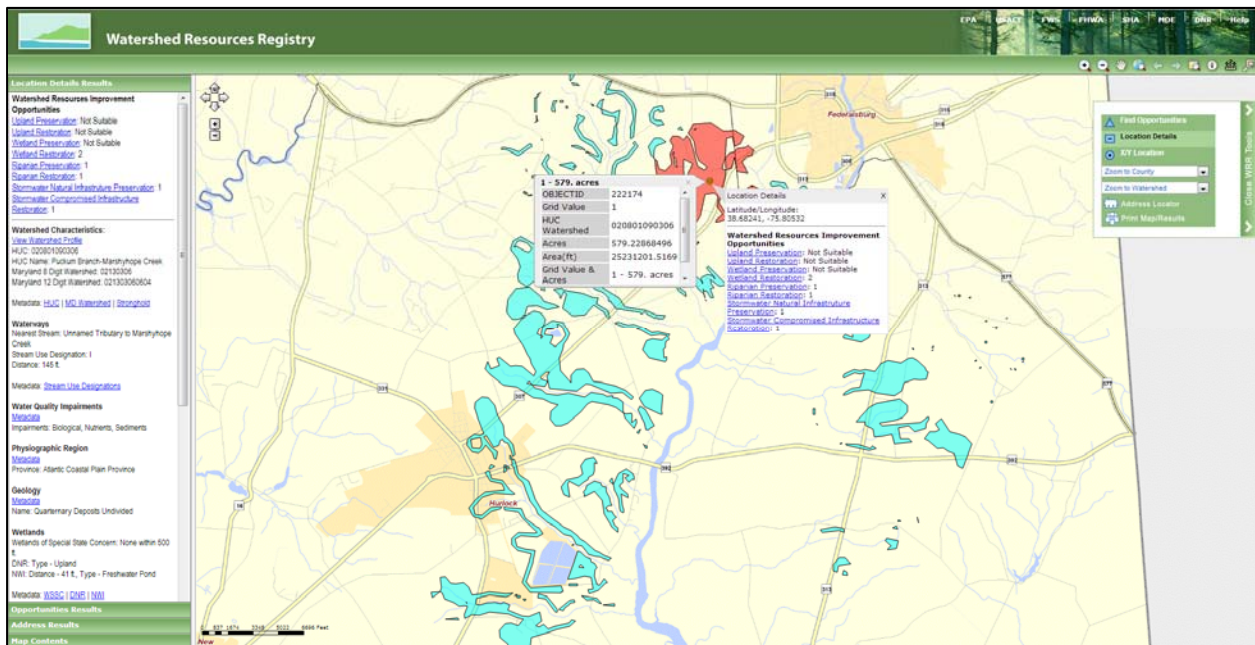
- Identify compensatory mitigation sites based on a watershed analysis and watershed goals/needs in accordance with the 2008 Mitigation Rule.
- Provide for the preservation, restoration, enhancement, and creation of aquatic resources while enhancing environmental outcomes on a watershed basis.
- Maximize the use of state mitigation dollars.
- Improve and streamline §404, the National Environmental Protection Act, and state-developed decision processes.
- Protect, restore, create, enhance, or preserve aquatic resources in rapidly developing watersheds and the last remaining linkage areas.
- Identify mitigation sites that are consistent with the site needs identified in various State plans.
- Target funding toward priority watershed restoration and/or preservation projects.
- Assist in identifying proposed projects and the writing of watershed plans and to identify and prioritize funding opportunities. Assist cities, counties and/or regional and local planning organizations in identifying high-quality areas.

- Guide municipal and regional planning offices.
- Aid the Fish and Wildlife Service in identifying Partners for Wildlife sites.

Potential mitigation sites make up the registry’s database and have been pre-evaluated for potential effectiveness. These are presented according to the benefits that a restoration project at the selected site can provide, including the potential for benefit beyond the scope of the project site, such as down-stream. The map data within the registry fall into eight categories:

- Wetland preservation.
- Wetland restoration.
- Wetland enhancement.
- Riparian zone preservation.
- Riparian zone restoration.
- Upland preservation.
- Upland reforestation.
- Storm water management (43).

Figure 8 depicts the output of a search in the registry, with details of the specific restoration site displayed on the left and the site itself highlighted in red.



Source: (40)

Figure 8. Maryland’s Watershed Resources Registry Output.

The registry’s developers assert that it is capable of saving both time and money when compared to traditional techniques for finding and assessing restoration sites. Figure 9 presents an example of the time and cost savings potential as related to a conceptual project.

Example of WRR Potential Cost Savings: MDSHA

	Costs	Time	Cost Savings w/WRR	Time Savings w/WRR
Site Search	\$50,000	4 months	\$37,500	1 month
Design	\$210,000	18 months	\$70,000	6 months
Agency Coordination/MDE Consultant Review	\$10,000	12 months	\$2,500	3 months
Total	\$365,000	2.5 years	<u>\$110,000</u>	<u>1 year</u>

- Estimates for a single project; potentially ~10 projects/year
- Estimates do not account for decreased employee time

Source: (41)

Figure 9. Maryland Watershed Resource Registry - Potential Cost Savings.

As of January 2013, the state’s highway administration has been using the registry to:

- Inventory areas that their plans have affected.
- Execute pre-plan screening.
- Determine opportunities for mitigation and stewardship efforts across the state (42).

The developers of the registry plan to adopt a regular update cycle so that decisions made using the information it provides can be as accurate and well-informed as possible (42).

Beyond the Maryland State Highway Administration’s efforts and the plans to further improve the registry, there is no evidence of its use in any current projects. The tool, in its statewide implementation, has been available for use only since fall 2012, which is likely the reason for the lack of project examples. As a tool for prioritizing mitigation efforts and achieving the most positive cost/benefit exchange, the Maryland Watershed Resource Registry is well-developed and executed. Conversely, the authors of a study on progressive mitigation approaches observed that “transportation practitioners will likely need to choose offset sites through an iterative mitigation approach that maximizes conservation results from compensation sites that are actually available for acquisition” instead of choosing from the most effective sites regardless of availability (43). Without examples of the Maryland Watershed Resource Registry’s use in practice, it is difficult to determine its true level of effectiveness or its relevance to Texas and the Texas Department of Transportation. The registry should be monitored and projects using its output should be investigated as they occur.

BACKGROUND

In 1997 North Carolina approved legislation that formed the Wetlands Restoration Program (WRP) within the state's Department of Environment and Natural Resources (NCDENR). This initial legislation was designed to focus on watershed scale mitigation in an attempt to avoid smaller scale strategies that had a track record of poor performance or failure within the state. Beginning in 1999 the North Carolina Department of Transportation (NCDOT) began to use the WRP process to execute mitigation efforts for some of its projects. However, both the NCDOT and the NCDENR programs were not thorough enough to satisfy federal level requirements. Because of the need for more thorough mitigation plans and processes a "process improvement initiative" was undertaken in 2001 and included over ten state and federal resource agencies. The result of this effort was a Memorandum of Agreement (MOA) that was signed in 2003 by NCDOT, NCDENR and the US Army Corp of Engineers-Wilmington District. This MOA stated that, "mitigation for NCDOT should be provided years in advance of project impact, and be designed to replace unavoidable functional losses to wetlands and riparian buffers" (44). The MOA also creates the Ecosystem Enhancement Program. Finally, in 2010, the MOA was succeeded by the In-Lieu Fee Instrument, which enables and outlines the continued implementation and use of in-lieu fees (ILF) for stream and wetland mitigation in North Carolina as an integral part of the EEP.

Figure 10 displays the Ecosystem Enhancement Program's biennial budget for fiscal years 2012 and 2013. The vast majority of the budget (88 percent) is dedicated to restoration (mitigation) activities.

Cash Flow Projection
EEP Biennial Budget State Fiscal Years (SFY) 2012/13 and 2013/14

Summary

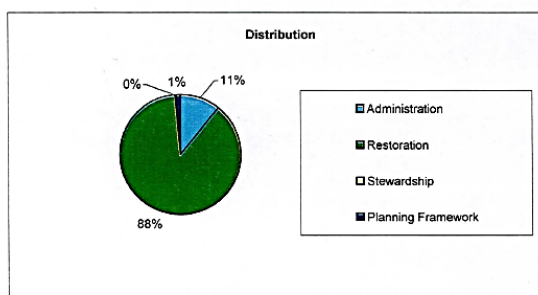
Line Item **	MOA Year 10* (SFY 2012/13)				MOA Year 11* (SFY 2013/14)				Total
	Quarter #1 07/12 - 09/12	Quarter #2 10/12 - 12/12	Quarter #3 01/13 - 03/13	Quarter #4 04/13 - 06/13	Quarter #5 07/13 - 09/13	Quarter #6 10/13 - 12/13	Quarter #7 01/14 - 03/14	Quarter #8 04/14 - 06/14	
Administration									
Salaries	\$ 899,991	\$ 899,991	\$ 899,991	\$ 899,991	\$ 899,991	\$ 899,991	\$ 899,991	\$ 899,991	\$ 7,199,928
Operating	\$ 78,945	\$ 78,945	\$ 78,945	\$ 78,945	\$ 78,945	\$ 78,945	\$ 78,945	\$ 78,945	\$ 631,560
SPO and legal	\$ 90,380	\$ 90,380	\$ 90,380	\$ 90,380	\$ 78,643	\$ 78,643	\$ 78,643	\$ 78,643	\$ 676,092
Restoration	\$ 6,878,115	\$ 14,727,709	\$ 7,697,056	\$ 6,603,795	\$ 9,514,932	\$ 12,531,523	\$ 4,956,252	\$ 5,458,560	\$ 68,367,943
Stewardship	\$ 22,430	\$ 22,430	\$ 22,430	\$ 22,430	\$ 35,657	\$ 35,657	\$ 35,657	\$ 35,657	\$ 232,348
Planning Framework	\$ 107,464	\$ 110,724	\$ 161,294	\$ 167,994	\$ 102,259	\$ 90,800	\$ 80,000	\$ 65,000	\$ 885,535
Total (by Quarter)	\$ 8,077,325	\$ 15,930,179	\$ 8,950,096	\$ 7,863,535	\$ 10,710,427	\$ 13,715,559	\$ 6,129,488	\$ 6,616,796	\$ 77,993,406

Total (Annual) **\$ 40,821,135** **\$ 37,172,271** **\$ 77,993,406**

* Year of operation as EEP since 2003
 ** See individual linetabs for details

Summary

Administration	\$ 8,507,580
Restoration	\$ 68,367,943
Stewardship	\$ 232,348
Planning Framework	\$ 885,535
Biennial Total	\$ 77,993,406



Note: Biennial budget reflects operating requirements of Code of Federal Regulations as agreed with USACE, Wilmington District

Figure 10. EEP Biennial Budget: 2012-2014 (45).

EEP describes its mitigation program as follows (46):

Acting on the philosophy that a programmatic, watershed-based planning process will focus all biological-engineering resources toward the best possible environmental return, EEP also embraces partnerships that work to create streamlined government for the state. EEP's formation by definition helps to eliminate duplicative resources, and also embraces the expertise of all shareholders affected by its processes.

EEP partners with a wide range of private biological-engineering and mitigation-banking companies on stream and wetland restoration and enhancement projects across the state. Early in its existence, the initiative also collaborated with local and regional land trusts across the state, an arrangement believed to have been unprecedented in the nation on this scale, to harness the expertise, innovation and local knowledge of 22 separate trusts to promote land acquisition and open-space protection.

EEP offers four types of in-lieu fee programs depending on the necessary form of mitigation and the stakeholder applying for mitigation (public or private sector). The programs are called: NCDOT Stream and Wetland, Statewide Stream and Wetland, Riparian Buffer and

Nutrient Offset. The NCDOT Stream and Wetland program is specifically for NCDOT projects. EEP describes each program as follows (47):

NCDOT Stream & Wetland ILF Program

EEP's nationally recognized NCDOT Stream & Wetland ILF fee program provides off-site compensatory wetland and stream mitigation for the N.C. Department of Transportation in advance of permitted impacts. Each year, NCDOT provides EEP an updated list of planned NCDOT transportation projects that are scheduled to go to construction over the next seven years, along with each project's estimated wetland and stream mitigation needs.

EEP continuously updates its planning to produce the necessary mitigation (i.e., land acquisition, and mitigation site design, construction, planting and monitoring) to meet NCDOT's future mitigation needs in advance of impacts. Each quarter, NCDOT pays EEP the actual mitigation production costs.

Statewide Stream & Wetland ILF Program

This initiative provides assistance to the private sector, state government agencies, municipalities, schools, military bases and other applicants to meet state and federal stream and wetland mitigation requirements. Applicants may voluntarily request to participate in the Statewide Stream and Wetland ILF Program.

Upon acceptance by EEP and approval of the regulatory agencies, the applicant makes a payment to EEP based on EEP's schedule of fees to satisfy the mitigation requirement specified in the permit(s). The permit's mitigation requirement is then transferred to EEP, which implements stream and wetland mitigation projects to satisfy the requirements.

Riparian Buffer Mitigation Program

The Riparian Buffer Program is offered to the private and public sectors to meet compensatory-mitigation requirements associated with riparian-buffer impacts in the Neuse, Tar-Pamlico and Catawba River basins, and the Randleman Reservoir and Jordan Lake watersheds in the Upper Cape Fear River basin. Upon acceptance into the program, applicants make a payment to the Riparian Buffer Restoration Fund according to the schedule of fees to satisfy the mitigation requirement. Upon payment, the permit's mitigation requirement is then transferred to EEP, which implements riparian buffer mitigation projects to satisfy the requirements.

Nutrient Offset Program

The Nutrient Offset Program for both the private and public sectors is designed to assist in meeting loading requirements for nitrogen and phosphorus in the Neuse and Tar-Pamlico River basins, and in the Jordan and Falls Lake watersheds, as part of the nutrient-management strategies in these areas.

Developers may choose to use a "buy-down option" and request to pay a fee to EEP to meet their nutrient loading requirements as specified by a local government. Once payment has been accepted and received by EEP, a receipt is issued which allows the developer to receive final approval from the local government. Upon receiving the payment, EEP assumes the responsibility for the mitigation requirement, including mitigation site construction and monitoring of buffer-restoration sites or other types of nutrient-offset projects (click here for more information).

In each ILF program the applicant pays EEP directly. These payments also transfer full responsibility for the mitigations requirements associated with the applicant's project to EEP. The state is then capable of pooling revenues and targeting large projects that achieve greater long-term return on investment when compared to project-by-project options while achieving the required mitigations.

The 2010 In-Lieu Fee Instrument describes EEP's responsibilities. The Ecosystem Enhancement Program is responsible for management, facilitation, identification, acquisition, planning, construction, monitoring, remedial action and long-term management/maintenance (as needed) of all mitigation projects funded through in-lieu fees. They are required to prepare site-specific plans prior to project approval by the Army Corps of Engineers as well as produce on-going annual monitoring reports that include the status of each completed project (submitted every October 1). EEP is also required to make all documentation publicly available on a dedicated website.

Land acquisition and initial improvements (as necessary to satisfy various mitigation requirements) must be completed by the end of the third fiscal year following the receipt of payment (for non-NCDOT projects) or the receipt of a permit (in the case of NCDOT mitigations). Furthermore, "all mitigation sites that are used to satisfy compensatory mitigation requirements will remain within the public domain in fee simple title in perpetuity and/or ... appropriate preservation mechanisms, including conservation easements and deed restrictions, approved by the DE, [shall be] placed on the sites... sites will be managed in perpetuity in accordance with the long-term management plan included within the mitigation plan or report for the property (48). Long-term responsibilities are transferred from EEP to the NCDENR Stewardship Program (or others, pending approval).

Figure 11 and Figure 12, below, outline the fees associated with the EEP ILF program.

Fee Category	Credit Unit	Fee per Unit Click below for (Higher Fee HUs)	Fee per Unit Click below for (Lower Fee HUs)
Riparian Buffer	square foot	\$1.02	\$1.02
Stream	linear foot	\$374	\$283
Nonriparian Wetland	acre	\$49,423	\$25,416
Riparian Wetland	acre	\$68,502	\$38,730
Coastal Wetland	acre	\$168,510	\$168,510

Figure 11. Stream, Wetland and Riparian Buffer Fees (49).

