

## REPORT SUMMARY

### LOWER COLORADO RIVER BASIN PHASE I, TEXAS

24 October 2006

#### STUDY INFORMATION

##### Study Authority

Authorities for conducting studies within the Colorado River Basin of Texas have been in place since the mid-1930's. For this study, there are several historical, but applicable, authorities as quoted below:

Resolution by the Committee on Commerce, United States Senate, adopted August 4, 1936:

*"Resolved by the Committee on Commerce of the United States Senate, That the board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act, approved June 13, 1902, be and is hereby, requested to review the reports on Colorado River, Texas, submitted in House Document Number 361, Seventy-first Congress, second session, and previous reports, with a view to determining if improvement in the interest of commerce and flood control is advisable at the present time."*

River and Harbor Act, approved August 26, 1937:

*"Section 4. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following named localities.....Colorado River, and its tributaries, Texas, with a view to its improvement in the interest of navigation and flood control."*

River and Harbor Act, approved March 2, 1945:

*"Section 6. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following named localities.....Colorado River, Texas."*

In addition to the broad, basinwide authorities noted above, more specific authority was provided for the Onion Creek portion of the study. This authority is contained in a resolution by the Committee on Transportation and Infrastructure, United States House of Representatives, adopted May 6, 1998, as quoted below:

*"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That the Secretary of the Army is requested to review the report of the Chief of Engineers on the Colorado River, Texas, published as House Document 361, 71st Congress, 2nd Session, and other pertinent reports, with a view to determine if improvements to the Onion Creek watershed in the interest of flood damage reduction, environmental restoration and protection, and other related purposes are advisable at the present time."*

## **Study Sponsor**

The Lower Colorado River Authority (LCRA) is the official non-Federal sponsor for the Lower Colorado River basin studies, and has entered into a 50/50 cost sharing agreement with the Corps. The LCRA, in turn, has entered into numerous inter-local agreements with other non-Federal entities within the basin for the purpose of sharing the non-Federal responsibilities among the interested and affected parties. For the portions of the study that affect the Wharton area, the City of Wharton provided cash and/or in-kind services, with LCRA acting as the focal point for all activities. For investigations within the Onion Creek watershed, additional local cost sharing sponsors included the City of Austin, Travis County, and the City of Sunset Valley.

## **Study Purpose and Scope**

This report is an interim response to the study authorities, and does not close out those authorities. Additional studies are anticipated within the basin, and will be documented in subsequent interim feasibility studies.

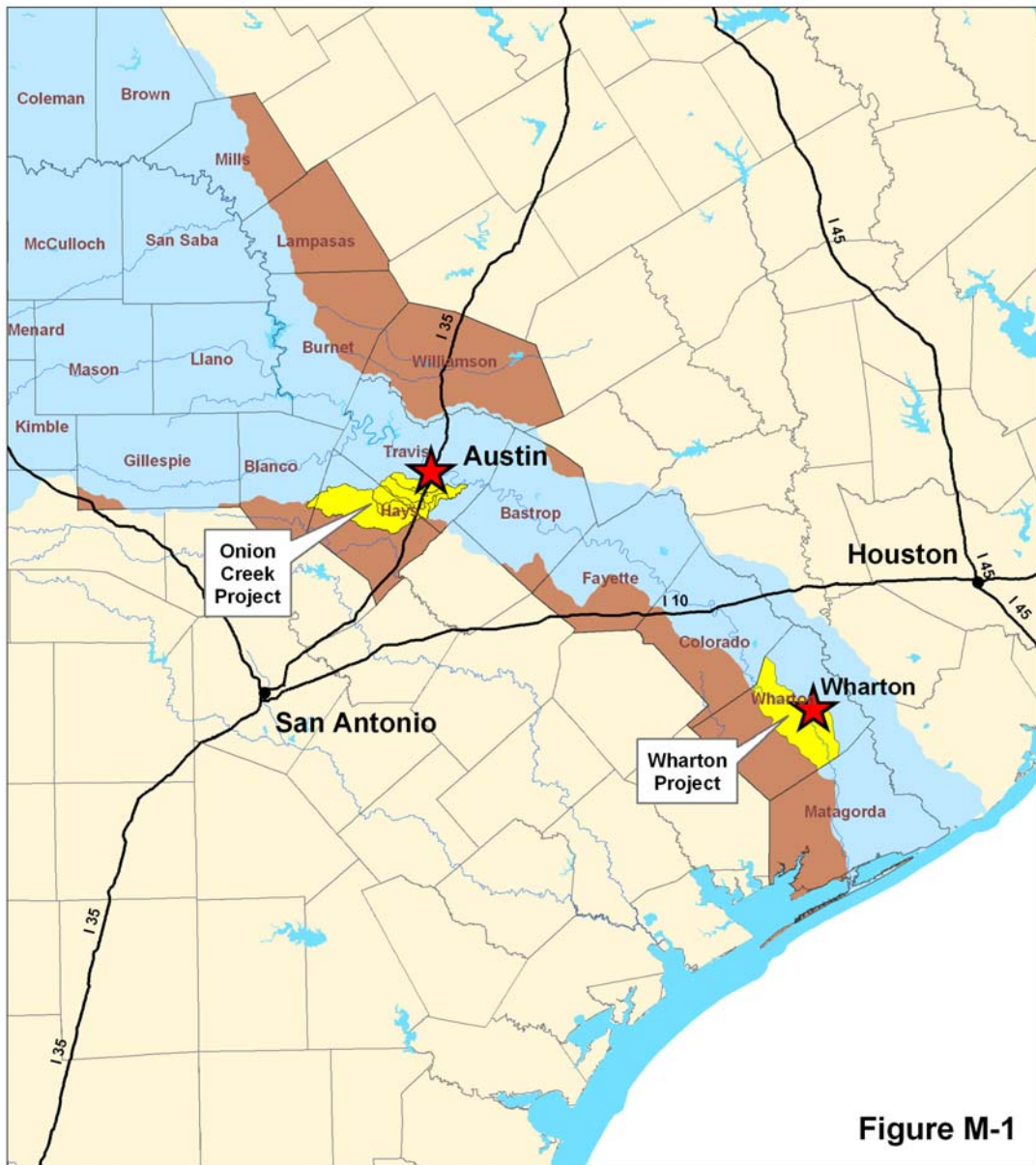
The primary purpose of the Lower Colorado River Basin Phase I, Texas Interim Feasibility Report and Integrated Environmental Assessment is to investigate the water-resource problems, needs, and opportunities within the Lower Colorado River Basin, and specifically within the Onion Creek watershed, and the city of Wharton, Texas. Because of the influence of the Colorado River on the San Bernard River tributaries in and around the city of Wharton, these tributaries are also included in the study area.

## **Project Location / Congressional District**

The proposed study area is located within the Lower Colorado River basin, and is broken into sub-areas for evaluating various portions of the study. This report deals with the sub-areas of Wharton County, Texas, including the city of Wharton, and the Onion Creek watershed.

Wharton County is bounded by Colorado County, Austin County, Fort Bend County, Brazoria County, Matagorda County, and Jackson County. It encompasses an area of 1,095 square miles. The city of Wharton is the county seat, located near the center of Wharton County. The city of Wharton lies approximately 55 miles southwest of Houston, 142 miles from Austin, 173 miles from San Antonio, and 200 miles from Corpus Christi, and is bounded by U.S. Highway 59 to the west and the Colorado River to the south. Wharton County is in Congressional District Number 14 (Ron Paul).

The Onion Creek watershed encompasses approximately 343 square miles and is located primarily in southern Travis and northern Hays Counties, with a minor part of the upper portion of the basin extending into eastern Blanco County. Major tributaries on Onion Creek include Cottonmouth, Williamson, Marble, South Boggy, Slaughter, Rinard, Bear and Little Bear Creeks. The Williamson Creek watershed, which is one of the focal points in the study, encompasses approximately 31 square miles, has a river-length of approximately 17.5 miles (from Onion Creek to the headwaters) and lies entirely within Travis County. Major tributaries to Williamson Creek include St. Elmo, Pleasant Hill, Sunset Valley, Cherry Creek, Kincheon Branch, Motorola, and Scenic Brook. Williamson Creek originates southwest of the city of Austin near the Balcones Escarpment and flows about 17.5 miles before its confluence with Onion Creek near Austin-Bergstrom International Airport. The Onion Creek watershed lies within Congressional Districts 21 (Lamar Smith) and 25 (Lloyd Doggett).



