LOWER COLORADO RIVER BASIN PHASE I, TEXAS

Interim Feasibility Report and Integrated Environmental Assessment - Final

Revised Final

Fort Worth District - December 2006

Lower Colorado River Basin, Phase I, Texas
Interim Feasibility Report
and Integrated Environmental Assessment

Volume III, Wharton

REVISED FINAL

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Lower Colorado River Basin, Phase I, Texas
Draft Interim Feasibility Report and Integrated Environmental Assessment

Volume III, Wharton

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Note: This report includes an integrated environmental assessment (EA) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk (*) in the Table of Contents.

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CHAPTER 1
INTRODUCTION

This volume of the Lower Colorado River Basin, Phase I, Texas, Interim Feasibility Study and Integrated Environmental Assessment documents the feasibility studies undertaken to determine a recommended plan for addressing water resource related problems and needs in the vicinity of Wharton, Texas.

STUDY AUTHORITY

Authorities for conducting studies within the Colorado River Basin of Texas have been in place since the mid-1930's. Despite being somewhat aged, they have remained active throughout the years, and remain valid today for studies in or near Wharton, Texas. The applicable Congressional Study Authorization is shown 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."*

STUDY PURPOSE

The primary purpose of the Wharton Interim Feasibility Study (WIFS) is to investigate the water-resource problems, needs, and opportunities within the City of Wharton, Texas and associated Colorado River and San Bernard River Watersheds. Efforts during Phase I of the study focused on evaluating the existing conditions, identification of problems and needs, and identifying preliminary alternative measures to minimize existing and future flood losses. The WIFS also evaluated preliminary alternative measures and study areas for possible protection and restoration of ecosystem integrity.

Phase I of the study specifically evaluated historical and recent flooding caused by localized storm events, Colorado River flood events, and overflow and backwater impacts from the Colorado River on Caney Creek, Baughman Slough, and Peach Creek. Since Baughman Slough and Peach Creek are in close proximity to the City of Wharton and are influenced by overflow from the Colorado River, these tributaries of the San Bernard River Watershed were also included in the WIFS. These areas of interest will be thoroughly described in the Existing Conditions section of the report.

STUDY PARTICIPANTS AND COORDINATION

The WIFS is being conducted by the U.S. Army Corps of Engineers (Corps), in cooperation with the Lower Colorado River Authority (LCRA) as the official non-Federal sponsor. In addition, an Interlocal agreement exists between the LCRA and the City of Wharton, who is the primary local proponent. A major project supporter is the Texas Water Development Board (TWDB). The TWDB has provided financial support to the non-Federal sponsor in the amount of 50% of the local sponsor's required contribution for the feasibility study efforts. This allowed the LCRA and the City to participate in the study without it being such a financial burden. This partnership with the TWDB and the local sponsor has extremely valuable.

Additionally, there has been coordination with the U.S. Fish and Wildlife Service (USFWS), the Texas State Historic Preservation Officer (SHPO), Texas Parks and Wildlife Department (TPWD), and numerous other State and local agencies.

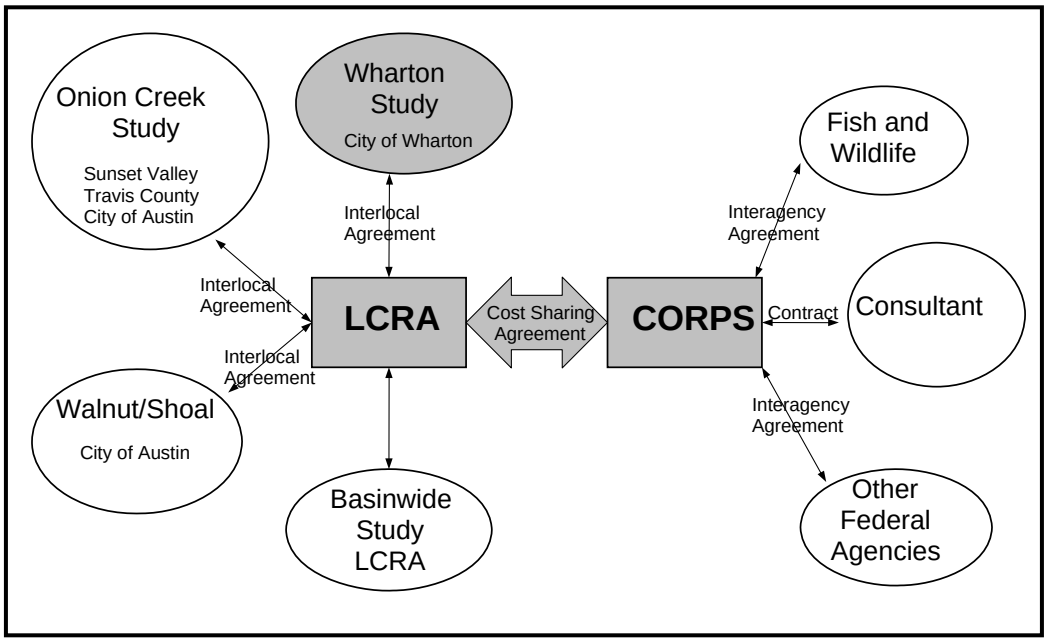
The USFWS was an active participant, and accompanied Corps environmental personnel on numerous site visits to the study area. While no major resources were specifically identified, it was noted that the Peach Creek corridor has remained relatively undisturbed, and any alternatives directly impacting the banks of Peach Creek would require special attention.

The WIFS is one of several interim studies being conducted as part of an overall Lower Colorado River Basinwide Initiative. Similar interim studies are also underway for Onion Creek, Lake Austin, and the entire Lower Colorado River Basin.

Figure 1-1 graphically depicts the entire study structure. The LCRA, the official non-Federal sponsor for Lower Colorado Basinwide Studies, has entered into a 50/50 cost sharing agreement with the Corps. The LCRA, in turn, has entered into numerous interlocal agreements. For purposes of Phase I of the WIFS, the City of Wharton provided cash and/or in-kind services, with LCRA acting as the focal point for all activities.

Throughout the course of this study, public workshops and Wharton City Council briefings have been conducted in order to keep City officials and interested citizens abreast of the study progress. Input from the public has been solicited at each meeting. In addition, an internet web site, http://www.fdep.org, was established to easily share information to the public for all the Lower Colorado River Basin studies.

Figure 1-1
Lower Colorado River Basin Study Structure



STUDY AREA AND SCOPE

The proposed study area is located within Wharton County, Texas including the City of Wharton. 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. The geographic relationship between Wharton County, which contains the study area for WIFS, and the rest of the Lower Colorado River basin, is depicted in Figure 1-2.

More specifically the study area is defined as the area within the left bank floodplain of the Colorado River between the community of Glen Flora and the downstream city limits of the City of Wharton. (Figure 1-3). This includes the area subject to overflow from the Colorado River into Caney Creek, Baughman Slough, and Peach Creek. The close proximity of Peach Creek and Baughman Slough, which are in the San Bernard River Watershed, to the Colorado River and Caney Creek make them susceptible to flood event overflows from the Colorado River. Therefore, Baughman Slough and Peach Creek above the confluence with Baughman Slough are included in this study, due to their close proximity to the city of Wharton and the influence of the Colorado River on them during a flood event.

Residences and other various urban structures have been built within the 100-year flood plain of the Colorado River, often experiencing substantial damages during flooding events, sometimes in excess of millions of dollars. Within the city of Wharton there are approximately 1100 structures in the 25-year flood plain, over 1600 in the 50-year flood plain, and more than 2100 in the 100-year flood plain. The areas surrounding the city of Wharton including Glen Flora contain over 200 structures in the 25-year flood plain, over 400 in the 50-year flood plain, and more than 600 in the 100-year flood plain.

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Figure 1-2. Lower Colorado River Basin

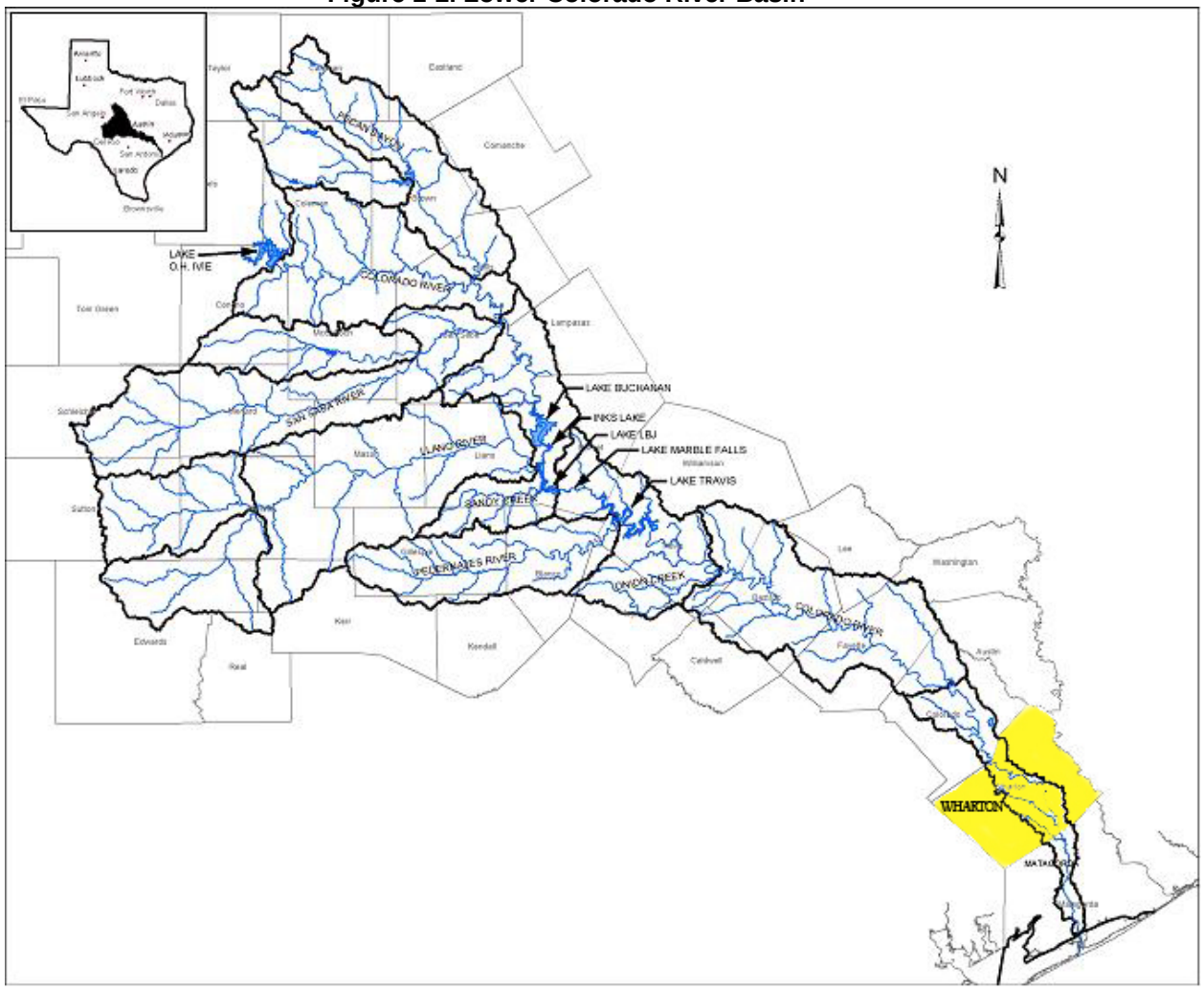

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Figure 1-3. Vicinity and Study Area Map for the Wharton Interim Feasibility Study

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In order to understand and address the flooding problems within the City of Wharton, the layout of the city with references to neighborhoods and points of interest are presented in Figure 1-4. The West End Neighborhood (1) has been severely impacted by Colorado River flooding in the past. The neighborhood is bounded by the Colorado River on the south, Farm-to-Market Road (FM) 102 to the north, U.S. Highway 59 to the west, and an abandoned railroad embankment to the east. A major horseshoe shaped bend in the Colorado River (2) further aggravates flooding problems in this low lying area. The straight line distance from Highway 59 through the West End neighborhood to the abandoned railroad is approximately 6,000 feet. However, almost 14,000 feet of Colorado River flows through this same reach.

East of the railroad and Business Highway 59 is downtown Wharton and the Riverside Park area (3). Downstream of downtown (southeast of Wharton) is the wastewater treatment plant (4). An outfall channel to the Colorado River (5) also exists in this area and drains a box culvert under Alabama Road. The inlet to the Alabama Box is a low-lying park area near Santa Fe Street and Alabama Road (6).

Northern Wharton includes the Ahldag subdivision (7). Two channels in the subdivision convey flow to the Alabama/Junior College Road ditch and into Baughman Slough. These channels have overflowed in the past, most often due to local rainfall independent of the Colorado River, and created problems for residents in the Ahldag neighborhood.

A U.S. Geological Service (USGS) gauging station is located in Wharton along the Colorado River (8). The gauge (ID# 08162000) is mounted on the Business Highway 59 Bridge, 1,100 feet downstream of the abandoned railroad. This location corresponds to Colorado River mile 65.0 (Station 343254.8).

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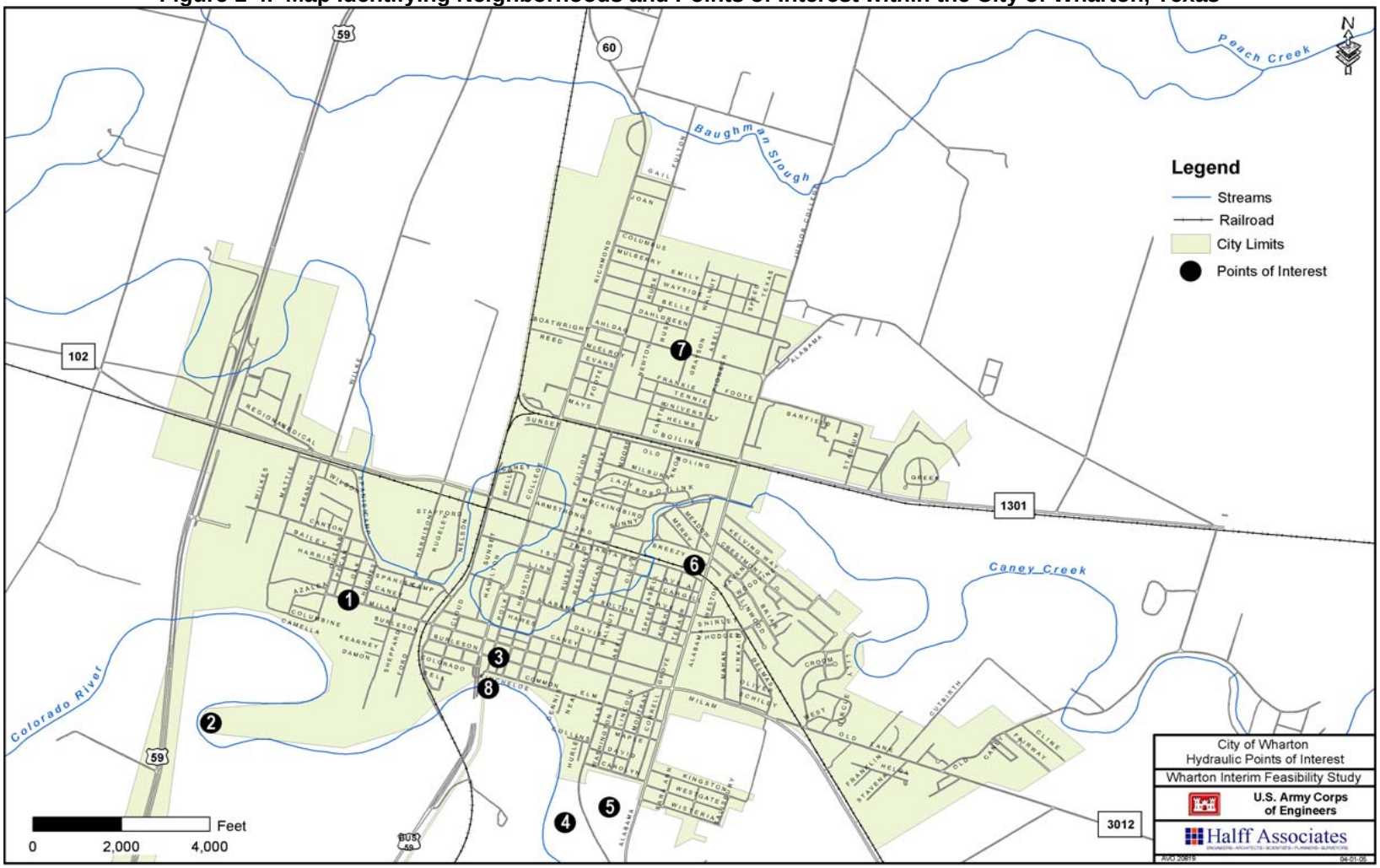
Figure 1-4. Map Identifying Neighborhoods and Points of Interest within the City of Wharton, Texas



PRIOR STUDIES AND REPORTS

Numerous water-resource related studies have been completed by various interests in past years, which contain information relating to flooding near the City of Wharton. A list of the most significant reports is shown below:

COLORADO RIVER RAFT REMOVAL

A significant collection of driftwood located near the mouth of the Colorado River grew significantly during the 1800's and early 1900's and came to be known as the "raft". The Texas Legislature passed an act in 1923 to clear the raft and build levees in the hopes of mitigating future flood damages. In 1934 the raft was completely removed into the Gulf of Mexico. The effects of the raft on the streambed elevations in Wharton were addressed in a 1975 study by the Wharton Fresh Water Resources Conservation & Development Commission (WFWRCDC). Inconsistencies in water surface elevations before and after the raft removal in the 1920's and 1930's indicated that the Colorado River channel bed was deepening following the raft removal as silt was carried away and higher velocities prevailed.

BAUGHMAN SLOUGH

In 1970, the Galveston District of the Corps published a report related to the floodplain of the Colorado River and Baughman Slough in Wharton, Texas. The report documented historic floods and the dimensions/elevations of bridges crossing Baughman Slough and the Colorado River in the study area. The study indicated that the Intermediate Regional Flood (100-year) on the Colorado River at Wharton would have a peak discharge of 178,000 cubic feet per second (cfs). This value was based on analysis of historical flows from 1900 to 1968 and flows prior to 1942 were adjusted to simulate the effects of Mansfield Dam. Also included in the study are profiles and inundation surfaces for the Colorado River and Baughman Slough resulting from the Intermediate Regional Flood on the Colorado River.

TURK, KEHLE & ASSOCIATES REPORT

In 1977, Turk, Kehle, & Associates prepared a report for Wharton County reviewing the 1970 Corps Baughman Slough report. The 1970 report was examined to determine if present (1977) channel conditions were considered and if flood control structures in the Colorado River drainage basin above Wharton were accounted for. The Turk, Kehle, & Associates report stated that the 1970 Corps study did not take into account flood control structures on Cummins Creek. As opposed to performing a historical flow analysis along the Colorado River, Turk, Kehle, & Associates centered the 100-year rainfall event on the most critical portion of the watershed, identified as the reach from Austin to Columbus. Using this procedure, a new 100-year flow rate at Wharton was found to be 145,000 cfs, nearly twenty percent less than the 1970 study. This lower flow rate resulted in water levels 1.6 to 2.1 feet lower than the 1970 report.

SAN BERNARD RIVER REPORTS

Although the San Bernard River was not directly a part of this study, issues related to the tailwater effects near the Peach Creek confluence were addressed. In response to this tailwater study, two reports related to the San Bernard River were investigated. The San Bernard River watershed is approximately 130 miles long and covers an area of 1,000 square miles. The San Bernard forms the county boundary between Wharton and Fort Bend Counties. The first report studied was a 1971 Corps Survey Report on the San Bernard River, Texas. The purpose of the report was to investigate flood control and major drainage improvements along the San Bernard River in Wharton County. A general description of the watershed was presented in this report, as well as proposed improvement alternatives. The conclusion of the study was that no improvements were economically justified at that time.

The second report, Reconnaissance Report, San Bernard River Watershed, Texas, was published in 1991. The report provides the results of a reconnaissance-level investigation of the feasibility of reducing flood damages in the San Bernard River watershed. The primary objective of the investigation was to determine if economically feasible measures exist to provide comprehensive flood control. The report did state that during flooding, the waters along the San Bernard River recede slowly because of dense vegetation, brush, and trees. The 1991 report also noted a 1989 study by VanSickle, Michelson, & Klein, Inc., San Bernard Drainage Analysis Channel Clearing Project. According to the 1991 reconnaissance report, the 1989 study identifies reaches of the San Bernard where clearing would reduce the elevation and duration of the flood flow.

WHARTON COUNTY FLOOD INSURANCE STUDY

The current effective Wharton County, Texas, Flood Insurance Study (FIS) was published in November 2001. Revisions published in the 2001 FIS did not update the hydrology and hydraulics of the Colorado River, Baughman Slough, and Caney Creek that were completed in 1982. At the request of the Federal Insurance Administration (FIA) in 1978, the Southwest Division of the Corps reviewed the 1970 report related to frequency discharges along the Colorado River in Wharton. A period-of-record analysis from 1930 to 1974 was executed as part of this study. This analysis resulted in a 100-year average daily Colorado River flow rate at Wharton, Texas, of 143,000 cfs. Ten percent was added to this flow (14,300) to account for instantaneous peak and another 5,000 cfs was added to account for Mansfield Dam (Lake Travis) releases. The 100-year peak flow rate for the Wharton gauge of the Colorado River prior to any overflow escape was adopted as 162,000 cfs for the 1981 FIS work performed by Turner, Collie, and Braden. However, much of this flow was found to overflow into Caney Creek, Baughman Slough, and Peach Creek upstream of the City of Wharton. These overflows were taken into account and the published 100-year peak flow rate along the Colorado River at Business Highway 59 in Wharton, Texas, is 139,500 cfs in the 2001 FIS.

WHARTON COUNTRY FIS/MAPPING UPDATE

The Wharton County FIS and floodplain maps were updated in 2005, and will become effective in January 2006. The Federal Emergency Management Agency (FEMA) approved the modeling and mapping of the Colorado River, Baughman Slough, Peach Creek, and Caney Creek. The modeling performed for this update is similar to the modeling performed for the WIFS existing conditions.

LOWER COLORADO RIVER BASINWIDE FLOOD DAMAGE EVALUATION PROJECT

The WIFS refines the Colorado River flows and hydraulic models around the City of Wharton that were developed as part of the Lower Colorado River Basinwide Flood Damage Evaluation Project (FDEP). The FDEP involved detailed period-of-record, hydrologic, hydraulic, and reservoir simulations for over 482 river miles of the Colorado River from near San Saba, Texas, to Matagorda Bay. The watershed of the Colorado River studied during the FDEP encompassed 18,300 square miles. A product of the FDEP was water surface elevations along the Colorado River near Wharton, Texas, for the 2-year through Standard Project Flood (SPF) events. These models included some Colorado River overflow into Caney Creek, Baughman Slough, and Peach Creek, but further refinement was needed to better analyze flooding problems and potential solutions in the City of Wharton.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act of 1969 (NEPA), as amended, is the nation's charter for environmental protection. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Section 102 (2) of the act includes a provision to prepare an Environmental Assessment (EA) on the effects of the proposed Federal action. The Federal regulations for implementing the procedural provisions of NEPA were published by the council on Environmental Quality (CEQ) in the Code of Federal Regulations (CFR) as 40 CFR Parts 1500-1508 (43 Federal Register 55978-56007, November 29, 1978).

Corps regulations permit an EA to be a self-sustaining document or an integration of NEPA required discussions in the text of a project planning report. Regarding the environmental nature of the Wharton study area and in the interest of reducing paperwork, costs, and redundancies, the Corps elected to integrate these documents. Sections in this report that include NEPA required discussions are marked with an asterisk in the Table of Contents to assist readers in identifying such material. The document addresses the alternatives investigated and the respective environmental effects to the Wharton study area.

In an additional effort to reduce paperwork, this Interim Feasibility Report and Integrated Environmental Assessment is tiered from the *Final Programmatic Environmental Impact Statement, Flood Damage Reduction and Ecosystem Restoration, Lower Colorado River Basin, Colorado River, Texas August 2005* (PEIS), and is hereby incorporated by reference. The PEIS established existing baseline conditions, future without project conditions and cumulative impacts for the lower Colorado River basin and was prepared so that future projects within the basin could be tiered from it in order to more efficiently incorporate the NEPA process. In addition, the PEIS served as a mechanism to begin early coordination with the resource agencies.

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CHAPTER 2
STUDY AREA DESCRIPTION

MAJOR STREAMS AND DRAINAGE PATHWAYS

There are several sources of flooding within and near the city of Wharton. Overflows from the Colorado River have impacted the West End neighborhood, downtown Wharton, and other low-lying areas. Localized flooding related to Baughman Slough and Caney Creek has also resulted in flooding problems in other neighborhoods of Wharton. Peach Creek, which flows north of the Wharton city limits, is another source of flooding for areas just outside of the city of Wharton. General locations of the streams within the study area can be seen in Figure 2-1.

COLORADO RIVER

The Colorado River drains over 42,000 square miles across the state of Texas of which 18,300 square miles are contained within the Lower Colorado River Basin. Rising from Dawson County, Texas, the river flows approximately 600 miles before emptying into Matagorda Bay and the Gulf of Mexico in Matagorda County, Texas. From the headwaters, the Colorado River flows through rolling prairie terrain before reaching the more rugged Hill Country area near San Saba County, Texas. Lake Travis, located on the Colorado River above Austin, regulates flows for storms centered on the upper reaches of the watershed. Leaving the Hill Country area, the Colorado River then passes through the Balcones Escarpment at Austin before flowing across the Coastal Plain to the Gulf of Mexico (The Handbook of Texas Online, 2002).

With respect to Wharton County, the Colorado River flows for over forty-seven miles through the center of the county from the Colorado/Wharton County line to the Wharton/Matagorda County line. Total drainage area of the Colorado River at the Wharton Gauge within the City of Wharton is approximately 42,000 square miles. The Lower Colorado River Basinwide study found that the 2 through 100-year frequency events on the Colorado River in Wharton are a result of storms centered below Lake Travis. The 500-year frequency event on the Colorado River in Wharton is a result of Lake Travis releases due to a storm centered above the reservoir.

The Colorado River has a mild bed slope of 0.0003 feet/feet through Wharton County. The river forms the southern boundary of the city of Wharton through much of the town. Downtown Wharton is built on the northern (left) bank of the Colorado River. The river is a major source of irrigation water within the county, and also a major source of flooding during heavy rainfall events. Six bridges cross the Colorado River in Wharton County (FM 960, U.S. Highway 59 (2), Railroad, and Business 59 (2)).

Within the city of Wharton, the Colorado River runs from west to east with the majority of the developed city on the north side of the river. The City has built two structures in recent years (See Figure 7, Appendix G, Page 8) to decrease water velocities and bank erosion along the river near the downtown area of Wharton. The breakwater structures are wooden walls that contain hollow horizontal empty spaces to allow water flow. Adjacent to the downtown area there is a park on the riverbank to allow pedestrian access to the river. Through the city of Wharton, the Colorado River varies in width from about 30 to 60 feet. The soil composition of the riverbanks in this area is generally silty to clayey loam. The less disturbed areas of the riverbanks are lined with trees such as oak, elm and hackberry. Adjacent to the Wharton Wastewater Treatment Plant, cement and rock riprap has been placed on the eastern bank of the river.

CANEY CREEK

Caney Creek was originally named Canebrake Creek due to the cane that grew along its sides until settlement of the area. The creek rises one mile south of Matthews in Colorado County, Texas from a maze of irrigation canals, dead-water sloughs, and old stream channels near the Colorado-Wharton county line. Caney Creek flows toward the southeast across the Coastal Plain approximately 155 miles to Gulf Intracoastal Waterway (GIWW) near Sargent, Matagorda County, Texas (The Handbook of Texas Online, 2002). The Colorado River and Caney Creek channels merge approximately a mile west of Glen Flora before separating again just to the south of Glen Flora (Appendix G, H&H Section, Figure 1). Caney Creek then flows through the city of Wharton on its path to the GIWW.

Caney Creek and the Colorado River most likely shared portions of the same channel many years go. Today, Caney Creek and the Colorado River still share a common channel for approximately one mile and then split into two separate channels near FM 960 and the town of Glen Flora, Texas. The split is actually an overflow point, and the water surface in the Colorado River must exceed elevation 114.0 feet at this point for water to spill into the Caney Creek channel. From this point, Caney Creek meanders through the City of Wharton and downstream with a final outfall into Matagorda Bay near Sargent, Texas, in Matagorda County. Although Caney Creek outfalls into Matagorda Bay, through much of Wharton County and especially the city of Wharton, the channel is not ill defined, tremendously disturbed, and essentially non-existent. As the city developed, the creek was modified and filled in many areas. Today, a defined creek channel is difficult to identify due to construction of homes, schools and parks over the historic location of the creek bed. In other locations, small earth embankments have created a series of private ponds and dams along Caney Creek. Caney Creek, throughout most areas of Wharton County does not exist in a riverine environment and resembles a series of storage areas. Within the city, the old Caney Creek channel has been filled and paved in most areas with development along and within the former channel. In some areas, natural flow direction has been reversed as a result of fill and grading.

SAN BERNARD RIVER

The headwaters of the San Bernard River begin just south of New Ulm in Austin County, Texas, then it flows toward the southeast approximately 120 miles before emptying into the Gulf of Mexico through the Gulf Intercoastal Waterway in Brazoria County. The river forms all or part of the county lines between Austin and Colorado, Austin and Wharton, and Wharton and Fort Bend Counties, and is fed by many smaller creeks, such as Peach Creek.

Figure 2-1 General Location Map

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PEACH CREEK

Peach Creek is a major tributary of the San Bernard River and flows north of the city limits of Wharton as seen in Figure 2-1). The headwaters of Peach Creek are between Bonus, Texas, and Egypt, Texas, west of FM 102 (approximately 13 miles northwest of the City of Wharton). Peach Creek outfalls into the San Bernard River approximately 11.8 miles downstream of the Business Highway 59 bridge crossing. Peach Creek flows from its headwaters in a generally west to east direction for approximately 28 miles before its outfall into the San Bernard River on the Fort Bend/Wharton County line. The channel area of Peach Creek is overgrown with dense vegetation and is relatively undisturbed throughout the vicinity of the city of Wharton. The creek is a characteristic bottomland hardwood system dominated by fairly young bald cypress trees. In addition to cypress many other types of vegetation can be found including alligator weed, palmetto, water lily, live oak, sagittaria, cedar elm, and cane. The bed slope of Peach Creek is mild averaging 0.0005 feet/feet. The Peach Creek channel is well-defined and over twenty feet deep in the area near the City of Wharton.

BAUGHMAN SLOUGH

Baughman Slough is located between Peach Creek and Caney Creek, as shown in Figure 2-1. Baughman Slough is a tributary of Peach Creek and flows just north of the city limits of Wharton. The headwaters of Baughman Slough are near Glen Flora, Texas, north of FM 102 (approximately six miles west of the City of Wharton). Baughman Slough outfalls into Peach Creek just downstream of the CR 129/Montgomery Road crossing northeast of the city of Wharton. Baughman Slough drains the northern sections of Wharton, including the Ahldag subdivision, which suffers from frequent localized flooding. Several man-made and natural channels divert stormwater runoff from the city of Wharton to Baughman Slough. The channel area of Baughman Slough does not have near the capacity as compared to Peach Creek. The Baughman Slough channel is well-defined, highly modified and devoid of most vegetation except grasses in the area near the city of Wharton. The channel of the slough winds through agricultural pasturelands north of Wharton and is generally about 10 feet wide and the banks of the slough vary between 2 to 5 feet. The slough is not fed by springs and is dependent on rainfall runoff for water flow. Therefore, the slough in the study area is dry throughout most of the year, except for a few small puddles between rainfall events.

ENVIRONMENTAL SETTING

ECOREGIONS OF TEXAS

The majority of Wharton County is located in the Gulf Prairies and Marshes ecoregion of Texas (Figure 2-2). The area of the county that is not located in the Gulf Prairies and Marshes ecoregion is located in the Post Oak Savannah ecoregion. The Post Oak Savannah portion of the county is outside of the study area. The Gulf Marshes, covering approximately 500,000 acres, are on a narrow strip of lowlands adjacent to the coast and the barrier islands (e.g., Padre Island), which extend from Mexico to Louisiana. The Gulf Prairies, about 9 million acres, include the nearly flat plain extending 30 to 80 miles inland from the Gulf Marshes. The Gulf Marshes are low, wet, marshy coastal areas that range from sea level to a few feet in elevation. The Gulf Prairies are nearly level with slow surface drainage and elevations from sea level to 250 feet (Hatch, 1990).

The original vegetation types of the Gulf Prairie were coastal prairie and post oak savannah. Characteristic oak species are live oak and post oak. Typical acacias are huisache and blackbrush. Bushy sea-ox-eye, a dwarf shrub, is also typical (Hatch, 1990). Principal climax grasses of the Gulf Prairie are Gulf cordgrass, big bluestem, little bluestem, Indiangrass, eastern gamagrass, gulf muhly, tanglehead, and many species of Panicum and Paspalum. Common increasers and invaders are yankeeweed, broomsedge bluestem, smutgrass, western ragweed, tumblegrass, threeawns, and many annual forbs and grasses. Characteristic forbs include asters, Indian paintbrush, poppy mallows, phloxs, bluebonnets, and evening primroses (Hatch, 1990). Approximately one-third of the inland prairies region is cultivated and is a major area of irrigated crop production, consisting primarily of rice cultivation, for the entire Lower Colorado Region. Bermudagrass and several bluestem species are common in tamed pasturelands.

Much of the land within the proposed project area, especially along Caney Creek, has been disturbed by human activities that have altered both the topography and vegetation cover of the landscape. These include construction of roads and instream sewer lines, conversion of land for agriculture, and the building of commercial businesses and residential neighborhoods. According to the United States Department of Agriculture 1997 Census of Agriculture County Profiles, Wharton County had 679,275 acres of land in farms with 722 full time farms. The total market value of agricultural products sold in 1997 was $133,550,000 with crops accounting for 80 percent and livestock accounting for 20 percent.

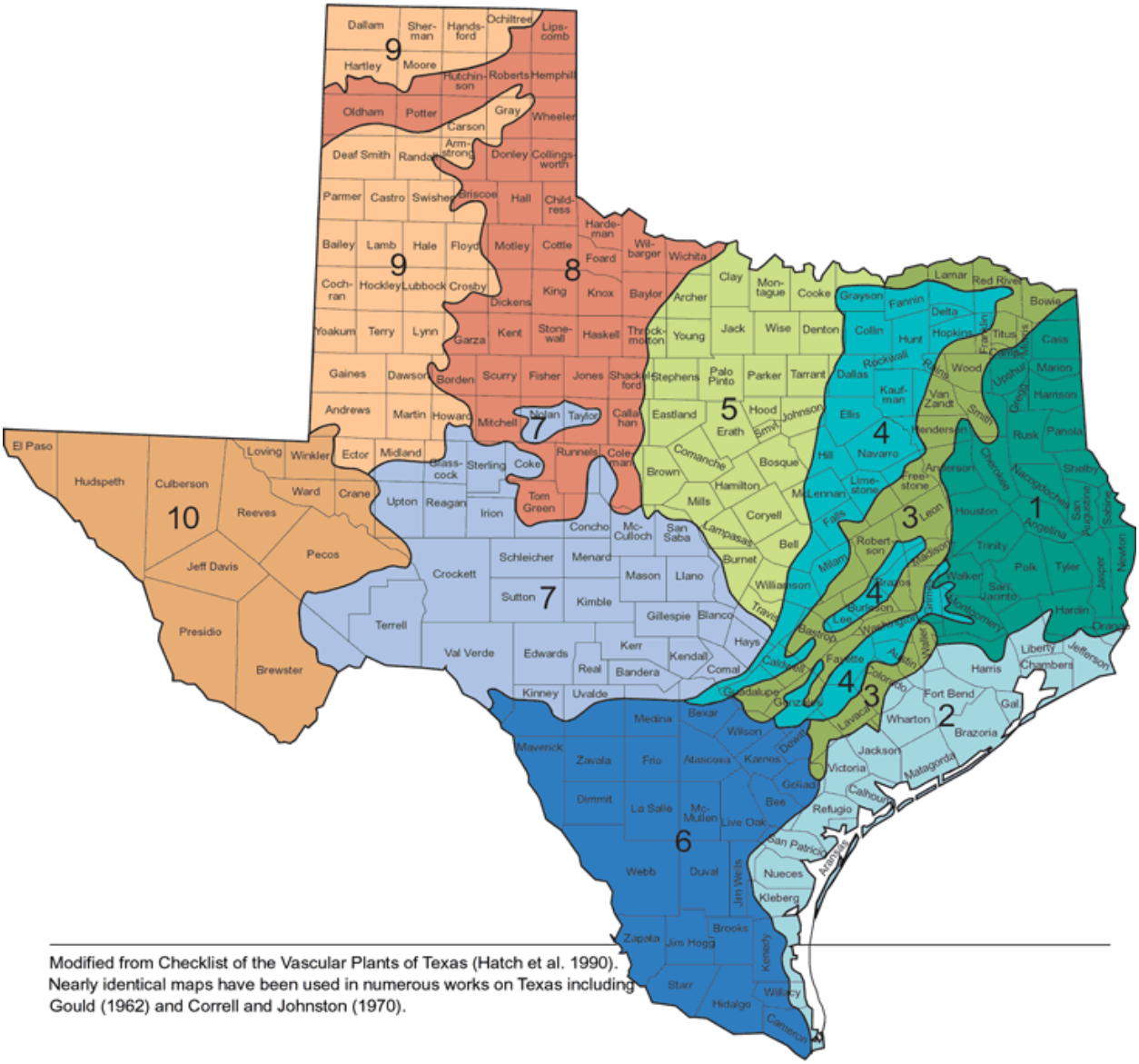
CLIMATE

The climate of Wharton County is generally characterized by hot, humid summers with temperatures averaging 92^{o}F in the July and mild winters with temperatures averaging 41^{o}F in January. The average rainfall for the area is 42.3 inches per year (Texas Almanac, 2002). Snowfall occurs only on rare occasions. One of those occasions was Christmas Eve, 2004, when approximately 4 inches of snow fell on the area.