Watershed	Nutrient	EEP Rate/pound
Neuse basin 8-digit HUCs 03020202, 03020203 and 03020204	N	\$13.44
Neuse - 03020201 outside Falls Lake watershed	N	\$21.02
Neuse - Falls Lake watershed	N	\$21.65
Neuse - Falls Lake watershed	P	\$209.35
Tar-Pamlico basin	N	\$21.65
Tar-Pamlico basin	P	\$209.35
Jordan Lake watershed	N	\$21.65
Jordan Lake watershed	P	\$209.35

Figure 12. Nutrient Offset Fee per Pound.⁶

Since the EEP program began it has helped NCDOT avoid mitigation related delays on all projects since 2003 and been a part of over 580 total projects while preserving over 50,000 acres of natural spaces. [Figure 13](#) highlights the main reasons stakeholders choose to participate in EEP’s in-lieu fee program – convenience is the standout favorite feature of the program.

More EEP achievements (50):

- Over 580 projects across the state
- Conserved/Restored/Enhanced:
 - Over 630 miles of streams
 - Nearly 30,000 acres of wetlands
 - Approximately 680 acres of buffers
- Nearly 4,000 developers and partners served
- Almost \$500 million in private sector contract awards
- Over 50,000 acres of natural areas preserved
- Zero NCDOT projects delayed since 2003 - \$14 billion in projects

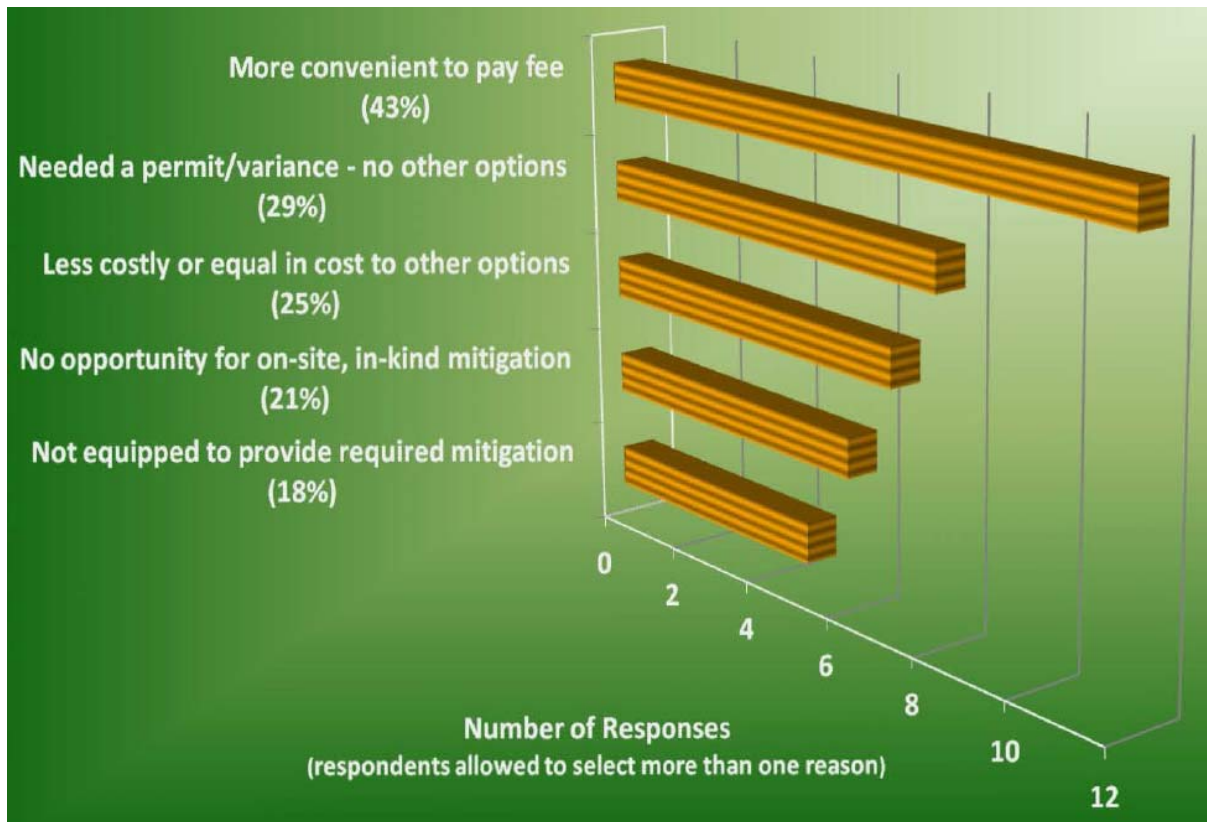


Figure 13. Reasons Stakeholders Choose EEP In-Lieu Fee Program (51).

Lessons for Texas

It is likely that a similar program in Texas would benefit from regional (instead of statewide) focus. At minimum, splitting a similar program in Texas into two regions (accounting for two Army Corps District) would be beneficial and enable more regionally responsive/appropriate mitigation efforts.

In 2004, an independent assessment of the EEP program found two main issues/concerns with the North Carolina EEP program (52). First, because of the fact that program operations are dictated by forecasting environmental impacts ahead of time the accuracy of such forecasts is critical to the successful day-to-day operation of a program like that of North Carolina’s EEP. Additionally, the amount of up-front funding (for the purchase of lands necessary for mitigation, research and planning) is substantial. Without planning for this fact and establishing reliable funding sources that can quickly react to changes in demand (growth years versus years with limited infrastructure investment) a program such as EEP will struggle.

RESOURCE AGENCY MANAGEMENT PLANS

There are numerous resource management plans throughout Texas. Many of these plans are listed below. This preliminary inventory demonstrates the complexity and diversity of resources that may be involved in the coordination and construction of the framework.

Watershed Plans (53, 54)

A Watershed Protection Plan (WPP) gives local governments, individuals, community groups, and business and industry a better understanding of the sources of water pollution and what they can do to improve water quality (55). In Texas, local stakeholders develop watershed protection plans to:

- Coordinate activities and resources to manage water quality.
- Facilitate the restoration of impaired water bodies.
- Protect threatened waters before they become impaired (56).

Watershed Protection Plans that the Clean Water Act §319(h) grants have funded must follow the EPA guidelines that describe nine elements needed for a successful plan:

- Identification of Causes and Sources of Impairment.
- Expected Load Reductions from Management Measures.
- Proposed Management Measures.
- Technical and Financial Assistance Needs.
- Information, Education, and Public Participation Component.
- Schedule for Implementing Management Measures.
- Interim Milestones for Progress in Implementation.
- Criteria for Determining Pollutant Load Reductions and Water Quality Improvement.
- Load Reduction and Water Quality Monitoring Component (56).

The Texas State Soil and Water Conservation Board (TSSWCB) makes technical and financial assistance available to develop and implement WPPs to address significant nonpoint source pollution issues (57). TSSWCB-sponsored WPP development projects are all funded through CWA §319(h) Nonpoint Source Grants to various entities. Table 3 lists these Watershed Protection Plans.

Table 3. TSSWB-Sponsored Watershed Protection Plans.

Location	Main Stakeholder	Description
Attoyac Bayou (58)	Texas Water Resources Institute	The Attoyac Bayou is a sub-watershed within the Upper Neches River Watershed extending approximately 82 miles through Rusk, Nacogdoches, San Augustine, and Shelby Counties before emptying into Sam Rayburn Reservoir. The majority of the lands in the watershed are used for cattle and poultry operations, forestry, or recreational/wildlife uses. The Attoyac Bayou is listed as an impaired water body on the <i>Texas Water Quality Inventory and 303(D)</i> List due to high levels of <i>E. coli</i> bacteria.
Buck Creek (59, 60)	Texas Water Resources Institute	Buck Creek is a small creek in the Texas Panhandle in the Red River Basin that was considered impaired by elevated levels of <i>E. coli</i> bacteria. This impairment was based on a limited dataset that did not accurately represent spatial and temporal water quality conditions in the creek. Through a series of intensive water quality monitoring projects, data collected led to the restoration of water quality and the removal of the creek's impaired status.
Cedar Bayou (61)	Houston–Galveston Area Council	Cedar Bayou is a tributary to the Galveston Bay system, meaning any sources of contamination could potentially impact a wide range of economic and ecological interests even beyond their watershed of origin. Some water quality impairments in Cedar Bayou include bacteria, dissolved oxygen, nutrients, and dioxin.
Concho River (62)	Upper Colorado River Authority	<p>The Concho River basin lies within 13 West Texas Counties and encompasses a watershed of approximately 4.5 million acres. Four major reservoirs (O.H. Ivie, O.C. Fisher, Twin Buttes, and Lake Nasworthy) are located within the watershed boundaries. This WPP is designed to evaluate and assess potential sources of nonpoint source (NPS) pollution basin-wide and to provide for the development of control strategies. Components of the plan include:</p> <ul style="list-style-type: none"> • Fixed station water quality monitoring. • Special study water quality monitoring. • Hydrologic monitoring. • Research involving surface and groundwater. • Development of Geographic Information Systems (GIS). • Hydrologic modeling. • Public outreach activities.
Double Bayou (63, 64)	Houston Advanced Research Center and Shead Conservation Solutions	The Double Bayou watershed is situated in the eastern portion of the Lower Galveston Bay watershed in an area with little urbanization. Water bodies that flow through the watershed drain into Trinity Bay. Land use is mainly pasture, with some agricultural crops, mostly in the form of rice farming. The watershed has an extensive network of rice irrigation canals as well as some channelized waterways that greatly alter the natural drainage pattern of the watershed. The West Fork of Double Bayou has been listed on the 2008 303(d) list for dissolved oxygen and bacteria impairment.
Geronimo Creek (65)	Guadalupe-Blanco River Authority and Texas A&M AgriLife Extension Service	Geronimo Creek, and its tributary Alligator Creek, are located in Comal and Guadalupe Counties, and lie within the larger Guadalupe River Basin. Geronimo Creek is listed on the Texas 303(d) List with a concern for nitrate-nitrogen and an impairment of the contact recreation use, due to elevated <i>E. coli</i> bacteria concentrations.

Table 3. TSSWB-Sponsored Watershed Protection Plans (Continued).

Location	Main Stakeholder	Description
Lake Granger (66)	Brazos River Authority	<p>Lake Granger is located in Williamson County and currently serves as a drinking water supply reservoir for approximately 20,000 residents. The public drinking water demands on the lake are expected to increase to exceed 100,000 residents in the next five to 10 years. The WPP’s goals are to:</p> <ul style="list-style-type: none"> • Reduce erosion within the watershed. • Reduce sediment loadings by 20–30%. • Reduce total suspended solids (TSS) concentration in the reservoir by 30%. • Reduce nutrient loadings from agricultural lands. • Monitor for results. <p>Sedimentation in the reservoir threatens to reduce the firm yield of the reservoir and causes significant problems in treating the water.</p>
Lampasas River (67)	Texas A&M AgriLife Research	<p>The Lampasas River, located in the Brazos River Basin, begins in western Hamilton County (16 miles west of Hamilton) and flows southeast for 75 miles, passing through Lampasas, Burnet, and Bell Counties. In Bell County, the river turns northeast and is dammed five miles southwest of Belton to form Stillhouse Hollow Lake. Below Stillhouse Hollow Lake, the Lampasas River joins with Salado Creek and the Leon River to form the Little River. The Lampasas River above Stillhouse Hollow Lake is listed as impaired due to elevated bacteria levels. In addition, population growth and rapid urbanization occurring in the lower portion of the watershed stress the need to protect the chemical, physical, and biological integrity of the river.</p>
Leon River (68)	Brazos River Authority and Central Texas Council of Government	<p>The Leon River watershed covers 2,600 square miles in Bell, Hamilton, Coryell, Comanche, and Eastland Counties. As of 2002, portions of the river north of Gustine and west of Highway 281 are listed as “impaired” for having <i>E. coli</i> bacteria concentrations that exceeded the state’s water quality standards.</p>
Lower Nueces River (69)	Nueces River Authority	<p>The Lower Nueces River begins 39 river miles from Lake Corpus Christi and flows to the saltwater barrier dam in Corpus Christi. It covers 182.6 square miles (116,862 acres).</p>
Pecos River (70)	Texas Water Resources Institute	<p>The Pecos River covers more than 800 miles through semi-arid and arid landscapes of eastern New Mexico and West Texas, and is crucial to many communities, mainly for irrigation, recreational and environmental use, and recharging underlying aquifers. The Pecos provides approximately 9.5% of the annual inflows to the International Amistad Reservoir, a major source of drinking and irrigation waters for the Lower Rio Grande Valley and its residents. The river also contributes an estimated 26% of salt loading to the reservoir annually, periodically causing salinity levels to approach the maximum drinking water standard.</p>
Plum Creek (71)	Texas A&M AgriLife Extension Service and Guadalupe–Blanco River Authority	<p>Plum Creek is a 52-mile stream that begins in Hays County north of Kyle and flows southeast through Caldwell County, passing Lockhart and Luling before meeting the San Marcos River near the Caldwell–Gonzales County line. With additional flow from Clear Fork, West Fork, Bunton Branch, Town Branch, Salt Branch, and other small streams, Plum Creek and its tributaries drain an area of 397 square miles. Other municipalities with all or part of their city limits within the watershed include Buda, Niederwald, Umland, Mustang Ridge, and Mountain City. The Carrizo–Wilcox formation is a significant local aquifer and the Edwards Aquifer is located in the far northern parts of the watershed.</p>

Table 3. TSSWB-Sponsored Watershed Protection Plans (Continued).

Location	Main Stakeholder	Description
South and North Llano Rivers (72)	Texas Water Resources Institute and Texas Tech University	The Llano River is a spring-fed perennial river and major tributary of the Colorado River. The Upper Llano River, which includes the North and South Llano Rivers, along with the springs that feed it, supports several unique plant and animal communities and provides constant critical flows downstream to the Llano and Colorado Rivers, Lake LBJ and other Highland Lakes, especially during times of drought. The loss of spring flow due to aquifer withdrawals, subtle changes from land fragmentation, loss of riparian habitat, spread of invasive species, and encroachment of juniper species on upland habitats threaten this system, potentially decreasing water quality and stream flows. The South Llano River flows through Edwards and Kimble counties. At Junction, the South Llano joins the North Llano River, becoming the Llano River for the final 100-mile journey to Lake LBJ in the chain of water-supply reservoirs known as the Highland Lakes.

WPP development projects that the Texas Commission on Environmental Quality (TCEQ) has sponsored have significant water quality issues related to urban nonpoint source pollution or wastewater treatment, and most have varying degrees agricultural or silvicultural nonpoint source pollution components. Table 4 lists the TCEQ-sponsored watersheds.

Table 4. TCEQ Sponsored Watershed Protection Plans.

Location	Main Stakeholder	Description
Armand Bayou (73)	Texas Sea Grant and Trust for Public Land	The Armand Bayou watershed is located in southeast Harris County, mostly east of Beltway 8 and south of Highway 225, draining approximately 59 square miles to Clear Creek. The tidal and above tidal portions of Armand Bayou are currently listed on the state’s list of impaired water bodies because of low dissolved oxygen levels that seasonally occur in the Bayou. Seven major fish kills have occurred in the Armand Bayou watershed since 1971; most were located in the tributaries and four were attributed to low dissolved oxygen. Additional problems include high fecal coliform bacteria counts and relatively high turbidity.
Arroyo Colorado (74)	Texas Water Resources Institute	The Arroyo Colorado is located in the Lower Rio Grande Valley of South Texas. Its headwaters are southwest of the city of Mission and it drains into the Lower Laguna Madre. The watershed is approximately 706 square miles (1,828 square kilometers) or 451,840 acres (182,853 hectares) and the river is approximately 90 miles long. The Arroyo is a sub-watershed of the Nueces–Rio Grande Coastal Basin, also known as the South (Lower) Laguna Madre Watershed. The Arroyo Colorado is listed as impaired for high bacteria levels, low dissolved oxygen, and high nutrient concentrations (nitrogen and phosphorus compounds).

Table 4. TCEQ Sponsored Watershed Protection Plans (Continued).