**LOWER COLORADO RIVER BASIN PHASE I, TEXAS**  
**Interim Feasibility Report and Integrated**  
**Environmental Assessment**  
**PROJECT LOCATION / STUDY AREAS**

### **Prior Reports and Existing Water Projects**

Numerous water resources-related studies have been completed by various interested parties that have addressed all or portions of the Lower Colorado River Basin. This report lists the existing reports that pertain to the sub-areas of Wharton County and the Onion Creek watershed. Most studies were conducted following the introduction of high level urban land use within the basin. A list of the most significant reports is shown below:

- **A PARSIMONIOUS MODEL FOR SIMULATION OF FLOW AND TRANSPORT IN A KARST AQUIFER**  
Barrett, M. E., and R. J. Charbeneau. Center for Research in Water Resources Technical Report 269. University of Texas. Austin, Texas, 1996.
- **BARTON SPRINGS WATERSHED RETROFIT MASTERPLAN**  
Loomis and Santos, October 1995.
- **ENGINEERING ASSESMENT AND ENVIRONMENTAL INVENTORY AND ISSUES REPORT ARTIFICIAL RECHARGE ENHANCEMENT ONION CREEK, HAYS COUNTY, TEXAS**  
Donald G. Rauschuber & Associates, Inc., April 1992.
- **ONION CREEK FLOOD CONTROL STUDY**  
Loomis & Moore, Inc., September 1997
- **ONION CREEK/LOWER COLORADO RIVER BASIN, TEXAS, RECONNAISSANCE STUDY**  
U.S. Army Corps of Engineers, September 1999
- **PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR FLOOD DAMAGE REDUCTION AND ECOSYSTEM RESTORATION, LOWER COLORADO RIVER BASIN , COLORADO RIVER, TEXAS, AUGUST 2005**  
U.S. Army Corps of Engineers, Aug 2005
- **REGIONAL DETENTION AND CULVERT REPLACEMENT FOR WILLIAMSON CREEK WATERSHED**  
Alan Plummer and Associates, Inc., March 2000
- **STATUS REPORT, COLORADO BASIN, TEXAS 1987**  
US Army Corps of Engineers, September 1987
- **THE TEXAS STATEWIDE INVENTORY OF FLOOD PROTECTION NEEDS, MAY 1990**  
Data from Corps planning studies and National Flood Insurance Program (NFIP).
- **WALNUT AND WILLIAMSON CREEKS, EXPANDED FLOOD PLAIN INFORMATION STUDY**  
May 1980.
- **WATER FOR TEXAS**  
The Texas Water Development Board, Austin, Texas, January 2002.

- **WATER RESOURCES DEVELOPMENT IN TEXAS 1971, 1981, 1988, 1989, 1991, 1995**  
U.S. Army Corps of Engineers
- **WATERSHED PROTECTION MASTER PLAN**  
City of Austin, June 2001
- **WILLIAMSON AND ONION CREEKS, AUSTIN, TEXAS**  
U.S. Army Corps of Engineers, July 1987.
- **WILLIAMSON CREEK EROSION ASSESSMENT**  
Raymond Chan and Associates, Inc., May 1997
- **COLORADO RIVER RAFT REMOVAL**  
Wharton Fresh Water Resources Conservation & Development Commission (WFWRCDC), 1975
- **BAUGHMAN SLOUGH**  
Galveston District of the Corps, 1970

In 1977, Turk, Kehle, & Associates prepared a report for Wharton County reviewing the 1970 Corps Baughman Slough report.

- **SAN BERNARD RIVER REPORTS**  
The first report studied was a 1971 Corps Survey Report on the San Bernard River, Texas.  
The second report, Reconnaissance Report, San Bernard River Watershed, Texas, was published in 1991.
- **WHARTON COUNTY FLOOD INSURANCE STUDY**  
The current effective Wharton County, Texas, Flood Insurance Study (FIS) was published in December 2003. The current with effective map date of April 2006.
- **LOWER COLORADO RIVER BASIN STUDY**  
U.S. Army Corps of Engineers, October 2003.  
Phase I Information Paper, identifying Problems, Needs, and Opportunities.

### **Federal Interest**

The Corps of Engineers is authorized to carry out projects in seven mission areas, of which three are included in the Recommended Plan presented in this report. Two of the three mission areas, flood damage reduction and ecosystem restoration, are considered high priority outputs, while recreation is included in this project only as an integral, compatible element in conjunction with non-structural flood damage reduction elements.

Project performance for flood damage reduction and recreation is based on monetary outputs. A project first cost of \$92,657,000 yields annualized net benefits of \$3,928,000 and a benefit to cost ratio of 1.7. For the ecosystem restoration component of the project, a first cost of \$4,592,000 provides increases of approximately 62.6 habitat units annually, at a cost of \$5,000 per average annual habitat unit. These outputs are considered to be within the Federal interest and consistent with current Army policies.

## STUDY OBJECTIVES

### Problems and Opportunities

There is a significant existing and historical flooding problem within much of the Lower Colorado River basin. This finding has been substantiated by recent flood events in October 1998, November 2001, and November 2004. The general magnitude and extent of the problem was originally defined by initial feasibility investigations, and published in Information Papers dated January 2003 and October 2003. Detailed feasibility analyses specifically addressing the Onion Creek and Wharton areas were then undertaken to further define the problem, and to develop an understanding sufficient to allow alternative solutions to be crafted. This study breaks out specific areas of interest within the Onion and Williamson Creek watersheds and the Wharton watershed based on the unique problems of each area within the basin and to aid in clarity and understanding.

The Onion Creek and Wharton study areas were evaluated in a traditional manner by dividing the area into smaller, more definitive study reaches. Total average annual damages within the project areas is estimated to be approximately \$10.8 million, based on 2004 prices and levels of development. Of this amount, \$4.5 million is attributed to Wharton, and \$6.3 million to Onion Creek. Findings indicated that essentially all reaches within the Wharton area encounter a high, unacceptable level of flood damages. For Onion Creek, however, further evaluation identified four key areas for project formulation and development. These are known as Timber Creek, Onion Creek Forest/Yarrabee Bend, Williamson Creek, and Bear/Onion Confluence.

Studies were also conducted to assess the problems and opportunities associated with the current ecosystem within the Onion Creek watershed. Findings indicate that there has been a large amount of urban and rural development in the Onion and Williamson Creek watersheds within the last fifty years. This has markedly reduced the overall width and quality of the riparian corridor in the watersheds, thereby degrading wildlife habitat and aquatic resources. There has been a further degradation to riparian habitat due to proliferation of invasive species such as ligustrum, Chinese tallow, and chinaberry. Identified ecosystem restoration opportunities to counter the continuing degradation include the following:

- Restore riparian woodland habitat along Onion Creek and Williamson Creek on public property where it has been completely lost.
- Purchase lands adjacent to the creeks and perform riparian woodland habitat restoration to improve the aquatic habitat in the creek.
- Restore habitat for the Barton Springs and Austin blind salamanders and well as other karst species by increasing water quantity and restoring water quality being recharged into the aquifer.

Development of recreation facilities is not a main Corps mission and therefore cannot be a stand alone project purpose. However, during the initial study phases, the high potential for combining recreation features with non-structural flood damage reduction measures was recognized, and as a result, an extensive recreation survey was undertaken, which found that there is a latent demand for several types of compatible recreation in the study area, including trails, picnicking facilities, outdoor cultural activities, and open sport fields.

### Planning Objectives

Comprehensive planning objectives for the Lower Colorado River Basin include a wide array of both reducing or eliminating problems and enhancing various areas. The basinwide

objectives include: reducing flood damages throughout the basin; reducing risk to life, health, and welfare of residents; enhancing the quality of life; reducing emergency costs associated to the occurrence of significant flood events within the Basin; reduce overall erosion; stabilize the geomorphology of the various channels; restore aquatic ecosystem and riparian zones; increase recreational opportunities; restore endangered species habitat; and improve recreational opportunities for residents and visitors to the Basin.