Prevailing winds generally from the southeast. During the winter months, frontal boundaries may pass through the area on a regular basis. This may set a cycle of northerly winds, usually shifting back to the south after a day or two.

Thunderstorm activity can occur during all seasons, but is most prevalent in the spring and fall. Finally, due to its coastal proximity, the area is subject to influences from tropical storms. Daily rainfall amounts may easily exceed over 12 inches during these events.

Figure 2-2. Vegetational Areas of Texas (Hatch et al.)



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PHYSIOGRAPHY

The study area is located in the Gulf Coastal Plains physiographic province of Texas. The Gulf Coastal Plains province is subdivided into 3 subprovinces named the Coastal Prairies, the Interior Coastal Plains, and the Blackland Prairies with Wharton County falling into the Coastal Prairies subprovince.

The Coastal Prairies begin at the Gulf of Mexico shoreline and contain young deltaic sands, silts, and clays eroding to nearly flat grasslands that form almost imperceptible slopes to the southeast. Trees are uncommon except locally along streams and in oak mottes, growing on coarser underlying sediments of ancient streams. Minor steeper slopes, from 1 foot to as much as 9 feet high, result from subsidence of deltaic sediments along faults (Wermund, 1996).

The elevation of Wharton County ranges from 50 to 150 feet. Most of the county is level to gently sloping from 2 to 5 feet of fall per mile causing runoff to move very slowly off the landscape. The Colorado and San Bernard Rivers are entrenched to depths of less than 50 feet (Soil Conservation Service, 1974).

GEOLOGY AND SOILS

The City of Wharton is located on the Coastal Plain of Texas, which is mainly a low-lying coastal plain with limited topographic relief that gradually rises from sea level in the east to as much as 900 feet in the north and in the west. The surface geology of the Coastal Plain is complex due to cyclic deposition of sediments and to repeated sea-level changes and natural basin subsidence that has produced discontinuous beds of sand, silt, clay, and gravel. The Coastal Plain is underlain by a massive thickness of sediments that form strata having the same dip (homocline). Several major rivers dissect the Coastal Plain and flow nearly perpendicular to the Gulf of Mexico; these rivers include the Sabine, Trinity, Colorado, Guadalupe, Brazos, San Antonio, and Rio Grande Rivers. During the Late Tertiary and early Quaternary Ages, the river systems brought in huge quantities of clay, silt, sand, and gravel from upstream sources. These sediments were spread over the Coastal Plain as the rivers shifted laterally over the nearly featureless coastal prairie. The city of Wharton is located on the east bank of the Colorado River. Caney Creek, which flows through Wharton immediately north of the main business district, occupies a former course of the Colorado River. The geology and the general soils of the project area are of the Holocene Age, as recent alluvium along the Colorado River, and of the Pleistocene Age, as older sediments underlying the alluvium and are of the Houston Group. The Houston Group is divided into two formations, the Lizzie, at the base, and the Beaumont, at the top. These formations both outcrop in Wharton County, with the Lizzie Formation outcropping only in the extreme northern portion of the county. The surface and near surface soils throughout the city of Wharton are alluvial in origin and generally consist of moderate to high plasticity clay (CL to CH) with sand at depth. The clay has low permeability, high water holding capacity, and poor drainage. The clay also has very high shrink-swell potential and exhibits high corrosivity for uncoated steel.

The soils found in Wharton County are generally of the Miller-Norwood, Crowley, Lake Charles, Edna-Bernard, or Edna-Crowley association (Soil Conservation Service, 1974) (Figure 2-3). These soils are fully described in Appendix B. The soils are alluvial in origin, and were found to be relatively uniform throughout the City of Wharton. Very minor variances in soil composition can be noted. Subsurface borings were conducted in the study area, and most were characterized as having a high plasticity clay content. The material would be ideal for use in construction of levees, for example. Additional information regarding the subsurface investigations can be found in the Geotechnical section of Appendix G.

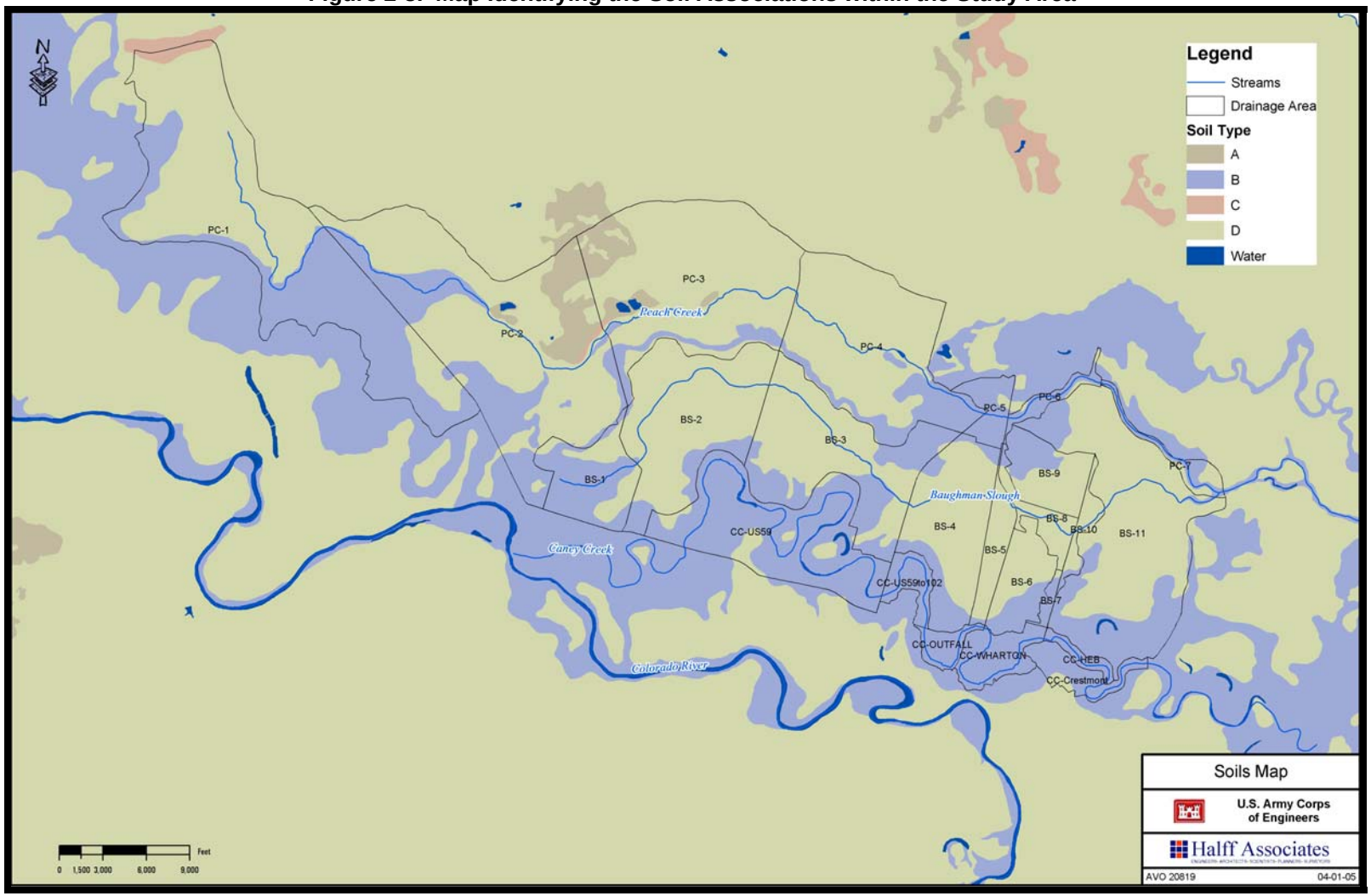
PRIME AND UNIQUE FARMLANDS.

The Farmland Protection Policy Act (FPPA) was included in the Agriculture and Food Act of 1981 and final regulations were published on June 17, 1994. The purpose of the FPPA is to minimize the unnecessary conversion of prime and unique farmland to nonagricultural uses by Federal programs. The Natural Resource Conservation Service (NRCS) administers the land evaluation and site assessment to determine if the potential impacts on farmland exceed the recommended allowable level. Prime farmland soils that are listed by the NRCS for Wharton County and occur within the project area are discussed above. The NRCS lists about 654,321 acres of prime farmlands occurring in Wharton County. An estimated 13,000 acres of prime farmland occur in the project area.

HYDROLOGY

For ease of presentation and clarification, all hydrologic and hydraulic information is presented in Chapter 3, with additional detail included in the Engineering Appendix.

Figure 2-3. Map Identifying the Soil Associations within the Study Area



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GENERAL WATER QUALITY

The TCEQ compiles a Clean Water Act Section 303(d) List for Threatened and Impaired Water Bodies every 2 years for submission to the Environmental Protection Agency (EPA). None of the listed segments within the Colorado River Basin or San Bernard River Basin, including Caney Creek, found on the 2004 Clean Water Act Section 303(d) List were located within the study area.

The criteria evaluated in determining if a water body is threatened or impaired are dissolved oxygen level, ammonia-nitrogen and nitrate-nitrogen, fecal coliform bacteria, ortho-phosphorus, pH, total suspended solids, total dissolved solids and conductivity, turbidity, and temperature.

AIR QUALITY

Wharton County is located in the EPA Air Quality Control Region (AQCR) 216. The EPA uses six “criteria pollutants” as indicators of air quality and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are referred to as the National Ambient Air Quality Standards (NAAQS). The areas of the country where air pollution levels persistently exceed the standards may be designated as ‘Nonattainment’ areas.

Areas of the country where the air pollutant concentration meets the national primary air quality standard are designated as being in “Attainment”. An “unclassifiable” designation is ascribed to areas of the country that cannot be classified based on available information. A sub classification may be ascribed by the EPA to areas that are currently in non-attainment. This classification describes the level of a particular air pollutant as being Severe 17, Severe 15, Serious, Moderate, Marginal, Sub marginal, Section 185A, or Incomplete (no data). The information presented represents the most relevant and accurate description of existing conditions for air quality within the study area since it is not feasible to establish air pollutant monitoring stations at specific project site locations.

The study area is classified as being in Region 12 by the Texas Commission on Environmental Quality (TCEQ), the state agency responsible for meeting the NAAQS. Wharton County is in attainment for all criteria pollutants; however, it is adjacent to Brazoria and Fort Bend Counties, which are in non-attainment for ozone pollution. The Houston Air Plan has been approved by the Texas Commission on Environmental Quality and has been forwarded to the Environmental Protection Agency for its approval to bring these counties into attainment for ozone by 2007.

LAND USE

Land uses for the area were categorized as: agriculture, heavy woods (dense, under story), industrial, light woods (relatively thin, no under story), public, residential, and water. Figure 2-4 shows the land use map of the study area. Approximately 80% of the area land use is agricultural, 15% woods (heavy and light), and 5% residential. Common crops in the area are rice, corn, cotton, and grain sorghum.

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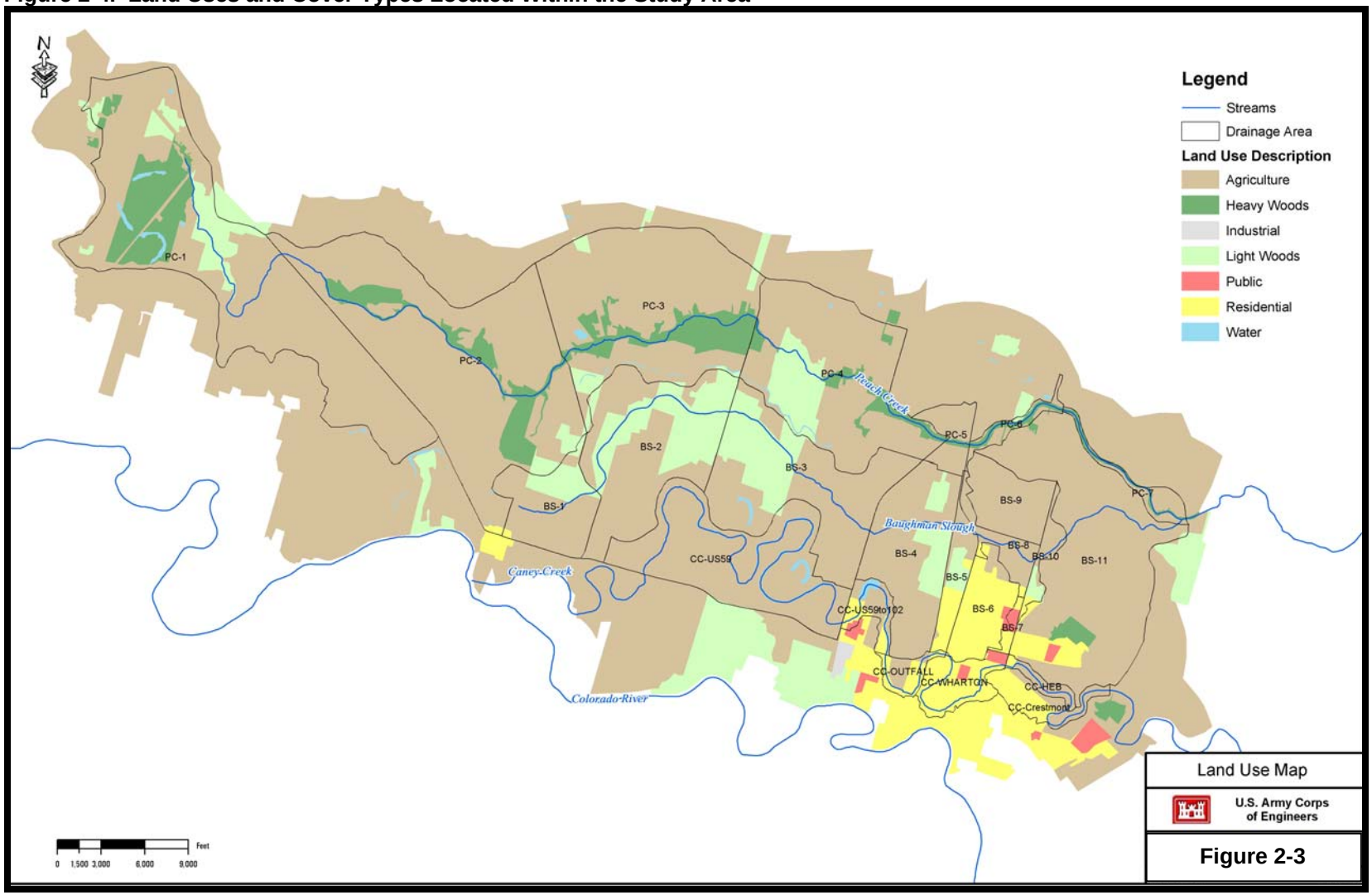
Figure 2-4. Land Uses and Cover Types Located Within the Study Area



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HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

General

An environmental site assessment (ESA) for the Wharton Interim Feasibility Study was performed to investigate the project site and its general vicinity for the presence or suspected presence of Hazardous, Toxic, and Radioactive Waste (HTRW) materials during existing conditions. The ESA works to facilitate early identification and appropriate consideration of HTRW problems in reconnaissance, feasibility, pre-construction engineering and design, land acquisition, construction, and operations, maintenance, repair, replacement, and rehabilitation phases of the project.

In April 2003 an environmental records search was conducted, by Environmental Data Resources, Inc, on the City of Wharton and the city's general vicinity. One solid waste facility/landfill site and two leaking underground storage tank (LUST) sites were identified as a result of this search. In March 2005 an environmental site reconnaissance was conducted consisting of site walkovers of the footprint area. Field observations documented during this visit found no evidence of additional HTRW issues.

Based on the findings from the ESA (see Appendix G), three individual properties were identified as having a potential HTRW issue. These three properties are located in or near the Wharton recommended study design, with the closest property approximately 200 feet away from the project boundary. See Appendix G, figure G-1. The properties with suspected HTRW issues for the City of Wharton were one solid waste facility/landfill and two registered LUST sites. More details regarding the findings of the ESA can be found in Appendix G.

Initial Assessment Conclusions

The assessment records search and follow site visited confirmed the existence of three individual properties having a moderate to high probability of having a potential HTRW issue. Two of these are located in the 100 block of Burleson Street, and the other is a closed municipal landfill at the end of Sheppard Street. These areas were taken into account during the formulation process, but did not figure into the selection process. Impacts pertaining to the Recommended Plan are presented in Chapter 5.

AQUATIC RESOURCES

The aquatic resources in the study area are confined primarily to the Colorado River, which contains the only permanent water source, two ponds in the Nanya Plastics Sump area, and one man-made pond in the old streambed of Caney Creek. The study area contains approximately 56,000 feet of the Colorado River. The Colorado River is approximately 30-60 feet wide and several feet deep as it flows through the study area. The Colorado River, like most river systems in the eastern half of Texas, is characterized by slowly flowing water. Any river flow makes it difficult for phytoplankton, microscopic algal forms that usually constitute the primary production in an aquatic ecosystem, to maintain substantial populations. As a result, riverine systems are frequently dependent on outside sources of organic material that are washed into the river during local rains.

Approximately 96,000 feet of Caney Creek runs through the study area, however, as mentioned above, the only aquatics are mainly contained in the on-man-made pond. Caney

Creek does not function as a creek; it primarily consists of a grass ditch that is several 10-12 feet wide. Several of the remnants of the original streambed of Caney Creek serve as detention pools during rain events. Caney Creek and the section of Baughman Slough in the project area are dry throughout the year, except when there is sufficient rainfall to create runoff conditions in the watershed. The study area contains approximately 59,000 feet of Baughman Slough. Baughman Slough is generally about 10 feet wide through the study area and has limited aquatic resources due it going dry in the summer months. A large ditch in the Alabama Street Sump may contain a few small puddles of water during periods between rainfall events.

Wetlands

According to the Texas Environmental Almanac (2000), interior wetlands which include bottomland hardwood forests, riparian vegetation, inland freshwater marshes, and the playa lakes of west Texas account for 80 percent of the total wetland acreage in Texas and the vast majority are located on private property. In the last 200 years, Texas has lost over 60 percent of these inland wetlands due to agriculture conversion, timber production, reservoir construction and urban and industrial development.

The USFWS National Wetland Inventory data for the project area showed scattered wetlands along parts of the Colorado River, in Baughman Slough, in tributaries feeding Baughman Slough, in Caney Creek, in old oxbows of Caney Creek, and in some swales and ditches draining some of the pastures and woodland areas outside the city. Most of these wetlands are ephemeral and contain water only after moderate to heavy rainfall events. However, these wetlands still retain wildlife value, especially during wet years. These wetlands total about 118 acres. Most of the wetlands are of poor to average quality. A small wetland near the Nanya Plastics Factory is a high quality wetland and should be avoided if possible during project design.

Ecologically Unique River or Stream Segment Nomination

The Wild and Scenic Rivers Act, approved on October 2, 1968, establishes a National Wild and Scenic Rivers System and prescribes the methods and standards through which additional rivers may be identified and added to the system. The Act authorizes the Secretary of the Interior and the Secretary of Agriculture to study areas and submit proposals to the President and Congress for addition to the system. It describes procedures and limitations for control of lands in Federally administered components of the system and for dealing with disposition of lands and minerals under Federal ownership. Rivers are classified as wild, scenic, or recreational, and hunting and fishing are permitted in components of the system under applicable Federal and State laws. (Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service). No Wild and Scenic Rivers are located within the project area.

The State of Texas has a similar law, the Texas Administrative Code, Title 31, Part 10, Chapter 357, Rule 357.8, Ecologically Unique River and Stream Segments. It outlines the process and criteria for designating a river or stream segment in the State as ecologically unique. The criteria used are biological function, hydrological function, riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value, and threatened or endangered species/unique communities. A regional water planning group can recommend a stream or river segment be designated as ecologically unique and include the recommendation in their regional plan. The Texas legislature can then officially designate a stream segment as having a unique ecological value after it has been nominated by a regional planning group. Designation by the legislature prevents a state agency or political subdivision from obtaining a fee title or an easement that would destroy the unique ecological value of the designated stream. The

designated segments also do not have to correspond to classified water quality segments (Ecologically Unique River and Stream Segments).

The Lower Colorado Regional Water Planning Group included a recommendation that the segment of the Colorado River (segment 1402) through Fayette, Colorado, Wharton, and Matagorda counties be designated as ecologically unique in their adopted plan. The recommendation was based on biological function: undeveloped riverine habitat in the segment, part of the Central Flyway of migratory birds passes over the segment, and the presence of a state-listed endangered species (the blue sucker) in portions of the segment. The Texas Legislature has not taken any action to designate the river segment as unique.

Groundwater – Gulf Coast Aquifer

The Gulf Coast aquifer forms an irregular belt along the Gulf of Mexico from Florida to Mexico. The Gulf Coast aquifer provides available groundwater to all or parts of 54 counties in Texas, including Wharton, as it stretches from the Rio Grande to the Louisiana-Texas border, and thus is an important part of the area's aquatic resources. The aquifer consists of complex interbedded clays, silts, sands, and gravels that are connected hydrologically forming a large, leaky artesian aquifer system (Lower Colorado Regional Water Planning Group (LCRWPG), 2000).

The system is comprised of two major components in the Wharton County area, the Evangeline aquifer and the Chicot aquifer. The Burkeville confining layer defines the bottom of the Evangeline aquifer, which is contained within Fleming and Goliad sands. The upper level of the Gulf Coast aquifer system is the Chicot aquifer that consists of the Lissie, Willis, and Beaumont formations with alluvial deposits overlying the aquifer. Maximum total sand thickness ranges from about 700 feet near the coast to 1,300 feet in the northern extent (LCRWPG, 2000).

Essential Fish Habitat

Essential fish habitat (EFH) is evaluated under authority of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA), as amended (16 U.S.C. 1801-1882). The act established national standards that require fishery management plans to create conservation and management measures based on the best scientific information to prevent overfishing and assure optimum yield. The MSFCMA was amended in 1996 by the Sustainable Fisheries Act, which established procedures for identifying EFH and required interagency coordination to further the conservation of Federally-managed fisheries. Rules published by the NMFS (50 Code of Federal Regulations (CFR) Sections 600.805-600.930) specify that any Federal agency that authorizes, funds or undertakes, or proposes to authorize, fund, or undertake an activity that could adversely affect EFH is subject to the consultation provisions of the act and identifies consultation requirements.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." These waters are generally found in estuaries and tidally influenced sections of rivers that flow into estuaries. Because this project is located well upstream of the Matagorda Bay system and is beyond tidal influence, there are no Federally-managed species that will be affected by this project. Therefore, there are no EFH considerations or consultation requirements needed for this project, and there will be no further discussion of this issue.

FISH AND WILDLIFE RESOURCES

The principal wildlife found in Wharton County are ducks, geese, quail, doves, raccoon, squirrel, nutria, and deer. Wharton County provides wintering grounds for rail, coot, crane, geese, ducks, and other migratory birds. Fish that inhabit the county include bass, channel

catfish, and bream. The county is divided into two wildlife sites. The first of which is generally accompanied by soils of the Miller-Norwood association. The areas that are not used for row crops can have cover from pecan, ash, elm, willow, oak, and hackberry trees that provide habitat for deer, squirrels, opossum, rabbit, raccoon, and many kinds of songbirds. The second type of wildlife site is usually accompanied by Edna-Bernard, Crowley, Lake Charles, and Edna-Crowley associations that provide habitat for deer, quail, doves, rabbit, opossum, raccoon, armadillos, and nutria (Soil Conservation Service, 1974).

Amphibians and reptiles are common in the project area and include a total of 25 species of amphibians and 96 species or subspecies of reptiles (Dixon 2000). These species include one siren, two salamanders, a newt, 21 species of frogs and toads, 10 species of turtles, the American alligator, 24 species or subspecies of lizards, and 62 species or subspecies of snakes (Dixon 2000). Widespread turtles within the basin include the common snapping turtle, yellow mud turtle, red-eared slider, ornate box turtle, and softshell turtle. Also, 12 lizard taxa and 37 snake taxa are expected to occur in the project area (Dixon 2000).

Fisheries located in the study area are abundant because of the diversity of species located within the Colorado River. The species are documented in the Programmatic Environmental Impact Statement conducted as part of the overall Basinwide Study. It documented that over 59 species of fish are located within the area. Species found on a daily basis include various minnow and sunfish species, largemouth bass, white bass, spotted bass, spotted and longnose gar, carp, channel and yellow catfish, drum, tilapia, and crappie.

A site visit was conducted on January 10, 2006, with United States Fish and Wildlife Service representatives. Species observed within the riparian forest adjacent to the Colorado River included the red tail hawk, red shoulder hawk, vermillion fly catcher, turkey vulture, savannah sparrows, and great egret. Another site visit with the USFWS on 15 June 2006 to three different sites containing grasslands, mixed forest and grasslands, hardwood forest, and wetlands produced a larger variety of birds to add to the list of observations. Birds sighted during this visit included: common grackle, mockingbird, cardinal, Carolina chickadee, yellow-billed cuckoo, mourning dove, swallow-tailed kite, white-eyed vireo, buteo hawk, little blue heron, turkey vulture, belted kingfisher, brown creeper, and eastern meadowlark.

Migratory Birds

The Colorado River bottomland forests in Wharton County are classified as part of the Austin's Woods or Columbia Bottomlands habitat. This once extensive hardwood forest occurs in the basins of the lower Colorado River, San Bernard River, Caney Creek, and Brazos River from within 6 miles of the Gulf coast to 50 miles inland. Besides their high biological productivity, these forests are critical to the survival of neotropical migratory birds which annually migrate in the spring from Central and South America and the Caribbean Islands across the Gulf of Mexico to their nesting areas in the United States and Canada. These birds depend on the Austin's Woods area for rest and replenishment during migration. Other birds using these habitats include migratory waterfowl, wading birds, colonial nesting birds, and migratory shorebirds. Investigations of the importance of these forests found that 237 species of birds totaling 239 million individuals migrate through the area each year. Therefore, the loss of this habitat could have significant consequences for these migratory birds (USFWS, 1997).

Threatened and Endangered Species

Correspondence with the United States Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) included requests for information, database searches, and a site visit to establish the potential presence of federally listed threatened and endangered species. Table 2-1 identifies the one federally listed threatened species that has been proposed

for delisting, the five state listed endangered species, and the ten state listed threatened species that have the potential to occur in Wharton County and the study area.

Table 2-1
Potentially Occurring Federal and State Threatened and Endangered Species for Wharton County

Common Name	Scientific Name	Federal Status	State Status
Birds			
American Peregrine Falcon	Falco peregrinus anatum	*	E
Arctic Peregrine Falcon	Palco peregrinus tundrius	*	T
Attwater's Greater Prairie-chicken	Tympanuchus cupido attwateri	*	E
Bald Eagle	Haliaeetus leucocephalus	T/PDL	T
Eskimo Curlew	Numenius borealis	*	E
White-faced Ibis	Plegadis chihi	*	T
White-tailed Hawk	Buteo albicaudatus	*	T
Whooping Crane	Grus Americana	*	E
Wood Stork	Mycteria Americana	*	T
Interior Least Tern	Sterna antillarum athalassos	*	E
Mammals			
Black Bear	Ursus americanus	*	T
Louisiana Black Bear	Ursus americanus luteolus	*	T
Reptiles			
Texas Horned Lizard	Phrynosoma cornutum	*	T
Timber/Canebrake Rattlesnake	Crotalus horridus	*	T
Fishs			
Blue Sucker	Cycleptus elongates	*	T

T – Threatened, E – Endangered, PDL – Proposed for delisting, PT – Proposed Threatened
**Not listed by USFWS as a Federally listed threatened or endangered specie with the potential for occurring in Wharton County.*

In addition to the State and Federal-listed threatened and endangered species in the list above, TPWD also lists several rare species potentially occurring in Wharton County, but these species have no regulatory listing status on the State list. Thus, they are not listed above and are not included in the species descriptions below. These rare species include one bird (Mountain plover, *Charadrius montanus*), one fish (American eel, *Anguilla rostrata*), one mammal (Plains spotted skunk, *Spilogale putorius interrupta*), and seven mollusks (Creeper (Squawfoot), *Strophitus undulates*; False spike mussel, *Quincuncina mitchelli*; Pistolgrip, *Tritogonia verrucosa*; Rock-pocketbook, *Arcidens confragosus*; Smooth pimpleback, *Quadrula houstonensis*; Texas fawnsfoot, *Truncilla macrodon;* and Texas pimpleback, *Quadrula petrina*).

Birds

The bald eagle has recovered sufficiently to be downlisted to threatened thoughout its range and the USFWS has proposed to completely delist the species in the near future (64 FR 36453-36463; July 6, 1999). Two subspecies are currently recognized based on size and weight.

The northern subspecies nests from central Alaska and the Aleutian Islands through Canada into the northern U.S. The southern subspecies primarily nests in estuarine areas of the Atlantic and Gulf coasts, northern California to Baja California, Arizona, and New Mexico (Snow, 1981). Wintering ranges of the two populations overlap. The bald eagle inhabits coastal areas, rivers, and large bodies of water as fish and waterfowl comprise the bulk of their diet. Nests are seldom far from a river, lake, bay, or other water body. Nest trees are generally located in woodlands, woodland edges, or open areas, and are frequently the dominant or co-dominant tree in the area (Green, 1985). Concentrations of wintering northern eagles are often found around the shores of reservoirs in Texas, with most wintering concentrations occurring in the eastern part of the state. Wintering bald eagles in Texas have been observed as far south as Cameron County (Oberholser, 1974) and are considered to be a rare permanent resident in the Coastal Bend (Rappole and Blacklock, 1985). TPWD surveys have recorded nests as close as 5 miles upsteam of Wharton on the Colorado River near Glen Flora.

All North American peregrine falcons were delisted from the Federal list of threatened and endangered species in 1999 (64 FR 46541-46558, August 2, 1999). The Arctic peregrine falcon, which was listed as endangered due to similarity of appearance to the American peregrine falcon was delisted Federally, but remains on the TPWD threatened list. The primary differences between the subspecies are their ranges and migration patterns. The Arctic peregrine falcon nests only from northern Alaska to Greenland and winters along the entire Gulf Coast. It occurs statewide during migration (USFWS, 1995). The American peregrine falcon remains on the State endangered list and nests from central Alaska across north-central Canada to central Mexico. It also overwinters in Texas and both subspecies could potentially occur in the project area, especially during spring and fall migration.

Attwater's greater prairie-chicken is a medium-sized grouse (TPWD, 1995). This species was once a common resident on most of the Texas coastal plain, including parts of Wharton County. However, the abundance of this species is currently declining from Galveston County to Aransas and Refugio Counties (USFWS, 1995). Remaining populations of Attwater's greater prairie-chicken are found only in the Texas costal prairie where native tallgrass prairie habitat still exists. No suitable habitat for Attwater's greater prairie-chicken is present in the project area.

The current status of the Eskimo curlew is considered uncertain and possibly extinct, but the species is Federally and State-listed as endangered. This species was very abundant in the nineteenth century, but was subject to extreme hunting pressure. The breeding habitat of the Eskimo curlew was treeless arctic and subarctic tundra (Gill, et al., 1998). Non-breeding birds use a variety of habitats, such as grasslands, pastures, plowed fields, and less frequently, marshes and mud flats (AOU, 1983). Spring migration would bring them through Texas and the midwestern U.S. (Gill, et al., 1998) from mid-March to late April (Oberholser, 1974). One record does exist from Galveston, Texas in 1962, and others since then have been reported. However, the validity of these records is uncertain. The Eskimo curlew is unlikely to occur in the project area due to its extreme rarity and the lack of recent records of occurrence.

The white-faced ibis is a coastal species that inhabits a variety of freshwater and estuarine environments. It is considered a rare to uncommon spring and fall migrant throughout Texas and a rare to uncommon post-breeding visitor north and west of its usual breeding range within Gulf coast counties (TOS, 1995). One sighting was recorded for this species in Wharton County in Oberholser (1974), but this species may migrate through the area and feed in the rice fields.

The white-tailed hawk is a large raptor that inhabits undeveloped coastal grasslands and inland mesquite-oak savannahs (Oberholser, 1974). White-tailed hawks are considered uncommon local summer residents of the coastal plain from Harris and Colorado Counties to south of the Rio Grande (TOS, 1995). This species may migrate through Wharton County and feed in any of the numerous pasturelands.

Each year the only remaining natural wild population of whooping cranes migrates 2,600 miles from its summer nesting grounds in Canada's Wood Buffalo National Park to its wintering grounds at Aransas National Wildlife Refuge in Aransas, Refugio, and Calhoun Counties. During migration, the whooping crane makes regular stops, during which they use a variety of habitats that are generally isolated from human activity. It can be found in the marshes of Matagorda and St. Joseph's Islands where it feeds mainly on blue crabs and clams. However, the birds will wander inland to oak mottes, swales, and ponds to feed on acorns, snails, crawfish, and insects (Campbell, 1995). The project area lies within the migration corridor, but it is unlikely the whooping crane will stop here due to human activity in and near the city.

Wood storks are semi-aquatic birds that prefer a variety of wet environments, including forested wetlands, irrigated fields and pastures, prairie ponds, and mudflats (Coulter, et al., 1999). Preferred habitats include coastal marshes, bays, prairies, and lakes (Sarkozi, 1996). They are not generally associated with upland areas with dense ground cover. The wood stork is a migratory species and is a common summer resident on the coastal plains from July to September (Sarkozi, 1996). The wood stork has been sighted in Wharton County and the project area contains habitats that may be used by this species. Therefore, this species could occur in the project area.

The interior least tern is a colonial nesting shorebird adapted to lacustrine and riverine sandbar and gravel beach habitats and has historically nested on sandbars of the Colorado River, Rio Grande, and Red River in Texas. Small, remnant breeding populations persist at isolated locations within its historic range. This species winters along the entire Texas coast, but the USFWS considers any least tern within 50 miles of the coast to be the coastal subspecies and, thus, not protected by the ESA (USFWS, 1995). Although listed as potentially occurring in Wharton County by TPWD, the USFWS does not list it on their county list for Federally-listed threatened and endangered species. Therefore, the occurrence of this species in the project area is highly unlikely.

Mammals

Black bears were historically widespread throughout Texas, but are now restricted to remnant populations in mountainous areas of the Trans-Pecos region (Davis and Schmidly, 1994). The Louisiana black bear, which is one of 16 recognized subspecies of black bear (Hall, 1981), was historically found in eastern Texas. It is distinguished from other black bears by its longer, more narrow, and flat skull and by it proportionately large molar teeth (Nowak, 1986). This subspecies is now restricted primarily to the Tensas and Atchafalaya River Basins in Louisiana, where its habitat consists primarily of bottomland hardwood timber. The Louisiana black bear is not known to occur in Texas, although potential habitat exists in the project area.

Reptiles

The Texas horned lizard has a broad and flattened body, short tail, and conspicuous elongated scales that form spines on the head, neck, and back. Texas horned lizards historically were widespread throughout Texas, but have experienced a rapid decline in number, possibly due to widespread use of insecticides, the introduction of imported red fire ants, and a decline in harvester ants, which are the lizard's primary food source. It has almost vanished from the eastern half of the state (Price, 1990). However, Bartlett and Bartlett (1999) state that the actual status of populations of this species is unknown. Since it has historically occurred in the region, the presence of the Texas horned lizard in the project area cannot be discounted.

Timber/canebrake rattlesnakes generally occur in lowland areas such as swamps, cane brakes, riverine thickets, pine and deciduous woodlands, and abandoned farmland, preferably with dense undergrowth. It primarily inhabits moist lowland forests and hilly woodlands near rivers, streams, and lakes in the eastern third of the state (Werler and Dixon, 2000). However, it

can also be found in open, upland pine and deciduous woods and the second-growth pastures of unused farmland. Because the preferred habitat for this species occurs in the project area, the potential for its occurrence cannot be ruled out.

Fish

The State-listed threatened blue sucker inhabits the larger portions of major rivers in Texas, usually within the deeper channels and flowing pools with a moderate current. Bottom type usually consists of exposed bedrock, perhaps in combination with hard clay, sand, and gravel. The adults winter in deep pools and move upstream in the spring to spawn on riffle beds. Construction of impoundments has led to a reduction of suitable silt-free gravel and rock bottoms by slowing the formerly constant strong flows and has led to blocked migratory routes resulting in depressed population levels. This species is known from further upstream in Colorado County in Stream Segment 1402 of the Colorado River (Celeste Brancel, TPWD, internet communication). This segment of the river flows through Fayette, Colorado, Wharton, and Matagorda Counties, including the project area. The TPWD Annotated County Lists of Rare Species for Wharton County last revised on December 11, 2002 does not list the blue sucker as occurring in Wharton County. However, the potential exists that this species could occur in the project area.

VEGETATION COVER TYPES

Within the study area, approximately 44% of the area is classified as grasslands, 32% as croplands, 13% urban, 7% other, and only 4% Riparian Woodlands.

Bottomland Vegetation/Riparian Woodlands

Bottomlands occur in the transition zone between aquatic and upland ecosystems. Bottomland hardwood systems are considered to be Texas' most diverse ecosystem. Prior to European settlement, Texas had approximately 16 million acres of bottomland hardwood riparian habitat. Today, the state has less than 5.9 million acres. There is expected to be a continual decrease of about 12% per decade due to future projections of pulpwood needs within the United States (Texas Environmental Almanac 2000). No logging operations are known to occur in Wharton County.

Bottomlands serve several important functions. They contribute to the state's biodiversity. According to the Texas Environmental Almanac (2000), 189 species of trees and shrubs, 42 woody vines, 75 grasses, and 802 herbaceous plants occur in Texas' bottomlands. They are also known to support 116 species of fish, 31 species of amphibians, 54 species of reptiles, 273 bird species and 45 species of mammals. At least 74 species of threatened and endangered animals depend directly on bottomland hardwood systems and over 50 percent of neotropical songbirds not listed as threatened and endangered species are associated with these systems. Besides providing critical wildlife and bird habitat, bottomland hardwood systems: 1) serve as catchments and water retention areas in times of flooding, 2) help control erosion, 3) contribute to the nutrient cycle, and 4) play a vital role in maintaining water quality by serving as a depository for sediments, wastes and pollutants from runoff. Despite these important functions, bottomland hardwoods ecosystems are one of the most endangered ecosystems in the United States (MacDonald et al. 1979). For all of these reasons, the bottomland vegetation system is of great environmental concern in the analysis of the proposed project impact areas.