Location	Main Stakeholder	Description
Bastrop Bayou (75)	Houston–Galveston Area Council	Bastrop Bayou is located along the Texas Gulf Coast 50 miles south of Houston in Brazoria County. Most residents live in small cities and towns (Angleton, Danbury, Richwood, Demi-John, etc.), rural subdivisions, or homes along the Bayou. Water from the Bastrop Bayou Watershed eventually makes its way to Christmas Bay, a coastal estuary home to several wildlife species and some of the last remaining sea grass beds along the upper Gulf Coast. Much of the land in the Bastrop Bayou Watershed (the land area that drains to the Bayou and its tributaries) is currently used for agriculture (rice farming, cattle grazing, and aquaculture). Bastrop Bayou and its tributaries are not currently on the State of Texas list of impaired water bodies, but projected future growth patterns and current water quality concerns have led area stakeholders to proactively address these issues. Some localized contamination issues, public health incidences, and projected impairments have provided further impetus to act.
Brady Creek (76)	Upper Colorado River Authority	Brady Creek Watershed encompasses almost 513,000 acres and includes the cities of Brady and Eden, and the town of Melvin. The majority of the watershed is used for agricultural production. Brady Creek is currently impaired for dissolved oxygen within the urbanized Brady segment. Other concerns throughout the watershed are increased salinity in Brady Lake, brush infestation, and maintenance of flood control structures.
Caddo Lake (77)	Northeast Texas Municipal Water District	The Caddo Lake watershed is a rich and unique ecosystem that straddles the Texas-Louisiana border. Issues such as point and non-point pollution affecting water quality; drought and water withdrawals; threats to habitats; floodplain management; and managing aquatic vegetation threaten to destroy aspects of the lake that make it valuable to humans and wildlife.
Cypress Creek (78)	Meadows Center for Water and the Environment	The Cypress Creek watershed is a part of the Edwards Plateau region of the Texas Hill Country located in northern Hays County, in and around Wimberley, Texas. Jacob’s Well is a natural flowing spring located in the bed of Cypress Creek and during low flow conditions, forms the headwaters for Cypress Creek. Water from Jacob’s Well flows into Cypress Creek, which runs through downtown Wimberley, and provides inflows to the Blanco River several miles downstream. During the dry conditions of July 2000, Jacob’s Well ceased to flow for the first time in recorded history, degrading fish, wildlife, and water quality.
Dickinson Bayou (79)	Texas Sea Grant	Located in Galveston and Brazoria counties, the Dickinson Bayou watershed encompasses approximately 100 square miles of land that drains water into the Bayou. This area is classified as impaired because higher-than-acceptable levels of bacteria have been consistently measured in the Bayou.
Lake Granbury (80, 81)	Brazos River Authority and Texas Water Resources Institute	Lake Granbury, which lies wholly within Hood County, consists substantially of unincorporated subdivisions that do not have sewage collection systems and centralized sewage treatment facilities. There are an estimated 9,000 septic tanks located around Lake Granbury with absorption fields installed on small lots in close proximity to the lake. Most of the inhabited areas around the lake exist on shallow, dead-end, man-made coves with little mixing or interaction with the main body of the reservoir. Elevated concentrations of <i>E. coli</i> and fecal coliform bacteria have been found in the coves of Lake Granbury over a long period of time, causing water quality to sometimes not meet the criteria set for contact recreation use.
Moses-Highland-Karankawa Bayou (82)	Texas Sea Grant	The Moses–Karankawa Bayous Alliance covers Galveston County, including Texas City, La Marque, Hitchcock, Santa Fe, Bayou Vista, and Tiki Island. The Highland Bayou project area is about 120 square miles in size, and includes Highland and Marchand Bayous, Moses Lake and Bayou, the Diversionary canal, and coastal bayous like Basford and Karankawa Bayous.

Table 4. TCEQ Sponsored Watershed Protection Plans (Continued).

Location	Main Stakeholder	Description
San Bernard River (83, 84)	Houston–Galveston Area Council	The San Bernard River Watershed is over 125 miles long and covers approximately 900 square miles. The headwaters of the San Bernard River originate in New Ulm in Austin County, and the river flows through Austin, Colorado, Wharton, Fort Bend, and Brazoria Counties, ultimately draining into the Gulf of Mexico, just past the Intercoastal Waterway. On the north and the east, the Brazos River basin bounds the San Bernard River watershed, and the Colorado River basin and Caney Creek bound the watershed on the south and west. Due to high bacteria levels, portions of the San Bernard River have been designated unsuitable for recreational activities, such as swimming. Also, excessive nutrients and low dissolved oxygen levels have also been found in the watershed.
Upper Cibolo Creek	City of Boerne	The Upper Cibolo Creek Watershed originates west of Boerne and ends at the confluence of the Upper Cibolo and Balcones creeks near the Kendall and Comal county line. The watershed has a drainage area of 76 square miles and contains just over 23 miles of the Upper Cibolo Creek. The watershed is mostly rural with light ranch and recreational use, but changes in land use due to development and suburbanization are expected to negatively impact water quality.
Upper San Antonio River (85)	San Antonio River Authority	The watershed of the Upper San Antonio River upstream of Loop 410 South and encompasses all of San Antonio’s downtown area and much of the central and eastern portions of the city. The total drainage area of the study is about 125 square miles (80,000 acres). Freshwater bacterial indicators for pathogens include fecal coliform and <i>E. coli</i> .

There are several watershed planning projects across the state that other stakeholders than TSSWCB or TCEQ have funded and sponsored, and may adequately satisfy the EPA’s nine elements. Table 5 lists some of these projects.

Table 5. Third-Party Sponsored Water Protection Plans.

Location	Main Stakeholder	Description
Barton Spring and Onion Creek (86)	Lower Colorado River Authority and Texas Water Development Board	The planning area for this study is the Barton Springs segment of the Edwards Aquifer and its contributing zone. The area covers northern Hays County, southwest Travis County and a small section of Blanco County, including the cities of Dripping Springs, Austin, West Lake Hills, Buda, Hays City, Kyle, Mountain City, Rollingwood, Sunset Valley; the villages of Bee Cave and Bear Creek; and the areas of the Barton Springs/Edwards Aquifer and Hays Trinity Conservation Districts. Increasing pollution of ground and surface waters, drinking water supply, and threats to local endangered species due to rapid growth and development in northern Hays County raised concerns about this area and prompted the study.
Cedar Creek Reservoir (87)	Texas Water Resources Institute and Tarrant Regional Water District	Cedar Creek Reservoir is located in East Texas about 80 miles southeast of Fort Worth in Kaufman and Henderson Counties. The project has generated substantial support from state agencies to implement best management practices in the Cedar Creek watershed and to assess the effects of urbanization on stream bank erosion and sedimentation of 25 major reservoirs in the Upper Trinity River Basin.
Eagle Mountain Reservoir (88)	Texas Water Resources Institute and Tarrant Regional Water District	Eagle Mountain Reservoir is located approximately 12 miles northwest of Fort Worth in Tarrant County. The Reservoir is also home to Eagle Mountain Park.

Table 5. Third Party Sponsored Water Protection Plans (Continued).

Location	Main Stakeholder	Description
Lake Arlington (89, 90)	City of Arlington	Lake Arlington is located on Village Creek, a tributary of the West Fork Trinity River on the western border of Arlington just north of Interstate 20 and covers about 2,000 surface acres (three square miles). Covering 143 square miles, the watershed area includes 13 cities and two counties, including Arlington, Briar Oaks, Burleson, Cross Timber, Crowley, Edgecliff Village, Everman, Forest Hill, Fort Worth, Johnson County, Joshua, Kennedale, Mansfield, Rendon Census Designated Place (CDP), and Tarrant County.
Paso del Norte de Rio Grande (91)	Paso del Norte Watershed Council and New Mexico Department of Agriculture	The Paso del Norte de Rio Grande watershed extends approximately 340 miles along the Rio Grande/Rio Bravo from Elephant Butte Reservoir in southern New Mexico to the confluence of the Rio Conchas in Presidio County, Texas (includes approximately 430 river miles). It is a sub-region of the larger Rio Grande Basin, extending from Elephant Butte Reservoir in New Mexico to the confluence of the Rio Conchas in Presidio County, Texas, and includes all the land that drains into the Rio Grande between those two points. With an average rainfall of about 8 inches per year, the watershed receives its water from the Rio Grande and the Hueco, Mesilla, and Jornada aquifers. It irrigates approximately 200,000 acres of farmland and is impacted by the needs of over 2 million people living primarily in the cities of Las Cruces, New Mexico, El Paso, Texas, and Ciudad Juarez, Mexico.
San Felipe Creek (92)	City of Del Rio	San Felipe Creek originates from spring-fed headwaters located approximately 3 miles northeast of downtown Del Rio, and flows a total of 9 miles through the city of Del Rio, ultimately discharging an average of 50 to 90 million gallons of water per day directly into the Rio Grande River.

Several agencies administer Watershed Protection Plans throughout the state. [Table 6](#) lists some of those agencies.

Table 6. Agencies that Administer Statewide Watershed Protection Plans.

Agency	Description
Brazos River Authority (93)	The Brazos River Authority was created in 1929 and maintains the Brazos River Basin, a watershed stretching from New Mexico to the Gulf of Mexico.
Colorado River Municipal Water District (94)	The Colorado River Municipal Water District was authorized in 1949 and provides water to the District’s member cities of Odessa, Big Spring, and Snyder. The District also has contracts to provide specified quantities of water to the cities of Midland, San Angelo, Stanton, Robert Lee, Grandfalls, Pyote, and Abilene (through the West Central Texas Municipal Water District), and to the Millersview-Doole Water Supply Corporation. The District owns and operates three major surface water sources on the Colorado River in west Texas: Lake J.B. Thomas, the E.V. Spence Reservoir, and the O.H. Ivie Reservoir.
Guadalupe–Blanco River Authority (95)	The Guadalupe–Blanco River Authority was created in 1933 and provides stewardship for the water resources in its 10-county statutory district, which begins near the headwaters of the Guadalupe and Blanco Rivers, and ends at San Antonio Bay. It includes Kendall, Comal, Hays, Caldwell, Guadalupe, Gonzales, DeWitt, Victoria, Calhoun, and Refugio counties.
Lower Colorado River Authority (LCRA) (96)	The Lower Colorado River Authority is located in Central Texas and delivers electricity, manages the water supply and environment of the lower Colorado River basin, provides public recreation areas, and supports community and economic development.

Table 6. Agencies that Administer Statewide Watershed Protection Plans (Continued).

Agency	Description
Nueces River Authority (NRA) (97)	The Nueces River Authority serves all or parts of 22 counties in South Texas, covering over 17,000 square miles, generally constituting the drainage area of the Nueces River and its tributaries and the adjoining coastal basins.
Paso del Norte Watershed Council (98)	The Paso del Norte Watershed Council covers approximately 430 river miles between Elephant Butte Reservoir in southern New Mexico to the confluence of the Rio Conchas in Presidio County, Texas. The Council also promotes projects to improve water quality and quantity. It provides a forum for exchanging information about any and all activities on the Rio Grande, ecosystem integrity, the quality of life, and economic sustainability in the Paso del Norte watershed.
San Antonio River Authority (99)	The San Antonio River Authority covers 3,658 square miles, including Bexar, Wilson, Karnes, and Goliad Counties.
Tarrant Regional Water District (TRWD) (100)	The Tarrant Regional Water District operates in an 11-county area reaching from Jack County to Freestone County, providing water to people in the North Central Texas area, including the cities of Fort Worth, Arlington, and Mansfield; and the Trinity River Authority. The TRWD owns and operates four major reservoirs (including Lake Bridgeport, Eagle Mountain Lake, and the Cedar Creek and Richland-Chambers Reservoirs), and maintains dams at the reservoirs. Also, the TRWD has constructed and maintains more than 150 miles of water pipelines, 27 miles of floodway levees, more than 40 miles of Trinity River Trails, and a 260-acre wetland water reuse project designed to increase future water supplies for the area.
Texas Coastal Watershed Program (TCWP)/Texas Sea Grant (101)	The Texas Coastal Watershed Program is part of the Texas Sea Grant and Texas AgriLife Extension Service, and is affiliated with the National Nonpoint Education for Municipal Officials (NEMO) Network. The TCWP provides education and outreach to local governments and citizens on the impacts of land use on watershed health and water quality.
Texas Water Development Board (TWDB) (102)	The Texas Water Development Board provides water planning, data collection and dissemination, financial assistance and technical assistance services to the citizens of Texas. The agency also administers the Texas Water Bank, which facilitates the transfer, sale, or lease of water and water rights throughout the state; and the Texas Water Trust, where water rights are held for environmental flow maintenance purposes.
The Meadows Center for Water and the Environment (103)	The Meadows Center for the Water and the Environment is located at Texas State University in San Marcos, Texas. The Center's areas of study include rivers and springs, streams, aquifers, and the watersheds that feed them, as well as the lakes, bays, and estuaries into which they flow. The main focus of The Meadows Center is to promote a holistic approach to the management of water and the environment that affects it, where key principles of sustainability and equitable use guide sound water policy.
Trust for Public Land (TPL) (104)	The Trust for Public Land worked with the Armand Bayou Watershed Partnership to establish land protection goals, identify high priority unprotected lands, develop a funding strategy, and set in motion an action plan to achieve their goals.

Table 6. Agencies that Administer Statewide Watershed Protection Plans (Continued).

Other Agencies	
Boerne, Texas	http://www.ci.boerne.tx.us/
Central Texas Council of Governments	http://www.ctcog.org
City of Arlington	http://www.arlingtontx.gov/
City of Del Rio	http://www.cityofdelrio.com/
Houston Advanced Research Center	http://www.harc.edu/
Houston–Galveston Area Council	http://www.h-gac.com/home/default.aspx
Northeast Texas Municipal Water District	http://www.netmwd.com/
Shead Conservation Solutions	http://www.linkedin.com/in/lindarshead
Texas A&M AgriLife Extension	http://agrilifeextension.tamu.edu/
Texas Tech University	http://www.depts.ttu.edu/hillcountry/llano-river/
Upper Colorado River Authority	http://www.ucratx.org/
Texas Water Resources Institute	http://twri.tamu.edu/

Forest Management Plans

In 2012, the Texas A&M Forest Service released the *Texas Statewide Forest Resource Strategy*, a comprehensive strategic plan used to “address forest-related conditions, trends, threats, and opportunities” as identified in an earlier assessment of forest resources in the state (105). The document discusses strategic issues, such as:

- Urban forest sustainability.
- Woodlands conservation.
- Sustainability of forest resources in East Texas.
- Water resources.
- Wildfire and public safety.

It goes on to give detailed information about programs within the Texas A&M Forest Service, including the Sustainable Forest Program, Urban and Community Forestry, Forest Health and Pest Management Programs, Stewardship Programs, and Law Enforcement. There are also sections about multi-state initiatives, coordination with other agencies, and stakeholder input.

Land and Water Plan

The Texas Parks and Wildlife Department authored the *2010 Land and Water Plan* to guide planning, operational, and financial decisions at the agency, as well as serve as a guide in conserving the natural and historic heritage of the state (106, 107). The Plan describes the agency’s four goals regarding the state’s conservation and recreation needs:

- Science-based stewardship of natural and cultural resources.
- Increased access and participation in the outdoors.

- Community support for conservation and recreation programs around the state.
- Sustainable business practices.

Special Area Management Plans (SAMPs) (108, 109)

A Special Area Management Plan can be defined as “a management tool for programs to address difficult resource management issues, or land/water use conflicts in a more integrated manner through the application of comprehensive land and water use planning and management” (109). SAMPs are often used to supplement existing management plans in coastal zones, and also when coastal issues and policies need to be addressed or better aligned. There are no examples of SAMPs for coastal areas in Texas listed on the Ocean and Coastal Resource Management (a division of the NOAA) website (110).

Coastal Management Plans and Programs

The National Marine Sanctuaries (NOAA) (111)

The National Oceanic and Atmospheric Administration’s National Marine Sanctuary program strives to conserve, protect, and enhance the nation’s system of marine-protected areas. The system encompasses over 150,000 square miles of marine and Great Lakes waters, consisting of 14 marine-protected areas and 13 national marine sanctuaries. Sanctuary habitats include reefs, kelp forests, migration corridors, and underwater archeological sites.

Flower Garden Banks National Marine Sanctuary is a federally designated underwater area and the only sanctuary located in the Gulf of Mexico, approximately 100 miles off the coast of Texas and Louisiana (112). The area was given its name for the brightly colored sponges, plants, other marine life, and colorful reefs seen below the surface. The Sanctuary protects three areas: East Flower Garden Bank, West Flower Garden Bank and Stetson Bank.

The National Estuarine Research Reserve System (NERRS) (113,114)

The Coastal Zone Management Act of 1972 established the National Estuarine Research Reserve System, which is a partnership program between the NOAA and coastal states. The NOAA is the main funding mechanism for this program, but a state agency or university manages each site. The NERRS network consists of 28 protected areas representing different biogeographic areas across the United States. Staff and local stakeholders at each location work together to address natural resource management issues, such as non-point source pollution, invasive species, and habitat restoration. The sites also offer training and field classes, professional development programs, and provide long-term water quality monitoring. There is one reserve in Texas located at the Mission-Aransas Estuary.