The plans formulated as part of this study were evaluated based on their contribution to the National Economic Development (NED), and are consistent with protection of the Nation's environment. In addition to these National objectives, additional planning objectives evolved from meetings with area residents, from contact with the local sponsor, State and Federal agencies, and from observations made in the area. Specific needs, desires, and goals of the community were identified. The planning objectives for this study were identified during the initial stages, and are presented by sub-areas to incorporate the unique objectives for these specific areas within the basin.

Specific planning objectives for Wharton are as follows:

- Reduce flood damages within the city of Wharton, which are inflicted by flood flows from the Colorado River, Caney Creek, Baughman Slough, and Peach Creek.
- Enhance the quality of life available to residents within the city of Wharton by reducing flood risk and providing recreation opportunities.
- Decrease the number of residents who reside in the 4% ACE and 1% ACE floodplain. Ideally, protect all structures in the 1% ACE floodplain from flooding.

Specific planning objectives for the Onion Creek Watershed are as follows:

- Reduce flood damages within the Onion Creek Basin, especially within the known areas of interest identified as Timber Creek, Onion Creek Forest/Yarrabee Bend Subdivision, Bluff Springs/Perkins Valley, Onion Creek Subdivision, Bear/Onion Confluence area, and Williamson Creek.
- Enhance the quality of life available to residents within the Onion Creek basin, and specifically the portions of the basin within the cities of Austin and Sunset Valley, and Travis County, by lowering flood risk, returning the area's ecosystem to more natural conditions, and providing increased recreation opportunities
- Decrease the number of residents who reside in the 4% ACE and 1% ACE floodplain. Ideally, protect all structures in the 1% ACE floodplain from flooding.
- Formulate alternative plans using a holistic approach, where practical. This approach includes restoration of a stable hydraulic regime by establishment of riparian habitat in headwater streams, reduction of pollutant loads, and preservation of high quality environmental features such as springs, seeps, wetlands, swimming holes, and threatened or endangered species. Restore and maintain natural character of floodplains.
- Stabilize the geomorphology along the main stem of Onion Creek and Williamson Creek. Current erosion that threatens aquatic and riparian ecosystems and recreational quality of Onion Creek and tributaries should be curtailed. Future channel enlargement by erosive forces should be eliminated.

## Planning Constraints

In order to provide direction for the plan formulation efforts, maximize beneficial impacts, minimize adverse impacts, and to reflect restrictions of the General Investigation Program, the following constraints were taken into account:

- All Federal, State, and local laws must be followed by the proposed solutions.
- To ensure future Federal support, all current administrative policies must be met. This constraint should not impede the development of any viable alternative, but may become important during the selection phase.

Specific constraints followed for the Wharton area included the following:

- Modification or any adverse impacts to Peach Creek should be avoided, due to its current, high environmental value.
- Structural features of sufficient height and magnitude to cut off the visibility of the Colorado River from the historic business district should be avoided.

Similarly for Onion Creek, the identified constraints were:

- Aquifer recharge enhancement features must not reduce aquifer water quality.
- Wetlands must not be constructed near the Austin Bergstrom International Airport, due to FAA regulations.

## ALTERNATIVES

### Plan Formulation Rationale

An overall basin wide consideration was given to economic, social, and environmental impacts for each alternative during the development of long-term solutions to the flood problems within the Lower Colorado River Basin. Appropriate Corps of Engineers engineering and design manuals, criteria, and regulations relating to flood control channels, outlet works, embankment, stream flow routing, backwater computation, cost estimates, etc., were used in developing alternative plans.

To meet the Federal guidelines for planning water resource projects, the following economic criteria were followed:

- The recommended plan must be economically feasible, i.e. the plan's benefits must exceed the cost of the plan.
- Alternative plans should be evaluated using the current Federal interest rate (5.125%) and price levels, and a 50-year period of analysis.
- Annualized costs must include the cost of operation, maintenance, repair, rehabilitation, and replacements.

Economic feasibility of a plan is displayed as a relationship of benefits to costs, expressed in terms of a benefit-cost ratio (BCR). Identified as benefits are the monetary savings or benefits due to damages prevented, reduction in the cost of emergency services, and reduction of economic disruption. These project benefits are subsequently annualized to represent an annual



benefit applicable for the life of the project. The project cost, which includes the construction or first cost, the interest on the first cost during construction, the operation and maintenance costs, and the interest to amortize the project cost over the life of the project are also annualized to represent an annual project cost applicable for the analysis period of the project. The annual benefits and the annual costs are then related in a ratio of benefits to costs.

### **Management Measure and Alternative Plans**

In selecting alternative plans for flood damage reduction, a full range of structural and nonstructural measures were considered. These were discussed at the Feasibility Scoping Meeting held on August 20-21, 2003.

Structural measures consist of diversion structures designed to control, divert, or exclude the flow of water from the flood prone areas, regional detentions, levees, floodwalls, and channel modifications.

Nonstructural measures attempt to avoid flood damages by exclusion or removal of damageable properties from the flood prone areas. These measures do not affect the frequency or level of flooding within the floodplain; rather, they affect floodplain activities. Raising of structures and floodplain evacuation (buyout) were measures considered in this analysis.

The basic alternative to any flood damage reduction plan is the No Action plan. Adoption of this alternative implies acceptance of the costs and adverse effects of continued flooding. The No Action alternative would recommend no plan and require no allocation of Federal funds.

Certain alternative solutions have been subjected to only preliminary investigations because of their evident economic infeasibility, social unacceptability, or increased adverse impacts on the environment. The more favorable alternative solutions progressed to more detailed studies for refinement of their costs and benefits. For the most favorable preliminary plans, an array of solutions, utilizing similar measures but varying by magnitude, were developed to optimize the net economic benefits of the plan.

### **Final Array of Alternatives**

In addition to the No Action alternative, a final array of alternatives was developed for each specific area being addressed in final formulation. In some instances, the options for each area are somewhat limited, due to the elimination of alternatives for engineering or economic viability reasons. Conversely, the array for the Wharton component is extensive, due to many additive features being used to develop a single, comprehensive flood damage reduction plan.

The final array of alternatives developed during formulation for Onion Creek are shown in Table M-1, while Table M-2 contains the final array of alternatives for Wharton.

**Table M-1**  
**Summarized Final Array of Detailed Alternatives**  
**Onion Creek Component, Grouped by Area of Interest**  
 (December 2004 Prices, 5.125% Interest Rate, 50-Year Period of Analysis)

Alternative	First Economic Cost	Ann. FDR/Rec Cost	Ann. FDR/Rec Total Ben	Ann. FDR/Rec Net Ben	BCR	Ann. ER Cost	Ann. AAHU	\$/AAHU
<b>Timber Creek</b>								
Non-Structural Flood Plain Evacuation	\$8,934,000	\$551,000	\$667,000	\$116,000	1.2	\$16,000	5.86	\$2,700
<b>Onion Creek Forest/Yarrabee Bend</b>								
100-foot Bottom Diversion	\$4,269,000	\$304,000	\$524,000	\$220,000	1.7	N/A	N/A	N/A
Non-Structural Combined Plan A (4%)	\$49,448,000	\$2,890,000	\$3,890,000	\$1,000,000	1.4	\$215,000	73.27	\$2,900
Non-Structural Combined Plan B (1%)	\$91,227,000	\$5,393,000	\$4,625,000	-\$768,000	0.9	\$215,000	73.27	\$2,900
<b>Bear/Onion Confluence</b>								
Non-Structural Combined Plan	\$1,074,000	\$30,000	\$30,000	\$0	1.0	\$30,000	6.15	\$4,900
<b>Williamson Creek</b>								
Optimum FDR Plan	\$2,039,000	\$141,000	\$462,000	\$321,000	3.3	N/A	N/A	NA/
Structural Combined Plan	\$5,535,000	\$213,000	\$659,000	\$446,000	3.8	\$161,000	42.05	\$3,800
Non-Structural Combined Plan	\$13,284,000	\$623,000	\$695,000	\$72,000	1.1	\$180,000	42.05	\$4,300
<b>Total Potential FSP</b>	<b>\$64,991,000</b>	<b>\$3,684,000</b>	<b>\$5,246,000</b>	<b>\$1,562,000</b>	<b>1.4</b>	<b>\$422,000</b>	<b>127.33</b>	<b>\$3,300</b>
Note: Shaded Components comprise the potential Federally Supportable Plan * The first costs shown above do not include relocation assistance costs of approximately \$9,975,000.								