Bottomland hardwood trees along the Lower Colorado River generally consist of bald cypress, pecan, oaks, elm, cottonwood, and hackberry. Most of these hardwoods are generally mature trees between 50-100 years old that provide food and shelter for wildlife. These large growth riparian woodlands are of average to quality woodlands for wildlife habitat.

A focus was placed in specific areas within the larger study area, specifically along the banks of the Colorado River, Baughman Slough, and areas adjacent to Caney Creek. The riparian/hardwood forest species growing in this area consist mostly of mature native pecan trees ranging in height from 30 feet to about 75 feet. These trees possibly invaded the area during past flood events which brought in the nuts that later sprouted and grew in the open fields near the river. Smaller trees scattered across the forested landscape include hackberry (8-20 feet in height), cedar elm (4-12 feet), wooly buckthorn (12-20 feet), cherry laurel (8 feet), and minor occurrences of the invasive Chinese tallow (up to 25 feet in height). Dominant species along the river bank (beyond the proposed project impact zone) include black willow and cottonwoods up to 60 feet in height. One pond of about 3 acres located adjacent to the Nanya Plastics plant appears to be an old oxbow of Caney Creek. It retains a fringe of mature bald cypress trees up to 40 or 50 feet in height. Understory vegetation growing at the base of the mature trees where frequent mowing is used as a management tool for improved pastures include smilex, mulberry, hawthorne, and viburnum, along with a mixture of grape vines, Virginia creeper, and blackberry and dewberry vines.

Peach Creek is relatively undisturbed throughout the vicinity of the city of Wharton. The creek is a characteristic bottomland hardwood system dominated by fairly young bald cypress trees. Other plants found in the Peach Creek vicinity include alligator weed, palmetto, water lily, live oak, sagittaria, cedar elm, and cane. This riparian habitat is of high quality and the resource agencies have suggested that these areas be avoided during project design.

Trees along the banks of Caney Creek and Baughman Slough are noticeably absent, except where homes are located near the streambeds. Most of these areas are pasturelands with some brush occasionally found in the streambeds. These streambeds appear to be mowed, at least on an infrequent basis, or grazed to control the growth of brush. The existing fragmented woodlands area of very poor quality.

There are over 1000 acres of riparian woodlands or bottomland vegetation within the study area. These are generally located along the Colorado River, Peach Creek, and Baughman Slough.

Bottomlands of Special Concern

The USFWS, TPWD, NRCS, Nature Conservancy, and other agencies and environmental organizations have a high priority in protecting the bottomland hardwood forests growing along the Colorado River, San Bernard River, Caney Creek, and Brazos River south of IH-10 to within 6 miles of the Gulf of Mexico. These woods are collectively known as Austin's Woods or the Columbia Bottomlands. In addition to their high biological productivity, they have an importance for neotropical migratory birds which depend on the woods for rest and energy replenishment during migration. The forests are also important resting, breeding, feeding, and escape habitats for a great number of other birds. A significant population of bald eagles is found in the area, due largely to the quality of the breeding habitat (USFWS, 1997).

The Austin's Woods are the only significant expanse of forest adjacent to the Gulf of Mexico in Texas. At the beginning of the 20th Century, the Austin's Woods occupied about 700,000 acres. However, human activities such as logging, agriculture, and development have slowly removed the forests until near the close of the century, it is estimated only 177,000 acres remain. The remaining 25% of the forest ecosystem is highly fragmented and continue to be threatened with commercial and residential development, logging, wetland drainage, and clearing for agriculture. Other threats include pipeline construction, road building, and power line construction. A new venture threatening bottomland forests is the hardwood pulp industry, which has recently clear cut, chipped, and exported hardwoods to Japan for paper production. In an effort to conserve this declining resource, the USFWS has proposed to acquire tracts of the

remaining forest from willing sellers and donors and manage them as units of the existing Brazoria National Wildlife Refuge Complex (USFWS, 1997).

Of the over 1000 acres of riparian bottomland hardwoods in the study area, approximately one-hundred could fall into this category. Most of these species are located on the West side of the Colorado River.

Grasslands

There are over 11,748 acres of grasslands within the study area. Wharton County grasslands are characterized by the Blackland Prairie ecoregion with tallgrass prairie to the Gulf Coastal Prairie ecoregion with tallgrasses and mid-grasses prairies. Many of the original prairie lands have been lost due to conversion of the land to farmland and cattle ranching. The high quality grasslands include the native vegetation including big bluestem, little bluestem, switchgrass, and sideoats. However, many of these have been converted to low habitat quality coastal Bermuda, King Ranch Bluestem, Johnson grass, and other range grasses that support cattle grazing or converted to rice fields.

CULTURAL RESOURCES

There have been few archeological investigations performed in the city of Wharton study area. Twelve recorded prehistoric archeological sites are in the vicinity of the study area. Seven sites are located north of Hwy 60, east of town along Caney Creek. One of these sites is the Crestmont Site (41WH39), an archaic burial site (Vernon 1987). Five sites are recorded along Peach Creek to the north of town; two sites (41WH4 and 41WH5) are located approximately 1.25 miles west of Hwy 59, and three sites (41WH40, 41WH74 and 41WH12) are found approximately 1.5 miles east of Hwy 59.

There is a potential for prehistoric archeological sites adjacent to both Baughman's Slough and the Colorado River, and many historic structures and districts within the project area that are listed on or potentially eligible for the National Register of Historic Places (NRHP).

In December 2005, The U.S. Army Corps of Engineers, Galveston District (USACE) Staff Archeologist conducted a cultural resources survey of the proposed levee alignment along the Colorado River. The purpose of the investigation was to identify and delineate any cultural resources located within the study area. The intensive pedestrian survey of 100 percent of the proposed levee alignment was supplemented by the systematic excavation of 5 shovel tests. All of the tests proved negative for cultural resources.

A cultural resources survey of Baughman's Slough was conducted by the USACE Staff Archeologist in June of 2006. No previously recorded archeological sites exist within this portion of the proposed levee alignment. Approximately 80 percent of the project area was investigated by a combination of pedestrian survey and shovel testing. A total of three shovel tests were excavated. All shovel tests proved negative for cultural resources. The proposed levee alignment is mostly pasture and rice fields and the channel shows signs of erosion. An inspection of the cut bank was negative for deeply buried cultural resources.

In June of 2006, The USACE contracted Prewitt and Associates, Inc. to perform a preliminary historic resources investigation the project area, which included intensive archival and historic map research combined with a windshield survey of historic resources.

Archival and historic map research identified numerous NRHP listed individual properties and historic districts in the study area; most notably, the Wharton County Courthouse Historic

Commercial District, the West Milan Street Mercantile Historic District and the Texas & New Orleans Railroad Bridge. The courthouse, constructed in 1889, is undergoing restoration with funding from the Texas Historic Courthouse Preservation Program.

Several NRHP eligible individual properties were identified in the study area including two long-established African American communities that retain many aspects of their early twentieth-century development.

Fieldwork consisted of a windshield survey to document listed or potentially eligible NRHP historic districts and individual properties with overall representative photographs. Approximately 90 resources were documented as representative of property types and listed or potentially eligible resources that may be in the study area. This included residential and commercial architecture, structures and historic landscapes.

RECREATION

LOCAL RECREATIONAL RESOURCES

Recreational facilities within the city include 10 small city parks, twelve tennis courts, and one private golf course and country club. The Colorado River Side Park contains picnic areas, children's playground equipment, volleyball court, restrooms, paved paths and limited access to the Colorado River for water-based recreational opportunities. According to Ms. Jones, the riverside park does not provide access for watercraft, which is desired by the community, and there are no trail-based activities within the city. The nearest public boat access ramp is the "David Hall Ramp" upstream, and is considered by Ms. Jones to be unsafe. Other than this ramp, the cities of Columbus and Bay City have the nearest boat ramps to the Wharton area.

According to the City Manager, Wharton utilizes the school facilities for most organized recreation. Hunting recreation is available within the county, particularly for ducks and geese. Lake Texana is 35 miles from the City. The Brazos Bend State Park is within easy access to the residents; however, according to local sources, the park is often closed, because visitor capacity limits are exceeded.

The Pierce Ranch, home of Karankawa Plains, is a working ranch that offers various recreational opportunities to the public for a fee, including bed and breakfast facilities, big game, upland and waterfowl hunting, horse back riding, nature tourism and wildlife viewing in spring and summer, fishing (from man-made ponds), and canoeing opportunities. The Wharton Chamber of Commerce partners with the ranch to conduct ranch tours, which is a popular attraction for wintering tourists.

Farmland, particularly rice fields, in the area is often marketed to goose and duck hunters. There is an active chapter of Ducks Unlimited in Wharton that is working with landowners to manage farmlands for waterfowl species. There should be some concern with attracting migrating waterfowl due to the presence of the airport; however, no current problems were identified as existing.

Wharton receives significant drive-through tourism, particularly in the winter season, which is spurring the recent growth in the Bed-and-Breakfast and nature-based tourism markets. Other towns within the area are beginning to establish RV facilities and camping to market to these groups. With the close proximity to the Gulf Coast and the popularity of the Great Texas Coastal Birding Trails, significant tourism travels through the Wharton vicinity.

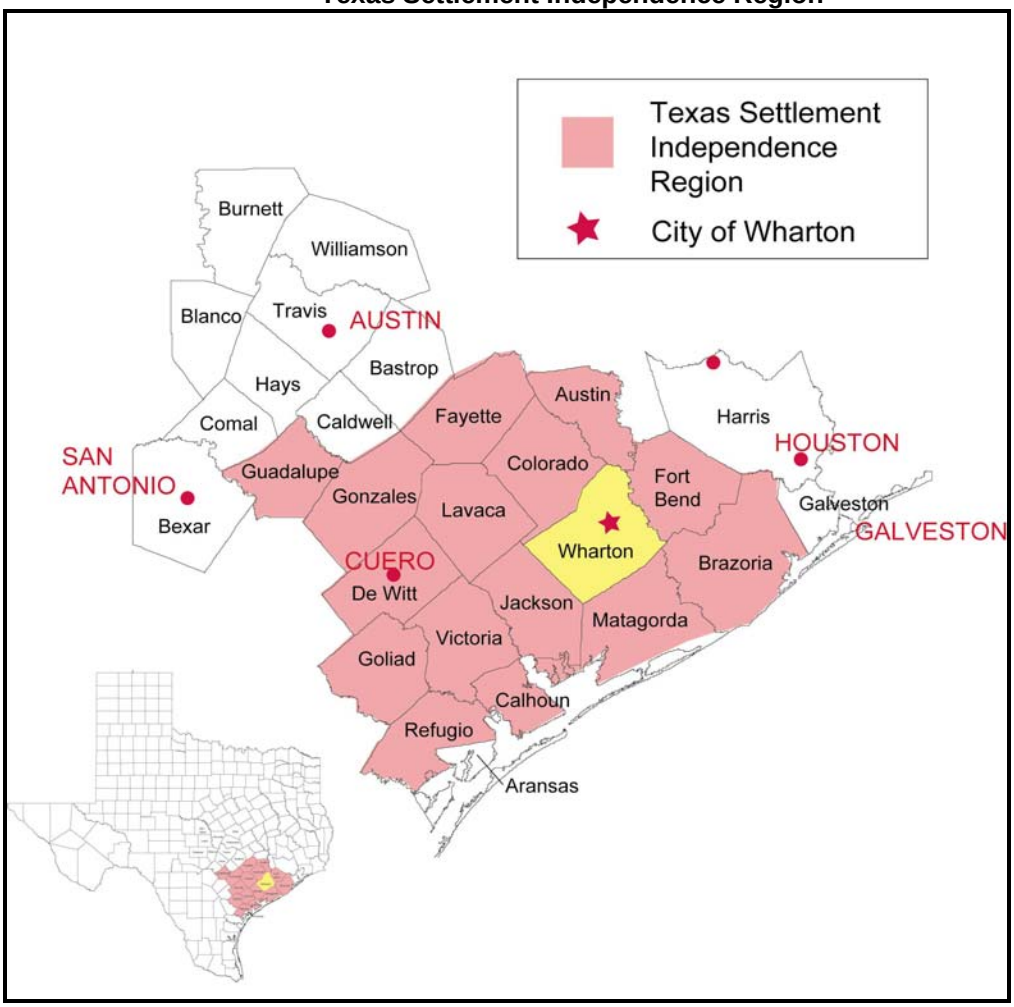
REGIONAL RECREATIONAL RESOURCES

Wharton County is part of the Texas Settlement Independence Region and the Texas Independence Trail. The Texas Independence Trail is an auto-trail (Figure 2-5) and was designated by the Texas Department of Highways in 1968. The trail region includes 28 counties from Liberty (east of Houston) along the Gulf Coast to Refugio (south of Victoria) to San Antonio (Bexar County) in the west and to Washington County in the north. It was designed with the purpose of encouraging travelers to experience the spirit of the Texas Independence Story. More information regarding the auto-trail can be obtained at the Texas Independence Trail Region Website www.texasindependencetrail.org.

Figure 2-5
Texas Independence Trail Region

The Texas Settlement Independence Region (Figure 2-6) was organized in 1998 a conglomeration of 17 counties, including Aransas, Austin, Brazoria, Calhoun, Colorado, DeWitt, Fayette, Fort Bend, Goliad, Gonzales, Guadalupe, Jackson, Lavaca, Matagorda, Refugio, Victoria and Wharton. The mission statement of the Texas Settlement Independence Region is "to protect, enhance and interpret our region's history, culture and natural attractions to promote our region as a heritage tourism destination". The region has recently been adopted into the Texas Historical Commission's new Texas Travel Trails program. Current efforts of the organization are to compile information for publications and to develop promotional literature and maps. The group has determined that the region's unique identity is linked to the birth of the Republic and the State of Texas, and thus is focusing on "Texas' First Settlements". They have joined with six museums to "interpret the LaSalle Odyssey, using artifacts recovered from the Belle shipwreck in Matagorda Bay, and from the excavation of Fort St. Louis. It also envisions a re-creation of Fort St. Louis on Tonkawa Bluff in Riverside Park, Victoria, TX. In addition to these, the El Campo Chamber of Commerce supplies guided tours of more than 20 outdoor building murals, which reflect the city of El Campo's heritage.

Figure 2-6
Texas Settlement Independence Region



Wharton is also included in the Great Texas Coastal Birding Trail System, and has the potential of supplying overnight and long-term accommodations for wintering tourists interested in visiting the various birding trails in the region.

OTHER SOCIAL RESOURCES

POPULATION AND STATISTICS

Wharton County had a population of 41,188 in 2000, an increase of 3% over 1990. The 2000 population ranked 68th out of 254 counties in the state of Texas. Per capita income was $23,212 and ranked 64th in the state. In 2000, the county's population was approximately 53% Anglo, 31% Hispanic, and 15% African-American. Approximately 54.1% of Wharton County residents were between the ages of 20-64, 32.1% were under 20 years of age, and 14% were over 65. The population of the city of Wharton is approximately 10,000, with the city serving an area of approximately 19,000 residents. (2000 Census).

NOISE

Pursuant to the Noise Control Act of 1972 as amended by the Quiet Communities Act of 1978, the EPA has developed appropriate noise-level guidelines, The EPA generally recognizes an average day-night noise level (Ldn) of less than 50 decibels a-weighting (dBA) (USEPA, 1978) for rural areas and between 55 and 60 dBA for urban areas. Hearing loss could result if the average outdoor noise level is in excess of 70 dBA or more for 24 hours over a 40-year period (USEPA, 1974). Several factors affect response to noise levels, including background level, noise composition, and level fluctuation, time of year, time of day, history of exposure, community tolerance, and individual emotional factors. In general, people are more tolerant of a given noise if the background level is closer to the level of the new noise source. People are more tolerant of noises during daytime than at night when background noise normally diminishes, increase sound awareness. Residences are more tolerant of an activity if it is considered to benefit the economic or social well-being of the community or them individually. Noise levels have a much greater affect on outdoor than indoor activities. The project area is located within the City of Wharton. Sound levels in the project area are affected by vehicular traffic on local highways and roads, construction activities in the area, and commercial and residential activities.

TRAFFIC

Traffic within the proposed project areas generally consists of the typical types of traffic flows associated with a small town of less than 10,000 residents. U.S. 59 is the major thoroughfare in the County, and crosses the all streams within the study area. There are also numerous small county road and residential streets within the study area.

CHAPTER 3
IDENTIFICATION OF PROBLEMS AND NEEDS

This chapter identifies and investigates the problems and needs of the study area with regard to flood damage reduction, environmental resources, and recreation.

IDENTIFICATION OF EXISTING FLOOD DAMAGE PROBLEMS

HISTORIC FLOODS

The city of Wharton has been impacted by numerous major floods throughout its history. The construction of Mansfield Dam and Lake Travis in 1940 decreased the Colorado River peak flows through the city of Wharton for major storm events, but flooding has still occurred. Recent significant Colorado River flooding impacted the City of Wharton in 1991, 1998, and 2004. The West End neighborhood of Wharton has been most severely impacted by historic Colorado River floods. Local flooding events have also caused problems in neighborhoods such as the Ahldag subdivision.

1998 Colorado River Flood

A significant Colorado River flood occurred in October of 1998. Rainfall of 8 inches to over 20 inches occurred within the Colorado River watershed along the Wharton/Colorado River county line. A minimal amount of rainfall fell within the city of Wharton. The peak flow on the Colorado River at Wharton occurred on October 23 with a rate of 74,800 cubic feet per second (cfs), equating to approximately a 25-year storm event. The river peaked at a stage of 48.7 feet (elevation 101.14 feet) at the Wharton gauge (Business Highway 59). This is only 1.3 feet less than the expected 100-year stage of 50 feet (elevation 102.4). Inundation areas and data related to the flood were obtained through interviews with City of Wharton officials, Wharton County officials, Wharton residents, aerial video footage, and aerial photographs. The West End neighborhood was inundated with two to four feet of water from the Colorado River. Over 500 homes in the neighborhood were infiltrated with floodwaters, and causing millions of dollars in damages. Residents were forced to evacuate. The Dawson Elementary School, as shown in the photograph below, in the neighborhood was flooded with three feet of water.

Farm-to-Market 102 was overtopped west of U.S. Highway 59 and this water escaped and filled Caney Creek which then began to spill north down CR 231/Wilke Road to Baughman Slough. Water did not overtop Highway 59, but passed through the bridge over the Colorado River and also through the FM 102 underpass. The estimated high-water mark at the Highway 59 Bridge was 105.0 feet, based on photographs and known elevations of top of road and low chords of the bridge structure. FM 102 was also overtopped east of U.S. Highway 59. Overflows from the river filled the Caney Creek channel and inundated the manufactured home park located northeast of the intersection of FM 102 and the abandoned railroad. The abandoned railroad embankment served as a levee preventing more extensive flooding within the City of Wharton. Water overtopped Richmond Road near the Dairy Queen (1,000 feet north of the FM 102 intersection) and old Caney Creek channel. Water rose to Elm Street along the bank of the Colorado River near downtown Wharton.

In addition, floodwaters backed up through the Alabama Box culvert and flooded the park near Santa Fe Road and Alabama Road. The water surface elevation of the Colorado River near the Alabama Box outfall was estimated to be near 100.0 feet. The Caney Creek channel filled through the City of Wharton due to flow escaping over Richmond Road near the Dairy Queen and flow from the park at Santa Fe and Alabama Roads. Although an old, extremely undersized storm sewer system exists along the Caney Creek channel through Wharton, the outfall is at Rusk Street and Elm Street. The tailwater (Colorado River) elevation at this point was near 101.0 feet. The pipe is equipped with a flapgate and prevented Colorado River flow from backing up through the system, but interior flows along Caney Creek could not drain and the storm system was of no benefit during the 1998 event. In all, a total of approximately 800 homes were damaged throughout the City of Wharton. Damages were conservatively estimated to be approximately $6 million.

2004 Colorado River Flood

In November 2004, the Wharton area was again impacted by a flood of slightly smaller magnitude than the 1998 event. The Colorado River crested at a stage of 48.1 feet with a peak flow of over 72,900 cfs. Many homes, businesses, and the elementary school in the West End neighborhood were again inundated similar to the October 1998 event. However, flap gates were installed on the Alabama Box after the 1998 flood event, and this prevented water from backing up through the Alabama Box into the low lying area near Santa Fe and Alabama Roads during the 2004 flood. Approximately 150 homes received damages from floodwaters.

Other Colorado River Flood Events

Although 1998 and 2004 are the last major Colorado River floods, the city of Wharton has experienced numerous floods within the last century. Floods prior to 1940 did not experience any flood control benefits of Lake Travis and Mansfield Dam. Table 3-1 provides a brief summary of other Colorado River floods within the city of Wharton. The peak water surface elevations and flows are approximate. The approximation and gauge rating curve revisions over time explain the variations in estimated flows and peak water surface elevations. The table provides a general overview of the persistent, historical flooding problems within the city of Wharton.

Table 3-1
Historic Colorado River Wharton Floods

Date	Peak Flow (cfs)	Peak Elevation (ft)	Comments
Dec. 1913	200,000	104.3	1-4 feet of water in streets. Peach Creek flooded. Colorado River water from Mackay to Hungerford (10-mile spread). **Brazos & Colorado Rivers converged below Wharton (70-mile wide body of water).**
May 1922	111,000	102.3	Storm centered near Smithville.
June 1935	159,000	103.6	12-mile spread of water. Richmond Road Bridge overtopped at Peach Creek & Baughman Slough. Richmond Road and Milam Street flooded.
July 1938	125,000	102.8	15-mile spread of water. Richmond Road covered with 5 feet of water at Caney Creek. Peach Creek out of banks. 75 blocks in Wharton entirely or partially flooded. Every highway submerged with 2-6 feet of water.
July 1940	100,000	101.4	Centered near Smithville.
Nov. 1940	92,000	100.6	Centered near Columbus.
Dec. 1991	61,900	97.7	Floodwaters from primarily from upstream of Lake Travis and near Austin.
Oct. 1998	74,800	101.1	West End Neighborhood flooded. Flow backed-up through Alabama Box.
Nov. 2004	72,900	100.5	West End Neighborhood flooded.

Other Flood Events

Floods originating on the Colorado River are not the only events impacting Wharton. Local flooding created by Peach Creek, Baughman Slough, and Caney Creek has also caused damage throughout the City. In September 2002, Tropical Storm Fay impacted Wharton. Over 22 inches of rainfall fell over portions of Wharton County. Approximately 100 homes in Wharton were damaged. Most of the residences were in the Ahldag subdivision near Junior College Boulevard (also known as Alabama Road, Lees Lane, and CR 135). Photos of previous flood events in Wharton are shown in the Engineering Appendix, H&H Section.

ESTIMATES OF FLOOD MAGNITUDE BY FREQUENCY

As part of the study efforts performed early in the process, estimates of flood magnitude were made based on recurrence interval. A statistical analysis of historical floods, as well as detailed hydrologic modeling are used to determine the peak flow rates that are likely to occur for a given interval. The hydrology portion of the Engineering Appendix G describes this process in greater depth.

It should be noted that due to the unique nature of Caney Creek in its current, disjointed state, it was more appropriate to evaluate its flood magnitude strictly in terms of stage versus frequency, using the sophisticated hydrologic model that was developed. Thus, peak discharges for Caney Creek were no applicable.

PROBABILITIES OF FLOOD EVENTS

The graph of the probabilities of all flood events forms is a continuous curve. For the sake of clarity, flood events are broken into individual recognizable flood events and the naming conventions simplified. Each of these events has an annual chance exceedence, or ACE probability. The ACE probability is defined as that (level of) event that has a particular chance of occurring once in any given year. Formerly, the 20% ACE was commonly called the 5-year event. This is a misnomer, because it implies that it will only occur once in a five-year time span. In reality, the 20% ACE event is that magnitude of flooding that has a 20% chance, or 1 in 5, of happening in any year. Also, it is not restricted to happening only once in a year. A list of the most recognized probabilities and their common reference is shown below:

Probability	***Common Reference***
50% ACE	2-year
20% ACE	5-year
10% ACE	10-year
4% ACE	25-year
2% ACE	50-year
1% ACE	100-year
0.2% ACE	500-year

COLORADO RIVER DISCHARGES

Flooding from the Colorado River is certainly the most visible and notable. Also, there have been many discharge and stage measurements, and other historical data collected for the river at Wharton. This made for a more confident estimate of peak discharges for various frequency flood events. The data was, however, divided into pre-Mansfield Dam and post-Mansfield Dam time periods. Mansfield dam is located approximately 240 miles upstream, and has been in place since 1941. It was constructed to help reduce flooding downstream, but quantification of this expectation at Wharton is unavailable.

The results of the analysis are shown in Table 3-2.

Table 3-2
Colorado River at Wharton
Discharge versus Frequency, Pre- and Post-Mansfield Dam

Frequency	*Current Q (Unsteady HEC-RAS, cfs)*	*Pre-1941 Estimated Unregulated Q (cfs)*	*% Reduction*
2-yr	25,270	25,100	-0.7%
5-yr	44,070	54,000	18.4%
10-yr	59,355	62,800	5.5%
25-yr	78,160	117,000	33.2%
50-yr	90,770	167,600	45.8%
100-yr	98,315	215,200	54.3%
500-yr	204,795	392,100	47.8%

Given that Mansfield Dam is located 240 miles upstream, changes in operation of Mansfield Dam would not make an appreciable difference in the flooding that is experienced in the Wharton area, and this is not a factor for consideration during formulation.

BAUGHMAN SLOUGH DISCHARGES

Shown below in Table 3-3 are discharge versus frequency data for Baughman Slough near Richmond Road, and near Alabama Road, as derived in the HEC-HMS hydrologic model. Additional details may be found in Appendix G.

Table 3-3
Boughman Slough
Discharge versus Frequency Data

Frequency	*Richmond Rd. Discharge (Q in cfs)*	*Alabama Rd. Discharge (Q in cfs)*
2-yr	615	1,270
5-yr	930	1,885
10-yr	1,155	2,305
25-yr	1,360	2,725
50-yr	1,540	3,070
100-yr	1,705	3,390
500-yr	2,105	4,170

EXTENT OF FLOODING

Unless one is familiar with the flooding issues of Wharton, it is difficult to fully comprehend the magnitude and extent of the problem. Approximately 75% of the town is within the 100-year flood plain, and virtually the entire town is within the 500-year flood plain. Figure 3-2 provides an estimate of the existing conditions 1 % Annual Chance of Exceedance (100-year) inundation.

Flooding can occur from two different types of storms, and from two different sources. A local storm event can create havoc to the central and northern portions of town, with shallow

depth flooding covering major sections of neighborhoods along Caney Creek and Baughman Slough. Due to the lack of relief and drainage facilities, it often takes several days for the waters to fully recede from a localized event.

Flooding from the Colorado River has a distinctly different characteristics. The waters are slow to rise, and even slower to recede, with the event taking as long as a week. Flood waters from the river can threaten the entire town, including the areas affected by Caney Creek and Baughman Slough, due to the fact that when the river overflows its banks, it actually spills over the basin divide, and runs into Caney Creek, Baughman Slough, and Peach Creek. Under existing conditions, these overflows never return to the Colorado River, but instead, drain into the San Bernard River.

There are several low-lying areas located along the river in the southern portion of Wharton, which can be flooded at considerable depth. For example, the 1998 flood (25-year magnitude) flooded the Dawson Elementary School in southwest Wharton to a depth of about three feet. A 100-year event would flood the same area with an additional two feet of depth. It is interesting to note, however, that the 500-year stage is only about 0.5 feet greater than the 100-year. This is due to the fact that once this plateau is reached, there is essentially miles of open water, with no boundaries. As noted in first comment in Table 3-1, the Brazos and Colorado Rivers converged in 1913 to form a 70-mile wide body of water.

SOCIAL ECONOMIC ANALYSIS

Economic Reaches

Economic analyses were conducted to quantify single event and average annual flood damages under the existing conditions scenario within the study area. Results of these analyses, together with the future without project conditions, if different from existing, will serve as a baseline for determining estimated reductions in damages from various structural and non-structural alternative plans. A summary of designated economic reaches used for this study is shown in Table 3-4 below. The location of the economic reaches are shown in Figure 3-1.

Table 3-4
Economic Reaches

Reach Name	*Description*
Baughman Slough	Below Alabama Alabama to Bus 59 Bus 59 to Hwy 59 Above Hwy 59
Caney Creek	Crestmont South of HEB Wharton Outfall Hwy 59 to 102 Above Hwy 59
Colorado River	Below Bus 59 Above Bus 59
Peach Creek	Below Alabama Alabama to Bus 59 Bus 59 to Hwy 59 West of Hwy 59

Figure 3-1 Reach Map

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Figure 3-2 100-year without project floodplain

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Structures And Investment Identified

Of major importance to determination of estimated flood damages is the flood plain investment that is present. Table 3-5 A-D displays a summary of values, broken down by structure type, for each reach, within the 500-year floodplain of the study area, using October 2004 prices and development levels. There are 5,537 structures that are expected to receive damages within the 0.2% ACE. The total estimated value of these structures and vehicles in the 0.2% ACE flood plain is $202,982,000, based on October 2004 price levels. In addition, there is an estimated $22,087,000 in vehicles associated with the residential structures, making the total value used in this analysis equal to $225,069,000.

Table 3-5A
Floodplain Investment Values
2004 Price and Development levels
(Values in $1,000s)

Stream/Reach	Structure Data		
Name	Category	Value	Number
Colorado			
Above Business 59	Commercial	$7,571	35
	Multi-family	$1,105	4
	Mobile Home	$687	100
	Public	$4,006	17
	Single Family Outbuilding	$666	208
	Single Family	$6,833	484
Reach Total		***$20,868***	***848***
Below Business 59	Commercial	$5,612	72
	Multi-family	$187	4
	Mobile Home Outbuilding	$6	1
	Mobile Home	$1,161	104
	Public	$1,012	17
	Single Family Outbuildings	$4,389	654
	Single Family	$21,116	691
Reach Total		***$33,484***	***1,543***
Stream Total		***$54,353***	***2,391***

Table 3-5B
Floodplain Investment Values
2004 Price and Development levels
(Values in $1,000s)

Stream/Reach Name	Structure Data		
	Category	Value	Number
Baughman Slough			
Above Highway 59	Commercial	$45	1
	Mobile Home	$34	5
	Single Family Outbuilding	$794	49
	Single Family	$1,793	57
Reach Total		***$2,666***	***112***
Alabama to Business 59	Commercial	$4,689	69
	MFR	$653	4
	Mobile Home	$842	78
	Public	$47,185	38
	Single Family Outbuilding	$1,527	365
	Single Family	$20,220	576
Reach Total		***$75,116***	***1,130***
Below Alabama	Commercial	$314	13
	Multi-family	$2,517	14
	Mobile Home	$157	15
	Public	$5,562	19
	Single Family Outbuilding	$2,701	220
	Single Family	$9,311	214
Reach Total		***$20,562***	***495***
Business 59 to Highway 59	Commercial	$528	11
	Mobile Home	$71	6
	Single Family Outbuilding	$640	71
	Single Family	$2,232	51
Reach Total		***$3,471***	***139***
Stream Total		***$101,815***	***1,876***

Table 3-5C
Floodplain Investment Values
2004 Price and Development levels
(Values in $1,000s)

Stream/Reach	Structure Data		
Name	**Category**	**Value**	**Number**
Caney Creek			
Above US 59	Commercial	$1	1
	Single Family Outbuilding	$0	1
	Single Family	$33	1
Reach Total		***$35***	***3***
Crestmont	Commercial	$7	1
	Single Family Outbuilding	$31	33
	Single Family	$17,781	306
Reach Total		***$17,820***	***340***
Outfall	Commercial	$223	9
	Multi-family	$1,693	10
	Mobile Home	$472	47
	Single Family Outbuilding	$291	13
	Single Family	$1,532	44
Reach Total		***$4,211***	***123***
South of HEB	Commercial	$6	1
	Multi-family	$99	1
	Mobile Home	$44	4
	Public	$1	1
	Single Family Outbuilding	$62	40
	Single Family	$5,139	86
Reach Total		***$5,351***	***133***
Wharton	Commercial	$584	22
	Mobile Home	$104	4
	Public	$461	8
	Single Family Outbuilding	$368	41
	Single Family	$9,373	209
Reach Total		***$10,891***	***284***
Stream Total		***$38,307***	***883***

Table 3-5D
Floodplain Investment Values
2004 Price and Development levels
(Values in $1,000s)

Stream/Reach Name	Structure Data Category	Value	Number
Peach Creek			
Alabama to Business 59	Commercial	$104	8
	Mobile Home	$12	1
	Single Family Outbuilding	$33	15
	Single Family	$333	9
Reach Total		***$482***	***33***
Below Alabama St	Single Family Outbuilding	$2	2
	Single Family	$148	2
Reach Total		***$151***	***4***
Business 59 to Highway 59	Commercial	$3	2
	Mobile Home	$7	1
	Public	$17	1
	Single Family Outbuilding	$91	6
	Single Family	$83	3
Reach Total		***$201***	***13***
West of Highway 59	Commercial	$644	3
	Mobile Home	$237	17
	Public	$62	3
	Single Family Outbuilding	$2,301	194
	Single Family	$4,429	120
Reach Total		***$7,673***	***337***
Stream Total		***$8,507***	***387***

SINGLE OCCURRENCE FLOOD LOSSES

Tables 3-6 A-D display a summary of the number of structures and amount of flood damages within each ACE floodplain (Single event damages), based on October 2004 prices and levels of development. Total number of structures damaged by the 0.2% ACE event is estimated to be 4,182. This value is less than the total number of structures identified within the floodplain, 5,537, due their estimated first floor elevations being above the ground elevation by a sufficient margin.

Damages to the various structures, accumulated by frequency, produce a frequency-damage function. An integration process using this frequency-damage data calculates estimates of Expected Annual Damages (EAD). Specifically, this involves aggregating the multiplication of the mean damage between each pair of flood events by the difference in exceedance probabilities. This is then repeated for the range of flood events in each property category. The Hydrologic Engineering Center's Flood Damage Assessment Program (HEC-FDA) was developed to facilitate the plan formulation and evaluation of flood damage consistent with Federal and Corps policy regulations. Expected annual damage is the mean damage obtained by integrating the damage exceedance probability curve for each flood event. The damage exceedance probability curve results from the discharge-exceedance probability, stage-discharge, and stage-damage functions derived for each defined reach along the stream.

It is the reduction in EAD which serves as the measure to derive total annualized benefits for any flood damage alternative that is evaluated. The total annualized benefits are then divided by annualized costs of an alternative to determine the benefit-to-cost ratio for each alternative. If the ratio is greater than 1.0, then the alternative is considered to be economically feasible. For this reason, the computation of the EAD for each area of interest is considered an important economic parameter.

Table 3-7 provides a summary of the EAD for all areas of interest investigated in the WIFS. The Economics Appendix also provides additional details for other portions of the economic analysis.