The Mission-Aransas Reserve (115)

The Mission-Aransas Reserve, the third largest reserve in the National System, is based in Port Aransas, Texas at the University of Texas Marine Science Institute. The Reserve is an 185,708-acre area comprised of wetland, terrestrial, and marine environments surrounded by a relatively rural watershed, with few large cities or metropolitan areas. The site encompasses state bay waters and state wetlands, which the Texas General Land Office controls. Most of the dry land is located in the Aransas National Wildlife Refuge. The Mission-Aransas Reserve works to:

- Improve knowledge and understanding of Texas coastal zone ecosystems.
- Promote public appreciation.
- Enhance coastal decision making through the integration of research, education, and stewardship.

The National Estuary Program (NEP) (116)

The National Estuary Program, a program within the EPA, was established under Section 320 of the 1987 Clean Water Act. The NEP is a network of voluntary programs designed to safeguard and protect the health of important coastal ecosystems across the country. The Program has 28 estuaries located along the Pacific, Gulf, and Atlantic coasts and Puerto Rico, including two in Texas. According to the guidelines in Section 320, each NEP must develop and implement a Comprehensive Conservation and Management Plan that contains scientific information and actions designed to address issues in its watershed.

The Galveston Bay Estuary Program (GBEP) (117)

The Galveston Bay Estuary Program is a non-regulatory program established in 1989 to preserve Galveston Bay. TCEQ administers this program, which is part of the NEP network created to guide the conservation and restoration efforts of estuaries of national significance.

The Galveston Bay Estuary Program collaborated with local, state, and national stakeholders to create and implement the Galveston Bay Plan, a long-term, comprehensive, science-based plan designed to protect and restore Galveston Bay (118, 119). The Plan includes information about:

- Habitat and living resource conservation.
- Balancing human uses (public health, spills, dumping, freshwater inflow, Bay circulation, and shoreline management).
- Water and sediment quality.
- Action plans.
- Regional monitoring programs.
- Implementation and funding of the Plan.

In the first 10 years of implementation, the Program restored and protected coastal habitats, and supported local water-management initiatives. It managed threats from invasive species,

protected and improved water quality, protected public health, and successfully built stewardship through public outreach programs (120).

The Coastal Bend Bays and Estuaries Program (CBBEP) (121)

The Coastal Bend Bays and Estuaries Program is a non-regulatory, voluntary partnership implemented to improve the health of the bay system in the 12-county region of the Texas Coastal Bend. It has been part of the National Estuary Program since 1994. The CBBEP is focused around six issues: human uses, freshwater inflows, maritime commerce and dredging, habitat loss, water and sediment quality, and public education and outreach. Funding is generated from a mix of local, state, and federal programs, and private industry.

MITIGATION

Many state DOTs face big challenges and costs as a result of compensatory mitigation resulting from transportation development process. Within the realm of compensatory mitigation, there is “regulatory” and “non-regulatory” compensatory mitigation. The most common example of “regulatory” compensatory mitigation is USACE Section 404 for wetlands mitigation, which is based on federal regulations (40 CFR Part 230). Non-regulatory compensatory mitigation usually involves mitigation for state-specific special habitats that may not be addressed in federal statutes and are conducted in accordance with individual state wildlife and regulatory agencies.

For most “regulatory” compensatory mitigation, there are three primary areas: USACE Section 404 (wetlands), Endangered Species Act (Section 7), and National Historic Preservation Act (NHPA) Section 106. The largest compensatory mitigation program for most state DOTs is associated with the USACE Section 404, followed by ESA Section 7, and NHPA (Section 106). The Environmental Law Institute reported that an annual \$2.9 billion is spent nationally on 404 mitigation, and the total mitigation costs expended or committed under major federal regulatory programs was \$3.8 billion.

Mitigation Defined

Environmental mitigation activities are defined as “strategies, policies, programs, actions, and activities that, over time, will serve to avoid, minimize, or compensate for (by replacing or providing substitute resources) the impacts to or disruption of elements of the human and natural environment associated with the implementation of a long-range statewide transportation plan or metropolitan transportation plan. The human and natural environment includes, for example, neighborhoods and communities, homes and businesses, cultural resources, parks and recreation areas, wetlands and water sources, forested and other natural areas, agricultural areas, endangered and threatened species, and the ambient air. The environmental mitigation strategies and activities are intended to be regional in scope, and may not necessarily address potential project-level impacts.” [23 CFR 450.104; Title 23-Highways; Chapter I-Federal Highway Administration, Department of Transportation; Subchapter E-Planning and Research;

Part 450–Planning Assistance And Standards; Subpart A–Transportation Planning and Programming Definitions]

USACE Section 404 (Wetlands) (122)

As described above, Section 404 accounts for approximately three-fourths of all mitigation dollars expended. In 2008, EPA and USACE published new regulations for compensatory mitigation, which created new requirements for in-lieu fee programs (33 CFR Parts 325 and 332). One of the outcomes of the rules was a requirement that the USACE use a watershed approach to select compensatory mitigation.

Previous guidance favored mitigation in proximity of impacts, but the new guidelines follow a hierarchy of mitigation types that favors:

- **Mitigation Banks:** A permit applicant may obtain credits from a mitigation bank. A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or preserved. This resource area is then set aside to compensate for future impacts to aquatic resources resulting from permitted activities. The value of a bank is determined by quantifying the aquatic resource functions restored, established, enhanced, and/or preserved in terms of “credits.” Upon approval of regulatory agencies, permittees can acquire these credits to meet their requirements for compensatory mitigation.
- **In-Lieu Fee Mitigation:** A permit applicant may make a payment to an in-lieu fee program that will conduct wetland, stream, or other aquatic resource restoration, creation, enhancement, or preservation activities. In-lieu fee programs are generally administered by government agencies or non-profit organizations that have established an agreement with the regulatory agencies to use in-lieu fee payments collected from permit applicants.
- **Permittee-Responsible Mitigation:** A permittee may be required to provide compensatory mitigation through an aquatic resource restoration, establishment, enhancement, and/or preservation activity. This compensatory mitigation may be provided at or adjacent the impact site (i.e., on-site mitigation) or at another location, usually within the same watershed as the permitted impact (i.e., off-site mitigation). The permittee retains responsibility for the implementation and success of the mitigation project.
- **Mitigation banks and in-lieu fee mitigation are forms of “third-party” compensation** because a third party, the bank, or in-lieu fee sponsor, assumes responsibility from the permittee for the implementation and success of the compensatory mitigation.

The emphasis is on:

- Mitigation in the large-scale, watershed context.
- Reduction in the number of individual mitigation projects.
- Greater financial and ecological assurances.
- Minimization of temporal losses of wetland functions.

In many states, payments and mitigation are right-of-way functions. In other words, the ROW division of the state DOT purchase mitigation credits and pay in-lieu fees.

Resource Agency Information and Management Systems

NEPAssist is one example of GIS analysis that TxDOT and other state DOTs have begun to employ. It is a GIS application that automates and Web-enables the collection and coordination of information inherent in the environmental review process. NEPAssist was developed for federal and state agencies and localities responsible for review processes associated with environmental assessments as an easy to use web-based application that draws environmental data dynamically from EPA regions' GIS databases. NEPAssist can provide a preliminary environmental assessment of a project's "footprint" and potential environmental impacts.

Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS)

The USACE, with support from the EPA and U.S. Fish and Wildlife Service (USFWS), developed the Regulatory In-Lieu Fee and Bank Information Tracking System to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas. The tracking system also allows access to information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation.

ESA Section 7

Federally funded programs at the state and local level, such as transportation projects and some habitat restoration projects, require a Section 7 consultation process, which includes a biological assessment. Each federal agency must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species in the wild, or destroy or adversely modify its critical habitat. Other consultation requirements for both federal and state agencies are required under the Magnuson-Stevens Fishery Conservation and Management Act.

National Historic Preservation Act, Section 106

Section 106 of the NHPA requires federal agencies to take into account the effects that their federally funded activities and programs have on significant historic properties. "Significant historic properties" are those properties that are included in, or eligible for, the National Register of Historic Places.

Section 4(f)

Section 4(f) of the U.S. Department of Transportation Act of 1966 (U.S. DOT Act) was enacted as a means of protecting publicly owned lands, public parks, recreation areas, and wildlife/waterfowl refuges as well as historic sites of local, state, or national significance, from conversion to transportation uses. [Title 49 United States Code (U.S.C.), Section 1653(f)].

Section 4(f) is a complex process with a long history of litigation against transportation agencies and court decisions on how to apply the statute. Section 4(f) resources are typically addressed as part of the NEPA process in assessing transportation projects. This statute applies only to those public parks, recreation areas, and refuges that are publicly owned, and for which the officials having jurisdiction over the property determine that its major purpose is to function as a park, recreation area, or refuge. DOTs typically avoid purchases of 4(f) properties because of the complexity and cost.

Emerging Mitigation

In addition to traditional mitigation programs, the emergence of carbon sequestration has transportation agencies considering their roadsides' opportunities and constraints. Historically, carbon sequestration has been assessed from an agricultural or forestry perspective. It is only in recent years that the vast quantity of land that transport agencies owned, operated, and maintained have been considered in the equation of carbon sequestration, carbon credits, carbon trading, and biomass production. These roadway systems have supporting vegetation within their rights-of-way that usually consists of various combinations of grasses, shrubs, and trees. With these new opportunities come issues for DOTs in implementing new programs.

In their recent research, the FHWA and the John A. Volpe National Transportation Systems Center, Carbon Sequestration Pilot Program (CSPP) assessed whether roadside carbon sequestration efforts through modified maintenance and management practices are appropriate and feasible for DOTs. Some of the logic behind this research stems from ecosystem service, defined as the inherent functions of natural ecosystem's that benefit human populations at little or no additional cost, i.e., the roadside. These functions include:

- Flood storage.
- Water quality treatment.
- Carbon sequestration.
- Provision of wildlife habitat.
- Genetic diversity.
- Landscape diversity.

Since DOTs must retain unused buffers in their right-of-way (ROW) for safety, operations, and maintenance purposes, FHWA recognized that an opportunity might exist to shape the future of a burgeoning ecosystem service market. The CSPP also demonstrated the "ecological, economic, and political uncertainties" that lie ahead for initializing biological carbon sequestration programs for DOTs.

CHAPTER 2: SUBTASK 2.2. REVIEW OF REGULATORY AND TXDOT FRAMEWORK

The regulatory framework is a work in progress as various roles, responsibilities, administrative, and information systems are defined. Although very well-documented, the regulatory framework is complicated.

Subtask 2.1 provides an overview and regulatory limits of mitigation responsibilities, broadly defines roles and responsibilities, and identifies a few of the administrative and information systems used to manage mitigation. The products of this task will also serve as a reference for inter-disciplinary practitioners to understand the major policy components of the framework. The regulatory framework review will assist researchers to identify barriers and constraints to maximizing mitigation benefits.

OVERARCHING FRAMEWORK LAWS AND POLICIES

Federal and state legislation, along with TxDOT statewide transportation plans, provide support for establishing an Eco-Logical framework for mitigation efforts. The legislation and Texas's statewide transportation plan are summarized below as important building blocks in support of the framework. Provisions within these broader policy documents provide the linkages across the various federal and state resource agencies with regard to memoranda of understanding and processes for environmental reviews.

MAP-21 ([123](#))

Moving Ahead for Progress in the 21st Century Act (MAP-21) is the federal authorization act providing funding for transportation infrastructure. It is the first multi-year transportation authorization enacted since 2005 and funds surface transportation programs at over \$105 billion for fiscal years (FY) 2013 and 2014.

MAP-21 provides an overarching framework with environmental mitigation efforts described in Section 1106 (a) (NHPP) and 1108(a)(8) (STP) and includes, but is not limited to:

- Participation in mitigation banking or other third-party mitigation arrangements.
- Contributions to statewide and regional efforts to conserve, restore, enhance, and create natural habitats and wetlands.
- The development of statewide and regional environmental protection plans, including natural habitat and wetland conservation and restoration plans.

Other provisions target the environmental review process, providing for earlier coordination, greater linkage between the planning and environmental review processes, using a programmatic approach where possible, and consolidating environmental documents. MAP-21 establishes a framework for setting deadlines for decision making in the environmental review process, with a process for issue resolution and referral, and penalties for agencies that fail to make a decision.

Texas Administrative Code, Title 43, Chapter 2 (124)

Title 43 TAC Chapter 2 1 provides new environmental processes for TxDOT in the transportation development process. The new rules:

- Reorganize previous environmental rules.
- Make additional statutory changes.
- Affirm memoranda of understanding with Texas resource agencies.
- Present deadlines for administrative and technical reviews for environmental documents.
- Set forth administrative review and project development processes.
- Require certification for TxDOT environmental specialists.

The subchapters include:

- Subchapter A General Provisions.
- Subchapter B Memoranda of Understanding with Resource Agencies.
- Subchapter C Environmental Review Process for Highway Projects.
- Subchapter D Requirements for Classes of Projects.
- Subchapter E Public Participation.
- Subchapter F Requirements for Specific Types of Projects and Programs.

TEXAS STATEWIDE LONG-RANGE TRANSPORTATION PLAN (125)

The Texas Statewide Long-Range Transportation Plan (SLRTP) recognizes the importance of mitigation in the development of transportation system. Chapter 8 (126) of the SLRTP presents priority corridors:

“For the SLRTP, an assessment was conducted to identify existing mitigation banks, habitat conservation plans (HCPs), federal and state parks, and wildlife refuges that might be available for mitigation purposes. Privately held land owned or controlled by such entities as The Nature Conservancy and The Trust for Public Lands are generally considered as constraints, but may provide an opportunity for mitigation on a case-by-case basis. In addition to these sources, counties and cities may offer partnering opportunities where improvements to their properties could be used to serve as mitigation for a project within the same geographical area.

Some of the environmental data is not suitable for mapping on a statewide basis. There are 300,000 identified cultural resources throughout the state, as catalogued by the THC in the Texas Historic Atlas.²⁰⁴ Mapping of those resources is typically done at the project level and is difficult to display effectively at a statewide scale. While details maybe lost when providing maps at this scale, biological constraints and hydrologic regions are provided on Figures 8-3 and 8-4. The Texas Highway Trunk System, with the segments identified for future improvements, are included on the figures to show proximity of the various environmental features.

The Priority 1 Texas Highway Trunk System corridors and the various potential sites and programs that might be considered to mitigate project impacts are provided in Table 8-4 by region.”

Table 7. SLTRP Chapter 8.

Table 8-3: Potential Mitigation Areas by Region			
Region	Priority 1 Corridors Improvement	Potential Mitigation Banks for Hydrologic Resource Mitigation	Potential Sites/Programs for Biological Resource Mitigation
East Texas	SH 7 SH 31 US 69 US 175	<ul style="list-style-type: none"> • West Mineola • Anderson Tract • Hawkins • KLAMM • Sabal Wetland Preserve • Byrd Tract • Martin Creek • Pineywoods 	<ul style="list-style-type: none"> • Caddo Lake Preserve • Sheff's Woods Preserve • Lennox Woods Preserve • Tridens Prairie Preserve • Knight Prairie Preserve • Cowleech Prairie Preserve • Clyner Meadow Preserve • County Line Prairie Preserve • Big Woods on the Trinity
North Central Texas	US 83 US 277	<ul style="list-style-type: none"> • Trinity River • Bunker Sands • South Forks Trinity River 	-
West Texas	US 82 US 83 US 87	-	<ul style="list-style-type: none"> • HCP in development for Real and Edwards Counties. • Independence Creek Preserve • Diamond Y Spring Preserve • Davis Mountain Preserve • Sandia Springs Preserve
Panhandle	US 87	-	<ul style="list-style-type: none"> • Yoakum Dunes Preserve
Central Texas	SH 6 SH 21 US 190	-	<ul style="list-style-type: none"> • Williamson County HCP • HCP in development for Caldwell, Hays and Blanco Counties • Leonhardt Prairie Preserve • Ruth P. Lehman Preserve • Barton Creek Habitat Preserve • Eckert James River Bat Cave Preserve

Table 7. SLTRP Chapter 8 (Cont'd).

