

## 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). <b>Brazos &amp; Colorado Rivers converged below Wharton (70-mile wide body of water).</b>
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 not applicable.

### **PROBABILITIES OF FLOOD EVENTS**

The graph of the probabilities of all flood events forms 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 exceedance, 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**

<i>Frequency</i>	<i>Current Q (Unsteady HEC-RAS, cfs)</i>	<i>Pre-1941 Estimated Unregulated Q (cfs)</i>	<i>% Reduction</i>
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**

<i>Frequency</i>	<i>Richmond Rd. Discharge (Q in cfs)</i>	<i>Alabama Rd. Discharge (Q in cfs)</i>
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**

<i>Reach Name</i>	<i>Description</i>
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 Name	Structure Data		
	Category	Value	Number
<b>Colorado</b>			
<u>Above Business 59</u>	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
<b>Reach Total</b>		<b>\$20,868</b>	<b>848</b>
<u>Below Business 59</u>	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
<b>Reach Total</b>		<b>\$33,484</b>	<b>1,543</b>
<b>Stream Total</b>		<b>\$54,353</b>	<b>2,391</b>

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

Stream/Reach Name	Structure Data		
	Category	Value	Number
<b><i>Baughman Slough</i></b>			
<u>Above Highway 59</u>	Commercial	\$45	1
	Mobile Home	\$34	5
	Single Family Outbuilding	\$794	49
	Single Family	\$1,793	57
<b><i>Reach Total</i></b>		<b>\$2,666</b>	<b>112</b>
<b><i>Alabama to Business 59</i></b>			
<u>Alabama to Business 59</u>	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
<b><i>Reach Total</i></b>		<b>\$75,116</b>	<b>1,130</b>
<b><i>Below Alabama</i></b>			
<u>Below Alabama</u>	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
<b><i>Reach Total</i></b>		<b>\$20,562</b>	<b>495</b>
<b><i>Business 59 to Highway 59</i></b>			
<u>Business 59 to Highway 59</u>	Commercial	\$528	11
	Mobile Home	\$71	6
	Single Family Outbuilding	\$640	71
	Single Family	\$2,232	51
<b><i>Reach Total</i></b>		<b>\$3,471</b>	<b>139</b>
<b><i>Stream Total</i></b>		<b>\$101,815</b>	<b>1,876</b>

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

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

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

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

## **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
Above Business 59	Commercial	0	\$0	0	\$0	0	\$0	4	\$10	16	\$660	22	\$934	27	\$1,075	27	\$1,203
	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
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>6</b>	<b>\$16</b>	<b>246</b>	<b>\$1,140</b>	<b>451</b>	<b>\$2,868</b>	<b>527</b>	<b>\$3,614</b>	<b>568</b>	<b>\$3,982</b>	<b>600</b>	<b>\$4,311</b>
Below Business 59	Commercial	0	\$0	0	\$0	0	\$0	7	\$2	16	\$24	33	\$55	49	\$74	58	\$106
	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
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>1</b>	<b>\$6</b>	<b>221</b>	<b>\$546</b>	<b>633</b>	<b>\$2,036</b>	<b>759</b>	<b>\$2,854</b>	<b>826</b>	<b>\$3,301</b>	<b>910</b>	<b>\$3,747</b>
<b>Colorado Structure Totals</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>7</b>	<b>\$22</b>	<b>467</b>	<b>\$1,686</b>	<b>1084</b>	<b>\$4,903</b>	<b>1286</b>	<b>\$6,468</b>	<b>1394</b>	<b>\$7,282</b>	<b>1510</b>	<b>\$8,058</b>
Vehicles																806	\$1,787

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

Stream/ Reach Baughman	Structure Type	50% No. Damage	20% No. Damage	10% No. Damage	4% No. Damage	2% No. Damage	1% No. Damage	0.4% No. Damage	0.2% No. Damage								
Above Highway 59	Commercial	0	\$0	0	\$0	0	\$0	0	\$8	1	\$10						
	Mobile Home	1	\$1	1	\$2	2	\$2	2	\$3	3	\$3						
	Single -Family	27	\$53	47	\$100	50	\$117	54	\$130	58	\$144	60	\$158	63	\$170	66	\$183
	<b>Total</b>	<b>28</b>	<b>\$54</b>	<b>48</b>	<b>\$102</b>	<b>52</b>	<b>\$119</b>	<b>56</b>	<b>\$132</b>	<b>60</b>	<b>\$147</b>	<b>62</b>	<b>\$161</b>	<b>66</b>	<b>\$181</b>	<b>70</b>	<b>\$196</b>
Alabama to Business 59	Commercial	4	\$0	6	\$2	7	\$13	10	\$31	15	\$128	36	\$291	53	\$390	68	\$526
	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
	<b>Total</b>	<b>76</b>	<b>\$397</b>	<b>187</b>	<b>\$966</b>	<b>228</b>	<b>\$1,191</b>	<b>244</b>	<b>\$1,351</b>	<b>378</b>	<b>\$2,328</b>	<b>765</b>	<b>\$9,022</b>	<b>967</b>	<b>\$14,266</b>	<b>1091</b>	<b>\$19,765</b>
Below Alabama	Commercial	0	\$0	0	\$0	0	\$0	0	\$0	1	\$1	1	\$5	3	\$21	13	\$51
	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
	<b>Total</b>	<b>30</b>	<b>\$85</b>	<b>52</b>	<b>\$179</b>	<b>63</b>	<b>\$247</b>	<b>83</b>	<b>\$320</b>	<b>174</b>	<b>\$901</b>	<b>315</b>	<b>\$2,300</b>	<b>376</b>	<b>\$3,942</b>	<b>459</b>	<b>\$7,342</b>
Business 59 To Highway 59	Commercial	0	\$0	3	\$0	3	\$0	5	\$0	5	\$3	7	\$8	9	\$13	11	\$24
	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
	<b>Total</b>	<b>39</b>	<b>\$134</b>	<b>63</b>	<b>\$239</b>	<b>78</b>	<b>\$319</b>	<b>89</b>	<b>\$423</b>	<b>98</b>	<b>\$546</b>	<b>116</b>	<b>\$765</b>	<b>119</b>	<b>\$875</b>	<b>127</b>	<b>\$991</b>
<b>Baughman Structure Totals</b>		<b>173</b>	<b>\$670</b>	<b>350</b>	<b>\$1,486</b>	<b>421</b>	<b>\$1,876</b>	<b>472</b>	<b>\$2,226</b>	<b>710</b>	<b>\$3,922</b>	<b>1258</b>	<b>\$24,494</b>	<b>1528</b>	<b>\$19,264</b>	<b>1747</b>	<b>\$28,294</b>
	<b>Vehicles</b>															<b>885</b>	<b>\$4,893</b>