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Table 3-6A
Single Event Damages – Colorado River
October 2004 Price and Development Levels - Values in 1000's

Stream/ Reach	Structure	50%		10%		20%		10%		4%		2%		1%		0.4%		0.2%		
Colorado	Type	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage
Above	Commercial	0	$0	0	$0	0	$0	4	$10	16	$660	22	$934	27	$1,075	27	$1,203				
Business 59	MFR	0	$0	0	$0	0	$0	0	$34	1	$178	2	$258	3	$304	4	$342				
	Mobile Home	0	$0	0	$0	0	$0	15	$35	45	$89	56	$113	60	$124	62	$137				
	Public	0	$0	0	$0	0	$0	5	$378	8	$434	10	$488	11	$515	11	$533				
	Single-Family	0	$0	0	$0	6	$16	222	$683	381	$1,507	437	$1,822	467	$1,962	496	$2,096				
Total		0	$0	0	$0	6	$16	246	$1,140	451	$2,868	527	$3,614	568	$3,982	600	$4,311				
Below	Commercial	0	$0	0	$0	0	$0	7	$2	16	$24	33	$55	49	$74	58	$106				
Business 59	Mobile Home	0	$0	0	$0	0	$0	3	$5	9	$18	10	$24	12	$27	13	$29				
	Public	0	$0	0	$0	0	$0	1	$2	3	$3	7	$20	8	$32	9	$45				
	Single-Family	0	$0	0	$0	1	$6	210	$537	605	$1,992	709	$2,755	757	$3,168	830	$3,567				
Total		0	$0	0	$0	1	$6	221	$546	633	$2,036	759	$2,854	826	$3,301	910	$3,747				
Colorado Structure Totals		0	$0	0	$0	7	$22	467	$1,686	1084	$4,903	1286	$6,468	1394	$7,282	1510	$8,058				
	Vehicles																	806	$1,787		

Table 3-6B
Single Event Damages – Baughman Slough
October 2004 Price and Development Levels - Values in 1000's

Stream/ Reach	Structure	50%		20%		10%		4%		2%		1%		0.4%		0.2%	
Baughman	Type	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage
Above	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$8	1	$10
Highway 59	Mobile Home	1	$1	1	$2	2	$2	2	$3	2	$3	2	$3	3	$3	3	$3
	Single -Family	27	$53	47	$100	50	$117	54	$130	58	$144	60	$158	63	$170	66	$183
Total		28	$54	48	$102	52	$119	56	$132	60	$147	62	$161	66	$181	70	$196
Alabama to	Commercial	4	$0	6	$2	7	$13	10	$31	15	$128	36	$291	53	$390	68	$526
Business 59	Multi-Family	0	$0	0	$0	0	$0	0	$0	0	$0	2	$175	2	$258	2	$342
	Mobile Home	0	$0	1	$4	1	$6	2	$7	2	$15	27	$102	44	$194	76	$356
	Public	0	$0	2	$14	3	$40	3	$55	4	$179	29	$3,108	35	$5,069	38	$6,891
	Single-Family	72	$397	178	$945	217	$1,132	229	$1,258	357	$2,007	671	$5,346	833	$8,354	907	$11,650
Total		76	$397	187	$966	228	$1,191	244	$1,351	378	$2,328	765	$9,022	967	$14,266	1091	$19,765
Below	Commercial	0	$0	0	$0	0	$0	0	$0	1	$1	1	$5	3	$21	13	$51
Alabama	Multi-Family	0	$0	0	$0	0	$0	0	$0	0	$11	0	$0	0	$0	10	$557
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$1	5	$17	11	$40	14	$89
	Public	0	$0	0	$0	0	$0	0	$0	1	$1	9	$4	17	$28	19	$595
	Single-Family	30	$85	52	$179	63	$247	83	$320	172	$886	300	$2,275	345	$3,853	403	$6,051
Total		30	$85	52	$179	63	$247	83	$320	174	$901	315	$2,300	376	$3,942	459	$7,342
Business 59	Commercial	0	$0	3	$0	3	$0	5	$0	5	$3	7	$8	9	$13	11	$24
To Highway 59	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	2	$9	2	$13	6	$16
	Single -Family	39	$134	60	$239	75	$319	84	$423	93	$543	107	$747	108	$850	110	$950
Total		39	$134	63	$239	78	$319	89	$423	98	$546	116	$765	119	$875	127	$991
Baughman Structure Totals		173	$670	350	$1,486	421	$1,876	472	$2,226	710	$3,922	1258	$24,494	1528	$19,264	1747	$28,294
	Vehicles															885	$4,893

Table 3-6C
Single Event Damages – Caney Creek
October 2004 Price and Development Levels - Values in 1000's

Stream/ Reach	Structure	50%		20%		10%		4%		2%		1%		0.4%		0.2%	
Caney Creek	Type	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage
Above	Commercial	0	$0	0	$0	1	$0	1	$0	2	$17	2	$29	2	$30	2	$31
Highway 59	Single -Family	0	$0	1	$0	1	$0	1	$0	2	$3	2	$5	2	$6	3	$7
Total		0	$0	1	$0	2	$0	2	$0	4	$20	4	$34	4	$36	5	$38
Outfall	Commercial	1	$1	8	$7	10	$16	10	$19	14	$29	14	$32	15	$34	17	$37
	Multi-Family	0	$0	1	$18	2	$83	3	$148	10	$395	10	$456	10	$491	10	$525
	Mobile Home	1	$9	10	$32	16	$54	18	$63	42	$106	45	$120	46	$127	46	$135
outfall	Single -Family	0	$0	0	$0	1	$9	1	$10	1	$18	1	$20	1	$22	1	$23
	Single -Family	3	$9	13	$73	25	$136	30	$157	39	$281	41	$324	42	$348	48	$371
Total		5	$19	32	$130	54	$297	62	$398	106	$828	111	$952	114	$1,021	122	$1,090
South of HEB	Commercial	10	$2	11	$3	11	$3	11	$3	14	$11	14	$13	14	$13	14	$14
So of HEB	Mobile Home	0	$0	0	$0	0	$0	0	$0	1	$2	1	$3	1	$3	1	$3
	Mobile Home	0	$0	0	$0	0	$0	0	$0	1	$2	1	$3	1	$3	1	$3
	Public	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1
	Single-Family	14	$110	27	$181	42	$279	47	$312	78	$621	79	$654	80	$670	82	$687
Total		25	$113	39	$184	54	$283	59	$316	95	$639	96	$673	97	$689	99	$706
Hwy 59 to 102	Single-Family	0	$0	0	$0	0	$0	2	$2	6	$6	6	$15	6	$20	7	$40
Total		0	$0	0	$0	0	$0	2	$2	6	$6	6	$15	6	$20	7	$40
Wharton	Commercial	1	$0	4	$5	8	$11	23	$17	27	$30	27	$31	27	$32	27	$121
	Public	0	$0	0	$0	3	$0	4	$0	5	$7	6	$10	6	$10	6	$11
	Single-Family	55	$643	82	$1,029	92	$1,287	98	$1,440	111	$1,888	113	$1,937	113	$1,942	113	$1,952
Total		56	$643	86	$1,034	103	$1,298	125	$1,457	143	$1,925	146	$1,978	146	$1,984	146	$2,084
Crestmont	Commercial	0	$0	0	$0	0	$0	0	$0	1	$0	1	$0	2	$2	2	$4
	Single-Family	4	$268	19	$529	43	$933	50	$1,056	161	$2,251	171	$2,383	176	$2,515	185	$2,646
Total		4	$268	19	$529	43	$933	50	$1,056	162	$2,251	172	$2,384	178	$2,517	187	$2,650
Caney Structure Totals		60	$911	105	$1,563	146	$2,232	177	$2,515	311	$4,182	324	$4,377	330	$4,520	566	$6,608
Vehicles																300	$1,554

Table 3-6D
Single Event Damages – Peach Creek
October 2004 Price and Development Levels - Values in 1000's

Stream/ Reach	Structure	50%		20%		10%		4%		2%		1%		0.4%		0.2%	
Peach Creek	Type	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage	No.	Damage
Alabama	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	8	$22	8	$41
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$2	1	$6
To Highway 59	Single-Family	0	$0	0	$0	0	$0	0	$0	1	$6	17	$82	24	$223	24	$296
Total		0	$0	0	$0	0	$0	0	$0	1	$6	17	$82	33	$247	33	$342
Below Alabama St	Single-Family	0	$0	0	$0	0	$0	0	$0	0	$0	3	$24	4	$65	4	$89
Total		0	$0	0	$0	0	$0	0	$0	0	$0	3	$24	4	$65	4	$89
Business 59	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	2	$0	2	$0
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$2	1	$5
To Highway 59	Public	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$2	1	$2
	Single-Family	0	$0	0	$0	0	$0	0	$0	0	$0	2	$9	9	$70	9	$119
Total		0	$0	0	$0	0	$0	0	$0	0	$0	2	$9	13	$73	13	$126
West of	Commercial	1	$9	1	$9	1	$10	1	$10	1	$10	1	$11	1	$12	3	$48
	Mobile Home	1	$6	2	$13	2	$18	2	$27	3	$39	8	$68	10	$117	11	$148
Highway 59	Public	0	$0	0	$0	0	$0	0	$0	0	$0	1	$2	2	$4	2	$5
	Single-Family	40	$164	72	$366	112	$659	143	$1,023	156	$1,399	213	$2,473	258	$3,404	293	$4,014
Total		42	$179	75	$388	115	$687	146	$1,060	160	$1,448	223	$2,554	271	$3,536	309	$4,215
Peach Structure Totals		42	$179	75	$388	115	$687	146	$1,060	161	$1,454	245	$2,669	321	$3,922	359	$4,772
Vehicles																127	$731

Table 3-7
City of Wharton Existing Condition
Expected Annual Damages*
October 2004 Price and Development Levels – Value in $1,000's

By Stream and Reach						
Peach Creek	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Alabama	0	0	0	0	1	1
Alabama to Business 59	1	0	0	0	9	10
Business 59 to Highway 59	0	0	0	0	1	1
West of Highway 59	7	0	10	0	372	389
EAD	8	0	10	0	383	401
Baughman Slough	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Alabama	0	10	1	3	254	268
Alabama to Business 59	43	9	9	186	1027	1274
Business 59 to Highway 59	2	0	1	0	224	227
Above Highway 59	2	0	1	0	93	96
EAD	47	18	12	189	1598	1864
Caney Creek	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
South of HEB	5	0	1	0	195	201
Wharton	10	0	0	6	883	899
Outfall	8	34	22	0	120	184
Highway 59 to Business 59	0	0	0	0	3	3
Above Highway 59	1	0	0	0	1	2
Crestmont	0	0	0	0	609	609
EAD	24	34	23	6	1810	1899
Colorado River	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Business 59	4	0	2	2	133	141
Above Business 59	33	11	5	37	122	208
EAD	36	11	7	40	255	349

*Vehicle damages are calculated into the single-family category

IDENTIFICATION OF ENVIRONMENTAL DEGRADATION

ENVIRONMENTAL RESOURCES

During initial scooping of this study, a general agreement was reached that due to a constrained budget, the study's primary focus centered on flooding issues. However, in concert with establishment of existing and future without project conditions from an environmental perspective, potential ecosystem restoration problems and opportunities were noted.

Colorado River

Since the mid-1800's, the riparian corridor associated with the Colorado River has steadily diminished through Wharton County. In many areas, intense agricultural usage is being undertaken immediately adjacent to the river banks.

Caney Creek

Caney Creek has little resemblance from the natural stream it once was. In reality, it is no longer a functioning, flowing stream within the city of Wharton. Many areas have been filled in, and structures have even been built within the old creek bed. The area is dependent on external structural drainage facilities in order to maintain proper drainage.

Baughman Slough

In most reaches of Baughman Slough, lands have been completely cleared of woody vegetation. Cropland or open pastureland generally exists immediately adjacent to the stream bank, with no vegetation buffer of any significance.

DETERMINATION OF FUTURE WITHOUT PROJECT CONDITIONS

The robust planning process used for this study required accurate identification of the future without project conditions, with the period of analysis for planning purposes being defined a 50 year period from years 2010 to 2060. This serves as the baseline against which all alternatives are compared. Use of the existing conditions, as identified above, as well as historic trends for significant parameters, such as population, development, and other land use changes, allowed for determination of future without project conditions.

In instances where flooding is the primary concern, changes in watershed conditions during the analysis period generally equates to an increase in peak runoff during the passage of storm events. Wharton's flooding problems are tied to two significantly different types of flooding events – basin wide and local. Changes in the significant parameters affect these differently.

The Colorado River at Wharton has a drainage area of over 14,000 square miles. In general, future land use is not anticipated to change appreciably over the period of analysis. While minor pockets of intensification are expected, they will follow a continued trend of conversion from row crop to grassland, as well as better soil conservation practices that encourage infiltration. Although there has been increased urbanization and population during the last several decades, the vast majority of the large increases are attributable to the Austin metropolitan area. Given that Austin is located several hundred miles upstream, the more

peaked flood waves have ample opportunity to attenuate during the three to five days of travel time to Wharton. In summary, it is concluded that existing conditions can be held steady throughout the period of analysis, and thus can serve as the future without project conditions.

The Baughman Slough and Caney Creek watersheds are located primarily to the west of the city of Wharton. This area is almost entirely under cultivation, with a smaller percentage of area being old fields or grassland. With the exception of the narrow band of area on both sides of U.S. Highway 59, this is no expected to change. Population in the county has increased at a modest rate of 3% during the last census period. As such, it was concluded that existing conditions cold be adopted as the future without project conditions for these regimes as well.

IDENTIFICATION OF NEEDS AND OPPORTUNITIES

IDENTIFICATION OF FLOOD DAMAGE REDUCTION NEEDS

Given the results shown in Table 3-4 and 3-5 above, it clearly indicates that most of the damages are located in the Baughman Slough and Caney Creek reaches within the city of Wharton. The Colorado River reaches also contain significant flood damages within the city. Finally, one reach on Peach Creek, west of Highway 59, has the potential for significant losses, but this reach is a lengthy, sparsely populated corridor outside of the City's primary area of responsibility.

These findings are generally consistent with historic losses and flood events. At first glance, it may appear that flooding from the Colorado River is only a minor concern. However, the hydraulics analysis provided in the Engineering Appendix provides a good description on how much of the existing damages on Caney Creek and Baughman Slough are attributable to Colorado River overflows. If the river source is addressed, benefits will be achieved throughout the system.

ECOSYSTEM RESTORATION NEEDS AND OPPORTUNITIES

Colorado River

Ecosystem restoration opportunities along the river include restoration of the riparian bottomland hardwoods and reduction of stream bank erosion in any disturbed, impacted or altered area in and around the city of Wharton.

A very strong meander of the river is located near the closed landfill facility (approximate station 3500+00. The area, which is almost totally surrounded by the river, floods frequently. It is believed that this would be an excellent site for restoration of riparian bottomland hardwoods. It could also potentially serve as a mitigation site, if one is deemed necessary.

Ecosystem restoration in the area adjacent to the wastewater treatment facility (near Station 3410+00) could include restoration of the stream bank by removing the riprap and cement, reshaping the bank then planting natural vegetation to reduce stream bank erosion.

Caney Creek

Restoration opportunities for Caney Creek include restoration of natural vegetation and/or a more natural flow regime. This, however, would be a major effort, and may not be justifiable in terms of cost per habitat unit gained.

Baughman Slough

Restoring the natural environment of the slough could be accomplished by restoring bottomland hardwoods and natural vegetation.

RECREATION NEEDS AND OPPORTUNITIES

Recreational opportunities are limited in the Wharton area and overcrowding is currently affecting availability and use of state parks within the region. Members within the Wharton community desire expansion of the Colorado Riverside Park, creation of hike/bike/nature trails and pedestrian linkage to the downtown center and courtyard. Currently trail-based bicycling and equestrian trail facilities do not exist, but are in high demand throughout the Lower Colorado River Authority's jurisdiction. The nearest equestrian facility is the county fairgrounds, but trails do not exist on the site. Skateboarders and inline skaters would also like trail-based recreational areas. The Pierce Ranch and other ranches in the region have been venturing into the recreational industry and providing horseback riding and other outdoor recreational opportunities for a fee. These ranch amenities are popular with tourists; however the local residents need access to everyday recreational opportunities within their communities.

Recreation desires and needs are summarized in the following paragraphs.

Access for watercraft: Access to the waters of the Colorado River is desired by the community; the nearest public boat access ramp is the "David Hall Ramp" upstream, and is considered by some residents to be unsafe. Other than this ramp, the cities of Columbus and Bay City have the nearest boat ramps to the Wharton area. The Lower Colorado River Authority is currently constructing a kayak trail in Matagorda County nearby: however; more access is desired. Wharton civic leaders are very interested in the construction of a safe boat ramp in the Riverside Park area. They have also tossed around development of a low water dam, which would accommodate kayaking, a larger lake for recreation and water storage.

Trails and/or Trail Systems: Trails were considered highly desirable by civic leaders. Currently, trail-based activities within the city are virtually non-existent, but local demand is not currently high enough to support. Serious consideration should be given to If there is an opportunity to include trails as an add-on to other primary project features,

RV Camping Park with Sewage Facilities: The city is also interested in developing an RV Park with sewage facilities. This was identified as a high priority along with pedestrian access to the riverside park and boat access. The RV development underway at Teepee Motel may meet a portion of this need.

Creation of a Lake: There is significant interest in developing a lake (off-stream) and providing additional water-based recreation. (The lack of significant topographic variation and geologic features will limit the development of this option. In regards to the creation of a lake, the close proximity of the Wharton Municipal Airport and Federal Aviation requirements must also be considered.)

PROBLEM STATEMENT

Given the assessment of existing and future, without project conditions, as depicted in the previous sections, as well as the supporting appendices, the problems can be summarized in the following clear, concise statement:

> *The city of Wharton, and the surrounding urban development, is at extensive risk of future flooding from both localized and regionalized events. This causes the community to incur estimated average flood losses of over $4.5 million annually, with health, safety, and potential loss of life being constant concerns.*

Although not specifically included in the problem statement, opportunities also exist for restoration of water-related ecosystems. A need for additional recreation features, particularly boat ramps and walking trails, was also identified.

CHAPTER 4
PLAN FORMULATION

This chapter details the steps that were taken to formulate a plan which best meets or exceeds the planning objectives as set forth below. The formulation of a plan to resolve the flood related problems and needs necessitates the exploration of possible alternative measures, including structural and non-structural solutions. Beneficial and adverse contributions of each alternative are evaluated against existing conditions.

PLANNING OBJECTIVES

Planning objectives are an expression of public and professional concerns about the use of water and related land resources resulting from the analysis of existing and future conditions in the study area. These planning objectives were used in guiding the development of alternative plans and their evaluation for the period of analysis.

Legislation requires that Federal water and related land resources planning be directed at contributing to National Economic Development (NED), consistent with protecting the Nation's environment. Contribution to NED is achieved by increasing the net value of the nation's output of goods and services, expressed in monetary units. NED contributions must also consider the environmental effects of proposed changes on ecological, cultural, and aesthetic attributes of natural and cultural resources.

Plans formulated as part of this study were evaluated based on their contribution to the National Economic Development, 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 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.

- Reduce risk to life, health, and welfare of the residents residing in Wharton by decreasing the risk of flooding to the extent practical.

- 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 are subject to zoning restrictions pertaining to the 100-year floodplain.

- Reduce emergency costs associated to the occurrence of significant flood events within Wharton.

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:

- 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.

- 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.

FORMULATION AND EVALUATION CRITERIA

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 Wharton area. Appropriate Corps of Engineers engineering and design manuals, criteria, and regulations relating to flood control channels, outlet works, embankment, streamflow routing, backwater computation, cost estimates, etc., were used in developing alternative plans.

TECHNICAL CRITERIA

Alternative plans must be feasible, practicable, and soundly engineered to provide a service life, with reasonable maintenance, for at least 50 years. Existing facilities should be utilized to the maximum extent possible. The plan should be complete within itself and not require additional future improvements other than normal operation and maintenance.

ECONOMIC CRITERIA

The NED objective is maximization of the economic worth of alternative plans as set forth in the Principles and Guidelines for Planning Water and Related Land Resources Implementation Studies. The NED objective is to increase the nation's output of goods and services and improve national economic efficiency. For flood control projects, this objective relates to a plan's capability to prevent flood damages by comparing the plan's economic benefits with the project cost. The amount that a project's economic benefits exceed the project cost is defined as net benefits. In the plan formulation process, the plan that yields the greatest net benefits best meets the NED objective.

The plan selected as the recommended plan should seek to provide a maximum of net benefits, unless certain provisions can be applied to supercede this criteria. One such provision cited in Corps guidance allows a locally preferred plan to be selected as the recommended plan if the plan yields greater net benefits than any smaller scale alternative. In such instances, larger scale plans need not be investigated in an effort to identify the NED Plan. The other provision allowing recommendation of a plan other than the NED Plan involves the granting of an exception by the Assistant Secretary of the Army (Civil Works). Such an exception may be granted for an economically justified plan when overriding and compelling reasons favor the selection of such a plan. Recommended plans which are less costly than the NED Plan would be cost shared on the same basis as the NED Plan. In the absence of special legislation, Federal participation in a recommended plan that is more costly than the NED Plan would be limited to the Federal share of the NED Plan, unless the increased development is deemed worthy of warranting Federal participation, and is specified as such in the exception. Cost sharing may then be calculated on the same basis as the NED Plan.

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 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 period of analysis. 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 period of analysis 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. To be economically feasible, a plan must have greater benefits than costs or, more specifically, a BCR greater than 1.0, based on the current applicable interest rate.

The evaluation of alternatives is presented using October 2004 prices and levels of development. The Fiscal Year 2005 interest rate of 5.375% was used to annualize all costs and compare against annualized benefits. The baseline expected annual damages can be found in Chapter 3, with additional details in Appendix A.

ENVIRONMENTAL AND SOCIAL CRITERIA

Plans formulated under Federal directives should be consistent with protecting and enhancing the existing environment by the management, conservation, preservation, creation, or improvement of the quality of certain natural and cultural resources and ecological systems in the proposed project area. Structural and non-structural measures must be evaluated in accordance with guidelines established by the National Environmental Policy Act of 1969 (Public Law 91 190), as amended, and the Principles and Guidelines for Water and Related Land Resources Implementation Studies, as developed by the U.S. Water Resources Council, dated July 1983. The following environmental and social criteria were considered:

- Promote the protection and enhancement of areas of natural beauty and human enjoyment.
- Protect areas of valuable natural resources.
- Protect quality aspects of water, land, and air resources in the watershed.
- Protect against possible loss of life and hazards to health.
- Promote safety.
- Preserve and enhance social, cultural, educational, and historical values within the project area.

- Minimize and, if possible, avoid the displacement of people and destruction or disruption of community cohesion.

INITIAL SCREENING OF ALTERNATIVES

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, 2003.

Structural measures consist of structures designed to control, divert, or exclude the flow of water from the flood prone areas to the extent necessary to reduce damages to property, hazard to life or public health, and general economic losses. The structural measures considered most appropriate in dealing with the character of the flood problems encountered typically include small detention lakes, channel modifications, flood flow diversions, and levees.

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. The technique of controlled land use is particularly helpful in planning for future development, but is limited in highly developed areas.

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 have been subjected to more detailed studies to define their costs and benefits.

NONSTRUCTURAL ALTERNATIVES

No Action

The “no action” alternative would not recommend any type of project, nonstructural or structural, be implemented. While the no-action measure does not require the expenditure of Federal funds, adoption of this alternative implies acceptance of the existing and future flood damages and other adverse impacts caused by continued potential flooding of the 3,252 structures within the 0.2 percent ACE (500 year) floodplain.

The “no action” alternative would not result in impacts to fish and wildlife habitat within the project area. This alternative may result in continued temporary water quality impacts to surface and ground water due to over bank flooding. An out-of-bank flood of the Colorado River impacts the water treatment plant and any septic systems in the city, which could lead to temporary discharges of sewage. Overall, this alternative would not result in any additional environmental impacts compared to the current conditions.

This alternative will continue to subject Wharton citizens to flooding hazards. Although flood insurance would partially compensate for flood damages, they would still be incurred at an estimated average rate of $4.5 million annually. The costs for flood fighting and recovery costs, public damages, the potential loss of life, and the overall threat to health and safety would continue under the no action alternative. The no action alternative does not meet any of the

previously stated planning objectives. For compliance with National Environmental Policy Act regulations (40 CFR 1502.14(d)), the no action alternative will, however, be carried forward to the final array of alternatives.

Floodplain Management

Floodplain management is most effective in controlling future development of the floodplain, thereby assuring that the existing flood problems do not become worse. However, floodplain management cannot, by itself, significantly alleviate existing flooding conditions within an existing floodplain. The technique of controlled land use is particularly helpful in planning for future development but is of limited use in highly developed areas. Effective regulation of the floodplain is dependent on developing enforceable ordinances to insure that floodplain uses are compatible with the flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building codes. Zoning regulations permit prudent use and development of the floodplain in order to prevent excessive property damage, expenditure of public funds, inconvenience, and most important of all, loss of life, due to flooding. Subdivision regulations guide the division of large parcels of land into smaller lots, and typically require the developer to show compliance with subdivision regulations, zoning ordinances, the local land use or master plan, and other regulations. A subdivision ordinance would require installation of adequate drainage facilities, prohibit encroachment into floodway areas, require the placement of critical streets and utilities above a selected flood elevation, and building lots or structures above a selected flood elevation, normally one foot above the 100-year floodplain elevation. Building codes specify the building design, materials and construction methods used for both construction of new buildings or repair of flood-damaged structures.

The City of Wharton currently participates in the National Flood Insurance Program (NFIP), and has been enrolled in NFIP's Regular Program since 16 September 1982. After joining this program, the City of Wharton has enacted and enforced numerous floodplain land-use restrictions, regulation, zoning ordinances, subdivision regulations, and building codes. While these measures will not reduce flood damages to the majority of the existing structures in the study area, they are important management tools for limiting the continued increase in population and property susceptible to flooding. However, given that the vast majority of the city is located within the FEMA designated Zone A, or existing 100-year floodplain, this has placed severe restrictions on any further development. From a local economic perspective, this has placed the city in a disadvantage when competing with other local communities to attract new businesses and development. This is directly linked to one of the Planning objectives.

Additional, more intense floodplain management does not warrant further evaluation due to its inability to address existing damages and meet the planning objectives. It should be noted that Wharton will be required to complete and implement a floodplain management plan within one year of the completion of any flood damage reduction plan recommended and implemented by the Corps of Engineers.

Flood Forecast and Warning

Flood forecast and warning involves the determination of imminent flooding, implementation of a plan to warn the public, and organization of assistance in evacuation of persons and some personal property. Notification of impending flooding can be by radio, siren, individual notification, or by more elaborate means such as remote sensors to detect water levels and automatically warn residents. These measures normally serve to reduce the hazards to life and damage to portable personal property. Flood warning and emergency evacuation should be considered as part of any flood control plan.

For flooding relating to the Colorado River, sufficient lead time exists, and local officials are already warning residents using various communications methods. Little would be gained, if this was converted to an automated system, and damage to structures would remain the same.

Flood proofing

Flood proofing of residential and commercial structures can include providing water tight coverings for door and window openings, raising structures in place, raising access roads and escape routes, constructing levees and floodwalls around individual buildings or groups of buildings, and waterproofing walls of structures. Flood proofing is more easily applied to new construction and more applicable where flooding is of short duration, low velocity, infrequent, and of shallow depths, and is also appropriate in locations where structural flood protection is not feasible or where collective action is not possible. Flood proofing techniques would require major modifications to existing structures. For water levels that are lower than the first floor of a home, flood proofing would certainly be a possibility. However, if a sustained water level in excess of one foot of the first floor elevation, the structural stability of a watertight home becomes a critical factor. A flood proofed structure generally cannot withstand hydrostatic pressures when water rise three feet above the lowest floor. This is especially true in the older, established neighborhoods that consist of small wood framed houses that flood most frequently. Additional shortcomings include not protecting public facilities such as roads, bridges, and utilities, and the continued threat of road closures and the isolation of residents trapped in their homes and businesses.

The elevating of structures in place has potential in some instances. This is especially true if the flooding involves a small number of structures sparsely distributed within the floodplain, and those structures are of the pier-on-beam foundation type. This criteria, however, does not fit the situation in Wharton, where flooding is to thousands of structures and many of the homes utilize slab-on-grade foundations.

While flood proofing would not likely result in any significant or permanent adverse impacts to ecological or cultural resources, and is appropriate under certain conditions, as a standalone alternative, it does not fully address the planning objectives or criteria previously discussed. In some instances, it may be a viable option in combination with another structural measure. If, however, a levee system is selected, additional flood proofing makes little sense, and would not be considered further under these circumstances.

Floodplain Evacuation

Floodplain evacuation, or buyout as it is commonly known, involves the acquisition, demolition, and removal of structures from the floodplain, and the relocation of residents to flood-free housing. The practicality of evacuation depends on several factors. They include the frequency and severity of flooding, the willingness of residents to move out of the floodplain, the availability of flood-free housing, the value of the property, and the need for areas of a more compatible floodplain use such as parks or nature areas. Permanent evacuation is a very effective means of reducing flood damages, as well as public damages and costs.

Past investigations have demonstrated that permanent evacuation is typically cost effective only up to and including the 4% ACE (25-year) floodplain. Within the study area, there are a total of 1,262 structures that would receive damages from the 4% ACE (25-year) storm. Also, many of these structures are concentrated in the southwestern portion of Wharton, populated by small, wood framed homes which could easily be removed. Based on this assessment alone, permanent evacuation warrants further investigation, and will be developed in more detail.

STRUCTURAL ALTERNATIVES

Detention

This alternative consists of constructing one or more structures to provide flood storage to detain peak flood flows and lessen downstream flood damages. Detention is used to temporarily impound floodwaters for later release when the downstream conditions permit. The feasibility of this measure depends heavily on the volume and timing of the flood flows, and the availability of an impoundment site capable of providing sufficient storage. Flood events within this area of the Lower Colorado River basin have tremendous volumes or extended durations of weeks. Additionally, since the overall topography of the area is relatively flat, no favorable sites exist in the area which could serve as a dam site to impound such high volumes of water. Therefore, this alternative was not considered any further.

Levees and Floodwalls

Levee systems traditionally provide high levels of protection to flood prone areas but often require substantial amounts of real estate between the stream and the structures being protected unless an existing levee is in-place, or the height of the levee is relatively small. Floodwalls (usually made of concrete) are used in lieu of levees in situations where the acquisition of real estate for the levee or other topographic problems may be prohibitive. The feasibility of either of these measures is based on the cost and availability of real estate, the number of structures along the levee alignment, and the additional costs necessary to alleviate interior drainage problems to prevent induced damages in adjacent areas. Construction of individual levees or floodwalls around specific structures or small groups of structures is normally considered cost prohibitive unless the individual structure is very valuable, has cultural significance, or is prone to frequent flooding.

The terrain and type flooding of experienced in the Wharton area lends itself well for resolution through implementation of a complete levee system. While the area flooded by events greater than the 10% ACE event is extensive, flooding at all levels is relatively shallow. In most areas, there is sufficient real estate available without incurring extensive relocation of existing structures or facilities. As a result, this measure will be carried forward for more detailed evaluation.

Channel Modifications

This measure consists of modifying an existing channel by either increasing the cross-sectional area of the stream channel and/or an existing bridge (widening and/or deepening), straightening and realigning the stream channel, and/or reducing the friction losses of an existing channel through concrete lining. The design of the channel modification can vary significantly and is primarily based on the topography of the existing stream channel and the existing development of properties within the floodplain. Other factors to consider in the design of these hydraulic channel improvement alternatives include the existence of known or potential significant ecological and cultural resources as well as contaminated material.

In general, large, mildly sloped rivers such as the Colorado River through Wharton, do not react well to extensive channelization. Only relatively small reductions in water surface profiles are achieved with major excavations. For smaller streams such as Baughman Slough, however, smaller excavations may create significant percent increases in channel area, which may be sufficient to realize significant reductions in flooding potential. For this reason, the channel

modification measure will be further analyzed in more detail for possible plan development on Baughman Slough.

Diversions

Diversions can exist in many types, sizes and shapes. Generally, it is defined as a feature which alters the stream flows in another direction or even into other streams. Diversions may also be used to create short cuts, or "cut-offs", across natural channel meanders.

Four different types of diversion schemes were initially discussed for possible implementation in Wharton:

- As discussed in previous sections, under without project conditions, flood flows overflow the banks of the Colorado River and actually depart the entire Colorado Basin, enter Peach Creek and Baughman Slough, and eventually enter the San Bernard River. Flooding in Wharton could perhaps be reduced in areas adjacent to the Colorado by diverting even more flows to the San Bernard. This, however, was eliminated from further consideration due to the significant flooding problems already existing along the San Bernard River.

- A cut-off diversion on the Colorado was also considered initially. A major meander of the Colorado is located adjacent to the city of Wharton. Preliminary hydraulic analysis revealed, however, that a diversion of this nature would require extensive excavation quantities, with the resulting reduction of water surfaces being relative minor. Thus, this measure was removed from further consideration.

- Significant flooding within Wharton occurs due to the lack of drainage capabilities along Caney Creek. In many areas along the creeks, no defined channel remains. Furthermore, the area along the creek, downstream of Wharton, is sufficiently blocked with low water dams and crossings such that no positive drainage can occur. Given the option of either diverting waters or opening up Caney Creek downstream, it was clear to the formulators that diversion of flows to the river would be by far the most cost effective and least environmentally damaging approach. Thus, diversion of Caney Creek was carried forward into more detailed studies.

- Baughman Slough is a significant source of flooding on the north side of Wharton. It was believed that since Peach Creek, located to the north of Baughman Slough, may have extra capacity during times when the Baughman Slough exceeded capacity, diversion of flows from Baughman to Peach should be investigated in more detail. Thus, it was carried forward to detailed investigations.

VALUE ENGINEERING

The Project Study Plan (PSP) for the Wharton and Onion Interim Feasibility Studies were amended in September 2003 to carry the study through the Feasibility Phase. On February 5, 2005, ER 11-1-321 was published after the final array of alternatives were developed and evaluated, which requires feasibility reports to undergo a Value Engineering (VE) Study before the final array of alternatives are evaluated. Realizing that the study would be grandfathered since the final array of alternatives had already been evaluated, but practicing good business the District Value Engineering Officer (VEO) accompanied the Project Manager to Austin to meet with the local sponsors on Feb 17, 2005 to discuss and perform a mini value engineering analysis and a need to revise the PSP if appropriate to conduct a VE Study. The VEO led the Team in identification of issues of concern associated with Onion Creek, Williamson, and Wharton

Studies. The VEO explained the VE Process and identified how it is used to resolve issues, clarify expectations, and develop alternatives that best meet the functional requirements of the project. The VEO discussed plans for the expanded VE Study, required by law, planned for the Design Phase of the projects. The study team decided that the mini-analysis would suffice for the Feasibility Study since the final array of alternatives were already evaluated and that a detailed study should be completed during the initial stages of the Preconstruction, Engineering and Design Phase.

DETAILED INVESTIGATION OF ALTERNATIVES

As a result of the initial screening of alternatives, four measures were selected to continue with more detailed investigations – the nonstructural permanent evacuation measure, levees and floodwalls, diversions, and the structural channel modification measure. These measures were then used to develop alternative plans in a systematic manner. Not all measures were used for each problem area. In general, Table 4-1 provides a relationship between the major flooding sources in Wharton to flood measures used in detailed plan formulation.

Table 4-1
Flood Measures Used For Various Flooding Sources

Primary Flooding Source	*Measure Used for Detailed Plan Formulation*
Colorado River	Levees and Floodwalls
	Floodplain Evacuation
Baughman Slough	Levees and Floodwalls
	Channel Modification
Caney Creek	Diversion
	Floodplain Evacuation

All structural and nonstructural plans were developed in accordance with the planning objectives, planning constraints, and plan formulation rationale as summarized in the section of this report, "Plan Formulation." Each alternative plan was evaluated for its magnitude in difference between without and with project conditions. This magnitude in difference was expressed in monetary terms (annual project benefits minus annual project costs) and identified as net benefits.

An item-by-item estimate utilizing construction software was not developed for each alternative. Instead, cost estimates for the various plans were developed in sufficient detail for comparison purposes only. In general, this included the construction costs of significant, large components such as excavation, fill, significant structures, real estate, development of plans and specifications, construction management, operation and maintenance, and contingencies.

Due to the many inter-relationships that exist between all major flooding sources within Wharton, solutions for each source cannot be formulated independently. As noted in the Problem Identification section, solutions to river flooding may or may not impact localized problems on Caney Creek or Baughman Slough.

NONSTRUCTURAL FORMULATION

A review of recent historical flooding, as well as the data associated with the existing conditions damages, was performed for the study area. While several areas appear to be good candidates, the development of a floodplain evacuation plan to address the river flooding in southwest Wharton was selected as the best, practical non-structural alternative. This is based on the following additional rationale.

- Flooding in this area typically begins with the 10-year event.

- Significant, continuous areas could be evacuated, if buyouts were undertaken to levels approaching the 4% ACE flood zone. Experience with floodplain evacuation plans of other recent projects reveal that evacuation to the 4% ACE, or 25-year flood level is, indeed, achievable, while maintaining a positive BCR.

- This is a neighborhood in which over 500 homes have flooded twice since 1998. The average depth of flooding was around 2-4 feet, as opposed to a more shallow type of nuisance flooding which occurs in other parts of the city. Implementation of a plan is this area would likely be supported by the residents.

- The area is primarily residential, consisting of older, wood frame, pier-on-beam structures, and not concrete slab-on-grade foundations. They are in less than excellent condition, due in part to recent, recurring flooding.

- The City of Wharton owns, operates, and maintains a city park in southwest Wharton, which could be expanded, if adjacent buyouts occur. An economically justified non-structural alternative is highly dependent on the ability to find suitable alternative used of the evacuated lands, such that additional benefits for the overall project are achieved.

A plan known as the 25-year buyout plan was formulated to buyout and remove structures with first floor elevations lower that the estimated water surface levels resulting from 4% ACE (25-year) storm. Figure 4-1 provides a plan view of the area, and identifies the structures that were included in the buyout plan.

For this level of detail, no specific details were developed regarding alternative uses of the lands. It was assumed that the evacuated lands would be used for recreational development, and possible development of some ecosystem restoration features. The decision was made to forego more detailed development of these features, unless it became apparent that this plan would compete for designation of the NED plan, or the local sponsor expressed an interest in implementation of the buyout as a locally preferred plan.

If the vacated areas were converted to ecosystem restoration areas, then it potentially could yield positive environmental impacts. This may be offset somewhat by areas of new replacement housing and development, which may be necessary. Air quality and noise impacts due to relocation and restoration efforts will be similar to normal background levels within Wharton. The overall environmental impacts would likely be positive.

A total 246 structures were identified for possible buyout in the area. This number consisted of 237 residential, 4 commercial, and 5 other structures. The first cost of this plan, excluding relocation assistance costs and costs for development of features for other purposes, is estimated to be $3.1 million. This results in an annualized cost of $180,000, to achieve annual benefits of approximately $94,000. The associated BCR, while less than untity, is sufficient such that if the alternative uses were fully developed and taken into account, the plan would have a BCR greater than unity, and have net benefits for contribution to NED.

The floodplain evacuation plan as formulated, could potentially be implementable and within current Federal policy. Of major concern, however, is that it fails to provide a complete, effective solution for addressing the flooding problems within the Wharton area. Following implementation, it would still leave nearly 2,900, or 92% of the structures within the 1% ACE (100-yr) flood zone with no flooding relief, which would be unacceptable to the City of Wharton.

Environmental Impacts

From an environmental perspective, this alternative would likely have a positive environmental impact, structures would be bought, removed, and then the area would be restored as riparian habitat. Residences would be offered relocation assistance to assist in finding alternate living arrangements. This plan would reduce county revenue by removing approximately 246 properties off of the Wharton County tax roles. The displacement of the residents would likely cause development in other areas outside of the floodplain and result in indirect environmental impacts to other privately owned properties. However, since there are limited areas out of the 1% ACE floodplain, it is possible that these residences would not be located back in Wharton County, and definitely not in the city of Wharton. Other residents would likely purchase already available housing in the community. The buyout alterative would reduce flooding hazards of the residents located in the most prone areas.

Only short term temporary adverse impacts to air quality, water quality, and aquatic resources would be expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would result in increase in sediment which results in an increase in turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. This alternative is the most environmental friendly alternative that was considered; however, it was not cost effective. A buyout alone with complete restoration of the area would be more environmentally friendly, but the project would not be justified either. There would be no mitigation required to implement this plan. This alternative would have some positive aspects, i.e. a reduction in flood hazards and the creation of additional riparian habitat; however, it does not address the complete flooding issues of the city of Wharton.

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Figure 4-1 Buy out map

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STRUCTURAL FORMULATION

Analysis of the findings from the Problem Identification phase of the study provided the insight to develop a systematic method for formulation of structural solutions to an extremely complex hydraulic regime. The following is a summary of observations provided in more detail in previous discussions:

- Flooding in Wharton can be primarily attributed to three sources: the Colorado River, Caney Creek, and Baughman Slough.

- Colorado River flows greater that the 4% ACE (25-year) storm can impact Caney Creek, Baughman Slough, and Peach Creek. Under existing conditions, any river flows entering these streams have actually exited the Colorado River basin and entered the San Bernard River basin.