Table 8-3: Potential Mitigation Areas by Region			
Region	Priority 1 Corridors Improvement	Potential Mitigation Banks for Hydrologic Resource Mitigation	Potential Sites/Programs for Biological Resource Mitigation
			<ul style="list-style-type: none"> • Big Woods on the Trinity • Steele Creek
South Texas	, SH 44 US 59 US 83	-	<ul style="list-style-type: none"> • HCP in development for Guadalupe, Comal, Kendall, Bexar, Atascosa, Medina, Uvalde, Bandera, Kinney, and Kerr Counties. • Mesquite Brushland Preserve • Love Creek Preserve • Dolan Falls Preserve
Coastal	FM 1774 SH 44 SH 105 US 59 US 69 US 83	<ul style="list-style-type: none"> • Mill Creek • Katy-Cypress • Greens Bayou • Neches River • Blue Elbow Swamp • Coastal Bottomlands • Palacios 	<ul style="list-style-type: none"> • HCP in development for Refugio, Calhoun, Victoria and Gonzales Counties. • Las Estellas Preserve • Chihuahua Woods Preserve • Lennos Foundation Preserve • Mesquite Brushland Preserve • Francine Cohn Preserve • Shamrock Island Preserve • Mad Island Marsh Preserve • Pierce Marsh Preserve • Texas City Prairie Preserve • Wilson Preserve • Wier Woods preserve • Roy E. Larson Sandyland Sanctuary • Big Thicket Bogs and Pinelands Preserve • Little Rocky Preserve

PROJECT DEVELOPMENT PROCESS AND MITIGATION (127)

There are numerous regulations and policies governing the determination of impacts to cultural and natural resources as listed in TxDOT’s *Project Development Manual* and *Environmental Manual* (see Figure 14 below). The two legislative acts that dominate most TxDOT mitigation efforts are the National Historic Preservation Act of 1966 and the Endangered Species Act of 1973. These two govern most cultural and natural resources found within TxDOT rights-of-way. TxDOT also has several Memoranda of Understanding (MOU) and/or

Memoranda of Agreement (MOA) and Programmatic Agreements (PA) with various state agencies to facilitate interagency cooperation and guide environmental decision making.

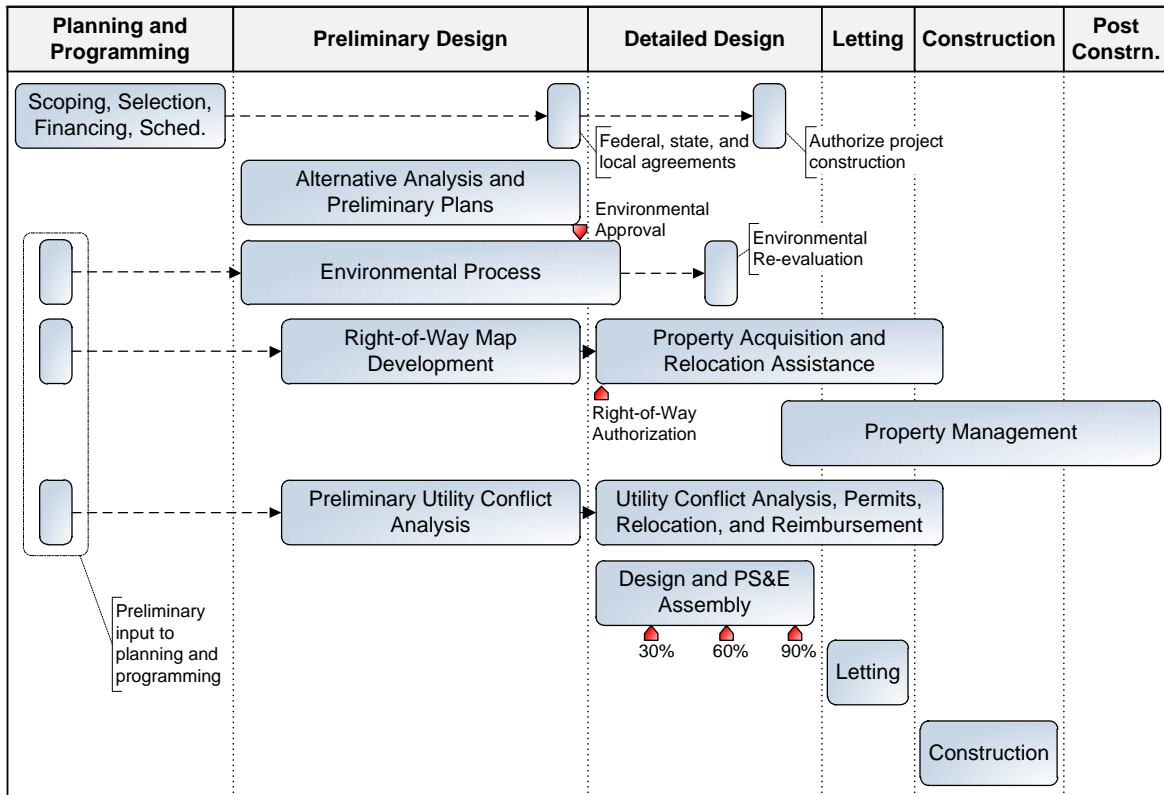


Figure 14. TxDOT Project Development Process.

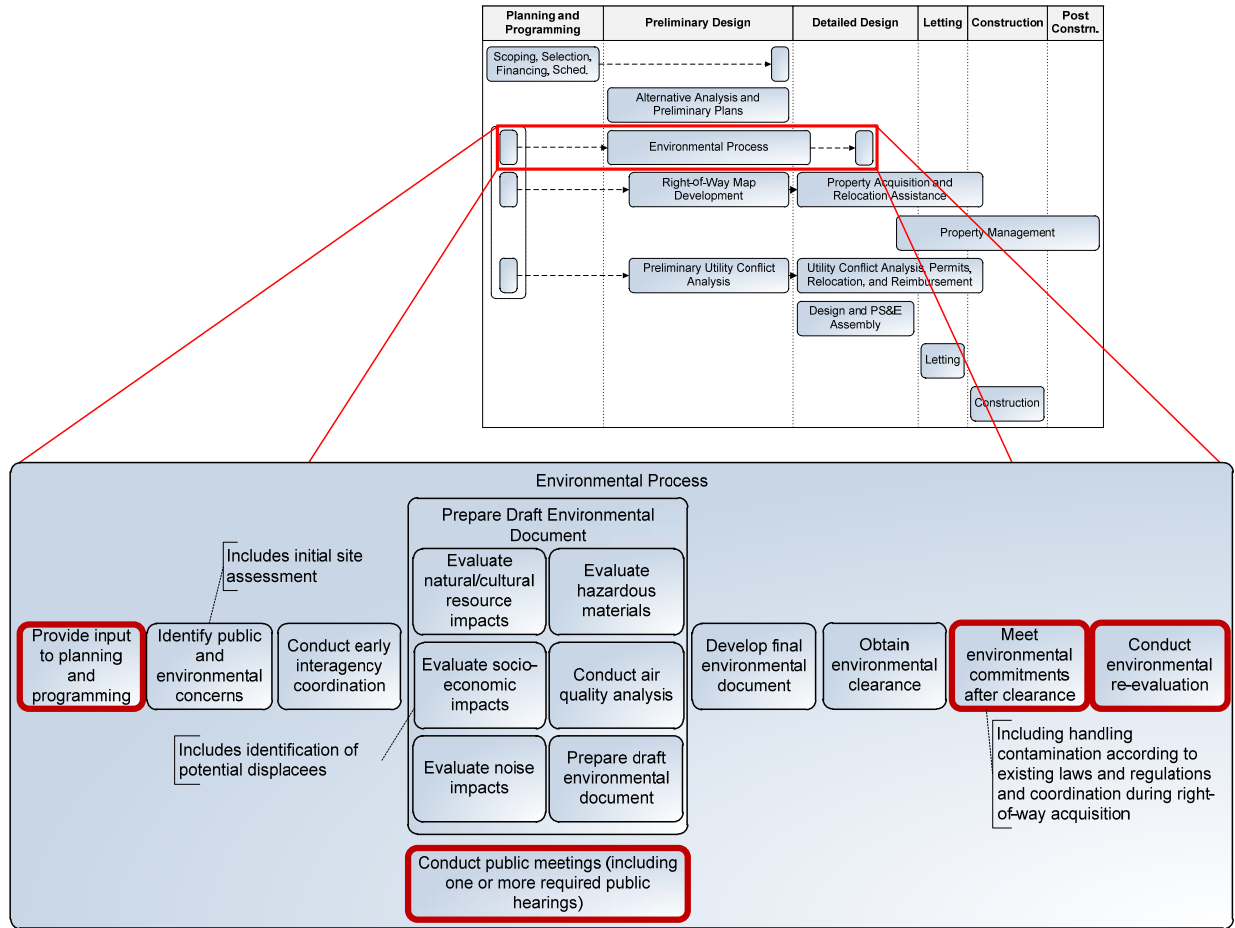


Figure 14. TxDOT Project Development Process (Cont'd).

NATIONAL HISTORIC PRESERVATION ACT OF 1966

The *Environmental Manual* describes Section 106 of the NHPA. Section 106 requires FHWA to:

- Take into account the effects of federally-funded and permitted projects on historic properties.
- Coordinate these effects with the staff of THC/SHPO.
- Avoid, minimize, or mitigate any adverse effects on historic properties.

Historic properties are any buildings, structures, objects, archeological sites or traditional cultural properties listed on or eligible for listing on the National Register of Historic Place (National Register) or State Archeological Landmark. Those cultural resources identified and/or considered must be more than 50 years of age with the potential to have significance in local, state, or national history.

Special coordination/consideration is given to historic bridges. The *Historic Bridge Manual* states that districts should contact the Environmental Affairs Division (ENV) as soon as possible to determine if the existing structure is historically significant if:

- Structure is 50 years of age or older. Confirm that the bridge inspection database record matches the correct determination of historic significance.
- Structure is on the list of historic steel trusses or is eligible to be placed on this list.
- Structure is on the list of historic concrete masonry or other bridges, or is eligible to be placed on this list.

Further information can be found in the PA among FHWA, Texas State Historic Preservation Officer, Advisory Council on Historic Preservation and TxDOT (*128*).

ENDANGERED SPECIES ACT (ESA)

Federally authorized, funded, or carried out transportation projects fall under the purview of the Endangered Species Act. TxDOT, as an agent for the FHWA, is required to comply. The ESA was established to ensure the conservation of threatened and endangered species and their respective habitats. According to the Act, any time an action (anything authorized, funded, or carried out) “may affect” a listed species, the agency, organization or individual taking the action should consult with the USFWS. Non-federally funded projects are also listed with prohibited activities that include:

- The import, export, interstate transport, or sale of protected animals and plants without a permit.
- Killing, harming, harassing, possessing, or removing protected animals from the wild without a permit or without consulting with the USFWS.
- Removing listed plants from federal lands without a permit.

CULTURAL AND ENVIRONMENTAL IMPACTS

TxDOT’s *Project Development Manual* and *Environmental Manual* outline the process, tasks, and sequencing for transportation projects. In both manuals, the identification of any potential physical/cultural/environmental constraints is one of the first described. Early identification of potential impacts is critical in determining the level of environmental documentation necessary to proceed with the project. TxDOT’s processes ensure communication from environmental clearance through detailed design, pre-bid conference, project letting, maintenance, and operation. In the *Project Development Manual*’s Chapter 1 Planning and Programming, Section 1: Needs Identification, the second task described is 1010: Perform site visit. The suggested method is to look for potential issues that might include wetlands, parks, historic structures, potential hazardous materials, floodplains, cemeteries, and cultural facilities. Section 3 of the *Environmental Manual* outlines the basic data collection necessary to obtain environmental clearance.

These include identifying:

- Parks, recreational areas known, historic/archeological sites, or wildlife areas, etc. in the project area.
- Potential environmental issues.
- Measures to avoid, minimize, or compensate for environmental impacts.
- Anticipated permits.

If there is a potentially significant threat to a cultural or natural resource location, then interagency coordination is required.

Mitigating Impacts

When impacts are identified, the type of impact is determined to assess the type of commitments necessary to proceed with the project. Impact types include:

- Direct impacts. Reasonably foreseeable effects caused by a proposed action.
- Secondary and indirect impacts. Reasonably foreseeable effects caused by a proposed action that will likely occur either later in time or further away in distance than direct project impacts.
- Cumulative impacts. Result from the incremental impacts of an action added to other past, present, or reasonably foreseeable future actions.
- Counterbalancing impacts. Trade-offs between beneficial and adverse impacts.
- Temporary impacts. Most often associated with construction periods and would no longer be an impact once the project has been completed.

MITIGATION DEFINITIONS

Once impact is determined, the most common mitigation efforts implemented are avoidance, minimization, compensation, and enhancements in accordance with the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1508.20. Mitigation alternatives are described in a Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army (MOA, 1990).

Avoid

Avoidance is the most preferred method of mitigation. Projects are modified to avoid the identified impacts. These project modifications may include re-alignment to avoid existing structures or environmentally sensitive areas or the addition of site features to meet community needs. In mitigation by avoidance, adverse impacts are avoided altogether through alteration of project location, design, or other related aspects. Avoidance is a common form of mitigation used by State DOTs. Mitigation by avoidance is seen as a sound strategy since it is the best way to prevent direct adverse impacts.

Minimize

Minimizing the project impacts or reducing the severity of impacts may involve project modifications similar to those used to avoid impacts. Minimizing, rectifying, or reducing project impacts are forms of mitigation that diminish the severity of project related impacts. Although these forms of mitigation can result in alterations to the project design, the overall integrity of the project is usually preserved.

Rectify

Rectify impact by repairing, rehabilitating, or restoring the affected environment (e.g., remediate contaminated areas).

Reduce or Eliminate

Reduce or eliminate the impact over time by preservation and maintenance during the life of the action (e.g., no-idling policy).

Compensate

When avoidance and mitigation are not feasible, compensation entails undertaking an action to alleviate an impact, such as the replacement of a community resource to be displaced, revegetation, or on-site wetland creation. Compensation includes mitigation undertaken to replace lost or adversely impacted habitat with habitat having similar functions of equal or greater ecological value. Typically, compensatory mitigation measures are included as an integral part of a project plan. This form of mitigation is often justified through arguments designed to show that, in the case of wetlands, acreage generated or enhanced through compensation is at least equal to the acreage lost through development. However, this example of compensatory mitigation fails to recognize the ecological complexity of wetlands, their relationship to the landscape, and the fact that wetland functions may not be directly related to acreage. In general, compensating for the adverse impacts to natural resources should only be considered as the last alternative, and only if there are no less environmentally damaging feasible alternatives.

Enhancements

Enhancements add desirable features together with the project to blend more harmoniously within a community such as signage, landscaping, and trails. It can be argued, there are shortcomings to all forms of mitigation. Avoidance and minimization require project alterations that may be unacceptable to the project proponent, while compensation may lead to a net loss of wetland habitat and/or function. Thus, while there are several forms of mitigation, achieving adequate and successful mitigation is no simple matter.

FHWA's *Every Day Counts Innovation Initiative (129)* has established the following definitions regarding in-lieu fees, mitigation banking, and compensatory mitigation. This initiative proposes expanded use of in-lieu fees and mitigation banking currently allowed under existing statute, FHWA regulations, State law, and court decisions in order to save time and expedite project delivery.

Mitigation Bank

A mitigation bank is a large scale mitigation site, which is approved through the Federal Clean Water Act, and other state programs. Each mitigation bank has a formal agreement between the bank sponsor and the Federal regulatory agencies that:

- Details the number of credits the bank can generate.
- Lists the types of habitat the mitigation bank intends to create, restore, or enhance
- Explains the long-term management mechanism which will be utilized to ensure the site is protected in perpetuity.

In mitigation banking, infrastructure developers buy credits from a bank sponsor before any impacts occur. These credits satisfy the regulatory Agency requirements for compensatory mitigation

In Lieu Fee and Mitigation Banking

An in-lieu fee (ILF) program conducts wetland, stream, or threatened or endangered species habitat restoration, creation, enhancement, or preservation activities. Unlike mitigation banks, ILF programs may perform various environmental enhancement activities throughout a watershed rather than at one particular site. These programs establish a similar agreement to a mitigation bank agreement, but the sites are not always completely constructed prior to the environmental impacts taking place. Once the ILF program receives enough money, it implements the project in that watershed.

Compensatory Mitigation

Compensatory mitigation is used to offset unavoidable impacts to the environment. It involves the restoration, establishment, enhancement, and/or preservation of the environment, including threatened or endangered species and/or their habitats.

Section 404 of the Federal Clean Water Act requires compensatory mitigation for projects that cause unavoidable impacts to streams, wetlands, and other waters of the United States. The FHWA also authorizes mitigation under Executive Order 11990, which requires federal agencies to minimize impacts to wetlands. Mitigation for federally protected species may also be required through the Endangered Species Act. Some state laws and regulations also require compensatory mitigation.