**Table M-2**  
**Summarized Final Array of Detailed Alternatives**  
**Wharton Component**  
 (December 2004 Prices, 5.375% Interest Rate, 50-Year Period of Analysis)

<i>Feature</i>	<i>Floodplain Evacuation 4% ACE SW Wharton</i>	<i>Colorado 2% levee</i>	<i>Colorado 1% levee</i>	<i>Colorado 0.2% levee</i>	<i>Baughman Slough 2% levee</i>	<i>Baughman Slough Max levee</i>	<i>Baughman 75-ft Channel</i>	<i>Baughman 85-ft Channel</i>
Demolition	\$923,000	0	0	0	0	\$0	0	\$0
Lands and Damages	\$4,699,000	\$75,000	\$78,400	\$80,000	\$127,500	\$130,000	\$10,000	\$12,000
Channels and Canals	\$0	\$0	\$0	\$0	\$0	\$0	\$2,007,000	\$2,047,000
Levees and Floodways	\$0	\$2,505,000	\$3,164,500	\$4,040,000	\$603,000	\$670,000	\$0	\$0
Relocations	\$0	\$0	\$0	\$0	\$0	\$0	\$832,000	\$832,000
F&W Mitigation	\$0	\$202,100	\$206,700	\$211,000	\$39,100	\$40,000	\$0	\$0
Engineering and Design	\$200,000	\$300,600	\$379,700	\$484,800	\$72,400	\$80,000	\$340,700	\$340,700
Construction Management	\$200,000	\$150,300	\$189,900	\$242,400	\$36,200	\$40,000	\$170,300	\$170,300
Contingency	\$1,506,000	\$819,000	\$1,004,800	\$1,257,800	\$219,800	\$237,000	\$828,000	\$838,000
<b>Total First Cost</b>	<b>\$7,528,000</b>	<b>\$4,052,000</b>	<b>\$5,024,000</b>	<b>\$6,316,000</b>	<b>\$1,098,000</b>	<b>\$1,197,000</b>	<b>\$4,188,000</b>	<b>\$4,240,000</b>
LERRD's	\$4,699,000	\$75,000	\$78,400	\$80,000	\$127,500	\$130,000	\$842,000	\$844,000
<b>Annual Benefits</b>	\$130,000	\$436,000	\$781,900	\$1,032,610	\$334,400	\$388,600	\$420,200	\$423,440
<b>Annual Costs</b>	\$436,000	\$235,000	\$291,000	\$366,000	\$64,000	\$69,000	\$243,000	\$246,000
<b>Net Benefits</b>	<b>-\$306,000</b>	<b>\$201,000</b>	<b>\$490,900</b>	<b>\$666,610</b>	<b>\$270,400</b>	<b>\$319,600</b>	<b>\$177,200</b>	<b>\$177,440</b>
<b>BCR</b>	0.3	1.9	2.7	2.8	5.2	5.6	1.7	1.7

**Table M-2 (continued)**  
**Summarized Final Array of Detailed Alternatives**  
**Wharton Component**  
 (December 2004 Prices, 5.375% Interest Rate, 50-Year Period of Analysis)

<i>Feature</i>	<i>CC Outfall 2-60 inch pipes</i>	<i>CC Outfall 3-60 inch pipes</i>	<i>CC Outfall Boxes</i>	<i>CC Wharton RR Culvert</i>	<i>CC Wharton 2-60 inch Richmond Pipes</i>	<i>CC Wharton 3-60 inch Richmond Pipes</i>	<i>CC Crestmont SF Initial</i>	<i>CC Crestmont SF Ultimate</i>
Demolition	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Lands and Damages	\$20,000	\$25,000	\$25,000	\$10,000	\$15,000	\$18,000	\$95,000	\$100,000
Channels and Canals	\$483,600	\$692,900	\$2,087,800	\$1,652,800	\$873,000	\$1,309,500	\$1,892,000	\$2,281,000
Levees and Floodways	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Relocations	\$11,700	\$11,700	\$11,700	\$7,800	\$0	\$0	\$0	\$0
F&W Mitigation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Engineering and Design	\$51,600	\$79,600	\$252,000	\$204,300	\$104,800	\$157,200	\$330,000	\$390,000
Construction Management	\$25,800	\$42,300	\$126,000	\$99,700	\$52,400	\$78,600	\$272,000	\$325,000
Contingency	\$123,300	\$187,500	\$594,500	\$474,400	\$242,800	\$367,700	\$311,000	\$404,000
<b>Total First Cost</b>	<b>\$716,000</b>	<b>\$1,039,000</b>	<b>\$3,097,000</b>	<b>\$2,449,000</b>	<b>\$1,288,000</b>	<b>\$1,931,000</b>	<b>\$2,900,000</b>	<b>\$3,500,000</b>
LERRD's	\$31,700	\$36,700	\$36,700	\$17,800	\$15,000	\$18,000	\$95,000	\$100,000
<b>Annual Benefits</b>	\$121,200	\$139,700	\$147,600	\$419,700	\$599,200	\$677,800	\$723,000	\$752,600
<b>Annual Costs</b>	\$42,000	\$60,000	\$180,000	\$142,000	\$75,000	\$112,000	\$168,000	\$203,000
<b>Net Benefits</b>	<b>\$79,200</b>	<b>\$79,700</b>	<b>-\$32,400</b>	<b>\$277,700</b>	<b>\$524,200</b>	<b>\$565,800</b>	<b>\$555,000</b>	<b>\$549,600</b>
<b>BCR</b>	2.9	2.3	0.8	3.0	8.0	6.1	4.3	3.7

The final array of alternatives for the Onion Creek component consisted of a floodplain evacuation in the Timber Creek reach; a diversion and two levels of floodplain evacuation in combination with recreation and ecosystem restoration for Onion Creek Forest/Yarrabee Bend reach; a floodplain evacuation in combination with ecosystem restoration for Bear-Onion Confluence; and three options for Williamson Creek. The Williamson Creek options consisted of a non-structural floodplain evacuation in combination with ecosystem restoration, and two structural plans, both which utilize a one-sided, benched channel modification concept to increase channel conveyance which minimizing environmental impacts. One of the structural plans adds ecosystem restoration and recreation features to form a complete, multi-objective plan.

The final array for Wharton consists of channel modifications, levees at varying heights, and numerous drainage facilities throughout the city.

### **Comparison of Alternatives**

A scan of the final array of alternatives for Onion Creek provided in Table M-1 reveals that there are choices to be made in only two of the four areas within the Onion Creek component of the project. Both the Timber Creek area and the Bear/Onion Confluence area were left with only a non-structural floodplain evacuation and/or Combined Plan (with recreation and/or ecosystem restoration) as a potential option to the no action alternative.

For Onion Creek Forest/Yarrabee Bend, one of the non-structural options can be eliminated from consideration because it was not economically feasible. The structural alternative was by far the least expensive. However, this alternative provided only \$0.52 million in annual monetary benefits, and would leave an unacceptable amount of residual damages. Finally, the smaller non-structural plan, known as Non-structural Combined Plan, would provide \$3.89 million in annual monetary benefits. This alternative also had the highest net benefits, \$1.0 million, and an overall benefit to cost ratio of 1.7. In addition, this plan would provide over 73 average annual habitat units, at an average cost of \$2,900 per unit.

The Williamson Creek was left with three options. The non-structural Combined Plan would have the highest first cost of over \$13 million, but the lowest net annual monetary benefits. The flood damage reduction only plan would have the lowest first cost of \$2 million, annual net benefits of \$0.32 million, and a benefit to cost ratio of 3.3. The third option, a structural plan combined with ecosystem restoration and recreation, would have a first cost of \$5.5 million, annual net benefits of \$0.47 million, with a benefit to cost ratio of 3.8. In addition, the structural combined plan would provide 42 average annual habitat units, at an average of \$3,800 per unit.