- Flooding in areas impacted by Caney Creek, Boughman Slough, and Peach Creek, can be the result of river overflows, local storm events, or even a combination of both.

- The Colorado River is not impacted by localized events.

- The terrain of the area offers little to no relief. Thus, one of the challenges in design of a levee system is to find sufficiently high enough ground elevations to tie in the ends of the levees such that flows will not flank the levee.

- Flood profiles for the more rare events that top the banks are closely spaced. Thus, flood heights for various frequencies can be estimated with a fairly high level of confidence, and the addition of as little as a foot to these heights can result in a high level of confidence that the true elevation for a given frequency is below that height.

- Caney Creek, which has a drainage area of approximately well over the minimum 1.5 square miles as it enters the city from the west, has essentially no remaining conveyance ability through the city, under existing conditions. Remaining low areas along the natural streambed act as storage areas. Following passage of a storm event, these areas are slowly drained primarily by an underground drainage system that is totally inadequate.

- During the inventory and forecast, it was noted that with the exception of the Peach Creek riparian corridor, the area is of relatively low value to the environmental habitat. Any structural measures would likely have similar, insignificant effects, and thus could be assumed as such.

Utilizing the conclusions shown above as guidance, a systematic approach was devised to formulate plans for flood damage reduction. The order of the evaluation of features is listed below:

1. Colorado River -- Since the Colorado River impacts essentially the entire area, it was decided to design and evaluate a levee that would eliminate flooding along the left overbank of the river, and also avoid river flood waters from entering the Caney Creek and Baughman Slough areas, unless the levee is flanked or overtopped. Three levels were evaluated, equating to heights of one foot above the 50-year, 100-year, and 500-year profiles. This was assumed to be the first added increment for evaluation, due to its impact on the entire city.

2. Baughman Slough – Levees, Channels, and combination plans were evaluated as the next added increment.

3. Caney Creek – Various drainage features to evacuate flood waters from major Caney Creek storage areas were evaluated as the final element. It should be noted that Boughman and Caney are essentially independent from one another, and their order of evaluation is irrelevant, as long as the River features are in place first.

COLORADO RIVER

This first increment of any structural flood damage reduction system in Wharton was determined to consist of features which reduce the flooding attributed to the Colorado River. During the initial screening, it was concluded that construction of levees or floodwalls provided the most favorable solution to river flooding.

The original alignment of a proposed levee system was performed by the project delivery team, utilizing available aerial imagery, as well as topographic mapping. These alignments were then discussed with the City staff, and refinements were made primarily in two areas – in Southeast Wharton near the wastewater treatment plant, and on the west side upstream of US 59, as shown in Figure 4-2. Finally, additional on-the-ground field investigations were conducted before a final formulation-level alignment was selected. None of the alignment variations significantly altered the water surface levels. Thus, the key factors for alignment were based on cost, real estate value, and environmental considerations. Availability of material was not a determining factor; all soils in the vicinity are very suitable for levee construction.

An earthen levee template, with a 12 foot top width and 1 foot vertical to 4 feet horizontal side slopes, was assumed for the entire length, with the exception of the reach immediately east of Business 59 and adjacent to East Elm Street. The total length of the earthen levee segments would be approximately 22,000 feet. Due to the extremely limited real estate available between Elm Street and the river bank, a 400 foot flood wall of relatively low height (3-5 foot average) was determined to be a better selection.

The formulation team used several criteria for the placement of the levee: the placement on elevated ground to reduce the footprint of the levee, the avoidance of existing structures, and the avoidance of high quality habitat.

The hydraulic design of the levee entailed use of the existing conditions hydraulic model, and then setting the levee profile to parallel the with-project water surface profiles. Three different levee heights (average levee heights of 4-6 feet) were developed for evaluation of costs and benefits. For the smaller, lower height levee, some consideration was given to acceptable protection levels, but due to the flat nature of the stage versus frequency correlation (less than 2 feet separates the 2% from the 0.2%), it was hypothesized that economic optimization would likely occur near the upper extreme of optimization curve.

Table 4-2 provides the results of the economic evaluation of the various levee heights, using 5.375% interest rate and October 2004 price levels.

Table 4-2
Costs and Benefits of Colorado River Levees
Various Heights by Frequency
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Level	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
2%	$4,052,000	$235,000	$436,000	1.9	$201,000
1%	$5,024,000	$291,000	$781,900	2.7	$490,900
0.20%	$6,316,000	$366,000	$1,032,610	2.8	$666,610

Interior drainage issues were also considered during this preliminary formulation level. It was assumed that only limited areas require any type of feature, primarily due to Caney Creek acting as a natural sump for the majority of the town. Some type of sump feature will be required in the southwest quadrant of town, but ample open areas exist for any possible sump requirements. The magnitude of these features will have no bearing on the level height selection.

During the time that these initial designs were being developed, it was determined that the maximum practical height (and thus protection levels) is actually constrained by the lack of any high ground for tie-in purposes. In reality, the 0.2% protection level is not achievable without extensive lengthening upstream. The 1% level is the maximum protection achievable, and given the results of the net benefits, will be carried forward as the first element.

While the river levees would provide excellent protection for the Wharton area, it must be recognized that for a range of storm frequencies, implementation of this feature will result in a deviation of flow depths and flow rates on the opposite overbank, as well as downstream of Wharton and even on Baughman Slough and the San Bernard Basin. In simple terms, if the levees are providing benefits, they are keeping water from escaping the Colorado River, which otherwise would have entered the San Bernard Basin. The San Bernard Basin has existing flooding issues, which are to be addressed in a separate study, and a possible reduction of this overflow would be beneficial. Larger flow rates, however, may be experienced downstream of Wharton on the Colorado River, affecting primarily agricultural lands such as rice fields. These will result in increased stages of several tenths of a foot for the 2% ACE and 1% ACE storms (assuming implementation of the 1% level levee). All other frequencies would remain unaffected. Utilizing the economic models developed for the main stem Colorado River, the induced damages are estimated at approximately only $1,300 annually, primarily due to the scattered, sparse development in the rural areas downstream of Wharton. This amount is considered to be insignificant, and would not constitute a taking. More details regarding changes in downstream flow rates can be found in the hydraulics section of the engineering appendix.

Environmental Impacts

The habitat along the Colorado River can be classified into three broad general categories: developed, pasture, and forested. The developed area is the area located in downtown Wharton, where, in lieu of a levee, a floodwall would be located along an existing side walk and city park. No environmental impacts will occur in the developed area. Forested habitat occurs sporadically along the levee route. Approximately 15 acres of upland forested habitat will be destroyed by the proposed plan. The loss of the forested habitat will be compensated for in the mitigation plan, and no other relevant resources are being adversely impacted. The remaining areas are categorized as cleared pasture for cattle grazing. The proposed plan would have impact pastures by either turning them into levees or temporarily using them for construction activities during construction

but would be restored to pre-construction use once the project is complete, except for the levees themselves. However, the levees could be used as pastures once vegetation is established. The proposed plan will also cross approximately seven small drainage tributaries, which may involve construction of culvert structures. Overall, the proposed Colorado River levee alternative will only result in the loss of upland forested habitat and minor impacts in the form of sediment discharge and increased turbidity to waters of the U.S. due to levee crossings. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would result from stormwater runoff if rainfall events occurred before vegetation was reestablished. The impacts would be increased sediment transport and increased turbidity. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increase in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal.

Differing levee highs have approximately the same direct impacts to the environment; however, differing levee heights provide differing levels of socioeconomic benefits. The 2% level would provide benefit from reduced flood damages, but would not allow for insurance rates to be reduced. The proposed plan would provide substantial socioeconomic benefits to the local community by providing 1% ACE protection for almost the entire city. The 0.2% ACE protection would provide the most economic benefit; however, upon further consideration it would not be economically feasibly nor would it be feasible from an engineering standpoint because there is no high ground to tie into.

Figure 4-2 Colorado River Levees

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BAUGHMAN SLOUGH

General

Two flood damage reduction measures were seriously considered and evaluated in depth for Baughman Slough. These measures were levees and channelization. Both measures serve to reduce flooding resulting from both localized as well as regional (river) flooding, but the levee is related more to the regional flooding, while the channel is related more to the local rain events. Please refer to the Hydraulics Appendix for a more detailed description of the flooding scenarios.

A channel modification was briefly considered, which extended from County Road 135 to the abandoned T&NO railroad. However, it was soon apparent that a levee within this same reach would produce higher benefits at a much lower cost. Preliminary construction costs for the channel were nearly four times the cost of a levee, due to extensive excavation quantities. Further, the initial estimates of benefits were lower. Thus, the full length channel modification alternative was eliminated from further consideration.

A shorter channel modification was also investigated as an add-on component to the levee feature. This alternative is discussed below.

Levee Component

An analysis of the existing conditions damages, as well as the plan view topographic map served as the basis for layout of a levee located adjacent to the right bank of Baughman Slough, extending from County Road 135 (Junior College Blvd.) to the abandoned T&NO railroad embankment, a total distance of about 7,500 feet, as depicted in Figure 4-3. Included within this reach are two road crossings, Fulton Road and State Highway 60 (also known as Business 59).

Two different levels of levees were investigated along Baughman Slough, both with side slopes of 1 foot vertical to 3.5 feet horizontal. As was the case with the Colorado River Levees, the levee heights were severely constrained due to the unavailability of high ground for levee tie-in points. The second height analyzed, which is near the level of the 1% profile, is the maximum levee height that can be effectively be utilized in this area, with the biggest constraint being the height of the downstream terminus at County Road 135. Average height of the levee is approximately 4 feet.

Table 4-3 includes the costs and benefits for the two levee heights evaluated. The second, or maximum height levee produces the highest net benefits, and was thus adopted as the next component of the overall plan.

Table 4-3
Costs and Benefits of Baughman Slough Levee
Various Heights
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Level	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
~2%	$1,098,000	$64,000	$334,400	5.2	$270,400
Max	$1,197,000	$69,000	$388,600	5.6	$319,600

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Figure 4-3 Baughman Slough levee

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Environmental Impacts

Only short term adverse impacts to air quality, water quality, and aquatic resources are expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would be increases in sediment transport and increases in turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. The majority of the area surrounding Baughman Slough is cleared and used as pasture or residential yards. Approximately three acres of forested riparian habitat would be from implementation of the proposed plan. A mitigation plan was developed to compensate for the impacted riparian habitat. No other relevant resources are being impacted. Cost of the mitigation would be similar for all sizes, and would not change the outcome of formulation.

Lower Channel Component

Despite that the maximum practical levee was selected as the Boughman Slough flood damage reduction component, a significant amount of residual damages, $740,000 annually (40% of existing) remained in the leveed reaches. Given that the critical elevation controlling the practical height of the levee was the downstream tie-in point, County Road 135, and that local drainage could be greatly improved by a reduction in tail water at this point, a channel modification component was designed and evaluated which would address these two issues. The grassed channel with 1 foot vertical to 3 foot horizontal side slopes would be approximately 6,500 feet in length, extending from Station 8237, downstream of County Road 150, to Station 14730, located between Fulton Road and County Road 135. Channel bottom widths of 75 foot and 85 foot were evaluated for the portion of the channel downstream of County Road 135.

Table 4-4 lists the costs and benefits associated with each plan. The net benefits of the two channel widths were very close. Both the costs and benefits did not vary significantly, but the larger channel provided just slightly greater net benefits. However, since the smaller channel met the local objective of providing 100-year level of protection, it was selected as the increment to be carried forward as part of the total plan.

Table 4-4
Costs and Benefits of Baughman Slough Lower Channel
Various Bottom Widths
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Size	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
75-foot	$4,188,000	$243,000	$420,200	1.7	$177,200
85-foot	$4,240,000	$246,000	$423,440	1.7	$177,440

Environmental Impacts

Only short term adverse impacts to air quality, water quality, and aquatic resources are expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would be an increase in sediment

transport and turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. Additional impacts to the aquatic resources would result from the excavation portion of the plan. It will impact approximately 2.3 acres of waters of the U.S. due to widening the channel to increase conveyance. The creek is dry on a regular basis, so impacts to aquatic habitat would be minimal. Overall, the Baughman Slough exhibits low habitat value and aquatic features. The Slough routinely goes dry and therefore, limited aquatics exist. The proposed alternative will result in minor impacts to the slough. Cost of the mitigation would be similar for all sizes, and would not change the outcome of formulation.

CANEY CREEK

General

Thousands of years ago, the Colorado River may well have been located where Caney Creek is today. As can be seen in Figure 4-4, its current lower watershed originates near Glen Flora, and extends southeastward through the city of Wharton. Overflows from the Colorado River can occur at several locations, including the area near Glen Flora, as well as just west of Highway 59. Its final outfall is into Matagorda Bay near Sargent, Texas.

The primary trait that makes Caney Creek a unique part of this study, is that it no longer actually flows through Wharton. In fact, it doesn't really flow anywhere. In many areas through Wharton, the channel is essentially gone. Fill has been placed in the area, and many buildings now stand where Caney Creek once had a small channel. West of Highway 59 (above Wharton), Caney Creek still resembles a stream. Downstream of Wharton, Caney Creek also resembles a stream, although it is blocked with many private crossings and low flow dams, causing it to be essentially useless for conveyance of floodwaters.

Through the city, what remains of Caney Creek can be described as a series of storage areas that collect local runoff, and are slowly drained to the river by a few totally inadequate and outdated storm drains. During large local storm events, however, the drainage area upstream of Wharton contributes to flooding by first filling the upstream storage area, the cascading downstream. During rare local events, or during passage of large flood events on the river where overflows have entered the Caney Creek watershed, the storage areas on Caney Creek can actually become so full that the flows cross the watershed boundary between Caney Creek and Baughman Slough.

During the initial formulation phase, an array of different alternatives to reduce flooding within the Caney Creek area were discussed. These included diversions to Baughman Slough, reopening the channel through Wharton and increasing the downstream capacity on Caney Creek, and draining the flows back to the river. The options were discussed in public workshops and at the feasibility scooping meeting held as part of the planning process. In summary, it was determined that the only practical means of reducing flood risk in Wharton from Caney Creek was to drain the flood waters back to the river. The Baughman Slough/ San Bernard system does not have any additional capacity, and in fact has significant downstream flooding issues which are to be addressed in a separate feasibility analysis. Also, the reach of Caney Creek below Wharton is extremely flat, and would require a substantial increase in cross sectional area in order to obtain the necessary drainage capacity. Modifications of this magnitude were deemed to infeasible as well as cause detrimental environmental damages.

Caney Creek – Figure 4-4

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Evaluation of Caney Creek during the development of existing conditions revealed that it could best be modeled for hydraulic purposes with a series of six storage areas. Each of these areas was also modeled as an economic reach for damage evaluation purposes. Existing conditions evaluation determined that the majority of the flood damages occurred in three of the six areas. Alternative solutions were formulated to address the flooding in the areas known as the Outfall, Wharton, and Crestmont storage areas. Locations of these areas are depicted in Figure 4-4.

Outfall Storage Area

The Outfall storage area is generally located immediately west of the abandoned T&NO Railroad. Spanish Camp Road generally follows the southern boundary, and separates it from the area sloping to the river.

After brainstorming with the project delivery team, local engineers, and other local officials, all agreed that the most straightforward, common sense approach was to pursue a storm water conveyance system extending from near the intersection of Spanish Camp and Hughes Street, and provide southward along Hughes Street to Milam Street, which is a distance of approximately 1,000 feet. Validity of this solution was confirmed by conducting an on-the-ground reconnaissance. Also, beyond Milam Street, an old channel (migrated river meander) already exists. The big question from an engineering standpoint was to determine the type and size of conveyance measure that would provide the highest net benefits.

Additional discussions among the team determined that our best possibilities would be to stay within the right-of-way of Hughes Street. Given that as a guide, the following alternatives were considered:

1. Two, 60-inch diameter pipes down Hughes Street.
2. Three, 60-inch diameter pipes down Hughes Street, utilizing the full available right-of-way.
3. Three, 7 foot-by-5 foot box culverts down Hughes Street, utilizing the full available right-of-way.

Costs and benefits for these three alternatives were developed, and the results are shown in Table 4-5 below. The three, 60-inch diameter pipes were found to have the highest net benefits at a significantly less cost that the box culverts. For the 7 foot-by-5 foot box culverts, it was assumed that residual damages were essentially zero. However, the three, 60-inch pipes were still far more cost effective.

Table 4-5
Caney Creek, Outfall Storage Area
Costs and Benefits for Hughes Street Drainage Facilities
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Size	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
2, 60" pipes	$716,000	$42,000	$121,200	2.9	$79,200
3, 60" pipes	$1,039,000	$60,000	$139,700	2.3	$79,700
3, 7'x5' box culverts	$3,097,000	$180,000	$147,600	0.8	-$32,400

Environmental Impacts

Only short term adverse impacts to air quality, water quality, and aquatic resources are expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would be an increase in sediment transport and an increase in turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. Only these minimal impacts to relevant resources would occur in the portion of the plan located along Hughes Street within a residential area. South of Caney Street, the pipes would be located within an old meander of the Colorado River that lies between a residential area and an upland mound. An open cut ditch is located within the meander and runs approximately 2,200 feet to the outfall at the river. This alternative would also utilize an existing drainage ditch and cleared right-of-way to reduce impacts to riparian areas.

Wharton Storage Area

The Wharton storage area is appropriately named because it generally includes the downtown area of the city. The town square, City Hall, and the County Court House are just few of the notable landmarks within the Wharton storage area.

Very similar circumstances and flooding issues can be derived between the Outfall area and the Wharton area. Not surprisingly, the proposed solutions are also similar in nature. Two different plans for draining the Wharton storage area to the river were evaluated for more detailed formulation purposes. These were named the Railroad Culvert, and the Richmond Pipes.

The first, more ingenious idea was to cut off an old filled meander of Caney Creek by placing two 12-foot by 4-foot box culverts through the embankment of the T&NO Railroad, near the intersection of Bolton and Sunset Streets (See Figure in H&H appendix for exact location). These boxes would directly connect the Outfall and Wharton Storage areas. In order to handle the additional flood flows in the Outfall area, the proposed Hughes Street drain would be upgraded from the 3-60 inch reinforced concrete pipes to the 7 foot by 5 foot concrete box culverts that were previously evaluated.

The second, and more straightforward approach was to evaluate the implementation of two, 60-inch reinforced concrete (RCP) pipes, extending from near the intersection of Richmond Road and Caney Street, and then extending approximately 1,350 feet southward under Richmond Road, with its outfall at the Colorado River near the Richmond (Business 59) bridge.

Preliminary findings found the Richmond Pipes alternative to be much more cost effective. As a result, another alternative specifying three 60-inch pipes was also evaluated to see if the additional pipe was incrementally justified. As can be seen in Table 4-6, the three Richmond Pipes alternative is indeed incrementally justified. After consultation with the local sponsor, no additional, larger alternatives were formulated for the purpose of finding a larger plan that would produce even greater net benefits. The three 60-inch Richmond Pipes alternative was identified to be carried forward as part of the overall plan. This plan was sufficient to meet the local objectives, and thus, no larger plan was evaluated.

Environmental Impacts

Only short term adverse impacts to air quality, water quality, and aquatic resources are expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short

term, temporary impacts to water quality and aquatic resources would be an increase in sediment transport and increased turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. Since the pipes would be located along existing roadways within residential and commercial areas, this alternative would pose no other adverse impacts to relevant environmental resources.

Table 4-6
Caney Creek, Wharton Storage Area
Costs and Benefits for Storm Drainage Facilities
Railroad Culvert and Richmond Road Alternatives
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Feature	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
Railroad Culvert	$2,449,000	$142,000	$419,700	3.0	$277,700
2, 60" Richmond Pipes	$1,288,000	$75,000	$599,200	8.0	$524,200
3, 60" Richmond Pipes	$1,931,000	$112,000	$677,800	6.1	$565,800

Crestmont Storage Area

The last storage area for Caney Creek, as well as the last increment for the overall project to be formulated is named the Crestmont Storage Area, as shown in Figure 4-4.

Under existing conditions, this area floods incurs some amount of flood damages almost annually, and it has been a problematic area for many years. Recently, as reoccurrence of flooding has continued at a particularly frequent pace, the City of Wharton has underscored its commitment to resolve the issues quickly in this area by submitting a request to construct this portion of the project in advance of the overall Federal Implementation. This authority has been provided under Section 104 of the Water Resources Development Act of 1986. The City's request was approved by the Assistant Secretary of the Army for Civil Works on January 25, 2006.

The Corps and the City of Wharton, in concert with its independent Engineering Consultant, began to brainstorm for possible solutions to provide flooding relief to this area even during the earlier phases of the study. While the decision process for this area followed the same rationale as the other storage areas, i.e., the only logical solution is to drain the area to the river, additional constraints exist. For example, for the Wharton area, the transport distance to the river was only about 1,300 feet. For Crestmont, even the shortest distance, ignoring any realism, is about 4,000 feet. Given the much longer distance, an open cut ditch stood out as the most and perhaps the only cost effective solution.

Also, during the formulation, the point was made that the City of Wharton already owned an abandoned Santa Fe Railroad right of way along State Highway 60 and east of Alabama Road. This right-of-way could easily be used, and while it is not a direct route to the river, it

would cut the remaining required distance in half. Also, general channel slope would be acceptable, and only a few bridge crossings would be required. From this point, the remaining portion of the channel would be outside of the city with few right-of-way issues, so the channel could turn, cross State Highway 60, and follow a generally straight path until it outfalls into the river. This alignment is depicted in Figure 4-2.

The Corps' technical staff concurred with this concept as being the most viable and engineeringly feasible option, and the City's consultant began to plan, size, and design the flood damage reduction feature known in this report as the Santa Fe Ditch.

The City of Wharton was advised that the Santa Fe ditch must still be sized and evaluated for NED purposes, and it must ultimately be designed as part of the Federally recommended plan in order for the City to receive credit for its advance expenditures. The urgency of the matter, however, dictated that the City take the risks associated with this uncertainty, and proceed with their advanced design and construction. The City would make available to the Corps any and all design information that can be used for their plan formulation purposes.

Two sizes of the Santa Fe ditch were designed and costs estimated by the City's consultant. These designs could also be considered as an initial and ultimate increment, if the economics of the alternative incrementally support such phasing. The initial design calls for an 8 foot bottom width earthen ditch, with 1 foot vertical to 3 foot horizontal side slopes. Given the open channel concept, this size is considered to be minimum size for ease of construction. Smaller configuration channels would have similar costs, but these would provide less total as well as net annualized benefits and thus, were not evaluated in detail. The ultimate design increases the bottom width to 15 feet. Both plans include a 20 foot maintenance and access area on each side, and 6 culvert-style bridges are also required.

Environmental Impacts

Only short term adverse impacts to air quality, water quality, and aquatic resources are expected during the Construction phase of the removal of houses. Short term impacts to air quality would be an increase in dust particles and exhaust from construction equipment. Short term, temporary impacts to water quality and aquatic resources would be an increase in sediment transport and turbidity from stormwater runoff if rainfall events occurred before vegetation was reestablished. These impacts would be reduced by implementing best management practices such as silt fences. There would also be temporary increases in noise and traffic levels from construction equipment during the construction activities, but these impacts would be minimal. The Santa Fe Ditch plan involves an open cut ditch that runs along the abandoned Santa Fe railroad and then along Mundel Street to the outfall at the Colorado River. This alternative has previously cleared right-of-ways, which would limit impacts to the environment. The outfall would result in the loss of some riparian areas that would be mitigated, but overall, this alternative would have only minor environmental impacts, and would not affect the alternative formulation or optimization.

Table 4-7
Crestmont Storage Area
Cost and Benefits for Santa Fe Ditch
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Size	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
Initial	$2,900,000	$168,000	$723,000	4.3	$555,000
Ultimate	$3,500,000	$203,000	$752,600	3.7	$549,600

Table 4-7 contains the costs and benefits associated with the two sizes. The ultimate increment was not found to be incrementally justified, so the initial, smallest size earthen channel was carried forward as part of the overall plan.

CONSOLIDATION OF COMPONENTS TO FORM A COMPREHENSIVE PLAN

An array of Structural Plans, as well as a non-structural plan and the no action alternative have been evaluated to address specific individual damage areas throughout Wharton. Table 4-8, containing a breakdown of costs by category, as well as associated annualized benefits and benefits-cost ratios, has been compiled for ease of comparison.

The rationale for selection of the first added and incremental elements of the project was presented in a previous section of this chapter. In summary, the proposed Colorado River levees benefit essentially all areas of the city, and was selected as the first element of the evaluation. The remaining features on Baughman Slough and Caney Creek have little, if any effects on other areas, and can be evaluated independently without regard to the other features.

Table 4-8 also identifies the components that are combined to produce the comprehensive plan. The components are identified by shaded columns. A summary of the rationale used for size and component selection is summarized below:

- Colorado River Levees: While the 0.2% ACE levees were shown to have the highest net benefits, there was insufficient high ground to properly terminate the upstream levee segment. Thus, the 1% ACE level was selected.

- Baughman Slough Levees: In similar fashion to the Colorado levees, the Baughman Slough levees were effectively limited in height and protection due to the lack of high ground for tie-in. The maximum practical height produced the highest net benefits, and was selected.

- Baughman Slough Channel: Levels of protection were further increased by channelization at the downstream area. The 85-foot bottom channel produced the highest net benefits, but the smaller 75-foot bottom channel met all the objectives, and was selected as part of the comprehensive plan.

- CC outfall: The three 60-inch pipes were produced the highest net benefits and was selected as part of the comprehensive plan. It should be noted that the net benefits of the two 60-inch pipe was not substantially smaller. However, the additional pipe increased the damages prevented from 85% to over 96%, leaving residual damages of

only $7,900 annually in the CC-Wharton economic reach. The additional increment has a positive BCR, more closely fulfill the study planning objectives, and still has a BCR of 2.3.

- CC Wharton: Three different options were formulated – a railroad culvert, a drain consisting of two 60-inch pipes, and a drain consisting of three 60-inch pipes. The largest plan produced the highest benefits and met the study objectives. Thus, it was selected as part of the comprehensive plan.

- CC Crestmont (Santa Fe Ditch): Two options were evaluated, with the smaller 8 foot wide ditch being selected because it produced the greatest net benefits. For construction purposes, this was deemed the smallest practical alternative; smaller sizes would be constructed with different types of construction equipment that is unable to handle substantial volumes of soil with the same efficiency. Thus, smaller plans may actually cost more with less outputs.

Table 4-9 includes a list of only those components selected to be carried forward as part of the comprehensive flood damage reduction plan, and forms the basis for the plan to be considered as the National Economic Development, or NED Plan. The total first cost of the plan is estimated to be approximately $16,279,000, with an overall benefit-to-cost ratio of 3.3 and net annualized benefits of $2,188,200.

Figure 4-5 provides a plan view of the locations of the various components associated with the Comprehensive Plan.

Table 4-8

Breakdown of Costs and Average Annual Benefits for Final Array of Alternatives, excluding No Action

(Formulation Level Detail, 5.375%, 50 years, October 2004 prices)

Feature	*Floodplain Evacuation 4% ACE SW Wharton*	*Colorado 2% levee*	*Colorado 1% levee*	*Colorado 0.2% levee*	*Baughman Slough 2% levee*	*Baughman Slough Max levee*	*Baughman 75-ft Channel*	*Baughman 85-ft Channel*
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
Total First Cost	**$7,528,000**	**$4,052,000**	**$5,024,000**	**$6,316,000**	**$1,098,000**	**$1,197,000**	**$4,188,000**	**$4,240,000**
LERRD's	$4,699,000	$75,000	$78,400	$80,000	$127,500	$130,000	$842,000	$844,000
Annual Benefits	$130,000	$436,000	$781,900	$1,032,610	$334,400	$388,600	$420,200	$423,440
Annual Costs	$436,000	$235,000	$291,000	$366,000	$64,000	$69,000	$243,000	$246,000
Net Benefits	**-$306,000**	**$201,000**	**$490,900**	**$666,610**	**$270,400**	**$319,600**	**$177,200**	**$177,440**
BCR	0.3	1.9	2.7	2.8	5.2	5.6	1.7	1.7

Table continues on next page.

Table 4-8 (continued)
Breakdown of Costs and Average Annual Benefits
for Final Array of Alternatives, excluding No Action
(Formulation Level Detail, 5.375%, 50 years, October 2004 prices)

Feature	*CC Outfall 2-60 inch pipes*	*CC Outfall 3-60 inch pipes*	*CC Outfall Boxes*	*CC Wharton RR Culvert*	*CC Wharton 2-60 inch Richmond Pipes*	*CC Wharton 3-60 inch Richmond Pipes*	*CC Crestmont SF Initial*	*CC Crestmont SF Ultimate*
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
Total First Cost	**$716,000**	**$1,039,000**	**$3,097,000**	**$2,449,000**	**$1,288,000**	**$1,931,000**	**$2,900,000**	**$3,500,000**
LERRD's	$31,700	$36,700	$36,700	$17,800	$15,000	$18,000	$95,000	$100,000
Annual Benefits	$121,200	$139,700	$147,600	$419,700	$599,200	$677,800	$723,000	$752,600
Annual Costs	$42,000	$60,000	$180,000	$142,000	$75,000	$112,000	$168,000	$203,000
Net Benefits	**$79,200**	**$79,700**	**-$32,400**	**$277,700**	**$524,200**	**$565,800**	**$555,000**	**$549,600**
BCR	2.9	2.3	0.8	3.0	8.0	6.1	4.3	3.7

Figure 4-5 Comprehensive Plan

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Table 4-9
Wharton Comprehensive Flood Damage Reduction Plan
Costs and Benefits by Feature
(Formulation Detail Level, 5.375%, 50 years, October 2004 prices)

Feature	*First Cost*	*Annualized Cost*	*Annualized Benefits*	*B/C Ratio*	*Net Benefits*
River Levees	$5,024,000	$291,000	$781,900	2.7	$490,900
Boughman Slough					
Levee	$1,197,000	$69,000	$388,600	5.6	$319,600
Channel	$4,188,000	$243,000	$420,200	1.7	$177,200
Caney Creek					
Hughes Street Drain	$1,039,000	$60,000	$139,700	2.3	$79,700
Richmond Drain	$1,931,000	$112,000	$677,800	6.1	$565,800
Santa Fe Ditch	$2,900,000	$168,000	$723,000	4.3	$555,000
TOTAL PROJECT	**$16,279,000**	**$943,000**	**$3,131,200**	**3.3**	**$2,188,200**

IDENTIFICATION OF THE NED PLAN

The identification of the NED plan depends upon careful consideration of engineering, economic, social, and environmental factors. The following paragraph outlines the process of identifying the NED plan.

Guidelines for selection of a plan for implementation, as provided by the Water Resources Council's "Principles and Guidelines for Planning Water and Related land Resources Implementation Studies," state that a plan recommending Federal action is to be the alternative plan with the greatest net national economic development (NED) benefits, i.e. the NED plan, unless the Assistant Secretary of Army (Civil Works) grants an exception. Current Policy allows such exceptions for locally preferred plans. Such locally preferred plans must comply with Federal rules and statutes, most important of which, the project benefits must exceed the project costs. Federal participation in a locally preferred plan is limited to the extent which would have been required by the NED plan. Consequently, the local sponsor is responsible for all additional costs of the larger plan above and beyond the costs of the Federal NED plan.

Prior to final selection, another important consideration is the amount of residual damages remaining under with-project conditions. In many instances, the components identified as part of the comprehensive plan reduced damages in more than one economic reach. Thus, in order to get a proper perspective, Table 4-10 was developed to present the residual damages remaining, as each component of cumulatively added to the comprehensive plan. The order of implementation is the same as that used in development of the plan. With all components in place, damages within the affected reaches are reduced by over 76%.

After consideration of all factors, all the features collectively identified as the Comprehensive Plan (shown above) was selected as the NED plan. Agreement and concurrence by Corps' Headquarters and Southwestern Division representatives was received at the Alternative Formulation Briefing held on April 24, 2006.

Table 4-10
Average Annual Residual Damage by Reach
As Components are Cumulatively Added
(Values in thousands, 5.375%, 50 years, October 2004 Prices)

Economic Reach	*No Project*	*Colorado 1% levee*	*Baughman Slough 1% levee*	*Baughman 75-ft Channel*	*CC Outfall 3-60 inch pipes*	*CC Wharton 3-60 inch Richmond Pipes*	*CC Crestmont SF Initial*
Colorado River							
Above Busness 59	$140.3	$17.3	$17.3	$17.3	$17.3	$17.3	$17.3
Below Business 59	$208.2	$45.3	$45.3	$45.3	$45.3	$45.3	$45.3
Baughman Slough							
Below Alabama	$267.5	$267.0	$267.0	$145.4	$145.4	$145.4	$145.4
Alabama to Bus 59	$1,273.3	$918.5	$473.9	$177.2	$177.2	$177.2	$177.2
Business 59 to Hwy 59	$227.6	$177.5	$205.6	$208.5	$208.5	$208.5	$208.5
Above Hwy 59	$95.8	$75.0	$102.8	$98.0	$98.0	$98.0	$98.0
Caney Creek							
South of HEB	$201.0	$201.0	$201.0	$201.0	$201.0	$201.0	$35.0
Wharton	$899.3	$868.6	$868.6	$868.6	$868.6	$193.3	$193.3
Outfall	$183.5	$146.6	$146.6	$146.6	$7.9	$6.0	$6.0
US59 to 102	$2.8	$1.5	$1.5	$1.5	$0.9	$0.9	$0.9
Above US 59	$1.4	$0.6	$0.6	$0.6	$0.2	$0.2	$0.2
Crestmont	$608.9	$608.9	$608.9	$608.9	$608.9	$608.3	$51.3
TOTAL	**$4,109.6**	**$3,327.7**	**$2,939.1**	**$2,518.9**	**$2,379.2**	**$1,701.3**	**$978.4**

SELECTION OF THE RECOMMENDED PLAN

The City of Wharton was involved throughout the formulation process. They indicated during the early stages of the feasibility studies that their planning objectives were similar to the Federal objectives. A project of this magnitude would place a substantial burden on the City's financial abilities, but they fully understand the need to provide their citizens with maximum possible relief from future flooding.

The addition of recreation and ecosystem features was discussed. However, due to fiscal constraints, the City has indicated that their priorities rest solely with flood damage reduction.

Careful consideration was given to all alternatives in the final array, including the no action plan. Based on the findings cited above, the City of Wharton concurs with the Corps of Engineers, and the NED plan was selected as the Recommended plan. This plan will be developed in more detail for implementation purposes.

CHAPTER 5
RECOMMENDED PLAN

PLAN FEATURES

The Recommended Plan to address the flooding problems for the city of Wharton consists of structural features in the form of earthen levees and accompanying sumps, floodwalls, a channel enlargement, storm drain type drainage structures, and an open cut ditch. These are scattered throughout the city, as shown in Figure 5-1. In concert with the information presented in Chapter 4, these features will be grouped for discussion by the primary sub-basin being benefited.

COLORADO RIVER

The Colorado River is certainly the most obvious drainage feature in Wharton. Analysis has shown that flooding attributed to the river affect the entire city in some form. This would be significantly reduced by construction of a levee and floodwall system along the left (northeast) bank of the river, as shown in Figure 5-1. Placement of this levee protects the low lying areas along the river, and also cuts off overflows, which escape the river basin and enter the Caney Creek and Baughman Slough drainage basins.

The proposed levee/floodwalls along the river can be divided into seven distinct segments, as depicted in Table 5-1.

Table 5-1
Recommended Plan
Colorado River Segments

Reach Name	*Start Location*	*End Location*	*Average Height (ft)*	*Reach Description*
CR-1	0+00	78+10	4	Levee from FM 102 to US Hwy 59 embankment along the Colorado River.
CR-2	0+00	42+50	4	Levee from US Hwy 59 embankment to Station 42+50
CR-2A	42+50	46+60	6	Floodwall from Station 42+50 to landfill berm
CR-3	0+00	14+60	5	Levee from landfill berm to abandoned RR embankment
CR-4	0+00	11+90	8	Levee from abandoned RR embankment to Richmond Street
CR-5	0+00	15+00	3	Floodwall from Richmond St to park area
CR-5A	15+00	71+00	4	Levee from park area to Alabama Street (end)

All levee segments have a similar general template, with a 12 foot top width, and 1 foot vertical to 3.5 foot horizontal side slopes.

Segment CR-1 is located primarily in an open field, and runs from FM 102 in a southeasterly direction for about 4,900 feet before changing to a more easterly direction perpendicular to U.S. 59 for an additional 2,900 feet. Segment CR-1 terminates at U.S. 59, which is on top of a roadway embankment of sufficient height to form a closure. Due to the nature of

the soils in the area, there is a fairly high confidence that the U.S. 59 roadway embankment will meet or exceed the geotechnical specifications for an earthen levee.

Segment CR-2 begins on the east side of U.S. 59, and runs generally in an east southeasterly direction for about 4,000 feet before making a southward turn for the last 250 feet. At this point, the levee transitions into a reinforced concrete floodwall, which runs for about 410 before terminating against the high ground associated with the existing, but closed sanitary landfill. The average height of the floodwall is about 6 feet above natural ground. A floodwall section was required in this segment, due the tight, unique topography in the immediate area.

Segment CR-3 begins on the east side of the closed landfill, and follows a southeasterly alignment for about 700 feet near the end of Ford Street, then it makes a left, generally eastward turn, and runs for another 760 feet to the abandoned railroad embankment, where it terminates.

Segment CR-4 begins near the bridge abutment of the old abandoned railroad. Its average height is substantially higher than other segments; Some portions have a height of as much as 15 feet. Thus, the overall footprint and volume is larger as it parallels the lower end of Sunset Street, before turning more northeasterly to parallel the river bank. A buffer is maintained between the toe of the levee and the river bank in order to avoid future erosion and stability issues. As the levee approaches Business 59, the required levee height decreases, and it terminates against the Business Highway 59 abutment.

Segment CR-5 is a floodwall beginning on the east side of Business 59. It then parallels Elm Street on the south side. The required height of the floodwall is only about 2 to 4 feet. As the wall passes Station 9+00 near Fulton Street, the direction of the floodwall turns southward, generally following the river for an additional 600 feet. At approximate station 15+00, the floodwall ends, and an earthen levee picks up. The levee follows the river bank for about 3,200 feet, where it turns and crosses a drainage ravine. The segment continues in this manner for approximately 3,300 feet, where it makes an abrupt left turn toward the east and heads to high ground at Alabama Road. The end of CR-5 is near the intersection of East Street and Alabama Road.