Mitigation Plan

A mitigation plan consists of:

- Objectives.
- Site protection instrument.
- Baseline information.
- Work Plan.
- Maintenance plan.
- Performance standards.
- Monitoring requirements.
- Financial assurances.
- Site selection factors.
- Credit determination.
- Long-term management plan.
- Adaptive management plan.

The plan must specify the following:

- Parameters to be monitored.
- Length of the monitoring period.
- Party responsible for monitoring.
- Content of the monitoring reports.

A site protection mechanism must ensure the mitigation area retains its function as a natural conservation area in perpetuity.

TXDOT AND RESOURCE AGENCIES AGREEMENTS

TxDOT has several existing agreements, such as MOUs and MOAs, with resource agencies, including the General Land Office (GLO), Texas Parks and Wildlife, the Federal Highway Administration, the Texas Commission on Environmental Quality, and historic preservation agencies.

The MOUs provide formal communication protocols at specific stages in the project development process, primarily after the design concept conference (i.e., after the environmental process starts). A number of tools, such as the Geographic Information System Screening and Analysis Tool (GISST) and NEPAssist, which were originally developed for use within the NEPA process, are slowly migrating to the transportation planning process. Several MOUs between TxDOT and agencies such as TCEQ, TPWD, the Texas Historical Commission (THC), and the GLO provide these communication protocols.

Following Texas Transportation Code Section 201.607, every five years TxDOT needs to examine and revise its MOUs with state agencies responsible for the protection of the natural

environment or preservation of historical or archeological resources. Each MOU must document the following:

- Agency responsibilities related to the review of a highway project and its potential environmental, historical, or archeological impacts.
- Type of information TxDOT must provide and the timeframe for doing so.
- Timeframe for the reviewing agency to provide comments back to TxDOT.
- Other agreements necessary for the effective coordination of the review.

General Land Office (GLO)

The MOU between TxDOT and the GLO covers all state-owned real property that the latter managed to be used by TxDOT for highway right-of-way purposes only. The MOU provides information on environmental protection on GLO land for construction project and discusses compensation for property acquisition. It also describes the rights of TxDOT, such as mineral rights, abandonment of property, and purchasing property for mitigation purposes. The MOU states that environmental issues regarding GLO-managed property must be addressed at the U.S. Army Corps of Engineers (USACE) Joint Processing Meeting (if USACE has jurisdiction over the affected property; otherwise, during the project development process with the appropriate environmental agencies). The MOU also stipulates that all government agencies responsible for the protection and preservation of public lands must coordinate a single environmental response.

Texas Parks and Wildlife (TPWD)

The MOU between TxDOT and TPWD offers procedures for providing habitat characterizations and impact descriptions for TxDOT projects involving no new ROW, for new locations, and for an existing location that require additional ROW. These involve descriptions of vegetation descriptions and special habitat features. A description of land use within and outside of the proposed ROW should also be described for projects at a new location and projects at an existing location requiring additional ROW. All project alternatives must be evaluated at the level of detail. The MOU also established criteria for the appropriateness, planning, and implementation of compensatory mitigation.

Texas Commission on Environmental Quality (TCEQ)

This MOU provides a tool that the Texas Commission on Environmental Quality can use to review TxDOT projects that have the potential to affect resources within TCEQ's jurisdiction. The MOU outlines the responsibilities of TxDOT—planning, construction, maintenance, preservation of environment, maintaining data, developing a STIP, etc. The responsibilities of TCEQ include air quality assessment and control, SIP conformity evaluations, and vehicle inspections program. The MOU also discusses the responsibilities of TCEQ revolving around air quality and water quality, and the coordination of environmental document review between parties.

Federal Highway Administration (FHWA)

The First Amended Programmatic Agreement (PA) is a document that stipulates implementation of transportation undertakings among the FHWA, TxDOT, Texas State Historic Preservation Office, and the Advisory Council on Historic Preservation. The PA describes how the FHWA will meet its responsibilities under Section 106, 110(d), and 110(f) of the NHPA for all FHWA undertakings that TxDOT implemented. The document outlines all agencies and regulations FHWA and TxDOT must comply with:

- Section 106 of the National Historic Preservation Act of 1966 (NRHP).
- Texas SHPO.
- Advisory Council on Historic Preservation.
- Indian tribes.
- Federal agencies.
- 23 USC 1309.
- 36 CFR 800.
- NEPA.
- Texas Transportation Code.
- The public.

The agreement also outlines how TxDOT shall review, document, and resolve activities with potential to affect historical properties. The MOU with the THC focuses on projects with a potential to adversely affect cultural resources. The MOU states that TxDOT must identify projects requiring archeological investigation as well as projects that do not require coordination for archeological sites. The MOU also states the TxDOT must identify historic properties within project limits and conduct field surveys for all projects with potentially affected historic properties.

Programmatic Agreement for the Consultation Process among the FHWA, TxDOT, and the Tonkawa Tribe of Oklahoma

The agreement discusses the consultation process between FHWA, TxDOT, and the Tonkawa Tribe. The PA describes the parameters of the consultation process that the FHWA, TxDOT, and the Tonkawa Tribe had agreed upon for federal-aid highway transportation projects in Texas, including:

- The agreement period.
- Federal recognition.
- The point of contact.
- The area of concern.
- Project-specific consultation.
- Timing.
- Eligibility of projects.

- The treatment of historic property and gravesites.

Programmatic Agreement for the Review and Approval of NEPA Categorically Excluded Transportation Projects between the FHWA-Texas Division and TxDOT

This agreement between FHWA and TxDOT provides blanket criteria used to streamline the environmental process and approve NEPA Categorical Exclusion (CE) transportation projects. This agreement applies to Class II CEs. The document provides background on documentation required for the different stages in the NEPA process and discusses the regulatory basis for CEs processed using this agreement. The document also defines and describes the conditions, classification criteria, and implementation process for the following types of classifications of NEPA decision documents:

- Blanket Categorical Exclusions (BCEs).
- Programmatic Categorical Exclusions (PCEs).
- Categorical Exclusions.

Historic Bridge Programmatic Section 4(f) Guidelines and Standards of Uniformity

The document describes how to prepare historic bridge programmatic Section 4(f) evaluation documentation and discusses SOUs for historic programmatic evaluations. The first section of the document provides background on:

- Section 4(f) regulations.
- The process of preparing a programmatic 4(f) evaluation.
- The elements of the evaluation, including:
 - A description of the proposed action,
 - A description of the property,
 - The purpose and need statement.
 - An alternative analysis.
 - Ways to minimize harm.
 - Coordination among agencies.

The second section of the document discusses the historic bridge programmatic Section 4(f) standards of uniformity, and provides sample evaluation outline, examples of purpose and need statements, marketing notices, examples of agreements and relocation packages.

CHAPTER 3: STAKEHOLDER OUTREACH

This chapter presents the initial results of Task 3—Stakeholder and Resource Agency Outreach and Interview. The purpose of this task is to seek out key stakeholders and conduct outreach to resources agencies and partners in the transportation development process. These generally include TxDOT, and other agencies. It provides summaries of the stake holder interviews and mitigation practices at TxDOT and other agencies.

OUTREACH SUMMARY

Based on outreach and interviews both with TxDOT and other agencies, the research team prepared a list of observations:

- TxDOT enjoys good relations with most resource agencies and state partners. Continued benefits from inter-agency coordination with federal resource agencies could be improved with regularly scheduled meetings with key agencies such as the USACE.
- Mitigation tracking on a statewide basis is difficult. TxDOT would benefit from creating the ability to measure and manage mitigation on a regional and statewide basis. Existing management systems, such as ECOS, could be enhanced to have more robust EPIC and mitigation tracking.
- MPOs provide an important potential resource and partner for regional mitigation coordination efforts. Example successful practices are occurring in North Texas between North Central Texas of Governments (NCTCOG), NTTA, USACE, and local jurisdiction to coordinate 404 and 408 mitigation and permitting for transportation projects. Additionally, regional toll revenues are being used to fund positions at the USACE to expedite regulatory permitting, reviews and coordination.
- TxDOT has benefited from funding positions at resource agencies to advance and expedite environmental reviews, permitting, and coordination for TxDOT projects. Other state DOTs and MPOs that have funded positions have also experienced significant time savings.

RIGHT OF WAY DIVISION (ROW)

The research team interviewed representatives from the Right-of-Way Division on June 20, 2013 regarding mitigation issues, practices, and procedures. In addition, they discussed opportunities for coordination with the Environmental Division and potential case studies. The ROW division was contacted because ROW issues ROW CSJs for mitigation projects requiring purchase of parcels or in-lieu fees.

As shown below in [Figure 15](#), the process for implementing a mitigation action involves several steps between the District, Environmental Division (ENV), and ROW Division. In general, when a District identifies the need for compensatory wetland mitigation, such as in-lieu fee, the district sends the Environmental Division a request along with supporting documentation. Once the

need, cost, and approach to mitigation is resolved, then ENV sends ROW a request to purchase credit or parcels. ROW tracks the mitigation purchases as if these are parcels of land in the Right of Way Information System (ROWIS). By statutory law, the remedy of environmental impact is considered a right-of-way acquisition cost. Simultaneously, while ENV evaluates the need, ROW delineates appropriate remedy and appropriateness of value. The ROW Division is often given options for mitigation, with different costs for each option. USACE often dictates these options. The selected option is referred to ENV to ensure it meets environmental requirements. ROW sets up the mitigation as a parcel in ROWIS coded with an “m” for mitigation or “w” for wetland. ROW then funds the parcel, or credit.

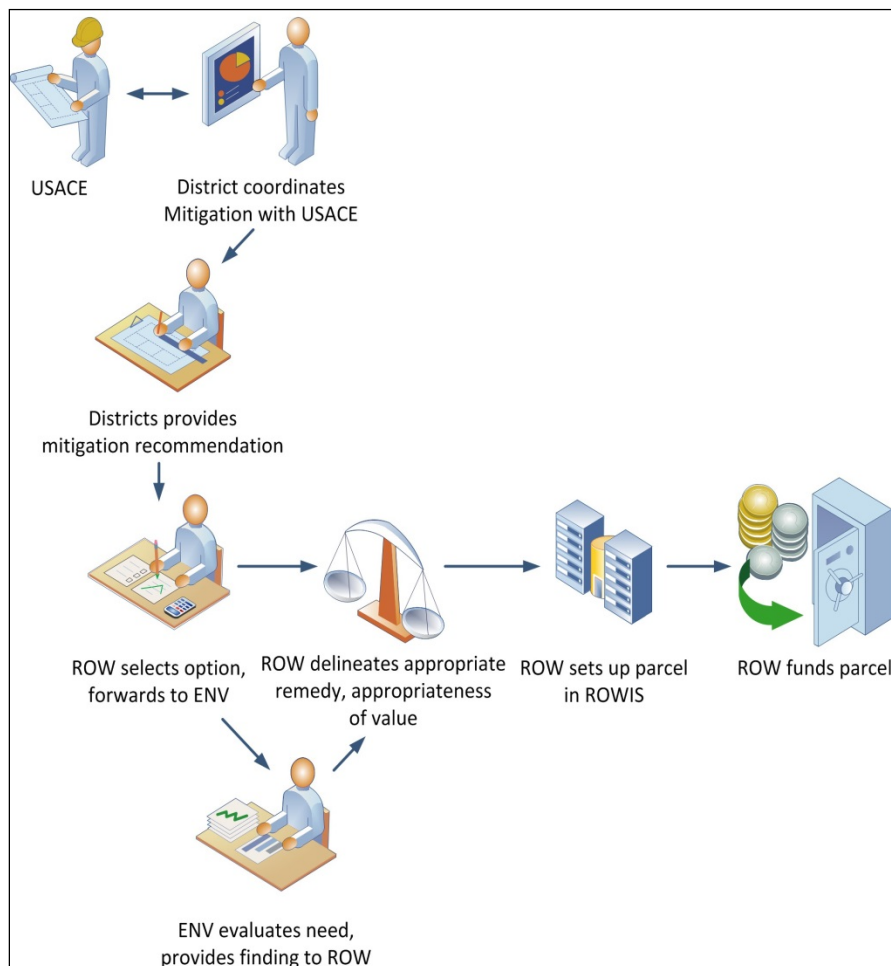


Figure 15. General ROW Parcel Acquisition Process for Mitigation or In-Lieu Fee.

ROW Observations

The following lists highlights from the interview:

- The main hurdle from ROW’s perspective that there is not a lot of flexibility in the process. ROW is required to engage with resource agencies, which can be very time consuming. ROW indicated that turnover within resource agencies is difficult to deal

with. As a result of these issues, ROW supports TxDOT funding a position within USACE that is dedicated to managing TxDOT permit requests. This helps TxDOT in meeting permit requirements.

- ROW indicated the long-term management of mitigation properties; cost estimating and cost controls for mitigation actions are problematic. Regarding long-term maintenance, ROW indicated that TxDOT is not well-suited for long-term management of mitigation, given the relative short term nature of transportation project development. Maintenance of mitigation properties and projects extend beyond construction completion, and are more difficult to track and manage over time. As such, the management of TxDOT mitigation banks is largely a TPWD function.
- In approximately 2007, TxDOT shifted from purchasing mitigation parcels and credits, and went to fee in lieu of mitigation. The shift to in-lieu fees coincided with the national trends towards fee in lieu purchases and the USACE initiative. Currently, the preferred type of mitigation is “fee in lieu of mitigation” purchase. This makes the use of TxDOT-owned mitigation banks less advantageous and not as beneficial investment due to ongoing management cost to maintain mitigation banks.
- One of the challenges to compensatory mitigation has been monetizing and valuing the cost of the impact to be mitigated. The USACE previous approach to quantifying mitigation credits was often unreliable, which made the process hard to manage, and added uncertainty to the overall banking process. ROW explained that it was not always certain what the ratio of required quantity of remedy would be (5:1, 3:1, etc.). As a result, “fee in lieu of mitigation” has brought much more predictability to mitigation.
- The Grand Parkway project in Houston offers lessons in a completely new area for TxDOT ROW–stream mitigation. The project alignment has been on the books for two decade. The alignment coincides with a stream for approximately 4 miles. As a result of the required stream mitigation, TxDOT is helping to set up and fund a stream mitigation bank in order to purchase credits from the bank in the future.
- ROW identified that after a parcel is purchased as part of mitigation, it is difficult for TxDOT to maintain the property. As a result, a lot of little mitigation projects just do not get maintained.

TRANSPORTATION PLANNING AND PROGRAMMING DIVISION (TPP)

TxDOT’s Transportation Planning and Programming Division (TPP) is responsible for long-term planning, programming, and administering planning funds. Additionally, it plays a significant role in travel demand modeling and air quality conformity for TxDOT. TPP does not have a direct role in mitigation at TxDOT, but the Division does direct long-term planning functions. As such, TPP could be an important partner in preparing and participating in Planning and Environment Linkages (PEL) efforts with ENV, and early identification of potential mitigation. Key outcomes from the TPP include:

- TPP indicated that it is willing to develop a greater link with the Environmental Division regarding long-term environmental planning and is open to having more active interaction and expand capabilities.
- TPP is familiar with the *Transportation for Communities—Advancing Projects through Partnerships (TCAPP)* processes, website, and various tools but has not used them. The Division is interested in promoting PEL/IEF within TPP and ENV, and some of the TCAPP process may be useful.
- TPP did not indicate that there would be any barriers or problems associated to coordination with ENV on long-term planning and identifying planning, but it has not been in that part of the environmental “business” before. The Division does not have any MOUs or agreements with outside resource agencies, nor would it be involved in project-level environmental issues.
- Opportunities for early environmental coordination and engaging in PEL/IEF will likely come from regional corridor studies. Some of these studies are listed below and are considered ongoing, committed, or potential new studies. It is from the statewide transportation planning studies that potential for PEL/IEF and early mitigation coordination may be possible.

TPP provided a list of current and future studies that may be candidates for integrated environmental framework studies, and PEL, including:

Current TPP Studies

- **IH 69 Corridor Study:** I-69 Angelina/Nacogdoches Counties Scoping Study begins environmental process in fall 2013. Eight planning and feasibility studies cover most of the route. Consultant selection for environmental/schematic work occurring in Yoakum, Beaumont, and Lufkin Districts.
- **IH 35 Corridor Study:** Finalizing segment committee update reports. The Capital Area implementation plan, Williamson County to Hays County are identifying range of solutions.
- **US 87 Dalhart Route Study:** Identifying alternative to eliminate low clearance issue with railroad grade separation.
- **SH 249 Route Study:** Current focus is on Grimes County from Todd Mission to SH 6 in Navasota section. The Montgomery County section is updating Draft Environmental Impact Statement (DEIS), recommending study area, preparing draft Purpose and Need, and beginning environmental/schematic.