The array of final alternatives for the Williamson Creek area underscored the trade-offs associated with this segment in particular. Comparison of the flood damage reduction only option with the more comprehensive plan would suggest the combined plan as an obvious choice. However, the citizens of the neighborhood are extremely protective of property rights, and would much rather retain as much ownership and privacy as possible. Proposing the procurement of additional, adjacent lands for ecosystem restoration purposes is contrary the views of many residents of the neighborhood. In summary, it results in a trade off of increased ecosystem and recreation outputs versus property rights and privacy.

Although the Wharton area is considered as one component, the array of final alternatives can be broken down into six specific areas, from which options can be selected to form a complete flood damage reduction system. There are two levee areas, a channel modification area, and three additional diversion drainage components.

## Key Assumptions

Planning assumptions made during the course of the feasibility analysis did not vary appreciably from other studies of similar type and magnitude. From a hydrologic perspective, the baseline (year 2010) and future without project hydrologic conditions for Onion Creek was considered to be sufficiently similar such that existing hydrologic conditions were used throughout the formulation process. Baseline and future without project hydrologic conditions, however, were both utilized for more precise computation of benefits for the Recommended Plan. For Wharton, since most of the hydrology is linked to the 40,000 square mile Colorado River basin, the hydrologic conditions were assumed to remain constant throughout the period of analysis.

From an environmental perspective, the ecosystem of the Onion Creek watershed was assumed to continue to decline at rates proportional to the anticipated urban growth of southern Austin and Travis County. Realization of the continued stress placed on the watershed ecosystem, especially the northern tributaries such as Williamson Creek, was an important in terms of trade offs and ultimate plan selection.

In addition to participating with the Corps for a solution to solve the water resource problems in the Onion Creek Forest area, the City of Austin actively pursued funding under FEMA's Hazard Mitigation Grant Program (HMGP), being administered by the State of Texas Division of Emergency Management. The application was approved on 16 June 2006, for an amount up to \$6,255,823, for purchase of up to 118 selected homes in the Onion Creek Forest area. These buyouts are to be performed only on a willing seller basis, and must be completed by 16 June 2008. This HMGP program is cost-shared at the rate of 75% Federal and 25% non-Federal. The Corps estimates that not all of the selected homes could be purchased under this grant program. The exact number will not be known until the program expires. However, this action would reduce the Corps' project by an unknown amount. It may also result in some modifications to the recreation plan features. Further, the City of Austin would receive no credit for the lands purchased under the HMGP grant program toward its share of the Corps project. Implementation of the Corps project (i.e., execution of a Project Cooperation Agreement) for the Onion Creek/Yarrabee Bend project area would not be undertaken until the HMGP program is completed in June 2008. For purposes of this evaluation, it was assumed that: 1) Due to the uncertainty, costs would need to be included, and 2) a worst case scenario for determination of the project benefit-cost ratio should be used for the final plan evaluation. Finally, it was assumed that it would be allowable to utilize the lands that were vacated as a result of the HMGP program, for purposes of developing a regional park.

## Recommended Plan

The identification of the NED plan depends upon careful consideration of engineering, economic, social, and environmental factors. A brief synopsis of plan selection is provided below for each project area:

**Timber Creek:** The NED/NER Combined plan, consisting of the acquisition and removal of 81 residential structures and 90 parcels of land in the 4% ACE floodplain, in combination with recreation features and ecosystem restoration, was selected as part of the Recommended Plan. The plan would combine recreational features including 20 picnic shelters, 8 small group shelters, 1 large group shelter, 5,300 feet of unpaved trails and 1,200 feet of paved 10 foot wide trails, 2 basketball courts, one waterborne restroom, 12,000 square feet of parking, and the infrastructure associated with these facilities on 40 acres of land. The ecosystem restoration would include restoring riparian woodlands on an additional 16 acres.

**Onion Creek Forest/Yarrabee Bend:** The NED/NER Combined Plan was selected as the Recommended Plan. The plan consists of acquisition and removal of 410 residential structures located in the 4% ACE floodplain, in combination with recreation features and ecosystem

restoration. Recreational features include 32 picnic shelters, 32 small group shelters, 1 large group shelter, 7,860 feet of unpaved trails and 9,680 feet of paved 10 foot wide trails (including 1 footbridge), 7,400 feet of equestrian trails, 4 basketball courts, 2 tennis courts, 19 volleyball courts, one waterborne restroom, 20,000 square feet of parking, and the infrastructure associated with these facilities. The Recommended Plan would result in a 100-acre park. The highest economic net benefits and high project performance, together with the increase in ecosystem habitat units and the plan's ability to most closely meet the planning objectives were the primary reasons for selection. Approximately 190 additional acres would be restored to riparian woodlands.

**Williamson Creek:** The NED plan included the creation of a vegetated channel bench on one side of the creek. The bench would be segmented, with a total length of 8,500 feet. The bench would be placed in strategic areas requiring additional channel conveyance. The Plan also included acquisition of 114 acres, which would be restored to riparian woodlands, and the construction of a low density hiking trail. After carefully considering the trade offs, and following extensive public involvement, the structural combined plan, with modifications, was identified as part of the Tentatively Selected Plan. The modifications included the elimination of the low density hiking trail included in the Structural Combined Plan, as well as elimination of a portion of the ecosystem restoration in the Broken Bow and Bayton Loop reaches. The selection was viewed as a compromise by all the stakeholders. However, during the review of the draft feasibility report, a potential policy issue regarding the cost of restoration lands in highly urbanized areas was identified. After consultation with the local sponsors, it was concluded that any decision on Williamson Creek would be deferred. This will allow for the Corps' evolving policies concerning ecosystem restoration in highly urbanized areas to mature, and perhaps for the project team to reformulate the plan to more closely adhere to policy.

**Bear/Onion Confluence:** Subsequent to the formulation process, an update to both costs and benefits of the plan was performed. Increases in real estate values were the primary factor in making the determination that the non-structural combined plan for Bear/Onion Confluence was no longer cost effective. Thus, the No Action alternative was selected for the Bear/Onion Confluence.

**Wharton:** The NED plan was selected as the Recommended Plan. The plan includes approximately 20,300 feet of levees (5 feet average height) and 1900 feet of floodwalls (4 feet average height) along the Colorado River, 6600 feet of levees (3 feet average height), 380 feet of floodwalls, and 7000 feet of channel modification (3 feet average height) along Baughman Slough, and three significant features to facilitate the drainage of Caney Creek. Some refinements of the plan were incorporated into the Recommended Plan, with the most significant being the incorporation of additional interior drainage facilities to adequately address any ponding issues resulting from implementation of the levee system. The plan would effectively remove the vast majority of the city of Wharton from the designated 1% chance floodplain.

## Systems/Watershed Context

The Lower Colorado River Authority (LCRA), the primary non-Federal sponsor, has a primary mission statement “..to provide reliable, low-cost utility and public services in partnership with our customers and communities and to use our leadership and environmental authority to ensure protection and constructive use of the area’s natural resources.” This mission, along with the floodplain management mission of the LCRA, was the impetus for a holistic watershed modeling effort to more accurately determine water related resource problems and needs. Therefore, the Lower Colorado River Basinwide Study was initiated. The LCRA also planned to use this information to more accurately manage the water resources within the basin in terms of balancing flood damage reduction and water supply needs. The *Lower Colorado River Basinwide Information Paper, October 2003* addressed the problems and opportunities in the basin. The report identified five areas that have historical reoccurring flood damages throughout the lower Colorado River basin. These areas included the Highland Lakes, Shoal Creek, Walnut Creek, Onion Creek, and city of Wharton. To foster the movement to approach the water resource needs on a holistic scale, the Texas Colorado River Floodplain Coalition was formed consisting of local, county and state organizations and officials so that the group could represent the basin on a united front. The unity of this group has led to a watershed approach to solve a wide array of problems, ranging from development of new FEMA floodplain maps to flood damage reduction studies. Removing structures from the floodplain as a result of the proposed project and restoring the area to a more natural historical state, or adding facilities that are more conducive to floodplain uses, fits within that mission statement and the Lower Colorado River Authorities Water Management Plan.