**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
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>1</b>	<b>\$0</b>	<b>2</b>	<b>\$0</b>	<b>2</b>	<b>\$0</b>	<b>4</b>	<b>\$20</b>	<b>4</b>	<b>\$34</b>	<b>4</b>	<b>\$36</b>	<b>5</b>	<b>\$38</b>
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
<b>Total</b>		<b>5</b>	<b>\$19</b>	<b>32</b>	<b>\$130</b>	<b>54</b>	<b>\$297</b>	<b>62</b>	<b>\$398</b>	<b>106</b>	<b>\$828</b>	<b>111</b>	<b>\$952</b>	<b>114</b>	<b>\$1,021</b>	<b>122</b>	<b>\$1,090</b>
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
<b>Total</b>		<b>25</b>	<b>\$113</b>	<b>39</b>	<b>\$184</b>	<b>54</b>	<b>\$283</b>	<b>59</b>	<b>\$316</b>	<b>95</b>	<b>\$639</b>	<b>96</b>	<b>\$673</b>	<b>97</b>	<b>\$689</b>	<b>99</b>	<b>\$706</b>
Hwy 59 to 102	Single-Family	0	\$0	0	\$0	0	\$0	2	\$2	6	\$6	6	\$15	6	\$20	7	\$40
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>2</b>	<b>\$2</b>	<b>6</b>	<b>\$6</b>	<b>6</b>	<b>\$15</b>	<b>6</b>	<b>\$20</b>	<b>7</b>	<b>\$40</b>
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
<b>Total</b>		<b>56</b>	<b>\$643</b>	<b>86</b>	<b>\$1,034</b>	<b>103</b>	<b>\$1,298</b>	<b>125</b>	<b>\$1,457</b>	<b>143</b>	<b>\$1,925</b>	<b>146</b>	<b>\$1,978</b>	<b>146</b>	<b>\$1,984</b>	<b>146</b>	<b>\$2,084</b>
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
<b>Total</b>		<b>4</b>	<b>\$268</b>	<b>19</b>	<b>\$529</b>	<b>43</b>	<b>\$933</b>	<b>50</b>	<b>\$1,056</b>	<b>162</b>	<b>\$2,251</b>	<b>172</b>	<b>\$2,384</b>	<b>178</b>	<b>\$2,517</b>	<b>187</b>	<b>\$2,650</b>
<b>Caney Structure Totals</b>		<b>60</b>	<b>\$911</b>	<b>105</b>	<b>\$1,563</b>	<b>146</b>	<b>\$2,232</b>	<b>177</b>	<b>\$2,515</b>	<b>311</b>	<b>\$4,182</b>	<b>324</b>	<b>\$4,377</b>	<b>330</b>	<b>\$4,520</b>	<b>566</b>	<b>\$6,608</b>
	<b>Vehicles</b>															<b>300</b>	<b>\$1,554</b>

**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 To Highway 59	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
	Single-Family	0	\$0	0	\$0	0	\$0	0	\$0	1	\$6	17	\$82	24	\$223	24	\$296
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>1</b>	<b>\$6</b>	<b>17</b>	<b>\$82</b>	<b>33</b>	<b>\$247</b>	<b>33</b>	<b>\$342</b>
Below Alabama St	Single-Family	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	3	\$24	4	\$65	4	\$89
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>3</b>	<b>\$24</b>	<b>4</b>	<b>\$65</b>	<b>4</b>	<b>\$89</b>
Business 59 To Highway 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
	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
<b>Total</b>		<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>0</b>	<b>\$0</b>	<b>2</b>	<b>\$9</b>	<b>13</b>	<b>\$73</b>	<b>13</b>	<b>\$126</b>
West of Highway 59	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
	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
<b>Total</b>		<b>42</b>	<b>\$179</b>	<b>75</b>	<b>\$388</b>	<b>115</b>	<b>\$687</b>	<b>146</b>	<b>\$1,060</b>	<b>160</b>	<b>\$1,448</b>	<b>223</b>	<b>\$2,554</b>	<b>271</b>	<b>\$3,536</b>	<b>309</b>	<b>\$4,215</b>
<b>Peach Structure Totals</b>		<b>42</b>	<b>\$179</b>	<b>75</b>	<b>\$388</b>	<b>115</b>	<b>\$687</b>	<b>146</b>	<b>\$1,060</b>	<b>161</b>	<b>\$1,454</b>	<b>245</b>	<b>\$2,669</b>	<b>321</b>	<b>\$3,922</b>	<b>359</b>	<b>\$4,772</b>
	<b>Vehicles</b>															<b>127</b>	<b>\$731</b>

**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 scoping 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 not 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 could 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.