Committed TPP Studies

- **IH 20 Corridor Study** from Dallas east to Louisiana line involves assessing Corridor Study to identify improvements for rural portion, and establish a working group.
- **Tyler Feasibility Studies** focuses on possible improvements at two intersections, develop purpose and need, identify alternatives, and estimate costs.
- **Lubbock Outer Loop Route Study** is from US 84 to US 84 in the southwest half of the city of Lubbock. The feasibility study was completed in 2010. Its purpose is to identify preferred route alignment with working group input process.
- **Loop 335 in Amarillo:** Master Plan will develop and implementation plan that addresses future growth using working group process.
- **IH 45 Freight and Needs Assessment:** Dallas to Houston identifying future freight demands and assessing corridor development needs.
- **US 281 Needs Assessment:** From the Mexico border to Oklahoma. Assess current conditions and future needs as an alternative to IH 35.
- **US 190 Implementation Plan Route Study** was completed in 2012. Now identifying specific projects for implementation and identifying new needs.

Other Potential TPP Studies

- IH 10 from Houston to San Antonio Needs Assessment.
- IH 30 from Dallas to Arkansas Needs Assessment.
- Ports To Plains Update/Implementation Plan.
- New Corridor Development: IH 35, IH 69, IH 45 and IH 10.

ENVIRONMENTAL DIVISION (ENV)

TxDOT's Environmental Division (ENV) is responsible for compliance and coordination of mitigation across a range of resource agencies and regulations. ENV works with districts and divisions to provide environmental policy, procedures, training, guidance, and technical assistance. Additional interviews with ENV are anticipated. The comments below represent a broad overview of issues affecting mitigation.

- ENV coordinates with ROW to purchase parcels or make in-lieu fee payments for wetland mitigation (see ROW narrative and [Figure 15](#)). ENV has not identified coordination with TPP on PEL/IEF issues as a priority, but recognizes it as a potential opportunity in the future.
- The Grand Parkway project was identified as a project with high stream mitigation costs (\$60 million). Stream mitigation is a relatively new issue that has arisen with the Grand Parkway project. Like ROW, ENV is looking for opportunities to address high mitigation costs. Stream mitigation banking is an option, but banking can also be costly and not an

ideal long-term solution. ENV indicated that many of the other current and planned projects have not identified significant mitigation or environmental issues.

- ENV indicated that there is no standing scheduled regular interaction between TxDOT and federal resource agencies such as USACE, but recognized that regularly scheduled resource interaction had occurred previously. There is no aversion to meeting on TxDOT's part; it's just these meetings are not currently being scheduled.
- TxDOT ENV is currently in the process of funding positions with the USACE Galveston office as a pilot project for expediting and coordinating permits and reviews. The Division wants to test to see how much a single person can cover with regard to permit management. If the pilot is successful, additional TxDOT-funded USACE staff positions may be pursued.
- Differences between processes, and inconsistency among the two USACE Texas offices (Fort Worth and Galveston) have been identified as ongoing issues. Coordination with USACE is seen as a big challenge for ENV, especially in regard to watershed-specific mitigations, and stream mitigation. Similar to ROW comments about USACE, there is very little flexibility in the rules to allow more innovative mitigation practices, which lead to a continuation of postage stamp mitigation for highway projects. ENV is interested in pursuing and promoting broader eco-perspective-based mitigation.
- TxDOT has a good working relationship with Texas Parks and Wildlife Department (TPWD) and is funding two positions at TPWD per a recent interagency MOU. One of the two positions will work on mitigation and add-ons to help the TPWD staff. The other TxDOT-funded TPWD position will be assigned to reviewing documents. TxDOT also pays for employees at the historic commission and TCEQ.
- Mitigation tracking in general has been difficult for all types of mitigation. Mitigation tracking strategies and efforts are also not well-known on *strategic projects*—projects within the Strategic Projects Office. These projects include Public-Private Partnership (P3s) program, design-build, and Comprehensive Development Agreements (CDA). There is concern that developers are motivated to streamline projects, including mitigation, to save costs, but may also shortcut environmental stewardship.
- Regional mitigation strategies make sense and TxDOT seeks to conduct mitigation on a larger scale versus postage stamp mitigation because it is easier to manage and produces better results. However, resource agencies are reluctant to expand their conduct of mitigation either because the 'postage-stamp type' is easier for them, or it is what they are accustomed to.

ENV Management Systems

Tracking and managing mitigation efforts for wetlands, biological and wildlife resources, and other mitigation has been a challenge for many state DOTs. TxDOT is among the many state transportation agencies that has tried to address these challenges using information management systems. One way in which TxDOT tracks commitments to conduct mitigation is using

Environmental Permits, Issues, and Commitments (EPICs). EPIC sheets are part of all TxDOT environmental documents such as Categorical Exclusions CEs and Environmental Assessments (EAs), but are also included in construction plan sheets.

The Environmental Compliance and Oversight System (ECOS) is a recently implemented information management system that includes environmental information for specific transportation projects. ECOS includes a listing of project-specific EPICs. Although these systems are evolving, EPIC is not specifically designed, or intended to track mitigation at this time. ENV recognizes that better tracking of mitigation efforts is needed and is working toward that goal. The responsibility for implementing, paying, and maintaining the many and various permits, mitigations and environmental commitments involves coordination between the District offices and the ENV. The Districts are generally responsible for permits and commitments, but there is not a single statewide repository, or tracking for mitigation and environmental permits. The Districts conduct information gathering and dissemination and tracking to ENV, and ENV provides technical assistance and oversight.

MITIGATION COST REVIEW

The research team sought to identify costs associated with mitigation on a statewide basis. Since mitigation costs are project-related costs and districts generally keep direct project costs, there is no single source or management system for capturing all mitigation costs statewide. Therefore, the research used the Right of Way Information System which tracks cost associated with ROW purchases and issues a ROW CSJ number. As such, any parcel purchase associated with mitigation should be discoverable in ROWIS. Although ROWIS does not capture all mitigation cost on a statewide basis, it does track a significant portion of wetland mitigation costs which accounts for the majority of all mitigation costs.

The TxDOT Right of Way Division conducted a search of ROWIS records on behalf of the research team to locate data about mitigation parcels that TxDOT paid for over the last 10 years. The search produced a spreadsheet containing 64 mitigation parcels, the earliest paid on 12/16/2003 and the latest paid on 06/24/2013.

For the 2003–2013 period, the research team found records for 64 mitigation parcels with a total payment amount of \$39.3 million. The cost of the parcels varied from \$550 to \$11 million, with a median value of \$76,000. However, 63 payments for mitigation parcels were lower than \$3.5 million, so that the \$11 million parcel can be considered an unusually high amount. [Figure 16](#) shows a histogram and cumulative frequency of payments for mitigation parcels over the last 10 years, excluding the highest valued parcel.

Mitigation payments identified in ROWIS only include compensatory wetland mitigation paid in relation to Section 404 mitigation actions involving the purchase of a parcel, credits, or a fee-in-lieu payment. The ROWIS system captures ROW CSJs for parcels, or payments in-lieu of parcels. Compensatory mitigation for ESA, hazardous material remediation, or other type of environmental mitigation payments are not captured and coded in ROWIS because it only tracks the purchase of a parcel, or fee for a parcel. Additionally, compensatory mitigation conducted as

part of comprehensive development agreement, or concession agreement, do not typically appear in ROWIS. Presumably, the concessionaire tracked these payments outside of ROWIS and TxDOT management systems.

The research team also analyzed the cost information by year, region, district, and control section job number (CSJ.) Figure 17 shows the total annual amount that TxDOT paid for mitigation parcels over the last 10 years. Between 2003 and 2011, the annual amount was between \$100,000 and \$2.8 million, with an average cost per parcel for that period of about \$200,000. In 2012, the annual cost for mitigation parcels increased significantly to \$9.46 million, which was slightly more than the total amount expended for the period from 2003 to 2011. As of June 2013, the cost for mitigation parcels has more than doubled from 2012 to \$20.5 million, and is expected to increase even further by the end of the year.

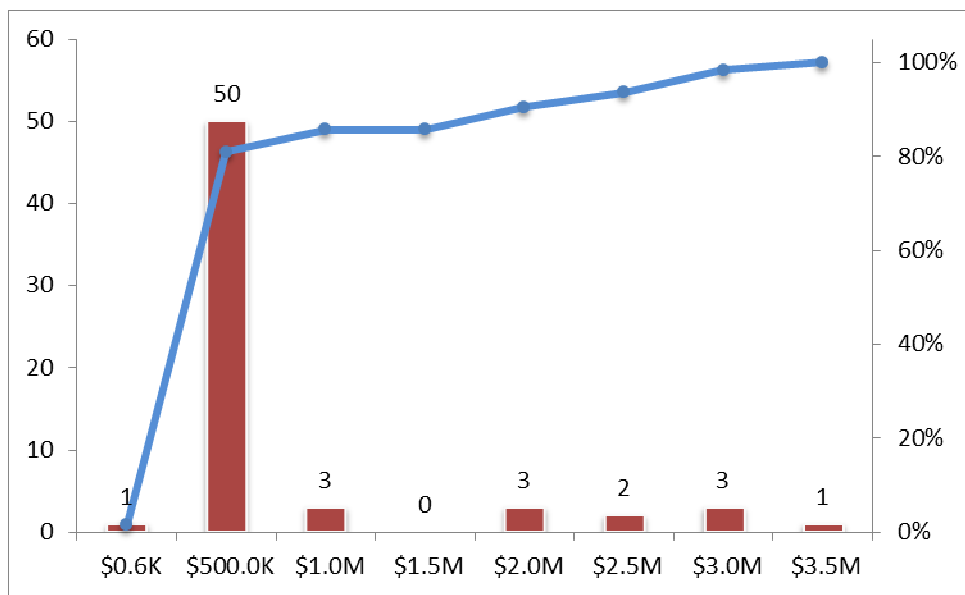


Figure 16. Histogram and Cumulative Frequency of Payments for Mitigation Parcels (Excluding Highest Value).

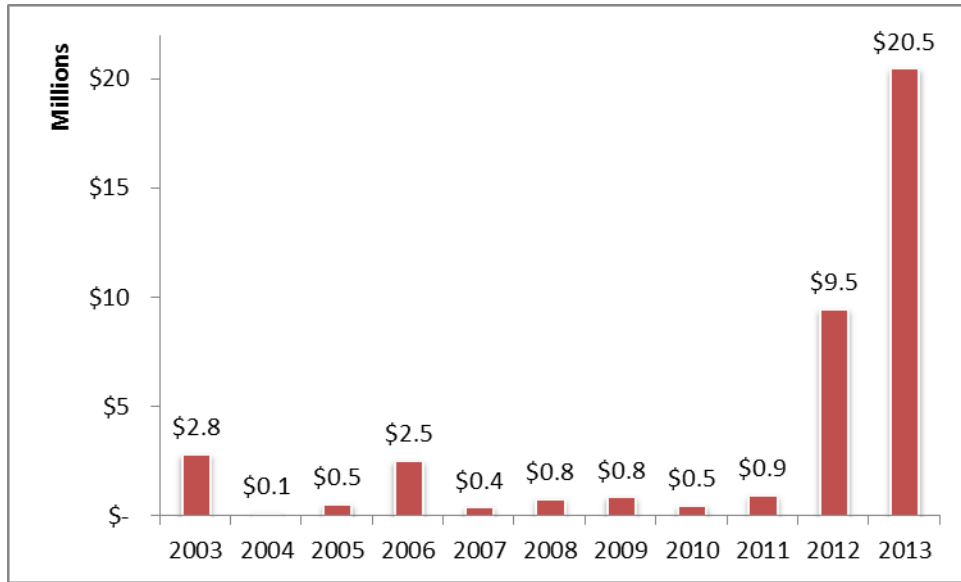


Figure 17. Annual Amount of Payments for Mitigation Parcels.

A look at the total number of parcels acquired reveals that the cause for the increase is not only a result of the number of parcels paid for, but also the average cost per parcel. For example, [Figure 18](#) shows the number of parcels purchased annually between 2003 and 2013. For the period of 2003 to 2011, the average cost per parcel was about \$200,000, but increased almost fivefold to \$945,000 per parcel in 2012, and \$1.2 million in 2013. However, 2012 and 2013 did not have the highest average cost per mitigation parcel (see [Figure 19](#)): In 2003, TxDOT purchased two parcels for \$2.8 million and in 2006, one parcel for \$2.5 million. The high mitigation costs for 2012 and 2013 are therefore a result of the combination of unusually high parcel costs and an unusually high number of parcels.

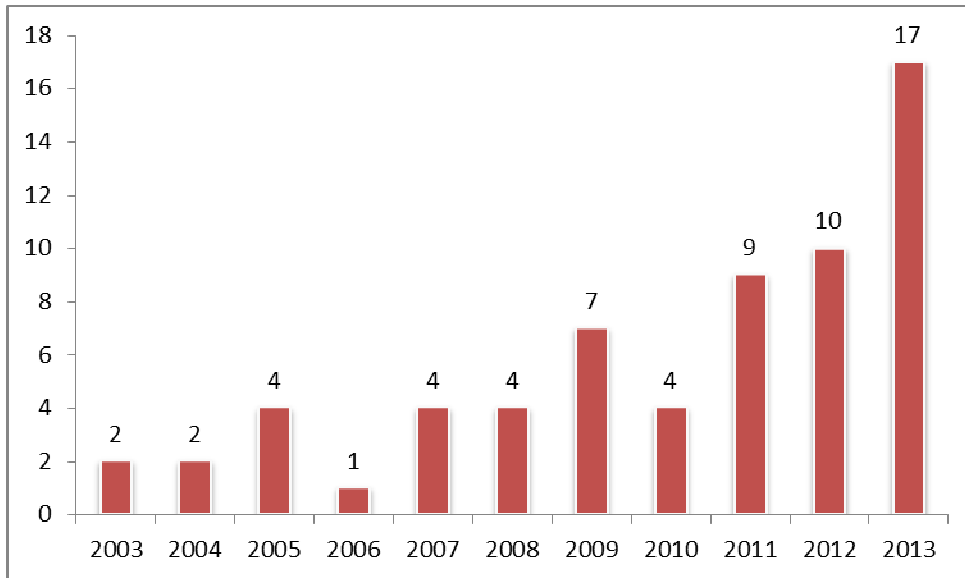


Figure 18. Annual Number of Mitigation Parcels Acquired.

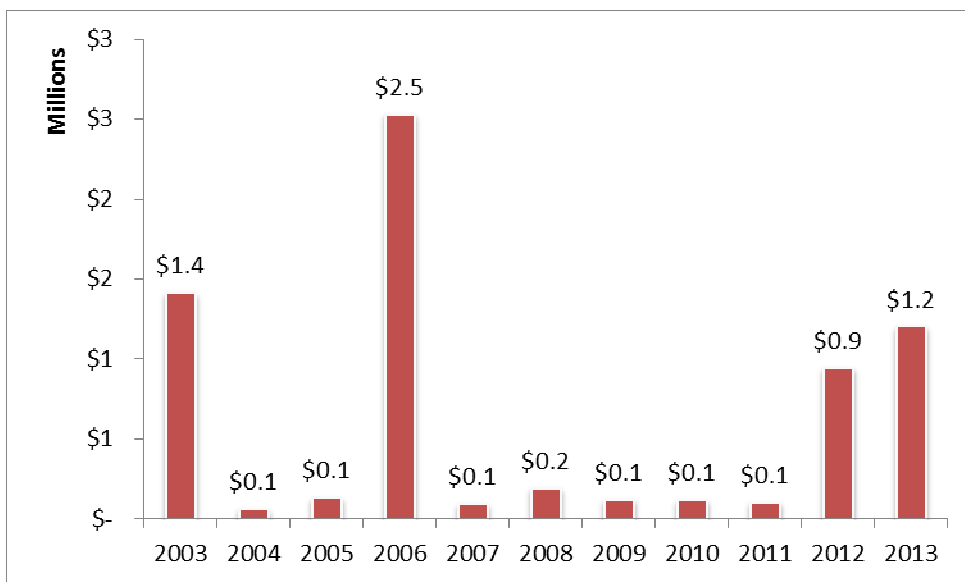


Figure 19. Average Cost per Mitigation Parcel by Year.