BAUGHMAN SLOUGH

Baughman Slough Levee

Baughman Slough is the flow path that provides drainage to the north side of Wharton. It frequently overflows its banks, causing significant flooding damages. Analysis has shown that an earthen levee or floodwall constructed along the southern bank can effectively reduce the flooding risk attributed to Baughman Slough.

For description purposes, the levee/floodwall can be divided into four segments, as indicated in Table 5-2. Three of these segments are earthen levees, which have a top width of 12 feet, and side slopes of 1 foot vertical to 3.5 feet horizontal. All segments have only a modest average height of 3-4 feet. Typical cross sections of the levee can be found in Appendix G, Plate C001. The detailed alignment of the Baughman Slough levees is depicted on Plates C101-C106.

Segment BS-1 begins at the downstream side of the abandoned railroad embankment, which is the highest ground in the area. The levee alignment is essentially parallel to Baughman Slough, with the toe staying about 20-30 feet from the bank. This alignment is maintained for the entire distance of 1,980 feet, until the levee reached Business 59 (Richmond Street). According to recent topographic surveys, Business 59 is sufficiently elevated for closure.

Figure 5-1 Recommended Plan

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Segment BS-2 picks up where BS-1 left off, and continues in the same manner as BS-1 for approximately 1,060 feet, until Fulton Street is reached. At Fulton Street, the earthen levee changes to a floodwall for a distance of 400 feet, so that there is sufficient clearance between the wall and a residential structure. The floodwall is designated as segment BS-3.

The floodwall reverts back to a standard earthen levee, known as segment BS-4, for the remaining distance of 3,570 feet until Junior College Boulevard is reached. For most of this reach, the levee is no higher than two feet above natural ground. For the last 1,200 feet upstream of Junior College Boulevard, the height is approximately 3-4 feet.

Table 5-2
Recommended Plan
Baughman Slough Segments

Reach Name	*Start Location*	*End Location*	*Average Height/ Depth (ft)*	*Reach Description*
BS-1	0+00	19+80		Levee from abandoned RR embankment to Richmond St along Baughman Slough
BS-2	19+80	30+40		Levee from Richmond Street to Fulton Street
BS-3	30+50	34+30		Flood wall from Fulton Street to Past the home east of Fulton and south of Baughman Slough.
BS-4	34+30	70+00		Levee from flood wall to Junior College Blvd
BS-4A	49+50	70+00		75 foot bottom modified channel begins. Continuation of levee from Station 49+50
BS-5	1+20	27+80		75 foot modified channel from Junior College Blvd. to County Road 150
BS-6	27+80	49+00		75 foot modified channel from County Road 150 to end

Baughman Slough Channel

In addition to the levee feature, a channel modification is also recommended for the lower reach of Baughman Slough. Its objective is to lower the tailwater under design conditions, particularly at Junior College Boulevard, which is the downstream end of the proposed levee segment.

The proposed earthen channel modification has a bottom width of 75 feet, with 1 foot vertical to 3.5 foot horizontal side slopes. Average depth of the channel is estimated to approach 4 feet.

The channel begins with a segment labeled as BS-4A. The start-of-channel location is approximately 2,100 feet upstream of Junior College Boulevard. The alignment generally follows the existing Baughman Slough channel, but it is not always centered on the existing channel. For the 2,100 foot reach upstream of Junior College Boulevard, the channel is also paralleled by the Baughman Slough levee.

Essentially the same channel configuration continues downstream of Junior College Boulevard for segments BS-5 and BS-6, for a total of 4,900 feet, including a 120 foot transition at the downstream end of the channel.

As part of the channel feature, new, wider bridges would be required for County Road 150, and for Junior College Boulevard. The bridges are anticipated to be a box culvert configuration of sufficient width to properly accommodate the new channel modification.

CANEY CREEK

Hughes Street Drain

Significant damages in the area along Caney Creek in the area upstream (west) of the abandoned T&NO railroad would be reduced with construction of the Hughes Street Drain. The feature consists primarily of three 60-inch reinforced concrete pipes run in parallel under Hughes Street. These would replace the current single 48-inch RCP, which is totally inadequate.

The inlet structure for the system would be located just north of the T-intersection of Hughes Street with Spanish Camp Road. The pipes would extend southward under Hughes Street for about 1300 feet, which is beyond the intersection of Hughes and Milam Streets. At this point, the pipes daylight into an existing open outfall channel. The area in and near the outlet structure is also being proposed for a sump area.

Polk Street Pipes

The area along Caney Creek incurring the most damages is located in and around downtown Wharton. Potential flood damages would be addressed by installation of three 60-inch reinforced concrete pipes below the surface of Polk Street. The headwall inlet would be located immediately beyond the intersection of Polk and Caney Streets, in the northeast quadrant. The three pipes would extend 1400 feet southward, where they would outfall into the Colorado River. An outfall structure with flap gates would be located at the terminus of the pipes.

During formulation, this drainage feature was known as the Richmond Pipes, and was envisioned to be placed under Richmond Street, which is located one block to the west of Polk Street. The location was, however, modified in order to avoid conflicts with other utilities and substantially reduce traffic disruption during construction.

Santa Fe Ditch

The residential neighborhood in eastern Wharton along Caney Creek incurs extensive flooding damage on a frequent basis. Construction of the Santa Fe Ditch would provide much needed relief from future flooding. The inlet of the ditch would be located near the intersection of Alabama Road and the old Santa Fe Railroad. For the upper portion, the ditch would have 1 foot vertical on 4 foot horizontal side slopes and an 8 foot bottom width, and follow the old railroad right-of- way until State Highway 60 is reached, which is a distance of approximately 5000 feet. The ditch would then turn southward, cross SH 60, and continue to the Colorado River, a distance of about 5700 feet. For this reach, the side slope would steepen to 1 foot vertical on 3 foot horizontal.

On January 25, 2006, the Assistant Secretary of the Army for Civil Works approved a request from the City of Wharton to construct this feature in advance of the Federal Project. If this project receives construction authorization from Congress, with the Santa Fe Ditch being part of the Recommended Plan, then the costs incurred by the city for advance construction would be factored into the cost apportionment. As of October 2006, all required right-of-way has been acquired, and construction has begun by the City. All designs and cost estimates for this portion of the project have been performed by firms under contract with the City of Wharton. The cost

estimates for the Santa Fe Ditch have been added to the MCACES for the remainder of the project to determine total project costs.

ADDITIONAL INTERIOR DRAINAGE FACILITIES

As part of the more detailed development of the Recommended Plan, all remaining interior drainage within the project area, but not captured by the Caney Creek storage areas, were investigated in more depth. During the formulation phase, the assumption was made that these additional facilities would be fairly minimal, and would not have an influence on the overall formulation.

A detailed hydraulic and hydrologic analysis was conducted of the study area for purposes of identifying the quantity and size of the additional drainage facilities. It was realized that facilities over and above the Caney Creek areas would be needed to fulfill interior drainage needs resulting from levee construction. Nine additional areas were identified that would serve as sump areas, with seven being located along the Colorado River levee segments, and two along the Baughman Slough levee. Details of the analysis can be found in the hydrology and hydraulics portion of Appendix G.

The following assumptions were made during the hydrologic and hydraulic interior design of the additional interior drainage facilities:

1. Initial sizing of the additional facilities was performed, assuming that the project would adhere to all local, state, and Federal regulations. This assumption provided a target elevation for the 1% chance maximum water surface for each drainage facility. Higher 1% design water surface elevations (i.e, design for less than a 1% storm) would place the first floor elevations of existing residences within the pool area of the proposed drainage facilities, violate local policies, and certainly not meet the study's planning objectives. Alternatively, a lower design water surface (i.e, design for greater than a 1% storm) would not result in any additional total benefits since the system levee design itself is restricted to a 1% level.

2. The combination of reasonable real estate ($ per acre) and excavation ($ per cubic yard) costs allowed for elimination of pumps as an option for use in the interior drainage design. Also, it is unlikely that the electrical infrastructure in Wharton could deliver sufficient power for pumps of sufficient size. Upgrading the delivery would be cost prohibitive.

3. Sump excavation would serve as materials for levee construction.

Placement of the additional drainage facilities was performed by taking advantage of localized low areas along the proposed levee segments. In addition, areas that are primarily open fields were selected to minimize impacts to woodlands. This resulted in a greater impact to grasslands, but grasslands are more easily restored and do not take 20-50 years to get reestablished. Unfortunately, some areas, such as the Nanya Plastics sump, have unavoidable impacts due to the fact that the interior drainage naturally drains to this specific location. However, impacts to wetlands and woodlands were avoided and minimized to the extent possible by refining the initial design of the Nanya Plastics sump. The original plan would have destroyed a high quality wetland and associated woodlands by excavating the entire area. Therefore, the excavation was removed from the west arm of the sump area and the interior is slated to be excavated deeper to compensate for the loss of storage. Utilization of this guidance produced what is believed to be the most cost effective location available. However, the exact placement may be revisited as part of the Value Management process during Preconstruction Engineering, and Design.

Geotechnical investigations performed as part of the design of the recommended plan confirmed that the soils excavated from the sump areas could be used to construct the adjoining levees. Any excess material would be deposited in nearby agricultural fields, with no permanent easement requirements. This construction method has been successfully utilized by the City of Wharton in recent construction projects.

Finally, it was known during the design of these facilities that the proposed sump areas would also be used for creation of wetlands and additional tree plantings to meet environmental mitigation requirements. This dual use concept further narrowed the flexibility in determining the most cost effective sizing solutions.

The resulting approximate size and excavation requirements for the additional drainage facilities as shown in Table 5-3 below. Also shown are the costs associated with the excavation. These costs, however, are shared with the levee construction, and are not necessarily fully allocated to the cost of the sumps. However, they do provide a good indication of magnitude, and can be used for relative comparison purposes.

Table 5-3
Sump Area Pertinent Data

Name	*Levee Segment*	*Excavation (cu. yds)*	*Excavation Cost **	*Area (ac)*	*Capacity (ac-ft)*
Wal-Mart Sump	Colorado River - 1	253,000	$1,475,000	32.3	250
Nanya Plastics Sumps	Colorado River - 2	41,000	$239,000	41.7	356
Hughes Sump	Colorado River - 2	42,700	$249,000	28.0	353
Ford Street Sump	Colorado River - 3	16,700	$97,000	3.2	9
Sunset Street Sump	Colorado River - 4	25,000	$146,000	1.7	14
Black/Rusk Street Sump	Colorado River - 5	29,500	$172,000	3.8	21
Alabama Road Sump	Colorado River - 5	213,000	$1,242,000	9.3	185
BS Railroad Sump	Baughman Slough	269,000	$1,568,000	34.5	132
Ahldag Sump	Baughman Slough	156,000	$909,000	8.4	250

* Note: For comparison purposes only. A portion of this cost would be allocated to the levees. Other appurtenances not included.

Several observations can be made from the information provided in the table. Most notably, the size and magnitude of the additional facilities in the mid section of the Colorado River levee system, known as Segments 2, 3, and 4, validate the original assumption in terms of significance. Conversely, the facilities added to segments 1, 5, and Baughman Slough are larger and more significant. Given the original cost of the Baughman Slough levee during formulation, this facility was determined to be the highest likelihood of triggering a formulation change, and was thus investigated in greater detail. The total sump excavation cost attributed to Baughman Slough is shown in the detailed cost estimate to be approximately $2.5 million. This compares to the original Baughman Slough levee cost of $1.2 million. At first glance, one would conclude that such a substantial increase would certainly effect the project formulation. However, for Baughman Slough, the levee concept was the only practical alternative included in the final array of alternatives, and the selected size had a relatively high benefit to cost ratio of 5.6. Even if one assumes the entire excavation cost to be attributable to the sump, the end result would still be a benefit to cost ratio of 1.8. A non-structural floodplain evacuation plan could possibly have been formulated for the Baughman Slough area, but such plans rarely have comparable benefit to cost ratios, and in almost all cases, have a higher first cost and may not be implementable. For

example the formulated non-structural plan for the Colorado River area had a benefit to cost ratio of 0.5.

During the initial phases of Preconstruction, Engineering and Design, the additional design facilities located in segments 1 and 5 of the Colorado River levee system, as well as the Baughman Slough facilities, will be thoroughly evaluated using Value Management principles. Lower project costs than those estimated in the study are likely, which will result in a more efficient project that what is currently identified. However, it is believed that the formulation of the project is sound, and selected measures and protection levels have been properly identified.

Materials from the excavation of the proposed interior drainage structures would result in excess disposal materials even though a large portion would be utilized during the levee construction. These materials would be placed in open fields that consist of either bare ground from agricultural practices or grasslands and would be reseeded and restored to grasslands in order to minimize impacts to the environment. These areas would be permanent disposal areas and would be used as the temporary disposal areas if temporary areas are needed during construction of the levees. A maximum of 171 acres of disposal areas would be needed for permanent disposal. An analysis using GIS indicated that there are over 5,400 acres of farm fields that could be used as disposal areas within a five mile radius of the center of town.

ENVIRONMENTAL IMPACTS

CLIMATE

No impacts to the climate are expected as a result of activities associated with the Recommended Plan.

PHYSIOGRAPHY/GEOLOGY/SOILS

The Recommended Plan would alter the soils on about 214 acres of land where the levees, sumps, and channel improvements in Baughman Slough would be constructed. The earthen levees would be seeded and returned to grassland habitat for most of the area. About 163 acres of land would be excavated for the sumps and the original grassland and forested habitat altered for temporary water storage. Much of the sump area would be reseeded with grass and trees replanted in the sumps to eventually return the area to a habitat resembling the one removed by construction.

PRIME AND UNIQUE FARMLANDS

Approximately 214 acres of surface soils would be impacted by construction activities associated with the Preferred Alternative. However, about 51 acres of earthen levees would be reseeded and returned to a grassland habitat suitable for livestock grazing, except in the urban environment, and as much as 171 acres in as yet unidentified storage sites would be used for storing the excess material excavated from the sumps. These storage areas would be located in open fields and reseeded with native grasses. These areas would be available for livestock grazing and would still be available as farmlands. Only about 2,290 feet of floodwalls and 162.9 acres of sumps would be permanently altered and no longer available for agricultural use. Coordination with the NRCS on scoring project impacts to prime farmland was accomplished on 9 January 2006 and again on 7 July 2006 due to project changes. The NRCS determined that project impacts to prime farmland soils scored 118 points, which is below the threshold value of 160. Any value above 160 points would trigger analysis of project alternatives to reduce impacts to prime farmlands. Therefore, this issue does not require further consideration. A copy of the NRCS letter dated 17 July 2006 is included in Appendix H.

HYDROLOGY AND HYDRAULICS

The primary impact of the project from a hydrologic and hydraulic standpoint is that for floods between the 4% annual chance of exceedance (ACE, or 25-year), and the 1% ACE (100-year), it retains more flow within the Colorado River basin. Without the levee system in place, some flows for floods in excess of the 4% ACE would escape the basin to Caney Creek and Baughman Slough. Those flows going to Baughman Slough do not return to the Colorado River basin, but instead stay in the San Bernard River basin. For the 1% ACE event, an increment of approximately 4,000 cfs is retained in the Colorado basin. It is assumed that for very rare floods that are larger than the design flow, the overflow rate remains relatively unchanged from without project conditions. It should be noted that for an event of this magnitude, the whole area is virtually underwater, under all conditions.

The rise in water surface within the extents of the levee (through the City of Wharton) ranged from 0.16' to 0.44' with an average rise throughout this reach of 0.33'. Although this rise has no impact on the City of Wharton since it is protected by the proposed levee, this rise would impact areas on the right overbank of the Colorado River not protected by a levee or other measure. This area is primarily agriculture and pasture land on the right overbank of the Colorado River opposite of the City of Wharton, as well as downstream. For the downstream area, the Colorado River water surface profile increased an average of 0.56' through the levee section from the 50-year event to the 100-year event. For economic purposes, the resulting changes have been addressed as dis-benefits totaling approximately $3,000 annually. In addition, a real estate takings analysis has been conducted, which found no taking, is documented in Appendix E. These are considered occasional consequential damages due to the project, and they would not arise to the level of "an inevitable recurrent flood."

WATER QUALITY

Construction of the proposed project could cause short-term disturbances resulting in potential impacts to water resources through soil erosion. The main potential impacts on water resources are siltation resulting from erosion and runoff from hauling and constructing the earthen levees, construction of ditches to return the stored flood waters in the sumps, and the stockpiling of excess excavated materials from the sumps. Temporary increases in suspended solids from soil erosion also increases turbidity which affects aquatic plants by reducing light penetration. In addition, extremely high turbidity levels could suffocate aquatic organisms. However, because these impacts would be temporary in nature and best management practices would be used to reduce erosion of bare earth surfaces along the levees, ditches, and stockpile areas, such as using hay bales, jute matting, silt fences, sand bags, and mulching, until the areas can be seeded to reestablish native vegetation that would help control erosion, these impacts are expected to be insignificant. Also, only the vegetation that is absolutely necessary to clear an area for construction would be removed.

To reduce the potential for petroleum products entering the Colorado River, Caney Creek, or Baughman Slough, contractors would take measures to prevent spills and leaks from their equipment. Littering in construction areas would be discouraged and surplus and waste materials would be removed from the work site and disposed of in a permitted disposal area. Spills of fuel, lubricants, or other petroleum products increase the potential for impacts to groundwater. The most effective method to avoid groundwater impacts is the proper implementation of spill-prevention and spill-response plans. Pollution from normal operation of heavy equipment during construction activities is unlikely to result in any groundwater contamination.

A Storm-Water Pollution Prevention Plan would be prepared during PED Phase and submitted to TCEQ along with a Notice of Intent to construct the project to comply with CWA Section 402(p).

AIR QUALITY

Implementation of the Recommended Plan would result in a temporary reduction in forested area, which in turn could adversely affect air quality. However, in the long term the impacts would be offset due to the mitigation requirements.

There may also be minor temporary impacts to air quality due to construction equipment used during the construction activities. There would be increases in particulate matter as a result of increased dust particles in the air. Best management practices would reduce these impacts. In addition, the exhaust from the construction equipment would result in temporary impacts to air quality. These impacts would be minor since Wharton County is not classified as a "Non-attainment" area.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

Based on the literature search conducted in April 2003, and the environmental site reconnaissance conducted in March 2005, no identified environmental sites are located in or within 200 feet of the proposed project footprint. Thus, there are no anticipated adverse impacts as a result of implementation of the Recommended Plan.

AQUATIC RESOURCES

There would be temporary impacts to the aquatic resources during project construction and until vegetation is reestablished on disturbed areas. These impacts would be as a result of storm water discharges. Fine sediments and nutrients would be transported in the storm water and deposited within the stream and river, also know as siltation. Impacts to Baughman Slough and Caney Creek would be more noticeable than to the Colorado River because of the quantity of water. Increased turbidity in the Colorado River as a result of project construction would not even be noticeable; however, there would be noticeable increased turbidity in Baughman Slough during project construction if there was a rain event that caused runoff. After the vegetation is reestablished within the channel bench and along the levee, the system and the aquatics would return to equilibrium within a few years. Best management practices would be utilized to decrease sediment transport and would hence decrease impacts to aquatic habitat.

Wetlands

The USFWS National Wetland Inventory data for the project area showed scattered wetlands along parts of the Colorado River, in Baughman Slough, in tributaries feeding Baughman Slough, in Caney Creek, in old oxbows of Caney Creek, and in some swales and ditches draining some of the pastures and woodland areas outside the city. Most of these wetlands are ephemeral and contain water only after moderate to heavy rainfall events. However, these wetlands still retain wildlife value, especially during wet years. These wetlands total about 118 acres.

All of the wetlands that currently have jurisdictional status under Section 404 of the Clean Water Act and would remain jurisdictional after the project is completed, even though they would be removed from the 100-year floodplain. The wetlands in Caney Creek and its old oxbows would remain jurisdictional because they would retain their hydraulic connection to the Caney Creek watershed. The remaining wetlands that drain into Baughman Slough or the Colorado River would retain their hydraulic connections because the tributaries and drainages would be allowed to pass under the levees through culverts with flapgates on the river or slough side. The flapgates would prevent water from backing up into the city during a river rise, but the connection

and, therefore, jurisdiction over the wetlands still remains. Since none of these wetlands outside the sump areas are otherwise affected by the project, mitigation is not needed.

The only wetlands to be negatively impacted by the project are about 1.4 acres where the Colorado River crosses 7 small drainages, 5.0 acres that would be removed during channel enlargement at Baughman Slough, 2.0 acres in a drainage ditch next to the Alabama St. Sump, and 1.5 acres in the Nanya Plastics Sump. The Nanya Plastics wetlands consist of a small ditch about 5-6 feet wide and 200 feet long that drains into an ephemeral pond at the bottom of a borrow pit. During the last site visit on 15 June 2006, the total area of these wetlands was about 1 acre. Another wetland of about 2.5 acres is located on the west side of the Nanya Plastics Sump and appears to be a remnant oxbow from a past meander of Caney Creek. This is a permanent wetland of higher wildlife habitat quality than any of the other wetlands in the project area. It is circled by a 100-200-foot wide band of fairly mature forest and has several mature bald cypress trees on the perimeter of the pond. This wetland would not be removed during construction of the sump, but it could be flooded during locally heavy downpours in the area and a simultaneous rise of the river which prevents the water in the sump from draining under the levee to the river. The oxbow wetland would retain its jurisdictional status since it retains a hydraulic connection to the Colorado River through a flapgated culvert under the levee. The two smaller wetlands inside the sump would be lost during construction, but they would be recreated in the sump and revegetated with emergent vegetation and trees as part of the mitigation plan during project construction.

VEGETATION

The Preferred Alternative consists of several flood protection features: a levee along the Colorado River and a segment of Baughman Slough, sumps located adjacent to the levees to collect floodwaters inside the city, channel enlargement on a section of Baughman Slough downstream of the levee, and storm water conveyance systems to drain storage areas within Caney Creek. The Preferred Alternative was designed to minimize impacts to riparian habitat along the Colorado River by pulling the flood protection levee back from the river bank as much as possible and locating the structure on the top of the river bank inside the city in an urban environment. This location also accomplished a reduction in levee height needed to provide the requisite flood protection and lowered the cost of the project. Existing features, such as the railroad embankment for the Kansas City-Southern Railroad and existing ditches were also utilized to reduce project impacts and costs. However, even with these precautions, approximately 64.9 acres of riparian/hardwood forest would be removed during project construction, along with 299.6 acres of grassland. Most of the grassland would be recreated by seeding the earthen levees and stockpile areas with native grasses. Table 5-4 lists the impacts to each vegetation type by flood damage reduction measure.

Table 5-4
Impacts of the Recommended Plan to Habitat Types

Flood Protection Feature	*Length (ft)/ Size (ac)*	*Habitat Impacts*			
		Forest	*Grass*	*Wetland*	*Resident*
Levee					
Colorado R.	20,310 ft. (earth) 1,910 ft. (floodwall)	14.9 ac.	14.1 ac.	1.4 ac.	0
Baughman S.	6,610 ft. (earth) 380 ft. (floodwall)	7.6 ac.	14.5 ac.	0	0
Channel Improvement					
Baughman S.	6,830 ft. (75 ft. wide)	0	0	5.0 ac.	0
Sumps					
Wal-Mart	32.3 ac.	11.2 ac.	21.1 ac.	0	0
Nanya Plastics	41.7 ac.	22.5 ac.	17.7 ac.	1.5 ac.	0
Hughes St.	28.0 ac.	6.0 ac.	22.0 ac.	0	0
Ford St.	3.2 ac.	0.2 ac.	2.6 ac.	0	0.4 ac.
Sunset St.	1.7 ac.	0.8 ac.	0.2 ac.	0	0.7 ac.
Black/Collins	3.8 ac.	1.0 ac.	2.8 ac.	0	0
Alabama St.	9.3 ac.	0	7.3 ac.[1]	2.0 ac.	0
Baughman - Railroad	34.5 ac.	0	25.2 ac.	0	9.3 ac.
Baughman S.- Ahldag	8.4 ac.	0	8.4 ac.	0	0
Caney Creek Storage					
Outfall Storage Drainage	300 ft.*	0.4 ac.	0	0	0
Wharton Stor. Drainage	0	0	0	0	0
Crestmont Stor Santa Fe Ditch	250 ft.*	0.3 ac.	0	0	0
Disposal Areas	65 ac. < 171 ac.**	0	171 ac.	0	0
Total		64.9 ac.	299.6 ac.	9.9 ac.	10.4 ac.

[1] The Alabama St. Sump is located in a cropland and does not contain grassland, except a small amount in a ditch.
* Distance from levee/road to river that crosses forest or wetland habitat.
** The disposal areas would impact at most 171 acres if the excess materials are spread 4 feet high. Materials would only be disposed of on grass or open agricultural fields.

Colorado River Levees – The levees along the Colorado River generally cross (1) pastureland west of Hwy. 59, some of which contain hardwood forests; (2) riparian habitat at the Nanya Plastics site; and (3) mostly urban habitat through the city with little or no forest habitat to the east end of the project. Approximately 15 acres of riparian/hardwood forest habitat would be removed during levee construction and would be compensated as described in the mitigation plan.

Wal-Mart Sump – This 32.3-acre sump is located in a pastureland consisting of about 11.2 acres of hardwood forest and 21.1 acres of grassland habitat (Figure 5-1). About 253,000 cubic yards (cy) of material would be excavated from the sump, which would be used to collect water from

local flooding. Some of the excavated material would be used to construct the nearby levee and the remaining material would be stored in an open field to be identified during the PED Phase.

Nanya Plastics Sump – This 41.7-acre sump consists of about 22.5 acres of riparian/hardwood forest habitat, 1.5 acres of wetlands, and 17.7 acres of grasslands. Approximately 41,000 cy of material would be removed from the sump and stored in an open field to be identified during the PED Phase.

Hughes St. Sump – This 28-acre sump is located in pastureland and contains about 6.0 acres of hardwood forest and 22.0 acres of grassland. Approximately 42,700 cy of material would be excavated for the sump.

Ford St. Sump – This approximately 3.2-acre sump is located in an open field with a few scattered trees in an urban setting. About 16,700 acres of material would be removed from the sump.

Sunset St. Sump – This is the smallest sump in the project with an area of about 1.7 acres. It is located in a residential area and consists of open field and residential yards. About 25,000 cy of material would be removed from the sump.

Black/Collins St. Sump – This 3.8-acre sump consists of open field with some scattered trees in an urban setting. About 29,500 cy of material would be removed from the sump.

Alabama St. Sump – This 9.3-acre sump is located in a corn field at the downstream end of the Colorado River levee. A large drainage ditch runs along the north side of the sump and contains mostly brush and tall grass in the channel. Approximately 213,000 cy of material would be removed from the sump.

Baughman Slough Levee – The levee along Baughman Slough crosses about 7.6 acres of forest and 14.5 acres of grassland habitat. Material to build the levee would come from the soil excavated from the nearby sumps.

Baughman Slough Railroad Sump – This 34.5-acre sump is located at the western end of the project in a pastureland next to Baughman Slough. Approximately 9.3 acres of the site consists of residential yard with pecan trees. The rest of the sump would be excavated from 25.2 acres of pasture. About 269,000 cy of material would be removed from the sump.

Baughman Slough Ahldag Sump – This 8.4-acre sump consists of pastureland with a few scattered trees. About 156,000 cy of material would be removed to create the sump.

Disposal Areas - About 1,302,300 cy of material would be excavated for the sumps and toe collector ditches. Only about 201,300 cy of this material would be needed to construct the earthen levees, leaving about 1,102,000 cy of material that would need to be disposed of. As discussed in the Interior Drainage Section of the chapter, there would be a need of permanent disposal area of approximately 68 acres of land if the excess materials are piled 10-feet high and 171 acres would be needed if it is piled 4-feet high. These impacts would only be to upland grasslands and after the disposal is complete, the areas would be reseeded and returned to grasslands, so no mitigation would be required. An analysis using GIS indicated that there are over 5,400 acres of farm fields that could be used as disposal areas within a five mile radius of the center of town.

Riparian/Hardwood Forests

The riparian/hardwood forest habitat that would be removed (approximately 65 acres as shown above) during project construction consists mostly of mature native pecan trees, with some hackberry, wooly buckthorn, cedar elm, and cottonwoods intermixed. There is very little brush or other understory vegetation, except around the base of the mature trees due to occasional mowing to maintain the pasture lands. Even the areas not used as pastureland in the urban setting are mowed frequently since they can be used for recreation. The one exception is the Nanya Plastics Sump where a more natural mix of native trees and brush can be found, including native pecan, hackberry, black willow, and cherry laurel. The non-native Chinese tallow also has invaded the area and is becoming widespread at this site. Much of this land was used as a borrow site around 12-15 years ago and the original trees and vegetation stripped for access to the sand.

Project impacts are listed for each levee and sump area separately, starting at the west end of the project area and running along the Colorado River to the east end at the Santa Fe Ditch; then the impacts will be described along Baughman Slough from west to east (downstream). Table 5-4 shows the area of forest, wetland, and grassland habitat that would be affected by project construction.

In aggregate, about 64.9 acres of riparian/hardwood forest would be removed during construction of the levee and sump system.

Bottomlands of Special Concern

No impacts to bottomland of special concern would occur as a result of implanting the Recommended Plan. The Austin Woods are primarily on the other side of the Colorado River, where no construction would occur. The project impacts are primarily secondary growth trees and pecan trees.

Grasslands

A total of about 299.6 acres of grasslands would be removed during project construction. Up to 171 acres would be used to store excess material excavated from the sumps, but this land would be reseeded with native grasses to reclaim its original habitat. Up to 45 acres of earthen levees would also be reseeded with native grasses to reclaim part of the lost habitat. Because this resource is neither rare nor declining on a local, regional, or national scale, it would not be included in the mitigation plan.

FISH AND WILDLIFE

There would be minor impacts to fish and wildlife species during the construction of the Recommended Plan. The construction related activities would temporarily displace resident wildlife species; however, they would be expected to return to the area once construction is completed and vegetation is reestablished. The impacted habitat would be fully compensated for in the proposed mitigation plan. Approximately 148 AAHU of riparian woodlands would be lost, but 151 AAHU would be restored through the proposed mitigation. Approximately 12 AAHU of wetland habitat would be lost, but over 15 AAHU would be restored through mitigation. Since the impacts to fish and wildlife resources would be temporary and the habitat would be fully mitigated, there would be no significant impacts.

Threatened and Endangered Species

A Biological evaluation was conducted for this project for the purpose of fulfilling the USACE requirements as outlined under Section 7(c) of the Endangered Species Act of 1973, as amended. The evaluation was reviewed by the USFWS to ensure that all potential project impacts have been discussed and coordinated with the appropriate agencies. Since the USACE concluded the project would not affect the only Federally-listed threatened species for the county, no further consultation was required. A description of potential project impacts to all species listed by the Federal Government and the State of Texas for Wharton County is presented below.

The bald eagle is the only species listed on the USFWS county list for Wharton County. The closest bald eagle nest to the project area is located near Glen Flora, about 5 miles upstream from the project area in the City of Wharton. Discussions with the TPWD and local city officials indicated that there were no known sightings of eagle nests or the birds roosting in the project area. However, since there is the potential for a pair of eagles to take up residence and construct a nest in the project area, the site will be reevaluated each fall just prior to and during project construction to ensure there would be no project impacts to this threatened species. The reevaluation will consist of coordination with the USFWS, TPWD, and local city officials or other knowledgeable local residents to elicit information on eagle sightings, as well as an informal survey of suitable wooded areas for nests.

The American peregrine and Arctic peregrine falcons have the potential of migrating through the project area during construction of the levees and sumps; however, the construction activities are expected to have only a temporary impact and the birds can easily avoid the area until construction is complete.

Project construction is not expected to have any impacts on the Attwater's greater prairie chicken, Eskimo curlew, whooping crane, or the interior least tern since they have little, if any, potential of occurring in the project area.

Both the white-faced ibis and white-tailed hawk are rare to uncommon visitors to Wharton County, but if they do visit the project area, it is doubtful that project construction would have any impact on these species, except a temporary one, since they can easily avoid the disturbance.

The wood stork is not a common visitor to Wharton County, but if one should wander through, it could easily avoid construction. Any impacts would be temporary.

Project construction is not expected to have any impact on the black bear or Louisiana black bear since there are no records of any occurring in the project area in recent times and there is little likelihood of one appearing in the area during project construction.

The Texas horned lizard and the timber/canebrake rattlesnake have the potential of occurring in the project area and could be adversely affected by project construction. However, the rattlesnake is more likely to avoid construction activities.

The blue sucker has the potential to occur in the Colorado River in the vicinity of the project area, but is not likely to be directly affected by construction activities since all construction would be located away from the river on higher elevations. There may be some indirect affects if soil erosion occurs on land freshly stripped of vegetation during construction and flows into the river during rains. However, the fish may avoid any local areas with higher levels of turbidity.

Migratory Birds

The bottomland hardwood forests in the project area are a declining resource and critical in the survival of neotropical migrating birds. The project would remove about 64.9 acres of this habitat during project construction, but would replace it with forest habitat of nearly equal value in the mitigation plan described below and Appendix B. Therefore, project construction would temporarily remove some habitat used by migratory birds, but the habitat would be replaced and preserved in the long term during the period of analysis.

CULTURAL RESOURCES

During the feasibility phase, no cultural resources sites have been identified along the proposed levee alignment, proposed sump areas, or any other areas targeted for construction activities. However, additional cultural resource work will be accomplished during Preconstruction Engineering, and Design, as well as during Construction, to insure that all potential Cultural impacts are properly addressed. Additional work may include archeological testing or monitoring during construction for deeply buried floodplain sites along Baughman's Slough and the Colorado River, survey of portions of project area not previously covered after final design, and additional historic research or evaluation of structures that may be impacted by the project for historic or architectural significance.

In order to facilitate coordination and approval of the project, a Draft Programmatic Agreement between the Corps and the Texas State Historic Preservation Office (SHPO), developed pursuant to 36 CFR 800, is contained in Appendix C to this report. The Agreement will address any additional work that needs to be done and establish guidelines for completing and coordinating the work with the SHPO. All cultural resource assessment and coordination required by 36CFR800 will be completed prior to project construction under the executed Agreement.

RECREATION AND PUBLIC ACCESS

The Recommended Plan did not include any new recreation features. The levee system being recommended would be extremely suitable for use constructing a recreational trail. The City of Wharton may opt to add this feature at a later time. It would not be part of the Federal project. One city park paid for with city funds would be impacted as a result of the levee going through the middle of the area; however, once the levee is in place, the area could still be used as open space; therefore impacts to recreation would be insignificant.

OTHER SOCIAL EFFECTS

Socioeconomic Resources

Overall, there would be positive and negative effects to socioeconomics as a result of implementation of the recommended plan. There would be long term annual savings from the reduction in flood damages to public and privately owned properties occurring in Wharton. In addition, the city would save money on cleanup costs. There would also be short-term employment effects associated with the with-project construction that would stimulate increased demand locally for construction materials and services. These expenditures would be expected to result in a positive multiplier effect on the local community and would last for the period of construction, which is estimated at 24-months. There would be a negative reduction in local tax base as a result of taking property off of the tax roles and putting it into public ownership. The

biggest direct benefit to the residents, however, is the elimination of the need to maintain flood insurance policies. The amount of this savings varies, but it can be as much as several thousand dollars per year for a typical homeowner. There would be minor negative impacts and overall positive benefits for implementation of the Recommended Plan on socioeconomic resources.

Noise

For on-site construction workers, the permissible exposure limits (PEL) and requirements for noise control are an 8-hour time-weighted average exposure level (TWA) of 90 dBA with a 5-dB exchange rate between allowable duration and noise level. Engineering or administrative controls are required to be implemented above this level, and hearing protection devices (HPDs) must be issued and worn when exposures exceed the PEL. Regulations require hearing conservation programs (HCPs) for overexposed workers. The Occupational Health and Safety Administration's Construction Regulation 1926.101 mandates the use of hearing protection above the PEL and requires insert devices to be fitted or determined individually by ''competent persons" (Suter 2002). Table 5-5 provides a summary of noise exposure levels experienced by heavy equipment operators. Heavy equipment such as backhoes, front-end loaders, and cement and dump trucks would cause short-term, localized, insignificant increases in noise levels. These short-term increases are not expected to substantially affect adjacent noise sensitive receptors or wildlife areas. Construction activities would increase noise levels temporarily at locations immediately adjacent to the project area, but would be attenuated by distance, topography, and vegetation. Noise levels created by construction equipment would vary greatly depending on factors such as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. The equivalent sound level of the construction activity also depends on the fraction of time that the equipment is operated over the time period of the construction. Construction would occur only during daylight hours, thus reducing the DNLs and the chances of causing annoyances. The use of BMPs such as keeping equipment in good operating condition, proper training, and providing appropriate health and safety equipment would minimize the potential noise impacts associated with the proposed action.

Table 5-5
Average Daily Noise Exposure Levels (8-hour TWA)
of Heavy Equipment Operators and Associated Laborers in dBA

Operator or Task	*Mean TWA*	*SD*	*Range*
Heavy-duty bulldozer	99	5	91-107
Vibrating road roller	97	4	91-104
Light-duty bulldozer	96	2	93-101
Asphalt road roller	95	4	85-103
Wheel loader	94	4	87-100
Asphalt spreader	91	3	87-97
Light-duty grader	89	1	88-91
Power shovel	88	3	80-93
Laborers	90	6	78-107
Crawler crane - .35 ton Noninsulated cab	97	2	93-101
Crawler crane - 35 ton Noninsulated cab Insulated cab	94 84	3 3	90-98 80-89
Rubber tired cane - 35 ton Noninsulated cab Insulated cab	84 74	5 9	78-90 59-87
Rubber tired crane - 35 ton Insulated cab	81	4	77-87
Truck-mounted crane	79	2	76-83
Tower crane	74	2	70-76

Traffic

There would be temporary impacts to traffic as a result of implantation of the Recommended Plan. Construction equipment would cause minor increases in traffic inconveniences, but since traffic is so minimal in the town, these impacts would be minor. As a result of project construction Polk Street from Caney to Elm Street would be closed while project features are placed within the road right-of-way. The road would be reopened after project construction.