The Recommended Plan also integrates into the city of Austin’s Watershed Management Plans by reducing flood damages and restoring environmental integrity to the city’s waterways. The city of Austin’s Watershed Protection Development Review Department’s mission is to “protect lives, property and the environment by providing development review and inspection services and reducing the impact of flood, erosion, and water pollution.” The Recommended Plan integrates well with this mission. In addition, the ecosystem restoration features of the Onion Creek component of the proposed project will restore aquatic integrity and a more natural functioning aquatic system, especially in the buyout areas.

Although the project had no formal cooperating agencies, the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service were heavily involved throughout the planning process. The two agencies cooperated in field surveys, habitat assessments, feasibility scoping meetings, public meetings and a few regular monthly planning meetings.

## Environmental Operating Principles

The U.S. Army Corps of Engineers reviews water resource developments holistically as an entire watershed/system/basin approach. The list of adopted Environmental Operating Principles includes the following items, among others:

- Contribute to environmental sustainability as defined in Environmental Operating Principles by formulating Combined NED/NER plans
- Strive to achieve environmental sustainability
- Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

The primary objective of the entire Lower Colorado River basin study is to reduce flood damage to residents and visitors. In the process of examining the entire basin, there are five areas have currently been identified where there is likely a high potential for Federal participation in the reduction of the level and frequency of flood losses. Currently, two portions of the basin



have been studied in sufficient detail to be able to recommend potential plans for implementation. These specific areas, namely Wharton and the Onion Creek Watershed, have been combined to ensure that their cumulative impacts, both positive and negative, are reviewed holistically and comprehensively.

### **Independent Technical Review**

The Independent Technical Review (ITR) was conducted by two separate review teams, each focusing on one of the components of the project.

The Corps' Louisville District was primarily responsible for ITR of the Alternative Formulation Briefing Package, as well as the Draft Report for the Onion Creek component of the project. The Draft Report version of the ITR team also included reviewers from the Tulsa and Los Angeles Districts. The team consisted of a diverse group of professionals with varied disciplines. Comments were documented using the Corps' Dr. Checks tracking program, and all technical comments were resolved and closed. The most substantive comments received for the Onion Creek portion of the study included a lack of consistency between the document and appendix in terms of costs and benefits. The District corrected the inconsistencies and ensured the information correlated in both the document and the appendix.

Similarly, the Corps' Tulsa District conducted both major ITR's for the Wharton Component. All reviewers were located in the Tulsa District. All comments were properly resolved and closed. No major technical issues were identified.

### **EXPECTED PROJECT PERFORMANCE**

The flood damage reduction measures within the Timber Creek segment of the Onion Creek watershed would remove approximately 81 residential structures from the 4 percent annual chance of exceedence (25-year) floodplain. The removal of these properties and the reuse of the land for recreation and ecosystem restoration would result in estimated equivalent annual benefits of \$850,000, and net annual benefits of \$330,000 with a benefit to cost ratio 1.6.

The flood damage reduction measures within the Onion Creek Forest/Yarrabee Bend segment would remove approximately 410 residential structures from the 4 percent annual chance of exceedence (25-year) floodplain. The removal of these properties and the reuse of the land for recreation and ecosystem restoration would result in estimated equivalent annual benefits of \$5,160,000 and net annual benefits of \$1,630,000 with a benefit to cost ratio of 1.5.

Equivalent annual benefits for the recommended flood damage reduction project in Wharton are estimated at \$3,640,000. This results in equivalent annual net benefits of \$1,960,000, and a benefit-to-cost ratio of 2.2. Most of the City of Wharton would be removed from the FEMA 100-year floodplain, where the expected annual flood damages in the Wharton area would be reduced by 65 percent

### **Project Costs**

All project costs are presented first in terms of the total project, and then segregated into the Onion Creek and Wharton components. Total Costs are presented in Table M-3, while Onion Creek and Wharton costs are shown in Tables M-4 and M-5, respectively.

<b>Table M-3</b> <b>Project First Costs</b> <b>TOTAL RECOMMENDED PLAN</b> <b>Lower Colorado River, Phase 1, Texas</b> (August 2006 Prices, 5.125%, 50 year period of analysis)	
Project Costs	First Cost
<b>Flood Damage Reduction</b>	
Lands and Damages	\$48,394,000
Relocation Assistance	\$12,905,000
Relocation (bridge)	\$785,000
Construction	\$17,220,000
Construction(mitigation)	\$612,000
HTRW	\$499,000
Preconstruction, Engineering and Design	\$1,853,000
Construction Management	\$963,000
Construction Contingency	\$5,000,000
Santa Fe Ditch (by City, Sec 104)	\$2,900,000
Real Estate Contingency	\$8,820,000
<b>Total Flood Damage Reduction</b>	<b>\$99,951,000</b>
<b>Recreation</b>	
Construction	\$3,811,000
Preconstruction, Engineering and Design	\$400,000
Construction Management	\$279,000
Construction Contingency	\$1,122,000
<b>Total Recreation</b>	<b>\$5,612,000</b>
<b>Ecosystem Restoration</b>	
Construction	\$1,608,000
Lands	\$1,864,000
Preconstruction, Engineering and Design	\$120,000
Construction Management	\$82,000
Construction Contingency	\$452,000
Real Estate Contingency	\$340,000
Adaptive Management	\$146,000
<b>Total Ecosystem Restoration</b>	<b>\$4,592,000</b>
<b>Total Recommended Plan Summary</b>	
<b>Project First Cost</b>	<b>\$110,155,000</b>

<b>Table M-4 Economic Summary Onion Creek Component</b> (August 2006 Prices, 5.125%, 50 year period of analysis)	
<b>Project Costs</b>	<b>First Cost</b>
<b>Flood Damage Reduction</b>	
Lands and Damages	\$44,584,000
Relocation Assistance	\$12,893,000
Construction	\$3,793,000
HTRW	\$499,000
Preconstruction, Engineering and Design	\$703,000
Construction Management	\$220,000
Construction Contingency	\$1,304,000
Real Estate Contingency	\$8,526,000
<b>Total Flood Damage Reduction</b>	<b>\$72,522,000</b>
<b>Recreation</b>	
Construction	\$3,811,000
Preconstruction, Engineering and Design	\$400,000
Construction Management	\$279,000
Construction Contingency	\$1,122,000
<b>Total Recreation</b>	<b>\$5,612,000</b>
<b>Ecosystem Restoration</b>	
Construction	\$1,608,000
Lands	\$1,864,000
Preconstruction, Engineering and Design	\$120,000
Construction Management	\$82,000
Construction Contingency	\$452,000
Real Estate Contingency	\$340,000
Adaptive Management	\$146,000
<b>Total Ecosystem Restoration</b>	<b>\$4,592,000</b>
<b>Total Recommended Plan Summary</b>	
<b>Project First Cost</b>	<b>\$82,726,000</b>

<b>Table M-5 Project Cost Summary Wharton Component</b> (August 2006 Prices, 5.125%, 50 year period of analysis)	
<b>Project Costs</b>	<b>First Cost</b>
<b>Flood Damage Reduction</b>	
Lands and Damages	\$4,103,000
Relocation Assistance	13,000
Relocations	\$785,000
Fish and Wildlife Mitigation	\$765,000
Channels and Canals	\$1,354,000
Levees and Floodwalls	\$15,430,000
Preconstruction, Engineering, Design	\$1,150,000
Construction Management	\$929,000
Total without Santa Fe Ditch	\$24,529,000
Santa Fe Ditch (as per Sec 104)	\$2,900,000
<b>Total Project Cost</b>	<b>\$27,429,000</b>

#### Equivalent Annual Costs and Benefits

Table M-6 and M-7 provide the Equivalent Annual Benefits and Costs associated with the monetary evaluation (FDR and Recreation, excluding Relocation Assistance) for the Onion Creek and Wharton components of the project. Table M-8 contains the annualized values associated with the ecosystem restoration components contained in the Onion Creek portion. No ecosystem restoration components are included in the Wharton component.