To reveal potential causes for the unusual high parcel cost in 2012 and 2013, the research team analyzed the data further. The Right Of Way Division provided data that included information about the expense type for each parcel acquired, namely “land acquisition” and “fee in lieu of mitigation.” [Figure 20](#) shows the number of parcels acquired by year, as shown in [Figure 18](#), but this time broken down into the two expense types. It becomes clear that prior to 2009, the Right of Way Division did not use the expense type “fee in lieu of mitigation,” but starting in 2010 switched to almost exclusively using fee in lieu payments. This is a direct

response to changes in the USACE rule changes allowing in-lieu fee compensatory mitigation. (*In-lieu-fee* mitigation occurs in circumstances where a permittee provides funds to an in-lieu-fee sponsor instead of either completing project-specific mitigation or purchasing credits from a mitigation bank.)

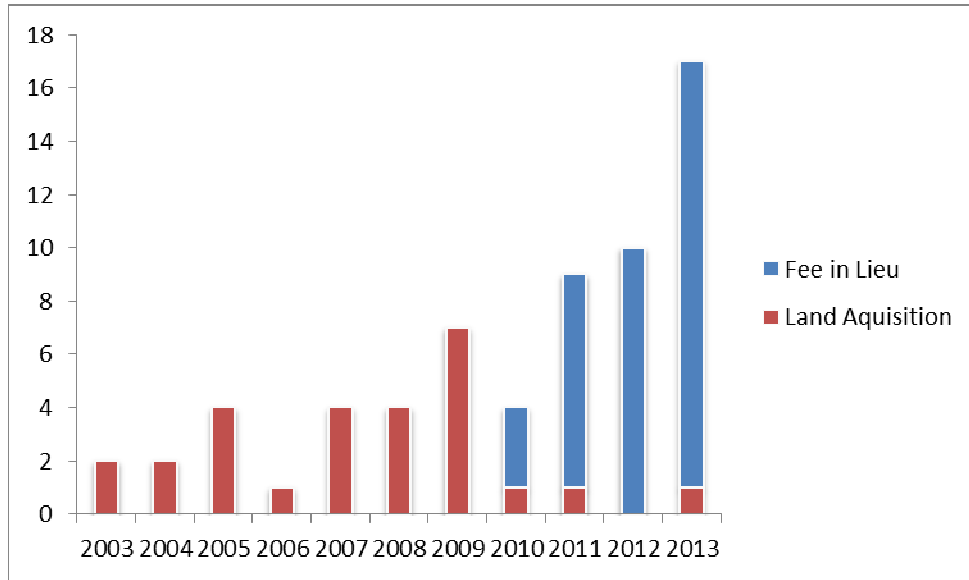


Figure 20. Annual Number of Mitigation Parcels Acquired by Expense Type.

The researchers summed up the cost of all parcels mitigated through land acquisition on one hand, and all parcels mitigated through fee in lieu of mitigation, to determine average costs for each. The researchers found that the average cost of land acquisition parcels over the study period was \$312,000 versus \$835,000 for fee in lieu of mitigation parcels. In other words, TxDOT spent per parcel an average amount 2.7 times higher on fee in lieu of mitigation parcels as compared to land acquisition parcels.

Researcher also analyzed in which region and district TxDOT purchases the most mitigation parcels by value. [Figure 22](#) shows that TxDOT expended the largest amount of funds in the East Region. [Figure 23](#) shows that in relative terms, more than 90 percent of the overall cost was expended in the east region (shown in red), based on a total of 34 parcels (shown in blue). In the North Region, 25 parcels were acquired, but only amounted to roughly 9 percent of the overall cost. In the South and West Region, TxDOT purchased only 4 parcels in total over the last 10 years, which amounted to less than 1 percent of the total mitigation cost. [Figure 24](#) shows that based on the number of parcels acquired, the expense type “fee in lieu of mitigation” was most popular in the East Region. TxDOT Regions are shown below in [Figure 21](#).



Figure 21. TxDOT Regions.



Figure 22. Amount of Mitigation Funds Expended by TxDOT Region.

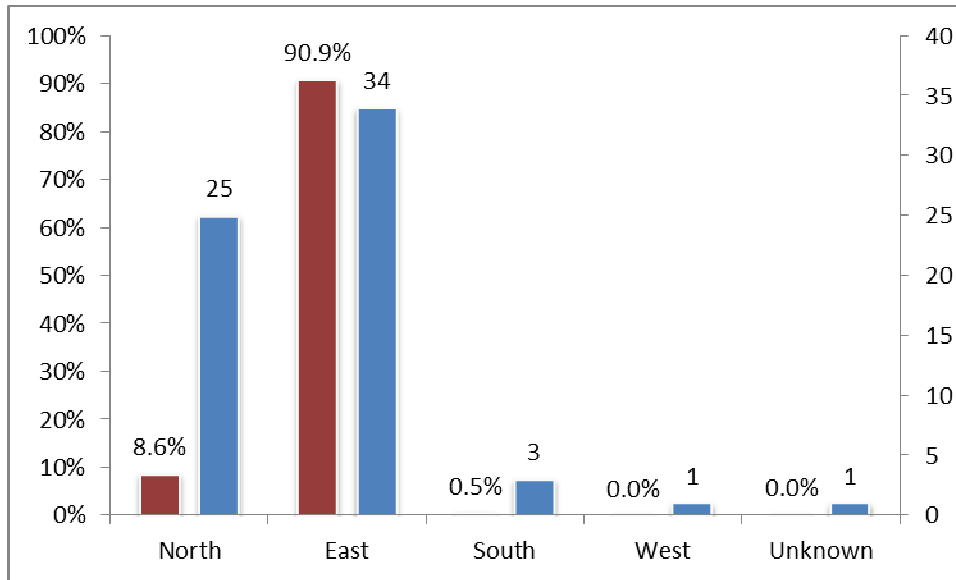


Figure 23. Percentage of Total Mitigation Funds Expended (Red) and Number of Parcels Acquired (Blue), by TxDOT Region.

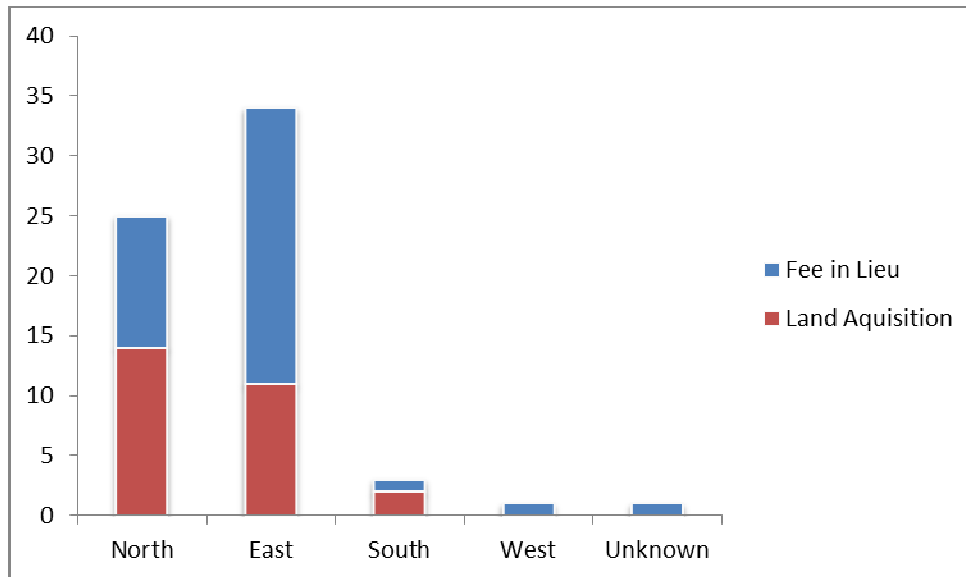


Figure 24. Number of Mitigation Parcels Acquired in Region by Expense Type.

In [Figure 25](#), the cost distribution by district revealed that TxDOT purchased mitigation parcels in 11 of 25 districts. The figure further shows that the vast majority of funds were expended at the Houston District. The Dallas District purchased 16 parcels over the last 10 years for a total of \$2.3 million, which amounts to about six percent of the total mitigation funds expended (see [Figure 25](#)). [Figure 26](#) shows that in relative terms, the funds expended for the Houston District

amounted to 82 percent of all mitigation costs, based on the purchase of 23 parcels. Figure 27 shows that in the Houston District, the majority of parcels were “fee in lieu of mitigation,” while the Dallas District purchased more parcels of the expense type “land acquisition.”

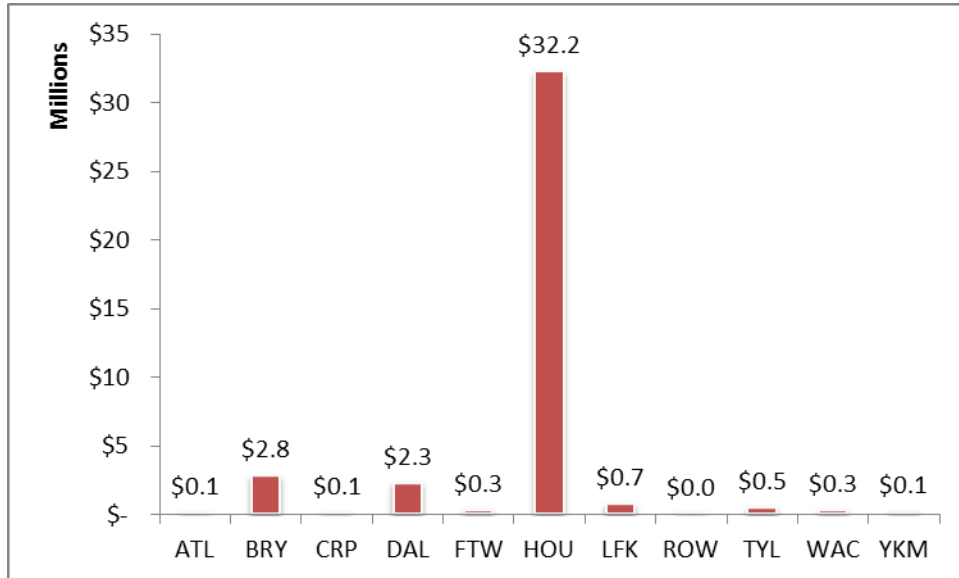


Figure 25. Amount of Mitigation Funds Expended by TxDOT District.

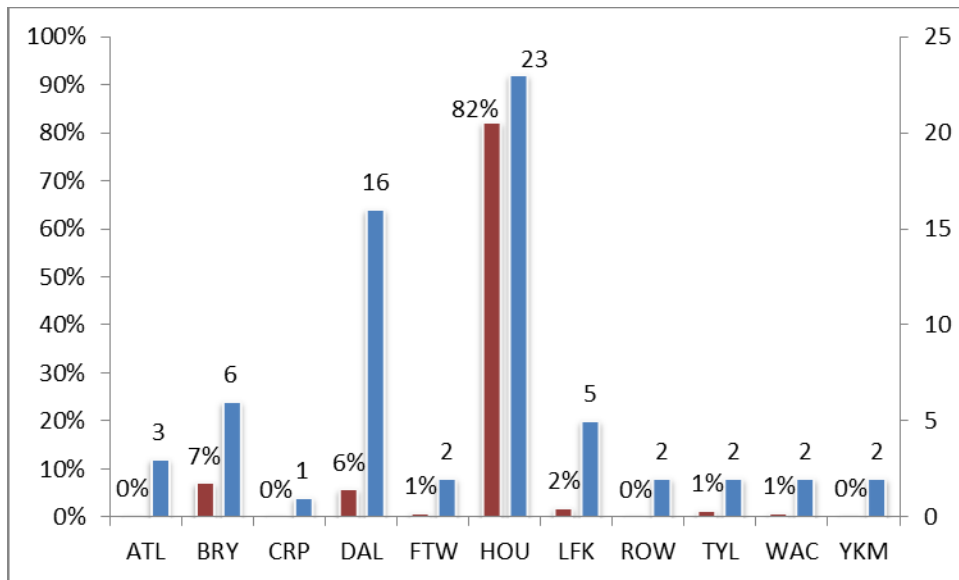


Figure 26. Percentage of Total Mitigation Funds Expended (Red) and Number of Parcels Acquired (Blue), by TxDOT Region.

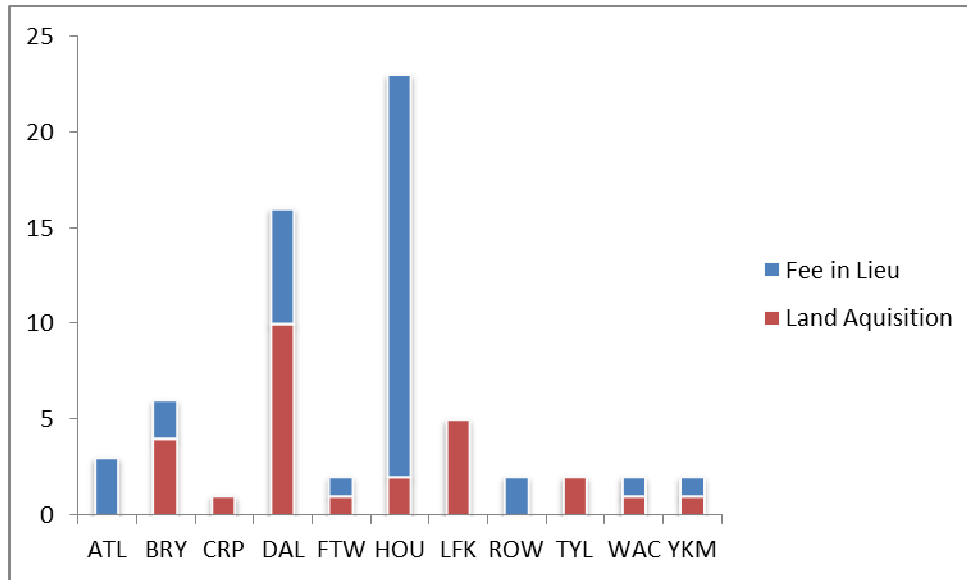


Figure 27. Number of Mitigation Parcels Acquired at District by Expense Type.

The research team also analyzed purchase patterns with regard to CSJs, and found that TxDOT purchased mitigation parcels for 47 different CSJs in the past 10 years. For the majority of CSJs (41), TxDOT purchased one mitigation parcel. For two CSJs, TxDOT purchased two mitigation parcels; for four CSJs, TxDOT purchased three or more mitigation parcels.

State Highway 99 – The Grand Parkway

Background

State Highway 99 (SH 99), also known as the Grand Parkway, is a beltway that serves the greater Houston metro area. It is the outer-most loop in the Houston area and, when completed, will be one of the longest of its type in the United States – over 180 miles. Construction efforts on SH 99 were split into a series of segments to facilitate management of the project and diversify funding sources. As of October, 2013, two segments are complete and open to traffic (of 11) with a third scheduled to be open by December, 2013. Of the remaining seven segments, all have been financed and three began construction in June, 2013. An additional segment is currently planned; however it has not received any financing. The entire route will operate as a toll road, with some sections offering free lanes, when complete.

According to the Houston-Galveston Area Council’s (H-GAC) 2035 Regional Transportation Plan (RTP) the cost for the Grand Parkway will be \$6.7 billion. However, this cost does not account for the cost of previously completed segments or the one segment that has not yet been financed; therefore it is a low estimate.

Environmental Mitigation Costs

The Grand Parkway has encountered significant stream and wetland mitigation requirements. Three segments (F-1, F-2, and G) are currently under construction. In an effort to determine the cost of the mitigation work on Grand Parkway, TTI contacted a variety of parties related to the project. Through these contacts TTI determined the cost of stream and wetland mitigation for three segments (those which are currently under construction) to be \$43,000,000. Mitigation expenses for these segments have totaled approximately \$34 million for stream mitigation, and approximately \$9 million for wetland mitigation. Mitigation for the three segments included:

- Segment F-1 included 7.22 acres of wetland impacts and 9,371 linear feet of stream impact.
- Segment F-2 included 40.67 acres of wetland impact and 2,589 linear feet of stream impact.
- Segment G included 81.14 acres of wetland impact and 8,804 linear feet of stream impact.
- The total for the three segments was 20,764 linear feet of stream mitigation and 129.03 acres wetland impact.

As with the previous evaluation of mitigation payments identified in ROWIS, it is difficult to accurately determine total mitigation costs because these costs are not recorded in a single accounting system or source. However, this is not an uncommon practice among state DOTs. A 2006 study by Nathan Macek found that, “Most states do not specifically track... environmental costs related to highway and transit construction. These costs are typically treated as overhead or rolled up into project construction costs. As a result, routine efforts to estimate or unbundle environmental costs are difficult if not impossible” (130). This study also found that environmental mitigation costs (excluding right-of-way) averaged 7.5 percent of the project costs and ranged between 2 and 12 percent. The findings were generally compatible with previous studies.

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