Public Health and Safety

There would be a positive benefit to public heath and safety as a result of implementing the Recommended Plan. The proposed project would provide 1% ACE flood protection to almost the entire city of Wharton. This would reduce the risk and hazards associated with flooding in Wharton. There would be no adverse impacts associated with project implementation.

Public Services

There would be a benefit to public services as a result of implementation of the Recommended Plan. The strain on public resources associated with emergency services and cleanup would be reduced. There would be no adverse impacts to public services as a result of project implementation.

CUMULATIVE IMPACTS

The subject of cumulative impacts, as it pertains to all known potential future actions within the Lower Colorado River Basin, has previously been addressed on the report titled *Final Programmatic Environmental Impact Statement, Flood Damage Reduction and Ecosystem*

Restoration, Lower Colorado River Basin, Colorado River, Texas, dated August 2005. This document is incorporated by reference.

Of particular interest is the hydrologic impacts, and the cumulative relationship between the proposed Wharton flood damage reduction project, and the Lower Colorado River/San Antonio Water System (SAWS) Project. While the SAWS project is still in the early planning stages, the concept of the project is to capture excess flood flows into off-channel storage areas. The peak capture rate may approach several thousand cubic feet per second. As noted earlier, an adverse impact of the Wharton project is that during passage of flood events with magnitudes between the 2% and 1% exceedence (50-year and 100-year) events, flow rates on the Colorado River are increased by several thousand cubic feet per second. In essence, these two projects would essentially cancel themselves out in terms of flow rate changes for these events, resulting in little to no changes downstream of Wharton if both were implemented.

There would be a potential cumulative beneficial impact to the economy from the increased potential for development as a result of the Recommended Plan. The project was not designed to allow for additional development; however, since most of the city would be protected from a 1% ACE event, some lands that were not available for development because of their location in the flood zone, may be able to be developed after project construction. This would increase the tax base of the county and the city. Exact properties were not identified, but the potential is likely. The construction that may occur would more than likely result in the loss of additional fish and wildlife habitat. However, existing wetlands would still be regulated under the Clean Water Act and any impacts would have to be permitted. This benefit would be minimal because there is already plenty of existing developable lands that are not being developed, so just because more land is available does not guarantee that it would ever be developed.

MITIGATION

The mitigation plan described in detail in Appendix B was developed with the help of USFWS and TPWD personnel who participated in collecting the field data to run the HEP analysis and provided valuable advice in completing the analysis. During coordination on where mitigation was to be located, these agencies stated a strong preference for acquiring some of the bottomland hardwood habitat found at two alternative sites located along the Colorado River just outside the levee system. Both agencies would like to see this land preserved as part of the Austin's Woods (Columbia Bottomlands) Conservation Plan, which could be administered by the Nature Conservancy or as part of the Brazoria National Wildlife Refuge Complex (USFWS, 1997). However, a full analysis described below and in more detail in Appendix B, shows that all of the mitigation can take place on project lands which eliminates the need to purchase any lands outside the project for preservation.

Although preservation of these ecologically sensitive and disappearing bottomland hardwoods is a worthy and needed goal, the USACE must follow its guidance in ER 1105-2-100. One of the principal requirements for complying with this guidance is the need to demonstrate that damages to significant ecological resources (wetlands and bottomland hardwood forests) have been avoided or minimized to the extent practicable and that unavoidable damages to these resources have been compensated to the extent justified. The guidance also requires that habitat-based analyses be used to determine the amount of mitigation needed to appropriately compensate for project impacts.

The project demonstrated minimization of impacts by locating levees inside the urban area, to the extent practicable, where resources have already been impacted and relocating the sumps, as much as possible, to avoid forests and high quality wetlands. The remaining impacts to wetlands and riparian bottomland forests are unavoidable and would be fully compensated in the plan described below.

The selected mitigation plan calls for all habitat mitigation to be placed on project sump lands. There are several advantages to locating the mitigation in the sumps. First, the mitigation is located at or near the location of the lost habitat, so the original conditions are restored, or nearly so, to the impacted area. Second, the land needed for mitigation would be acquired for project construction and it would not be an additional cost to the project. Finally, almost all of the wetland construction would be done when the sumps are excavated as a project feature and very little additional cost would be incurred while doing some minor earthwork to complete the design of the wetlands. The drains would be elevated a little higher than in the normal design of the sumps so the wetlands would not completely drain after the flood waters have receded.

An incremental analysis was conducted for each habitat type that was going to be impacted and is described in detail in Appendix B. Each sump area was used as a measure and three scales were developed for possible implementation on each measure/area. Forested habitat scales were developed using seedlings, one inch caliper and two inch caliper trees. Wetland habitat scales were using low, medium or high density of cages per acre. Approximately 148.4 AAHU of riparian/forest habitat on 65 acres and 12.2 AAHU of wetlands on 10 acres would require mitigation as a result of implementing the Recommended Plan.

The results of the incremental analysis for the forested habitat show that implementing the woodland plantings using scale 2, or one inch caliper trees, in any of the sumps would be incremental justified and cost effective. Therefore, selecting a few sump locations that would attain the 148.4 AAHU of woodland impacts would satisfy the required mitigation. Since most of the woodland habitat loss is occurring in the Nanya Plastics sump and that area has the most established habitat for connectivity, this area was selected as the first location for mitigation (Figure B-10). The Nanya Plastics Sump would provide 54.73 AAHU. Furthermore, since the Wal-Mart location had the next largest impacts to woodlands, it was also selected (Figure B-9). The Wal-Mart sump would provide 44.29 AAHU, which would bring the cumulative total to 99.02. The Baughman Slough Railroad sump (Figure B-13) would provide an additional 46.27 AAHU, which would bring the cumulative total to 145.29 AAHU. Therefore, one additional sump would be required to meet the 148.4 AAHU of impact. The Ford Street sump would provide 5.94 AAHU, which would bring the cumulative total to 151.23, so it was selected as the final sump that would be used as a mitigation area. The proposed woodland planting using scale 2 in the Nanya Plastic, Wal-Mart, Baughman Slough Railroad, and Ford Street Sumps would provide the required mitigation to fully mitigate the impacts of the proposed levee and sump construction for the Wharton Project by restoring 85 acres. The projected first cost of implementing the forest mitigation is approximately $619,500 with an average annual cost of approximately $48,980. The annual cost per annual habitat unit would be $324.

The results of the incremental analysis for the wetlands show that implementing any of the measures using the high density scale (40 cages per acre) would be cost effective and incrementally justified. Therefore, selecting a sump location or combinations of sump locations that would attain the 12.2 AAHU of wetland impacts would satisfy the required mitigation. Since most of the wetland habitat loss is occurring in the Nanya Plastics sump and that area has the most established habitat for connectivity, this area was selected as the first location for mitigation (Figure B-10). The Nanya Plastics Sump would provide 15.74 AAHU by restoring 10 acres. The proposed wetland planting using the High Density Scale in the Nanya Plastic sump would provide the required mitigation to fully mitigate the impacts of the proposed levee and sump construction for the Wharton Project. The projected first cost of implementing the wetland mitigation is approximately $52,675 with an average annual cost of approximately $4,563. The annual cost per annual habitat unit would be $289.

The preliminary cost for implementing the mitigation plan is estimated at about $672,175 for planting trees, shrubs, and wetland vegetation, as well as using protective cages for the wetland vegetation until they become established. An additional $92,312 would be required for

perimeter fencing, which would bring the total first cost of mitigation to $746,025. The perimeter fences would be to keep cattle out of the sites. Since it was a shared cost for wetlands and woodlands, the cost could not be added to the incremental analysis, it had to be added after the fact. See Appendix B for a more detailed explanation of the mitigation plan and how mitigation quantity and quality were calculated.

ENVIRONMENTAL COMPLIANCE

Table 5-6 shows the status of environmental compliance of this report with applicable laws, executive orders and other environmental issues. More detailed descriptions of environmental compliance are explained where compliance issues were encountered.

ENDANGERED SPECIES ACT OF 1973

The project would not affect T&E species and was coordinated with USFWS.

FISH AND WILDLIFE COORDINATION ACT, 1958

A draft Fish and Wildlife Coordination Act Report dated September 2006 was received. As letter response, enclosed in Appendix H, was prepared and sent to the U.S. Fish and Wildlife Service on October 4, 2006. USFWS was involved in project formulation. A final Coordination Act Report will be included in Appendix D.

CLEAN WATER ACT – SECTION 404

USACE has been directed by Congress under Section 404 of the Clean Water Act (33USC 1344) to regulate the discharge of dredged and fill material into all waters of the United States, including adjacent wetlands. The intent of Section 404 is to protect the nation's waters from indiscriminate discharge of material capable of causing pollution and to restore and maintain the chemical, physical and biological integrity of these areas. Although USACE does not issue itself permits for proposed activities which would affect waters of the U.S., USACE must meet the legal requirements of the act. The Section 404 (b)(1) analysis for the Recommended Plan is included in Appendix B. Section 401 of the Clean Water Act requires that State Water Quality Certification be obtained for the project. The proposed project was coordinated with Texas Commission on Environmental Quality and a joint public notice was issued in order to obtain Section 401 compliance. The TCEQ requested additional information, which was subsequently provided by the Corps. Water quality certification will be placed in Appendix H.

SECTION 106 COMPLIANCE

Coordination was initiated with the State Historic Preservation Officer (SHPO) during the feasibility study. A draft programmatic agreement (PA) for the project component was prepared and forwarded to SHPO for their concurrence on how to address Section 106 compliance. Comments on the proposed PA were provided to the Corps and the Corps forwarded a final PA via email (included in Appendix C). A PA will be executed between the SHPO and the Corps to ensure Section 106 compliance. The Correspondence is enclosed in Appendix H.

EXECUTIVE ORDER 11988 – FLOOD PLAIN MANAGEMENT

Executive Order 11988, Floodplain Management, was considered during the development of the proposed project. There are no practical alternatives to achieve the project purposes of flood damage reduction without placing fill within the floodplain. Material removed from the project area requiring disposal, as part of the proposed plan, would be placed in approved landfills for the types of materials involved. Excess material excavated from the sumps would be placed on upland pasturelands to be determined during the PED Phase. The proposed fill actions would not result in adverse environmental impacts.

EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS

Executive Order 11990 was considered during the development of the proposed project. The proposed project would remove about 9.9 acres of wetlands, but these would be replaced through mitigation on project lands. Therefore, the project is in compliance with Executive Order 11990.

ADVISORY CIRCULAR 150-5200-33 – HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

The final project report will be sent to the Federal Aviation Administration (FAA) as required by the Memorandum of Agreement. There is only a very small airport in the Wharton area; therefore, it is not expected that this is an issue.

ENVIRONMENTAL JUSTICE

On February 11, 1994, the President issued Executive Order (EO) number 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*." In general, the order states that Federal agencies shall specifically analyze environmental effects of Federal actions, including health, economic, and social effects, on minority and low-income populations, as part of the analysis prepared for the national Environmental Policy Act (NEPA). The EO is designed to focus the attention of Federal agencies on the disproportionate impacts to health or environment that could result from undertakings in areas of minority and/or low-income communities. It further directs agencies to identify potential effects and possible mitigation measures in consultation with the identified affected communities. In order to determine potential impacts to minority and/or low-income populations within the study area, information obtained from a review of the existing demographic and census data should be combined with a series of community participation meetings.

The US Census Bureau divides the city of Wharton into 4 census tracts. All tracts have high concentrations of ethnic and racial minorities. The Hispanic population of Wharton makes up the largest minority population of the city. 31% of the population of Wharton claims some type of Hispanic descent; many are from multiracial backgrounds. Hispanic residents are distributed fairly evenly across the census tracts that make up the city. African Americans make up about 25% of the city population, but that population is not as evenly distributed across the city. The highest concentration of African Americans in Wharton is in the southern section of the city. This is the lowest income area for all census tract residents and is subject to frequent flooding from the Colorado River.

Frequent flooding is a problem in all tracts. Each tract is expected to benefits from the planned flood control project that meets NED standards. There are no buyouts planned for recreation, and only one structure is being acquired in order to build any of the proposed project components. Thus, there would be no significant adverse socio-economic effect on any minority present in the city of Wharton.

Public workshops and City Council updates were held throughout the course of the study, as documented in Chapter 6. These meetings are all open to the public, and the minority interests are well represented on the City Council. The Recommended Plan will result in the relocation of one residence, but thousands, particularly the minority and low income sector, will benefit. It is this group that generally does not have insurance to offset flooding losses.

Table 5-6
Relationship of Plan to Environmental Protection Statutes and Other Environmental Requirements

Policies	Compliance of Plan
Public Laws	
Archeological and Historic Preservation Act, 1974, as amended	Plan in Full Compliance
Archeological Resources Protection Act, 1979, as amended	Plan in Full Compliance
Clean Air Act, 1977, as amended	Plan in Full Compliance
Clean Water Act, 1972, as amended	Plan in Full Compliance
Coastal Zone Management Act, 1972, as amended	Not Applicable
Endangered Species Act, 1973, as amended	Plan in Full Compliance
Farmland Protection Policy Act	Plan in Full Compliance
Fish and Wildlife Coordination Act, 1958, as amended	Plan in Full Compliance
Magnuson Fisheries Conservation and Management Act	Not Applicable
Migratory Bird Treaty Act, 1918, as amended	Plan in Full Compliance
National Environmental Policy Act, 1969, as amended	Plan in Full Compliance
National Historic Preservation Act, 1966, as amended	In Progress
Native Graves Protection and Repatriation Act, 1990	Plan in Full Compliance
Rivers and Harbor Act, 1899	Not Applicable
Wild and Scenic Rivers Act, as amended	Not Applicable
Executive Orders	
Environmental Justice (E.O. 12898)	Plan in Full Compliance
Flood Plain Management (E.O. 11988)	Plan in Full Compliance
Protection of Wetlands (E.O. 11990)	Plan in Full Compliance
Protection of Children from Environmental Heath Risks (E.O. 13045)	Plan in Full Compliance
Others	
FAA Advisory Circular 150-5200-33	Plan in Full Compliance

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. The restoration measures will be periodically surveyed to provide feedback on the response of the ecosystem to the management measures taken. By connecting the ecosystem response to the restoration as well as the management measures, potential beneficial adaptations and adjustments to the project or management plan can be identified to ensure continued success of the project. To accomplish this goal, periodic monitoring of the restoration measures by the Government will be conducted during project implementation prior to the project being turned over to the non-Federal sponsor for operation and maintenance, and will be cost-shared between the Government and the non-Federal sponsor as part of the total project cost. A monitoring and adaptive management plan will be developed during the Preconstruction, Engineering and Design phase and will not exceed five years after the end of the construction phase.

OPERATION, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION

These costs represent the current value of materials, equipment, services, and facilities needed to operate the project and make repairs, rehabilitate, and make replacements necessary to maintain project measures in sound operating condition during the period of analysis.

The Federal Government and the city of Wharton will enter into a local cooperation agreement under which the city will accept the project after completion of construction, and insure operation and maintenance in accordance with Federal regulations. The major items of operation and maintenance include mowing of the levees and sumps, management of the open space within the project, management of the mitigation areas, and operation and maintenance of the inlet and outlet control structures pertaining to the sumps and Hughes Street and Polk Street drainage facilities. An operation and maintenance manual will be prepared by the Corps after construction completion of the project. The manual will include specific, detailed requirements for the operation and management of the levees and fish and wildlife mitigation areas. These requirements will be developed through coordination with State and Federal resource agencies to assure that environmental attributes of the project meet regulatory and agency mandates. In addition to routine operation and maintenance, the city will be responsible for repair, replacement and/or rehabilitation of all components and features of this project. Periodic inspections will be performed by Corps personnel to insure that all required maintenance is being performed.

PROJECT PERFORMANCE AND RISK

The proposed Wharton flood damage reduction project relies heavily on a system of levees to keep Colorado River and Baughman Slough floodwaters from entering the city of Wharton. The design profile and height of the levees for this project was set based primarily on economic optimization. However, when urbanized, highly populated areas are being protected, minimum standards must be taken into consideration to insure the safety and welfare of the citizens. In general, levee systems for populated areas should minimally provide adequate performance to withstand the 1% annual chance of exceedence (ACE) (100-year) event. The 1% ACE floodplain, with the recommended plan in place, is shown in Figure 5-2.

Extensive hydraulic and hydrologic data exists on the Colorado River, which enables prediction of various stages versus frequency with a relatively high degree of certainty. This fact, coupled with the generally flat slope of the stage versus frequency curve in the high stages, are the primary reasons for achievement of a high performance Colorado River levee with a relatively small height over and above the 1% ACE profile. The design height included for this feasibility level design is 1 foot above the 1% ACE profile. This height produces a reliability rate of over 96%, meaning that if a 1% event were to occur on the Colorado River, there is greater than a 96% likelihood that the system would be adequate. This exceeds the amount required for levee certification as part of FEMA's flood insurance program.

Baughman Slough has substantially different factors involved. Over the years, stages and flows have not been recorded with a high degree of certainty. Thus, the level of confidence in the predicted flows and stages are not as high, resulting in broad required confidence bands. The selected design height for this feasibility level design was 1.2 feet instead of the 1 foot used on the Colorado River levees. However, due to the larger uncertainties, at this time, there is an 81% level of confidence that the 1% ACE storm event would be safely pass. During the Preconstruction Engineering and Design phase, additional hydraulic studies would be undertaken on Baughman Slough to increase the confidence levels associated with our estimates. In conjunction with higher confidence levels, the design profile may require slight modification in order to achieve the 95% level of confidence required for levee certification.

ECONOMIC ANALYSIS

UPDATED BASELINE CONDITIONS

Prior to performing an evaluation of the benefits associated with the Recommended Plan, an update of all structure and contents values was performed. The economic evaluation for the recommended plan is based on August 2006 prices and development levels.

Updated Structures And Investment

Tables 5-7 A-D displays the number and estimated value of properties located within the economic reaches in Wharton as of 2006. There are 5,537 structures that are located within the 0.2% ACE, with a value totaling $258,070,000. By including associated vehicles, the total estimated value increases to $309,684,000, based on August 2006 price levels.

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Figure 5-2 - With project inundation map

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Table 5-7A
Number and Value of Structures by Stream and Reach
August 2006 Price and Development levels
(Values in $1,000s)

Stream/Reach	*Structure Data*		
Name	*Category*	*Value*	*Number*
Peach Creek			
Alabama to Business 59	Commercial	$142	8
	Mobile Home	$16	1
	Single Family Outbuilding	$45	15
	Single Family	$456	9
Reach Total		$660	33
Below Alabama St	Single Family Outbuilding	$3	2
	Single Family	$203	2
Reach Total		$206	4
Business 59 to Highway 59	Commercial	$4	2
	Mobile Home	$10	1
	Public	$23	1
	Single Family Outbuilding	$125	6
	Single Family	$114	3
Reach Total		$276	13
West of Highway 59	Commercial	$882	3
	Mobile Home	$325	17
	Public	$85	3
	Single Family Outbuilding	$3,152	194
	Single Family	$6,068	120
Reach Total		$10,512	337
Stream Total		$11,654	387

Table 5-7B
Number and Value of Structures by Stream and Reach
August 2006 Price and Development levels
(Values in $1,000s)

Stream/Reach	*Structure Data*		
Name	*Category*	*Value*	*Number*
Baughman Slough			
Above Highway 59	Commercial	$62	1
	Mobile Home	$47	5
	Single Family Outbuilding	$1088	49
	Single Family	$2,456	57
Reach Total		$3,653	112
Alabama to Business 59	Commercial	$6,424	69
	MFR	$895	4
	Mobile Home	$1,154	78
	Public	$64,643	38
	Single Family Outbuilding	$2,092	365
	Single Family	$27,701	576
Reach Total		$102,909	1,130
Below Alabama	Commercial	$430	13
	Multi-family	$3,448	14
	Mobile Home	$215	15
	Public	$7,620	19
	Single Family Outbuilding	$3,700	220
	Single Family	$12,756	214
Reach Total		$28,169	495
Business 59 to Highway 59	Commercial	$723	11
	Mobile Home	$97	6
	Single Family Outbuilding	$877	71
	Single Family	$3,058	51
Reach Total		$4,755	139
Stream Total		$139,586	1,876

Table 5-7C
Number and Value of Structures by Stream and Reach
August 2006 Price and Development levels
(Values in $1,000s)

Stream/Reach	*Structure Data*		
Name	*Category*	*Value*	*Number*
Caney Creek			
Above US 59	Commercial	$1	1
	Single Family Outbuilding	$0	1
	Single Family	$45	1
Reach Total		$46	3
Crestmont	Commercial	$10	1
	Single Family Outbuilding	$42	33
	Single Family	$24,360	306
Reach Total		$24,412	340
Outfall	Commercial	$306	9
	Multi-family	$2,319	10
	Mobile Home	$647	47
	Single Family Outbuilding	$399	13
	Single Family	$2099	44
Reach Total		$5770	123
South of HEB	Commercial	$8	1
	Multi-family	$136	1
	Mobile Home	$60	4
	Public	$1	1
	Single Family Outbuilding	$685	40
	Single Family	$7,040	86
Reach Total		$7,330	133
Wharton	Commercial	$800	22
	Mobile Home	$142	4
	Public	$632	8
	Single Family Outbuilding	$504	41
	Single Family	$12,841	209
Reach Total		$14,919	284
Stream Total		$52,477	883

Table 5-7D
Number and Value of Structures by Stream and Reach
August 2006 Price and Development levels
(Values in $1,000s)

Stream/Reach	*Structure Data*		
Name	*Category*	*Value*	*Number*
Colorado			
Above Business 59	Commercial	$10,372	35
	Multi-family	$1,514	4
	Mobile Home	$941	100
	Public	$5,488	17
	Single Family Outbuilding	$915	208
	Single Family	$9,361	484
Reach Total		$28,591	848
Below Business 59	Commercial	$7,688	72
	Multi-family	$256	4
387	Mobile Home Outbuilding	$8	1
	Mobile Home	$1,591	104
	Public	$1,386	17
	Single Family Outbuildings	$6,013	654
	Single Family	$28,929	691
Reach Total		$45,871	1,543
Stream Total		$54,353	2,391

Updated Single Occurrence Flood Losses and Expected Annual Damages

Utilizing the updated economic database, the without project conditions flood losses were recomputed for the standard range of frequency storm events, ranging from a 50% Annual Chance of Exceedance (ACE, or 2-year) to 0.2% ACE (500-year). The results of the analysis are provided in Tables 5-8 A-D.

Results from the single occurrence determinations were integrated to determine an annualized damage for each economic reach. The updated total expected annual damage for the study area is estimated to be $6.18 Million. These updated results are presented in Table 5-9. For additional details, please refer to Appendix A.

Table 5-8A
Single Event Damages – Baughman Slough
August 2006 Price and Development Levels - Values in 1000's

Stream/ Reach	*Structure*	*50%*		*20%*		*10%*		*4%*		*2%*		*1%*			*0.4%*	*0.2%*	
Baughman	*Type*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*
Above	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$11	1	$14
Highway 59	Mobile Home	1	$1	1	$3	2	$3	2	$4	2	$4	2	$4	3	$4	3	$4
	Single -Family	27	$73	47	$137	50	$160	54	$178	58	$198	60	$216	63	$233	66	$251
Total		28	$73	48	$140	52	$163	56	$182	60	$202	62	$220	66	$248	70	$269
Alabama to	Commercial	4	$0	6	$3	7	$18	10	$42	15	$176	36	$399	53	$534	68	$721
Business 59	Multi-Family	0	$0	0	$0	0	$0	0	$0	0	$0	2	$240	2	$353	2	$469
	Mobile Home	0	$0	1	$5	1	$8	2	$10	2	$21	27	$140	44	$267	76	$488
	Public	0	$0	2	$19	3	$55	3	$75	4	$246	29	$4,258	35	$6,945	38	$9,941
	Single-Family	72	$544	178	$1,295	217	$1,551	229	$1,723	357	$2,756	671	$7,234	833	$11,445	907	$15,961
Total		76	$544	187	$1,322	228	$1,632	244	$1,851	378	$3,199	765	$12,461	967	$19,544	1091	$27,580
Below	Commercial	0	$0	0	$0	0	$0	0	$0	1	$1	1	$7	3	$29	13	$70
Alabama	Multi-Family	0	$0	0	$0	0	$0	0	$0	0	$15	0	$0	0	$0	10	$763
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$1	5	$23	11	$55	14	$122
	Public	0	$0	0	$0	0	$0	0	$0	1	$1	9	$5	17	$38	19	$815
	Single-Family	30	$116	52	$245	63	$338	83	$438	172	$1,214	300	$3,117	345	$5,279	403	$8,290
Total		30	$116	52	$245	63	$338	83	$438	174	$1,234	315	$3.152	376	$5,401	459	$10,060
Business 59	Commercial	0	$0	3	$0	3	$0	5	$0	5	$4	7	$11	9	$18	11	$33
To Highway 59	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	2	$12	2	$18	6	$22
	Single -Family	39	$184	60	$327	75	$437	84	$580	93	$746	107	$1,023	108	$1,165	110	$1,302
Total		39	$184	63	$327	78	$437	89	$580	98	$750	116	$1,046	119	$1,201	127	$1,357
Baughman Structure Totals		173	$918	350	$2,034	421	$2,570	492	$3,051	710	$5,385	1258	$16,779	1528	$26,394	1747	$39,266
Vehicles																885	$6,703

Table 5-8B
Single Event Damages – Caney Creek
August 2006 Price and Development Levels - Values in 1000's

Stream/ Reach	*Structure*	*50%*		*20%*		*10%*		*4%*		*2%*		*1%*			*0.4%*		*0.2%*	
Caney Creek	*Type*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*
Above	Commercial	0	$0	0	$0	1	$0	1	$0	2	$23	2	$40	2	$41	2	$43		
Highway 59	Single -Family	0	$0	1	$0	1	$0	1	$0	2	$4	2	$7	2	$8	3	$10		
Total		0	$0	1	$0	2	$0	2	$0	4	$27	4	$47	4	$49	5	$53		
Outfall	Commercial	1	$1	8	$10	10	$23	10	$26	14	$40	14	$44	15	$47	17	$51		
	Multi-Family	0	$0	1	$25	2	$114	3	$203	10	541	10	$625	10	$673	10	$719		
	Mobile Home	1	$12	10	$44	16	$74	18	$86	42	$145	45	$164	46	$174	46	$185		
outfall	Single -Family	0	$0	0	$0	1	$12	1	$14	1	$25	1	$27	1	$30	1	$32		
	Single -Family	3	$12	13	$100	25	$186	30	$215	39	$385	41	$444	42	$477	48	$508		
Total		5	$25	32	$179	54	$409	62	$544	106	$1,136	111	$1,304	114	$1,401	121	$1,495		
South of HEB	Commercial	10	$3	11	$4	11	$4	11	$4	14	$15	14	$18	14	$18	14	$19		
So of HEB	Mobile Home	0	$0	0	$0	0	$0	0	$0	1	$3	1	$4	1	$4	1	$4		
	Mobile Home	0	$0	0	$0	0	$0	0	$0	1	$3	1	$4	1	$4	1	$4		
	Public	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1	1	$1		
	Single-Family	14	$151	27	$248	42	$382	47	$427	78	$851	79	$896	80	$918	82	$941		
Total		25	$157	39	$253	54	$382	59	$432	95	$873	96	$923	97	$945	98	$969		
Highway 59 To Rte102	Single-Family	0	$0	0	$0	0	$0	2	$3	6	$8	6	$21	6	$27	7	$54		
Total		0	$0	0	$0	0	$0	2	$3	6	$8	6	$21	6	$27	7	$54		
Wharton	Commercial	1	$0	4	$7	8	$15	23	$23	27	$41	27	$42	27	$44	27	$166		
	Public	0	$0	0	$0	3	$0	4	$0	5	$10	6	$14	6	$14	6	$15		
	Single-Family	55	$881	82	$1,410	92	$1,764	98	$1,973	111	$2,587	113	$2,654	113	$2,661	113	$2,674		
Total		56	$881	86	$1,417	103	$1,779	125	$1,996	143	$2,637	146	$2,710	146	$2,718	146	$2,855		
Crestmont	Commercial	0	$0	0	$0	0	$0	0	$0	1	$0	1	$0	2	$3	2	$5		
	Single-Family	4	$367	19	$725	43	$1,278	50	$1,447	161	$3,084	171	$3,265	176	$3,445	185	$3,625		
Total		4	$367	19	$725	43	$1,278	50	$1,447	162	$3,084	172	$3,265	178	$3,448	187	$3,630		
Caney Structure Totals		90	$1,430	105	$2,574	146	$3,853	298	$4,419	311	$7,758	324	$8,249	330	$8,562	564	$9,002		
Vehicles																300	$2,129		

Table 5-8C
Single Event Damages – Colorado River
August 2006 Price and Development Levels - Values in 1000's

Stream/ Reach	*Structure*	*50%*		*20%*		*10%*		*4%*		*2%*		*1%*			*0.4%*	*0.2%*	
Colorado	*Type*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*
Above	Commercial	0	$0	0	$0	0	$0	4	$14	16	$904	22	$1,280	27	$1,473	27	$1,648
Business 59	MFR	0	$0	0	$0	0	$0	0	$47	1	$244	2	$354	3	$416	4	$469
	Mobile Home	0	$0	0	$0	0	$0	15	$48	45	$122	56	$156	60	$170	62	$188
	Public	0	$0	0	$0	0	$0	5	$518	8	$595	10	$669	11	$706	11	$730
	Single-Family	0	$0	0	$0	6	$22	222	$936	381	$2,065	437	$2,496	467	$2,688	496	$2,872
Total		0	$0	0	$0	6	$22	246	$1,563	451	$3,930	527	$4,954	568	$5,453	600	$5,907
Below	Commercial	0	$0	0	$0	0	$0	7	$3	16	$33	33	$75	49	$101	58	$145
Business 59	Mobile Home	0	$0	0	$0	0	$0	3	$7	9	$25	10	$33	12	$37	13	$40
	Public	0	$0	0	$0	0	$0	1	$3	3	$4	7	$27	8	$44	9	$62
	Single-Family	0	$0	0	$0	1	$8	210	$736	605	$2,729	709	$3,774	757	$4,340	830	$4,887
Total		0	$0	0	$0	1	$8	221	$749	633	$2,791	759	$3,909	826	$4,522	910	$5,134
Colorado Structure Totals		0	$0	0	$0	7	$30	467	$2,312	1084	$6,721	1286	$8,863	1394	$9,975	1510	$11,041
Vehicles																806	$2,448

Table 5-8D
Single Event Damages – Peach Creek
August 2006 Price and Development Levels - Values in 1000's

Stream/ Reach	*Structure*	*50%*		*20%*		*10%*		*4%*		*2%*		*1%*		*0.4%*		*0.2%*	
Peach Creek	*Type*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*	*No.*	*Damage*
Alabama	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	8	$30	8	$56
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$3	1	$8
To Highway 59	Single-Family	0	$0	0	$0	0	$0	0	$0	1	$8	17	$112	24	$306	24	$406
Total		0	$0	0	$0	0	$0	0	$0	1	$8	17	$112	33	$339	33	$470
Below Alabama St	Single-Family	0	$0	0	$0	0	$0	0	$0	0	$0	3	$33	4	$89	4	$122
Total		0	$0	0	$0	0	$0	0	$0	0	$0	3	$33	4	$89	4	$122
Business 59	Commercial	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	2	$0	2	$0
	Mobile Home	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$3	1	$7
To Highway 59	Public	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	1	$3	1	$3
	Single-Family	0	$0	0	$0	0	$0	0	$0	0	$0	2	$12	9	$96	9	$163
Total		0	$0	0	$0	0	$0	0	$0	0	$0	2	$12	13	$102	13	$173
West of	Commercial	1	$12	1	$12	1	$13	1	$14	1	$14	1	$15	1	$16	3	$66
	Mobile Home	1	$8	2	$18	2	$25	2	$37	3	$53	8	$93	10	$160	11	$203
Highway 59	Public	0	$0	0	$0	0	$0	0	$0	0	$0	1	$3	2	$5	2	$7
	Single-Family	40	$225	72	$501	112	$903	143	$1,402	156	$1,917	213	$3,388	258	$4,336	293	$5,499
Total		42	$245	75	$531	115	$940	146	$1,453	160	$1,984	223	$3,499	271	$4,517	309	$5,775
Peach Structure Totals		42	$245	75	$531	115	$940	146	$1,453	161	$1,992	245	$3,623	321	$4,958	359	$6,418
Vehicles																127	$1001
Total All Streams		305	$2,593	530	$5,139	689	$7,393	1,403	$11,265	2,266	$21,856	3,113	$37,527	3,573	$49,889	4,180	$65,727
Total Vehicle Damage																2,118	$12,281

Table 5-9
Wharton Without Project
Expected Annual Damages*
August 2006 Price and Development Levels – Value in $1,000's

By Stream and Reach

Peach Creek	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Alabama	$1	$0	$0	$0	$1	$1
Alabama to Business 59	$19	$0	$0	$0	$12	$14
Business 59 to Highway 59	$0	$0	$0	$0	$1	$1
West of Highway 59	$10	$0	$14	$0	$510	$533
Total EAD	$11	$0	$14	$0	$524	$551

Baughman Slough	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Alabama	$0	$14	$2	$4	$348	$368
Alabama to Business 59	$58	$12	$12	$255	$1,407	$1,744
Business 59 to Highway 59	$3	$0	$1	$0	$307	$311
Above Highway 59	$3	$0	$1	$0	$127	$132
Total EAD	$64	$25	$16	$259	$2,234	$2,555

Caney Creek	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
South of HEB	$7	$0	$1	$0	$267	$275
Wharton	$14	$0	$0	$8	$1,209	$1,232
Outfall	$11	$47	$30	$0	$164	$252
Highway 59 to Business 59	$0	$0	$0	$0	$4	$4
Above Highway 59	$1	$0	$0	$0	$1	$1
Crestmont	$0	$0	$0	$0	$833	$833
Total EAD	$33	$47	$32	$8	$2,478	$2,594

Colorado River	Commercial	Multi-Family	Mobile Home	Public	Single-Family	Total
Below Business 59	$5	$0	$3	$3	$182	$193
Above Business 59	$45	$15	$7	$51	$167	$285
Total EAD	$51	$15	$10	$55	$349	$478
EAD All Streams	***$159***	***$87***	***$72***	***$322***	***$5,585***	***$6,178***

*Vehicle damages are calculated into the single-family category

COST ANALYSIS

Projected First Cost

The projected first cost for the Recommended Plan is $27,429,000. This includes lands and damages, relocations, channels, levees, floodwalls, sumps, environmental mitigation, engineering and design, construction management, and contingencies. The cost estimate was developed using August 2006 price levels. A summary breakdown of the costs is provided in Table 5-10. A detailed breakdown of costs in the Cost Estimate section of Volume III, Appendix G. The cost of the Santa Fe Ditch is shown separately, since it is being constructed in advance of the remainder of the project. The cost apportionment for this effort is discussed in the "Cost Apportionment" section later in this chapter.

Table 5-10
Summary of Costs by Account
August 2006 Prices

Code	*Account*	*Cost*	*Contingency*	*Total*
01	Lands and Damages	3,822,000	294,000	4,116,000
02	Relocations	628,000	157,000	785,000
06	Fish and Wildlife Mitigation	612,000	153,000	765,000
09	Channels and Canals	1,083,000	271,000	1,354,000
11	Levees and Floodwalls	12,344,000	3,086,000	15,430,000
30	Preconstruction, Engineering, Design	920,000	230,000	1,150,000
31	Construction Management	743,000	186,000	929,000
	Total without Santa Fe Ditch	$20,152,000	$4,377,000	$24,529,000
	Santa Fe Ditch (as per Sec 104)	2,620,000	280,000	2,900,000
	Total Project Cost	**$22,772,000**	**$4,657,000**	**$27,429,000**

Annualized Cost

For purposes of performing a benefits versus cost comparison, the cost of the project was annualized using a 50-year period of analysis. The designated Fiscal Year 2006 interest rate of 5.125% was used to annualize the first cost.

The projected first cost includes $13,000 associated with Relocation Assistance costs, as per Public Law 91-646. These are considered financial costs only, and not economic costs. Thus, the first cost used for economic purposes is $27,416,000.

Prior to being annualized, interest during construction is added to the first cost to produce a total investment cost. Interest during construction is based on the current applicable fiscal year interest rate and an estimated period of construction. In addition, value of lands are charged interest during construction, as well as Preconstruction Engineering and Design (PED) costs. For the Wharton project, PED expenditures were assumed to begin in January 2007 and accumulate at a constant rate until the assumed start of construction in October 2008. The construction

period was assumed to be 24 months, with construction expenditures accumulating at a constant rate. This is highly dependent on a number of factors, including Federal funding, and even the weather conditions.

In addition to the annualized first cost, there is also an annual estimate of operation, maintenance, replacement and rehabilitation of the project facilities. These two values are summed to obtain the total annualized cost of the project, as shown in Table 5-11.

Table 5-11
Annualized Cost
50 Year Analysis Period, August 2006 Prices

Description	*Amount*
Project Financial First Cost	$27,429,000
PL 99-646 Deduction	$13,000
Project Economic First Cost	$27,416,000
Interest During Construction	$1,746,000
Total Investment Cost	$29,162,000
Interest Rate	5.125%
Annualized Cost of Investment	$1,628,000
OMRR&R	$50,000
Total Annualized Cost	$1,678,000

ECONOMIC BENEFITS SUMMARY

Prior to computation of the flood damage reduction benefits for the Recommended Plan, the without project conditions were updated to reflect August 2006 prices. Since the existing conditions was adopted to adequately represent the hydrologic conditions for the start of the analysis period (2010), as well as the future (2060) conditions, only one set of values was needed to properly compute the project benefits for the 50-year period of analysis.

Details of the entire economic analysis can be found in Appendix A of Volume III. This includes specific information regarding the updated without project conditions, such as the number and value of all structures by reach, single event damages by reach and frequency, and expected annual damages. Similar information is also included for the with project conditions.

Table 5-12 provides an economic benefit summary of the Recommended Plan, with details for each economic reach. Benefits are shown as annualized values, and are summed to produce en estimate of the total flood damage reduction benefits attributable to the project.