<b>Table M-6 Lower Colorado River Phase I, Texas Equivalent Annual Benefits and Costs Onion Creek Component Flood Damage Reduction and Recreation Portion</b>	
<b>Description</b>	<b>Value</b>
<b>Total Project First Cost</b>	<b>\$82,726,000</b>
<b>Project Cost Allocated to FDR and Recreation (excluding relocation assistance)</b>	<b>\$65,241,000</b>
<b>Interest During Construction</b>	<b>\$2,928,000</b>
<b>Total Investment</b>	<b>\$68,499,000</b>
<b>Annual Costs</b>	
Interest and Amortization	\$3,825,000
OMRR&R	\$225,000
Total Annual Costs	\$4,050,000
<b>Annual Benefits</b>	
Flood Damage Reduction	\$2,767,000
Municipal and Insurance Reduction	\$185,000
Recreation	\$3,062,000
Total Annual Benefits	\$6,014,000
<b>Net Annual Benefits</b>	<b>\$1,964,000</b>
<b>Benefit-to-Cost Ratio</b>	<b>1.5</b>

<b>Table M-7</b> <b>Lower Colorado River Phase I, Texas</b> <b>Equivalent Annual Benefits and Costs</b> <b>Wharton Component</b>	
Description	Value
<b>Total Project First Cost</b>	<b>\$27,429,000</b>
<b>Project Cost Allocated to Flood Reduction (excluding relocation assistance)</b>	<b>\$27,416,000</b>
<b>Interest During Construction</b>	<b>\$1,746,000</b>
<b>Total Investment</b>	<b>\$29,162,000</b>
Annual Costs	
Interest and Amortization	\$1,628,000
OMRR&R	\$50,000
<b>Total Annual Costs</b>	<b>\$1,678,000</b>
Annual Benefits	
Flood Damage Reduction	\$3,642,000
<b>Net Annual Benefits</b>	<b>\$1,964,000</b>
<b>Benefit-to-Cost Ratio</b>	<b>2.2</b>

<b>Table M-8</b> <b>Lower Colorado River Phase I, Texas</b> <b>Equivalent Annual Benefits and Costs</b> <b>Ecosystem Restoration Portion</b> (August 2006 Prices, 5.125%, 50-year Period of Analysis)			
Costs	Timber Creek	OCF/YB	Total
Costs			
First Cost	\$325,000	\$4,267,000	\$4,592,000
Interest During Construction	\$8,000	\$108,000	\$116,000
<b>Total Investment</b>	<b>\$333,000</b>	<b>\$4,375,000</b>	<b>\$4,708,000</b>
Annualized First Cost	\$19,000	\$244,000	\$263,000
Annual O&M	\$3,000	\$45,000	\$48,000
<b>Average Annual Cost (AAC)</b>	<b>\$22,000</b>	<b>\$289,000</b>	<b>\$311,000</b>
Benefits			
AAHU	<b>5.86</b>	<b>56.76</b>	<b>62.62</b>
Summary			
<b>Annual Cost/AAHU</b>	<b>\$3,800</b>	<b>\$5,100</b>	<b>\$5,000</b>
<b>Cost per Acre</b>	<b>\$21,000</b>	<b>\$23,000</b>	<b>\$23,000</b>

### Cost Sharing

Cost apportionments are shown for the Recommended Plan, broken down by the Onion Creek and Wharton components of the project. The Onion Creek component is further segregated into two separable elements: Timber Creek and Onion Creek/Yarrabee Bend. It is highly likely that Project Cooperation Agreements would be negotiated and executed for each element. The cost apportionments are provided in Tables M-9 through M-11.

<b>Table M-9</b> <b>Cost Apportionment for the Recommended Plan</b> <b>Onion Creek Component, Timber Creek Segment</b> August 2006 Prices			
<i>Feature</i>	<i>Federal</i>	<i>Non-Federal</i>	<i>Total</i>
<b><i>Flood Damage Reduction</i></b>			
Lands, Structures		\$5,182,000	\$5,182,000
Relocation Assistance		\$1,823,000	\$1,823,000
Demolition, Removal	\$544,000	\$0	\$544,000
Preconstruction, Engineering & Design	\$143,000	\$0	\$143,000
Construction Management	\$33,000	\$0	\$33,000
Contingency	\$180,000	\$0	\$180,000
RE Contingency		\$965,000	\$965,000
Unadjusted total	\$900,000	\$7,970,000	\$8,870,000
<b>Adjustment to achieve 65/35</b>	<b>\$4,866,000</b>	<b>-\$4,866,000</b>	
<b>Subtotal FDR</b>	<b>\$5,766,000</b>	<b>\$3,104,000</b>	<b>\$8,870,000</b>
<b><i>Recreation</i></b>			
Recreation Facilities			
Fed Cost Shared	\$476,000	\$476,000	\$952,000
100% Local Sponsor Cost	\$0	\$104,000	\$104,000
Preconstruction, Engineering & Design	\$37,500	\$37,500	\$75,000
Construction Management	\$65,000	\$65,000	\$130,000
Contingency	\$144,500	\$144,500	\$289,000
<b>Subtotal Recreation</b>	<b>\$723,000</b>	<b>\$827,000</b>	<b>\$1,550,000</b>
<b><i>Ecosystem Restoration</i></b>			
Restoration Facilities (excluding lands)	\$129,000		\$129,000
Lands		\$83,000	\$83,000
Preconstruction, Engineering & Design	\$40,000		\$40,000
Construction Management	\$8,000		\$8,000
Contingency	\$44,000		\$44,000
RE Contingency		\$15,000	\$15,000
Adaptive Management	\$6,000		\$6,000
Unadjusted Total	\$227,000	\$98,000	\$325,000
Adjustment to achieve 65/35	-\$16,000	\$16,000	
<b>Subtotal ER</b>	<b>\$211,000</b>	<b>\$114,000</b>	<b>\$325,000</b>
<b>Total Cost Apportionment</b>	<b>\$6,700,000</b>	<b>\$4,045,000</b>	<b>\$10,745,000</b>
<b>Cost Percentage</b>	<b>62.4%</b>	<b>37.6%</b>	<b>100%</b>

<b>Table M-10</b>			
<b>Cost Apportionment for the Recommended Plan</b>			
<b>Onion Creek Component, Onion Creek Forest/Yarrabee Bend Segment</b>			
August 2006 Prices			
<i>Feature</i>	<i>Federal</i>	<i>Non-Federal</i>	<i>Total</i>
<b>Flood Damage Reduction</b>			
Lands, Structures		\$39,402,000	\$39,402,000
Relocation Assistance		\$11,070,000	\$11,070,000
Demolition, Removal	\$3,249,000		\$3,249,000
HTRW	\$499,000		\$499,000
Preconstruction, Engineering & Design	\$560,000		\$560,000
Construction Management	\$187,000		\$187,000
Contingency	\$1,124,000		\$1,124,000
RE Contingency		\$7,561,000	\$7,561,000
Unadjusted total	\$5,619,000	\$58,033,000	\$63,652,000
<b>Adjustment to achieve 65/35</b>	\$35,755,000	-\$35,755,000	
<b>Subtotal FDR</b>	<b>\$41,374,000</b>	<b>\$22,278,000</b>	<b>\$63,652,000</b>
<b>Recreation</b>			
Recreation Facilities			
Fed Cost Shared	\$1,251,000	\$1,251,000	\$2,502,000
100% Local Sponsor Cost	\$0	\$288,000	\$288,000
Preconstruction, Engineering & Design	\$143,000	\$177,000	\$320,000
Construction Management	\$63,000	\$77,000	\$140,000
Contingency	\$364,000	\$448,000	\$812,000
<b>Subtotal Recreation</b>	<b>\$1,821,000</b>	<b>\$2,241,000</b>	<b>\$4,062,000</b>
<b>Ecosystem Restoration</b>			
Restoration Facilities(excluding lands)	\$1,479,000		\$1,479,000
Lands		\$1,781,000	\$1,781,000
Preconstruction, Engineering & Design	\$80,000		\$80,000
Construction Management	\$74,000		\$74,000
Contingency	\$408,000		\$408,000
RE Contingency		\$325,000	\$325,000
Adaptive Management	\$120,000		\$120,000
Unadjusted Total	\$2,161,000	\$2,106,000	\$4,267,000
Adjustment to achieve 65/35	\$613,000	-\$613,000	
<b>Subtotal ER</b>	<b>\$2,774,000</b>	<b>\$1,493,000</b>	<b>\$4,267,000</b>
<b>Total Cost Apportionment</b>	<b>\$45,969,000</b>	<b>\$26,012,000</b>	<b>\$71,981,000</b>
<b>Cost Percentage</b>	<b>63.9%</b>	<b>36.1%</b>	<b>100%</b>

<b>Table M-11 Cost Apportionment for the Recommended Plan Wharton Component August 2006 Prices</b>			
<i>Feature</i>	<i>Federal</i>	<i>Non-Federal</i>	<i>Total</i>
Lands and Damages		\$4,116,000	\$4,116,000
Relocations		\$785,000	\$785,000
Fish and Wildlife Mitigation	\$765,000		\$765,000
Channels and Canals	\$1,354,000		\$1,354,000
Levees and Floodwalls	\$15,430,000		\$15,430,000
Preconstruction, Engineering, Design	\$1,093,000	\$57,000	\$1,150,000
Construction Management	\$929,000		\$929,000
Santa Fe Ditch (by City, Sec 104)		\$2,900,000	\$2,900,000
Subtotal	\$19,571,000	\$7,858,000	\$27,429,000
5% Cash by Non-Fed Sponsor	-\$1,371,000	\$1,371,000	
Additional cash for 35% minimum	-\$371,000	\$371,000	
<b>Total Cost Apportionment</b>	<b>\$17,829,000</b>	<b>\$9,600,000</b>	<b>\$27,429,000</b>

### Project Implementation

Currently, the Lower Colorado River Authority (LCRA) is acting as the official non-Federal sponsor for the project. It is envisioned that LCRA will continue to act as the primary sponsor as the project enters into the Preconstruction Engineering and Design Phase. Similar to the Feasibility Phase, LCRA may, in turn, enter into Interlocal agreements with the City of Austin, City of Wharton, and Travis County.

An implementation schedule for the project has been developed, assuming unrestricted availability of Federal and local funds, and is shown in Table M-12.

<b>Table M-12 Project Implementation Schedule</b>			
<i>Milestone</i>	<i>Wharton</i>	<i>Timber Creek</i>	<i>Onion Creek Forest Yarrabee Bend</i>
Initiate PED	Jan-07	Jan-07	Jan-07
Execute PCA	Oct-08	Jan-08	Jun-08
Complete Initial DDR	Dec-07	Jun-07	Oct-07
Acquire Real Estate	Aug-09	Oct-08	Aug-09
Demolition by IDIQ	N/A	Jan-09	Sep-10
Advertise Contract 1	Jan-10	Feb-09	Oct-11
Award Contract 1	Mar-10	Mar-09	Dec-11
Complete Contract 1	Sep-11	Dec-09	Jun-13
Advertise Contract 2	Nov-11	N/A	N/A
Award Contract 2	Jan-12	N/A	N/A
Complete Contract 2	Sep-13	N/A	N/A
Complete Monitoring	Sep-16	Sep-12	Sep-17
Project Closeout	Sep-16	Sep-12	Sep-17



As implementation proceeds, adjustments to the schedule will be made, based on availability of funds. Additionally, Table M-13 provides a breakdown of Federal and Non-Federal funding requirements in order to maintain the ideal schedule. Requirements are shown by Fiscal Year through 2013, and by project component. Please note that the adaptive management and monitoring for Yarrabee Bend occurs in years 2014-2017, with estimated expenditures of \$50,000, \$50,000 \$10,000 and \$10,000 respectively.

<b>Table M-13</b>								
<b>Estimated Schedule of Federal and Non-Federal Expenditures</b>								
<b>By Fiscal Year, in thousand \$</b>								
	<b>Total</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>FEDERAL</b>								
Wharton								
PED	\$863	\$200	\$331	\$332				
Construction Ph 1	\$9,045				\$4,000	\$5,045		
Construction Ph 2	\$7,694						\$3,451	\$4,243
Timber Creek								
PED	\$197	\$150	\$47					
Demolition Contract	\$757		\$344	\$413				
Recreation Contract	\$1,475			\$1,475				
Land Acquisition	\$4,265		\$4,265					
Adaptive Management	\$6				\$2	\$2	\$2	
Yarrabee Bend/OC Forest								
PED	\$720	\$150	\$285	\$285				
Demolition Contract	\$5,059			\$2,500	\$2,559			
Recreation Contract	\$5,703						\$3,000	\$2,703
Land Acquisition	\$34,127			\$11,368	\$22,759			
Adaptive Management	\$120							
<b>TOTAL FEDERAL</b>	<b>\$70,031</b>	<b>\$500</b>	<b>\$5,272</b>	<b>\$16,373</b>	<b>\$29,320</b>	<b>\$5,047</b>	<b>\$6,453</b>	<b>\$6,946</b>
<b>NON-FEDERAL</b>								
Wharton								
PED	\$288	\$88	\$100	\$100				
Cash	\$1,742				\$1,742			
Land Acquisition	\$4,115			\$4,115				
Relocations	\$782			\$782				
Timber Creek								
PED	\$66	\$66						
Land Acquisition	\$3,979		\$3,979					
Yarrabee								
PED	\$240	\$60	\$90	\$90				
Land Acquisition	\$26,012		\$7,380	\$18,632				
<b>TOTAL NON-FEDERAL</b>	<b>\$37,224</b>	<b>\$214</b>	<b>\$11,549</b>	<b>\$23,719</b>	<b>\$1,742</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

### **Monitoring and Adaptive Management**

ER 1105-2-100 allows for monitoring and adaptive management. Adaptive management for complex specifically authorized projects may be recommended. The cost of adaptive management is limited to 3 percent of the total project cost excluding monitoring costs. The Federal Government is responsible for monitoring and adaptive management.

### **Operation, Maintenance, Repair, Rehabilitation, And Replacement**

Potentially, the Federal Government will execute as many as four separate Project Cooperation Agreements with the City of Austin, City of Sunset Valley, City of Wharton, and Travis County. By execution of the PCA, the entities would accept the project following completion of construction and insure operation, maintenance, repair, rehabilitation and replacement (OMRRR), in accordance with Federal regulations. The major items involved would include: maintenance of benches, regular maintenance of park facilities, restriping access areas, debris cleanup, selective trimming in restoration and invasive species control, levee embankment mowing, management of the mitigation areas, and operation and maintenance of the inlet and outlet control structures pertaining to the sumps. An operation and maintenance manual would be prepared by the Corps after completion of the project, and periodic inspections would be conducted to ensure that all required maintenance was being performed.

### **Key Social and Environmental Factors**

No additional key social and environmental factors are identified over and above those factors already presented in previous sections. The Wharton component includes plantings to create replacement forest, shrub, and native prairie habitat, as well as replacement wetland habitat. No additional lands would be required, as proposed sump areas would serve a dual capacity. Maintenance of the mitigation areas would be a non-Federal responsibility, and a cost is included for this item.

### **Stakeholder Perspectives and Differences**

Coordination was undertaken with the U.S. Fish and Wildlife Service, the Texas State Historic Preservation Officer, Texas Parks and Wildlife Department, the Barton Springs/Edwards Aquifer Conservation District, and numerous other State and local agencies.

The Texas Water Development Board was heavily involved with this study, and in fact provided grant funds equal to 50% of the non-Federal share. Their involvement included monthly participation in the project management meetings.

The study team worked closely together over a four-year period in an effort to inform and involve the concerned citizens in the study areas. The team did this by holding various public workshops and by maintaining a project website, <http://www.fdep.org>, that was updated monthly. The public involvement team included members from Corps, the City of Wharton and Austin, and LCRA. Jones and Carter, the City of Wharton's Engineering firm, was involved with all of the public involvement as well. In addition to the public meetings, the project sponsors hold monthly business meetings, which are open to the public. These meetings are either held in Austin or Wharton, but are open to the public.

The draft report underwent a 30-day public review period. A Notice of Availability was sent to the PEIS mailing list, as well as a local mailing list provided by the city of Wharton. In addition, a notice was published in the local paper advising the general public of the availability of the draft report.