Table 5-12
Economic Benefit Summary
For the Recommended Plan
(in $1,000's, 50-year Period of Analysis, August 2006 Prices)

Economic Reach	*Without Project*	*With Project (Residual)*	*Expected Annual Benefits*
Colorado River			
Below Business 59	$193	$23	$170
Above Business 59	$285	$61	$224
Total Colorado River	$478	$84	$394
Baughman Slough			
Below Alabama	$368	$200	$168
Alabama to Business 59	$1,744	$243	$1,501
Business 59 to Highway 59	$311	$286	$25
Above Highway 59	$132	$132	$0
Total Baughman Slough	$2,555	$861	$1,694
Caney Creek			
South of HEB	$275	$46	$229
Wharton	$1,232	$264	$968
Outfall	$252	$0	$252
Highway 59 to FM 102	$4	$1	$3
Above Highway 59	$2	$0	$2
Crestmont	$833	$73	$760
Total Caney Creek	$2,598	$384	$2,214
Total Project	**$5,631**	**$1,329**	**$4,302**

As shown, some residual damages would still remain. The majority of the residual damages within Wharton would be attributable to occurrence of extremely rare flood events that exceed the formulated design level of 1% annual chance of exeedance (100-year level). Despite project implementation occurrence of a 0.2% percent (500-year) storm would inundate the entire city of Wharton, as well as most of the county. More discussion on this topic is contained in the section on risk, provided in this chapter.

BENEFIT-COST SUMMARY

The annualized flood damage reduction benefits are compared against the annualized costs of the project to determine two important economic performance parameters. The benefit to cost ratio (BCR) is determined by dividing the total annualized benefits by the total annualized costs of the project. Finally, total net benefits are found by subtracting the total costs from the total benefits. The results of these computations are shown in Table 5-13. The Recommended Plan has a benefit to cost ratio of 2.2, with total net benefits of $2.62 Million.

Table 5-13
Benefit-Cost Summary
Recommended Plan
50-year Period of Analysis, 5.125% Interest, August 2006 Prices

Description	*Factor/Value*
Annualized Project Benefits	$4,302,000
Annualized Project Costs	$1,678,000
Net Annual Benefits	$2,624,000
Benefit-Cost Ratio	2.6

PROJECT COST SHARING

The provisions of the Water Resources Development Act of 1986 (Public Law 99-662), approved November 17, 1986, stipulate cost sharing requirements applicable to flood damage reduction, which local sponsors must meet for the Federal Government to be involved with water resource projects. Cost sharing provisions for the flood damage reduction features are outlined below. The costs of removing and/or preserving cultural resources which may be discovered during implementation of this project would be borne as a 100 percent Federal cost, up to a maximum of one percent of the total Federal project costs. Should the cost of cultural resource preservation exceed this one percent limit, cost sharing provisions would be implemented.

For structural flood control projects, the non-Federal cost is to be a minimum of 35 percent and a maximum of 50 percent of total project costs. The non-Federal sponsor is responsible for 100 percent of the operation, maintenance and replacement costs of the project. In addition, the designated Sponsor would be required to formally approve the recommendations of this Feasibility Report prior to initiation the Preconstruction, Engineering, and Design Phase of the project.

NON-FEDERAL RESPONSIBILITIES (ITEMS OF LOCAL COOPERATION)

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. Provide a minimum of 35 percent, but not to exceed 50 percent of total project costs as further specified below:

    1. Provide 25 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

    2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs;

    3. Provide, during construction, a contribution of funds equal to 5 percent of total project costs;

4. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project;

5. Provide, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of total project costs;

b. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

c. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

d. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

e. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a project cooperation agreement, and to implement such plan not later than one year after completion of construction of the project;

f. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

g. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

h. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

i. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

j. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the

project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

k. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

l. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

m. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

n. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

o. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

p. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources

project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

COST APPORTIONMENT

Based on the items of local cooperation listed above, the project costs can be segregated by Federal and non-Federal responsibilities. This information is provided in Table 5-10.

Table 5-10 was developed while fully recognizing the impacts as a result of the City of Wharton's application for Section 104 (Public Law 99-662) credit, which was approved by the Assistant Secretary of the Army for Civil Works by letter dated January 25, 2006. In summary, the City of Wharton has received approval to construct the Santa Fe Ditch component of the Recommended Plan in advance of the remainder of the Federal project. If this component is included as part of a Federal project that is ultimately authorized for construction by Congress, the City of Wharton will receive credit for costs incurred for the portion of the advanced construction which would have been a Federal responsibility if it had been constructed at the time of project implementation. The estimated amount of credit for this advanced construction is approximately $1,817,000. In addition, the costs for lands, easements, rights of way, relocations, and disposal areas (LERRDs) associated with this advanced construction will be counted toward the non-Federal share of total project costs. These LERRD costs, including land acquisition and bridge/culvert relocations, are estimated at approximately $1,083,000. The total cost for the Santa Fe Ditch, therefore, is approximately $2,900,000. For ease in presentation of this advanced effort, the entire amount of $2,900,000 is separated and shown as a non-Federal cost in Table 5-14.

As of October 4, 2006, the City was acquired the necessary lands for construction of the Santa Fe Ditch, and construction has been initiated. Completion is anticipated within the next 18 months.

As discussed at the Civil Works Review Board Meeting held on October 26, 2006, the interior drainage facilities included in the design of the recommended plan are more substantial than what is considered to be minimum facilities. Additional analyses were performed to determine minimum facilities, and specifically the difference in cost between minimum facilities, and those facilities being recommended. The additional increment is considered a betterment, and will be the full responsibility of the non-Federal sponsor. An endorsement letter from the City of Wharton is included in the correspondence section. It is understood that additional refinement of the interior drainage facilities will occur during the Preconstruction Engineering and Design Phase.

Table 5-14
Wharton Flood Damage Reduction Project
Cost Apportionment for the Recommended Plan
August 2006 Prices

Account	*Fed*	*Non-Fed*	*Total*
Lands and Damages		$3,339,000	$3,339,000
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	$14,404,000		$14,404,000
Preconstruction, Engineering, Design	$1,093,000	$57,000	$1,150,000
Construction Management	$867,000		$867,000
Santa Fe Ditch (by City, Sec 104)		$2,900,000	$2,900,000
Subtotal	$18,483,000	$7,081,000	$25,564,000
5% Cash by Non-Fed Sponsor	-$1,278,000	$1,278,000	
Additional cash for 35% minimum	-$588,000	$588,000	
Cost Apportionment (Min. Facilties)	**$16,617,000**	**$8,947,000**	**$25,564,000**
Sump Upgrade (Betterment)		**$1,865,000**	
Total Cost Apportionment	**$16,617,000**	**$10,812,000**	**$27,429,000**
Cost Share Percentage	**60.6%**	**39.4%**	

FULLY FUNDED COST ESTIMATE

The fully funded cost estimate is intended to provide an indication of total project costs when inflation is taken into account. Inflation rates are based on rates developed as part of the Corps budgeting process. The fully funded estimate for the Wharton project is $29,072,000.

FINANCIAL ANALYSIS

FINANCIAL CAPABILITY

A financial capability analysis of he City of Wharton was conducted in accordance with ER 1105-2-100 to ascertain the sponsor's financial condition and its ability to meet the cost sharing responsibilities for the proposed project. The assessment involved the calculation and analysis of nine key financial indicators. The selected indicators explain the difference in credit worthiness between communities with strong and weak credit ratings. Other relevant facts and data about the community which play a role in the analysis include population, per capita income and property tax information. Table 5-15 provides a key of the financial indicator ratings. Table 5-16 shows the indicator values and rating for the City of Wharton. The indicators, calculated values and corresponding rating have been updated to reflect the sponsors' capability as of 2005, the most recent year where all data are available, and are summarized in Table 5-17.

The population for the City of Wharton between 2000 and 2005 exhibits a 0.29 percent annual rate of change. The population growth indicator's stability in the economic base is useful

because the economic base typically rises and falls with changes in the population. In the case of the City of Wharton, the indicator is weak. Though it shows no decline in population, there is no significant growth that would expand the economic base.

The proportion of surplus/deficit expenditures to total expenditures is also a significant indicator of the community's strength. For Wharton, the ratio is 4.01% and is within average range.

The third indicator measures the efficiency of the city's tax collection system. Wharton has a collection rate of 97%, providing a near strong indicator of their ability to collect the funds to meet financial obligations.

Indicators' five through eight are used to assess the community's debt capacity. The current and future debt situation of the Wharton is very stable. Indicator five compares the amount of tax supported debt to the full market value of real property. A value that exceeds 5 percent shows a weakness, while values between three and 5 percent are considered average. The City of Wharton exhibits a strong value of 1.28 percent.

Personal income can be used as a yardstick to judge the city's ability to repay debt. Personal incomes are not reported at the city level, so data for Wharton County were used to estimate the per capita income of City of Wharton. In 2004, the personal income of Wharton County was $1,061,253,000. Looking at population and employment trends for the region, it is reasonable that the growth in income between 2004 and 2005 would be similar to the annual rate of change between 2000 and 2004. This would give an estimate personal income of $101,807,000. Using population data for the city of Wharton, the estimated personal income for 2004 would be $248,389,795.

Indicator six shows net debt representing about 1.62% of personal income for the City of Wharton, which shows a strong position indicating available area income to support additional debt.

Indicators' seven and eight represent the per capita direct and overall net debt. For Wharton, the direct net per capita is $301, which is within the better than average for most cities. Its overall net debt per capita is $428, also indicating a stable standing.

Finally, indicator nine compares the percentage of direct net debt due within five years to total outstanding direct net debt. Wharton has a strong indicator rating of 98%.

Overall, the City of Wharton has strong showings among the nine indicators, with the exception of population growth with a weak indicator, and an average bond rating of BBB+. The indicators suggest that the city could take on additional debt.

Table 5-15
Financial Indicator Rating Key

Indicator	*Weak*	*Average*	*Strong*
1.Annual rate of change in population	<1%	1%	>1%
2. Current surplus/deficit as a percent of total current expenditures	<0%	0% to 5%	> 5%
3. Real property tax collection rate	<96%	96% to 98 %	>98%
4. Property tax revenue as a percent of full market value of real property	>4%	2% to 4%	<2%
5. Overall net debt as a percent of full market value of real property	>5%	3% to 5%	<3%
6. Overall net debt outstanding as a percent of personal income	>12%	4% to 12%	<4%
7. Direct net debt per capita	>$1,492	$663 to $1,492	<$663
8. Overall net debt per capita	>$1,989	$829 to $1,989	<$829
9. Percent direct net debt outstanding due within next 5 years	<10%	10% to 30%	>30%

Table 5-16
Current Community Financial Indicator Values
For the City of Wharton

Indicator	*Value*	*Rating*
1. Annual rate of change in population.	0.29%	Weak
2. Current surplus/deficit as a percent of total current expenditures.	4.01	Average
3. Real property tax collection rate.	97%	Average
4. Property tax revenues as a percent of full market value of real property.	.56%	Strong
5. Overall net debt as a percent of full market value of real property	1.28%	Strong
6. Overall net debt outstanding as a percent of personal income	1.62%	Strong
7. Direct net debt per capita	$301	Strong
8. Overall net debt per capita	$428	Strong
9. Percent direct net debt outstanding due within next 5 years	98%	Strong

Table 5-17
City of Wharton
Summary of Financial Capability

A. BOND RATINGS	***Rating***	***Date***	
General Obligation	BBB+	Oct 04	
Revenue Bond	NA	NA	
B. DEBT	***Outstanding***	***Projected***	***Total***
General Obligation Bonds	$6,685.000		$6,685,000
Revenue Bonds	$0		$0
Gross Direct Debt			
Direct Net Debt	$2,820,988	$0	$2,820,988
Overlapping Net Debt 1/	$1,190,955		$1,190,955
Overall Net Debt	$4,011,943		$4,011,943
Other Debt 2/	$527,901		$527,901
Estimated Future Debt	$2,500,000		$2,500,000
C. DEBT REPAYMENT SCHEDULE (principle only)			
	Outstanding	***Projected***	***Total***
Year 1	$495,000	$175,000	$670,000
Year 2	$545,000	$185,000	$730,000
Year 3	$580,000	$195,000	$775,000
Year 4	$610,000	$205,000	$815,000
Year 5	$645,000	$215,000	$860,000
D. DEBT LIMITS			
There is no legal debt limit for the City. Texas municipalities are not bound by any direct constitutional or statutory maximums as to the amount of obligation bonds which may be issued; however, all local bonds must be submitted to and approved by the State Attorney General. It is the established practice of the Attorney General not to approve a prospective bond issue if it will result in a tax levy for general bonded debt of over $1.00 for cities under 5,000 population, or $1.50 for cities over 5,000 population.			

[1] Overlapping net debt is the sponsor's share of taxes owed to other taxing bodies within the community, ie., a flood district.

[2] Other debt obligations include outstanding leases, unfunded pension liabilities, and notes with a maturity.

NON FEDERAL FINANCIAL PLANNING

The purpose of strategic financial planning is to optimize the use of capital over time in response to long term financial goals. The three principal elements involved include cost recovery alternatives, if needed; selection of the preferred financing alternative; and implementation of the cost recovery approach. Although financing decisions are ultimately the sponsors', the Corps of Engineers can assist in the decision making through the provision of timely information on costs, benefits and cost recovery opportunities. The sponsor is responsible for making arrangements to finance the project sufficiently in advance of construction to enable the project schedule to be met.

ABILITY-TO PAY ANALYSIS

Based on ER 1165-2-121 an ability-to-pay test should be applied to all flood control projects. The test determines the eligibility of the study area to qualify for a reduction in the amount to be cost shared by the Non-Federal interest. To qualify for a reduction the results of both the benefit and income portions of the twofold ability-to-pay test must fall within the specified guidelines.

The benefits' test determines the maximum reduction, called the "benefits based floor" (BBF), in the level of non-Federal cost sharing for any project. The factor is determined by dividing the project B/C ratio by four. If the factor (expressed as a percentage) is less than the standard level of cost sharing, the project may be eligible for a reduction in the non-Federal share to this BBF. The standard level cost share for a flood damage project is 25 percent. The recommended plan's B/C ratio of 1.4 was divided by four to yield a BBF of 35 percent.

The income test determines qualification for the reduction calculated in the benefit step. Qualification depends on a measure of the current economic resources of both the project area and the State in which the project is located.

In accordance with factors released in Economic Guidance 05-03, the income index factors for the state of Texas is 94.5 and for Wharton the index value is 77.16. The Eligibility Factor (EF) for a flood control project is calculated according to the following formula:

$EF = a - b_1 * (\text{State factor}) - b_2 * (\text{area factor})$

where:

$a = 18.1375$

$b_1 = 0.0790$

$b_2 = 0.1579$

Utilizing the above formula, an EF of -1.51 was calculated for Wharton. An EF less than zero indicates ineligibility for a reduction in construction cost sharing.

As stated previously, a BBF factor for the investigated plan was calculated at 35 percent. However, to qualify for a reduction, the BBF factor must be less than the standard level of cost sharing. According to ER-1165-2-121 paragraph 5a(2), the sponsor does not meet the criteria for a reduction in construction cost. This project does not meet either of the tests, therefore, the sponsors must pay the standard percentage of the total project cost.

CHAPTER 6
PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION

PUBLIC INVOLVEMENT

PURPOSE OF PROGRAM

This Feasibility Study focused on the development of an economically feasible, environmentally acceptable, publicly supportable solution to the flooding problems within the city of Wharton. Numerous meetings and conversations have been held with the various entities and interested citizens to share the latest possible information and to focus this study toward investigating the most viable alternatives. In addition, various public workshops/meetings were held in the study area for the citizens to give input into the problems and possible solutions, as stipulated by Public Law 99 662 and Public Law 104-303.

The Final Programmatic Environmental Impact Statement (PEIS) for Flood Damage Reduction and Ecosystem Restoration, Lower Colorado River Basin, Colorado River, Texas dated August 2005 was prepared for the LCRA and USACE sponsored projects in the lower Colorado River basin. This document underwent a public involvement process as required by the National Environmental Policy Act (NEPA), of which the Wharton Interim Feasibility Study was a part of. Meetings were held throughout the basin as described in Chapter 8 of that document. The meetings held in Bay City, Texas are described below as they targeted the Gulf Coast Area.

PARTICIPANTS

The study team worked closely over a four-year period in an effort to inform and involve the concerned citizens in the study area. The team did this by holding various public workshops and by maintaining a project website that was updated monthly. The project website is located at www.fdep.org . The public involvement team included members from USACE, the City of Wharton, and LCRA. Jones and Carter, Inc., the City's contractor, 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.

PUBLIC WORKSHOPS

Public involvement for the Lower Colorado River Basinwide Feasibility Study, to which this document is tiered, started very early in the process as documented in Chapter 8 of the *PEIS*. This document can be found on the Fort Worth District at www.swf.usace.army.mil . A summary of the public involvement for the PEIS is as follows:

1. On July 31, 2001, the Corps issued a Notice of Intent (NOI) to prepare an Environmental Impact Statement
2. Three NEPA Public Scoping Meetings were held on the following dates and locations:
    a. September 16, 2003, LCRA Western District Complex at Buchanan Dam, Texas
    b. September 17, 2003, LCRA McKinney Roughs facility near Bastrop, Texas
    c. September 18, 2003, Bay City Civic Center in Bay City, Texas
3. A Notice of Availability of the Draft PEIS was mailed out to the public and 3 public meetings were held to answer questions and receive comments on the following dates and locations:
    a. April 12, 2005, LCRA McKinney Roughs facility near Bastrop, Texas

b. April 13, 2005, LCRA Western District Complex at Buchanan Dam, Texas
c. April 14, 2005, Bay City Civic Center in Bay City, Texas

Workshops specific to the Wharton study were also conducted throughout the course of the study. On March 21, 2002, the USACE Project Manager gave a presentation at the Town Hall Meeting at the Wharton Junior College. This was a project information meeting to inform the public that the City of Wharton, LCRA, and USACE was partnering to study and attempt to resolve the flooding problem within the City of Wharton and ask the general public for comments on the study. Comments received were that the residents wanted flood protection and that the Corps process was slow with proposed project implementation being in 2008.

On April 30, 2003 a Public Information Meeting was held in Smithville, Texas for members of the Texas Colorado River Flood Plain Coalition. An overview of the Lower Colorado River Basinwide Study was presented and how the study is trying to address the overall flooding problems within the basin including the Wharton Interim Feasibility Study. The Coalition thanked the Corps and the LCRA for helping in the basin and that they wanted to see plans in the future to try and solve a majority of the flooding problems in the future. One big concern of the Coalition is that one county of municipality not increase flooding so as to cause additional damages and increase flooding downstream.

On January 22, 2004, a public workshop was conducted at Wharton City Hall where USACE revealed preliminary results of the formulation of alternatives. The structural alternative was identified as the plan that would be support by the Federal government. 47 people attended the meeting.

On April 14, 2005, a PEIS public meeting was held to receive comments on the draft PEIS. Notices were published in the Bay City Gazette and a mailing was mailed to over 800 people; however only two people participated in the meeting. No public comments were received in the meeting.

On May 22, 2006, a project update including schedule and budget was given to the Wharton City Council by the Fort Worth District Project Manager, which is broadcast on local public broadcast channels. The city council offered continued support for the project and looked forward to seeing the draft report in August 2006.

PUBLIC REVIEW

On August 18, 2006 a Notice of Availability was sent out to the public officially releasing the draft Report for a 30-day public review period. A copy of the report was sent to the Wharton Public Library. The Notice of Availability (Appendix H) was sent to the PEIS mailing list as well as a local mailing list provided by the city of Wharton. No comments from the general public were received regarding the Wharton Interim Feasibility Study.

The Corps held a public meeting on September 14, 2006 during the public comment period to discuss the Recommended Plan and the future of the Study. Over 25 people attended and there was overwhelming support for the project by the local community. The main comment was that the study was moving way to slow and the local residents wish the Corps could move faster to implement the project. One local resident was not real happy with the placement of the sumps as one of the sumps would be located on what it currently his property. Overall, the public supports the entire Wharton Project.

AGENCY COORDINATION

Federal and State agencies were informed of the ongoing study. Agency coordination is documented with various agencies including: the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), U.S. Department of Agricultural (Natural Resource Conservation Service (NRCS)), National Marine Fisheries Service (NMFS), Department of Homeland Security (Federal Emergency Management Agency (FEMA)), Texas Parks and Wildlife Department (TPWD), Texas Water Development Board (TPWD) and Texas Commission on Environmental Quality (TCEQ), Texas State Historical Preservation Officer (SHPO) and various Indian Tribes. General coordination letters were sent to these agencies presenting the proposed plan and notification of when the draft report would be available for public and agency coordination (Appendix H). Coordination with the agencies is documented below.

The earliest coordination, which included members from USFWS, TPWD, NMFS TCEQ, and FEMA was conducted during the preparation of the PEIS conducted as part of the Basinwide planning effort, of which Wharton was a part of. This coordination is documented in that document, which is located on the Fort Worth District website at www.swf.usace.army.mil.

USFWS participated in early project planning efforts. Participation included phone calls, email, going on site visits to Wharton and meetings at the Corps office in Galveston. Agency concerns documented early in the process include:

1. Keep impacts, as a result of project implementation, to Peach Creek to a minimum. USFWS recommended not implementing project alternatives in Peach Creek so as not to impact some of the only remaining high quality habitat within the study area.

2. Mitigation requirements for riparian woodlands as a result of project implementation should be mitigated by preserving the remaining “Austin Woods” segments in the Wharton Area. Only about 25% of these resources remain and are currently in private ownership, so protection is limited. Preservation would be the best mitigation measure for impacts to riparian woodlands.

The Corps also mailed a scoping letter specific to the Wharton Study to USFWS on June 20, 2006 (Appendix H). USFWS provided a draft Fish and Wildlife Coordination Act Report (CAR) dated September 2006. The main recommendation in the draft CAR was to not perform mitigation for riparian woodlands in the proposed sumps, but rather perform preservation of the Austin woods as previously discussed. The Corps responded to the draft CAR by letter on October 4, 2006. The Corps advised USFWS that Corps regulations did not allow the Corps to pick a mitigation measure that was not cost effective when there is a measure that would offset the impacts that is cost effective and incrementally justified. USFWS has prepared a final CAR, which is enclosed in Appendix D.

A meeting was held on June 6, 2006 at the EPA office in Dallas, in which the Corps presented the Recommended Plan of the Wharton Study. The EPA agreed that the Recommended Plan was the only viable option in the Wharton Area and generally supported the project. The EPA was sent a copy of the draft report and no comments were received from EPA.

A coordination letter was sent to the NRCS on January 9, 2006, to gain compliance with the Farmland Protection Policy Act (FPPA). The NRCS replied to the letter on January 25, 2006, stating that the Corps was in compliance with the FPPA and no further consideration was necessary. Due to the sumps being added and project impacts changing, a second letter was sent to NRCS on July 7, 2006. A response dated July 17, 2006 was received from the NRCS and stated that projects impacts were in compliance with the FPPA and that no further consideration was needed (Appendix H).

A letter dated June 28, 2006, was received from NMFS in response to the Corps' coordination letter in which NFMS indicated that no further coordination was needed since no impacts to the coastal area were expected.

TPWD also attended meetings and went on site visits. Early concerns of TPWD mirrored those of USFWS and included avoiding Peach Creek and preservation of the Austin Woods as mitigation measures. A letter of support dated October 3, 2006 for the Wharton Study was received from TPWD and is included in Appendix H.

A meeting was held with the TCEQ at their office in Austin on June 23, 2006 in order to discuss the Wharton Study. TCEQ agreed that the Recommended Plan was the only viable alternative. TCEQ was concerned that the proposed Colorado River levee may have secondary effects on adjacent wetlands that were hydrologically connected to the Colorado River. The Corps assured TCEQ that this would not happen and that the wetlands would still be jurisdictional under the Corps permitting requirements. TCEQ commented on the draft report with a letter dated September 18, 2006. The Corps responded to the comments with a letter dated September 27, 2006 (Appendix H). The comments were generally about the Onion Creek project, but TCEQ reiterated the concern about the wetlands and asked for additional information on Baughman Slough. The information was provided and subsequent telephone conservations indicated that water quality certification will be provided and will be included in Appendix H.

A letter was sent to SHPO on August 16, 2006, transmitting a draft Programmatic Agreement (PA) for SHPO review. On August 18, 2006, SHPO sent comments on the draft PA to the Corps, and on August 21, 2006 having not received the letter from SHPO yet, a second letter was sent to SHPO transmitting the draft Project Report, with the same draft PA included in the Report. Therefore, since the draft Report still had the same draft PA without SHPO's comments addressed, a second letter was received from SHPO on September 18, 2006, in which SHPO stated that the Corps was not in Section 106 compliance because the draft PA had not been changed. Since then, the Corps has submitted the final PA to SHPO via email as requested in the letter and the final PA is being negotiated.

FEMA provided their boiler plate response to the draft Report, that the proposed project should be coordinated with the local floodplain administrator. Mr. Prudencio Arriaga Sr., City of Wharton Floodplain Administrator, is aware of the proposed project and has no negative comments on the Recommended Plan. He attended the public meeting.

The TWDB has been a project partner due to the fact that they are providing 50% of the funding requirements of the Non-Federal Sponsor for the Feasibility Study. Their participation in this effort has allowed the Lower Colorado River Authority and the City of Wharton to participate in the study without being an excessive cost burden. TWBD has been a valuable project partner.

COMMENTS AND RESPONSES

No public comments were received from the general public during the 30-day public review. Overwhelming support for the project was documented in the public meetings held during the comment period. Agency comments and responses are addressed in the above Agency Coordination Section.

CHAPTER 7
LIST OF PREPARERS

The people who were primarily responsible for contributing to the preparation of this Interim Feasibility Report and Integrated Environmental Assessment are listed in Table 7-1.

TABLE 7-1
LIST OF PREPARERS

NAME	DISCIPLINE/ EXPERTISE	EXPERIENCE	ROLE IN DOCUMENT
Armstrong, Steve	Senior Civil Engineer	32 Years, Corps of Engineers	Preparation of Quantities and Civil Design Appendix
Ickert, Andrew	Hydraulic Engineer	5 years with Halff Associates, Inc.	H&H Analysis
Eckhardt, Elston	Civil Engineer	25 years, Corps of Engineers	Project Mgmt, Plan Formulation, Report Preparation
Gibbs, Julie	Economist	5 ½ years, Corps of Engineers	Economics
Hopkins, David	Cost Estimating	19 years, Corps of Engineers	MCACES
LeCren, Lauren	GD&S Manager-GIS Analyst	4 years, Corps of Engineers	GIS Support
Lewis, Norman	Economist	15 Years, ½ year with Corps of Engineers	Financial Capability
Minnibach, Nicole	Cultural Resources/Archaeology	16 years, 13 with Corps of Engineers	Cultural Resources
Newman, Rob	Environmental Resource Planner	12 years, Corps of Engineers	EA Preparation, Report Preparation
Reed, Ricky	Civil Engineering Tech	31 years, Corps of Engineers	Civil Design Plates
Rice, Caitlin	Report Formatting	Summer Hire, Corps of Engineers	Report Formatting/ Editing
Roberts, Randy	Realty Specialist	23 years, Corps of Engineers	Real Estate Appraisal
Roberts, Terrell	Environmental Resource Planner	25 years, 20 with Corps of Engineers	EA Preparation
Schweitzer, Thurman	Review Appraiser	31 Years, 3 with Corps of Engineers	Real Estate Plan
Sears, Jim	Cost Estimating	55 years, 37 with Corps of Engineers	Cost Estimating
Sewell, Valerie	Landscape Architect	5 years Corps of Engineers, MLA 2001, 5 yrs NRCS RangeConservation	Recreation Planner
Walker, Willis	Civil Engineer	32 years, 25 with Corps of Engineers	Geotechnical
Welch, Roxanne	Environmental Design	13 years, Corps of Engineers	HTRW Analysis

CHAPTER 8

Discussions, Conclusions, and Recommendations

DISCUSSIONS

The Wharton Interim Feasibility Study is one of two interim studies being conducted as the first phase of the Lower Colorado River Basin studies. Initial Basinwide efforts were started in May 2000, with the Wharton Interim being initiated in September 2004. The purpose of the study was to address the significant flooding issues that have plagued the city of Wharton since its establishment in 1846.

After the significant Colorado River flood event in 1998, which caused millions of dollars in damages to homes, schools, and businesses, governments at all levels became interested in helping the city of Wharton to find a workable solution. The Lower Colorado River Authority became the lead non-Federal agency, with the Texas Water Development Board providing additional monetary support.

The city of Wharton is vintage small town Texas. The citizens are friendly, the pace and lifestyle are less hectic than their big city counterparts, and their fiscal matters have historically been dealt with in a conservative manner. However, Wharton can be differentiated from other small towns when discussing significant flooding problems. Heretofore, the problems have been considered by some to be too great for feasible, practical resolution. Only in recent years has the technology existed to reasonably and adequately analyze the complex flow regime in and around Wharton. As a result, it was discovered that Wharton's flooding problems could be addressed in a cost effective manner.

Two different types of storm scenarios contribute to Wharton flood problems. Most recently, it is the waters from the upstream areas of the Colorado River watershed that have presented most of the problems as evidenced in October 1998 and again in November 2004. Under this scenario, it is possible that the city would receive little to no rainfall during an event, but still suffer tremendous flood damages. The second scenario is tied to intense, localized events, which cause significant losses along the Caney Creek and Baughman Slough drainage paths. Both scenarios were addressed in order to devise a comprehensive flood solution.

The NED plan was identified as a series of levees placed on the east bank of the Colorado River and Baughman Slough, together with an array of interior drainage facilities targeted to efficiently evacuate floodwaters from the Caney Creek storage areas. All features of the plan were fully optimized, when possible.

Study coordination was maintained throughout the course of the study by conducting monthly management meetings with stakeholders from all Federal, city, and state agencies. As the plan formulation progressed, the Wharton City Council was kept apprised of the study progress, with the Project Manager providing briefings at City Council meetings. The City was pleased with the results of the formulation process, and has embraced the selection of the NED plan as the Recommended Plan.

The first cost of the Recommended Plan is estimated to be approximately $27.7 million. This amount includes an estimated cost of $1 million for fish and wildlife mitigation. The project is expected to reduce flood damages within the study area by an average of $4.30 million annually. If costs are annualized and compared to the benefits, there are annual net benefits of approximately $2.62 million, and a benefit to cost ratio of 2.6.

Without of the project, over two-thirds of the city is located within the flood zone designated by FEMA as "Zone A", which equates closely to the 1% exceedance (100-year) floodplain. Implementation of the Recommended plan would essentially remove the city from this floodzone. Flood insurance would become optional for most residents, and its cost for premiums would be greatly reduced, resulting in benefits directly to the residents, whether or not significant storm events occurred.

The planning process for this study followed the traditional sequence, with identifying problems and opportunities, inventory and forecast, then followed by plan formulation. During the later stages of formulation when the recommended plan started to take shape, the city of Wharton expressed their satisfaction and concurrence and with the direction of the study. However, they also believed that their flooding risk was too great for them to follow the Federal process in its entirety. Instead, the City sought approval under Section 104 of WRDA 1986 to construct a portion of the project in advance of the remainder. Specifically, they sought to construct an identified feature of the project, which would address a particularly problematic flood prone area. The feature, known as the Santa Fe ditch, would be constructed with 100% non-Federal funding. If this feature were eventually to become part of an authorized Federal project, the city would receive full credit for their work performed.

CONCLUSIONS

The following conclusions were reached based on the results of the investigations conducted for this study.

1) A significant need exists to provide flood damage reduction within the Wharton study area.

2) The Recommended Plan can provide affordable and economically viable flood damage reduction through the use of a system of levees, a channel modification, and associated drainage facilities.

3) The City of Wharton has fully endorsed the Recommended Plan, and has agreed to serve as the ultimate local sponsor for the project. The total project first cost is estimated at $27,429,000, of which 39.4%, or $10,812,000 would be the responsibility of the local sponsor. Their expression of support is evidenced by their pursuit of construction for the Santa Fe Ditch utilizing 100% non-Federal funds, in advance of the remainder of the Federal project.

4) According to an Environmental Assessment, no significant environmental impacts would occur as a result of implementation of the Recommended Plan. Therefore, A Finding of No Significant Impact (FONSI) has been prepared and is included herein.

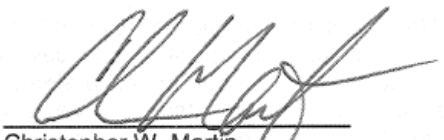
5) Further evaluation for purposes of design efficiencies will be conducted during the preconstruction, engineering and design (PED) phase. A Value Management process will be deployed during the PED phase. The results of these studies may alter the project materials, design, costs, and ultimately the cost apportionment or amount of Federal participation in the project.

RECOMMENDATIONS

I recommend that the flood damage reduction measures identified as the Recommended Plan for the Wharton study area be authorized for construction.

This recommendation is made with the provision that prior to project implementation the non-Federal sponsors shall enter into a binding Project Cooperation Agreement (PCA) with the Secretary of the Army to perform the items of local cooperation, as specified in Chapter 5 of this document.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgetary priorities inherent to the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded the opportunity to comment further.



Christopher W. Martin
Colonel, Corps of Engineers
District Engineer

FINDING OF NO SIGNIFICANT IMPACT

LOWER COLORADO RIVER BASIN PHASE I, TEXAS
WHARTON COMPONENT

At the request of the Lower Colorado River Authority (LCRA), and under authority of an August 4, 1936, resolution by the Committee on Commerce, Section 4 of the August 26, 1937, River and Harbor Act, and Section 6 of the March 2, 1945 River and Harbor Act the U.S. Army Corps of Engineers (Corps) conducted an Interim Feasibility-Level Report and Integrated Environmental Assessment to identify water and water-related land resource needs of the City of Wharton floodplains within the Lower Colorado River Basin, Texas. This Environmental Assessment was tiered from the Final Programmatic Environmental Impact Assessment for Flood Damage Reduction and Ecosystem Restoration, Lower Colorado River Basin, Colorado River, Texas, August 2005. The LCRA, in cooperation with the City of Wharton and with partial funding by the Texas Water Development Board (TWDB), provided non-Federal sponsor support for the Wharton Component of the Lower Colorado River Phase I, Texas Project.

Alternatives considered while evaluating the flooding problem within the city of Wharton included structural and non-structural alternatives as well as the No Action Alternative. Structural alternatives included combinations of levees, floodwalls, channel modifications and diversion pipe/channels. Non-structural alternatives included buyouts. The Recommended Plan consists of structural features in the form of earthen levees and accompanying sumps, floodwalls, a channel enlargement, storm drain type drainage structures and an open cut ditch. Most of the project features would be implemented in three different drainage areas: Colorado River, Baughman Slough and Caney Creek.

Recommended Plan features associated with the Colorado River would include the construction of 20,310 feet of levees, 19,010 feet of floodwalls and seven sump areas. The seven sumps would occupy 140 acres. Recommended features in Baughman Slough would include 6,610 feet of levees, 380 feet of floodwalls, 4,780 feet of channel modification and two sump areas of approximately 44 acres. Recommended features in Caney Creek would include placement of reinforced concrete pipes and approximately 10,700 feet of open cut ditch.

Implementation of the Recommended Plan would adversely affect approximately 65 acres of riparian/hardwood forests (148 average annual habitat units (AAHU) using 4 species), 129 acres of grassland (193 AAHU using 3 species) and 10 acres of wetlands (12 AAHU using 3 species). Another 171 acres of grasslands would be used for disposal areas. The recommended mitigation plan includes creating forest, shrub, and wetland habitat within the sump areas. All of the grasslands would be reseeded after construction ends unless they are being uses as additional project features such as woodlands. The plan would also create approximately 85 acres (151 AAHU) of forest habitat and 10 acres (16 AAHU) of wetland habitat as is the most cost effective mitigation plan. The U.S. Fish and Wildlife Service has recommended purchasing and preserving existing woodlands as mitigation instead of creating habitat in the sump areas. However, this would be more expensive and Corps regulations require selection of the most cost effective plan.

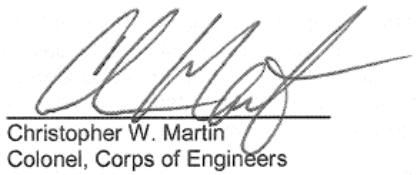
The Recommended Plan has been reviewed in accordance with Section 404 of the Clean Water Act. Approximately 10 acres of Waters of the United States would be impacted and would be mitigated under the recommended mitigation plan. Water Quality Certification was obtained from the Texas Commission on Environmental Quality on October 6, 2006.

Executive Order 11988, Floodplain Management, was considered during the development of the Recommended Plan. There are no practical alternatives to achieve the project purposes of flood damage reduction without placing fill within the floodplain. Excavated material requiring disposal would be placed in approved landfills for the types of materials involved. Excess material excavated from the sumps would be placed on upland pasturelands to be determined during the

detailed design phase. Executive Order 11990, Protection of Wetlands, was also considered and impacts to wetlands would be fully mitigated to ensure no net loss of wetlands. Executive Order 12898, Environmental Justice, was considered during the development of the Recommended Plan. Low income and minority populations do exist in the city of Wharton, but the Recommended Plan would only benefit all residents so there would not be any adverse effects to minority or low income populations.

Cultural resources compliance issues are being coordinated with the Texas State Historic Preservation Office (SHPO). No cultural resources are expected to be impacted as a result of implementation of the project components along the Colorado River; however sump areas and project features along Baughman Slough need to be studied further during detailed design to ensure compliance with environmental laws and regulations. A programmatic agreement (PA) is being negotiated with the SHPO to ensure compliance with Section 106 of the National Historic Preservation Act. The Recommended Plan has been coordinated with the United States Fish and Wildlife Service. The Recommended Plan would not impact Federally-listed threatened or endangered species. Texas Parks and Wildlife Department as concurred with the project determinations.

Based upon review of the information contained in the Environmental Assessment and results of coordination, I have concluded that the recommended plan will not have a significant adverse effect on the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969, as amended. In addition, construction of the project will not constitute a major Federal action of sufficient magnitude to warrant preparation of an Environmental Impact Statement.



Christopher W. Martin
Colonel, Corps of Engineers
District Engineer

Date: 10 October 2006