Section 4: Hazards the Basin Faces and What's at Risk

Contents

Risk Assessment Methodologies

The probability of occurrence of various hazard events in the Guadalupe River Basin and the costs of potential associated losses were evaluated during a risk assessment completed on September 3, 2003. The resulting loss estimates are starting points from which to evaluate the effectiveness of mitigation measures instituted pre-event if a real disaster should occur. The loss estimates also are intended to support mitigation decision-making. It is important to note, however, that data were obtained from a variety of previous studies and reports and loss estimates were calculated using available data and methodologies. Consequently, these data are approximate. The estimates should be used to understand relative risks from hazards and potential losses and are not intended to predict precise results. Uncertainties are inherent in any loss-estimation methodology and arise, in part, from incomplete scientific knowledge about natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications (such as incomplete or outdated inventory, estimated demographic or economic parameter data) that are necessarily used during a comprehensive analysis. These data can result in a range of uncertainty in loss estimates, perhaps by a factor of two or more.

Two distinct methodologies were applied during the risk assessment: HAZUS-MH, FEMA's loss-estimation software, and a statistical risk-assessment methodology. Each provided estimates of potential effects using a common, systematic framework for evaluation.

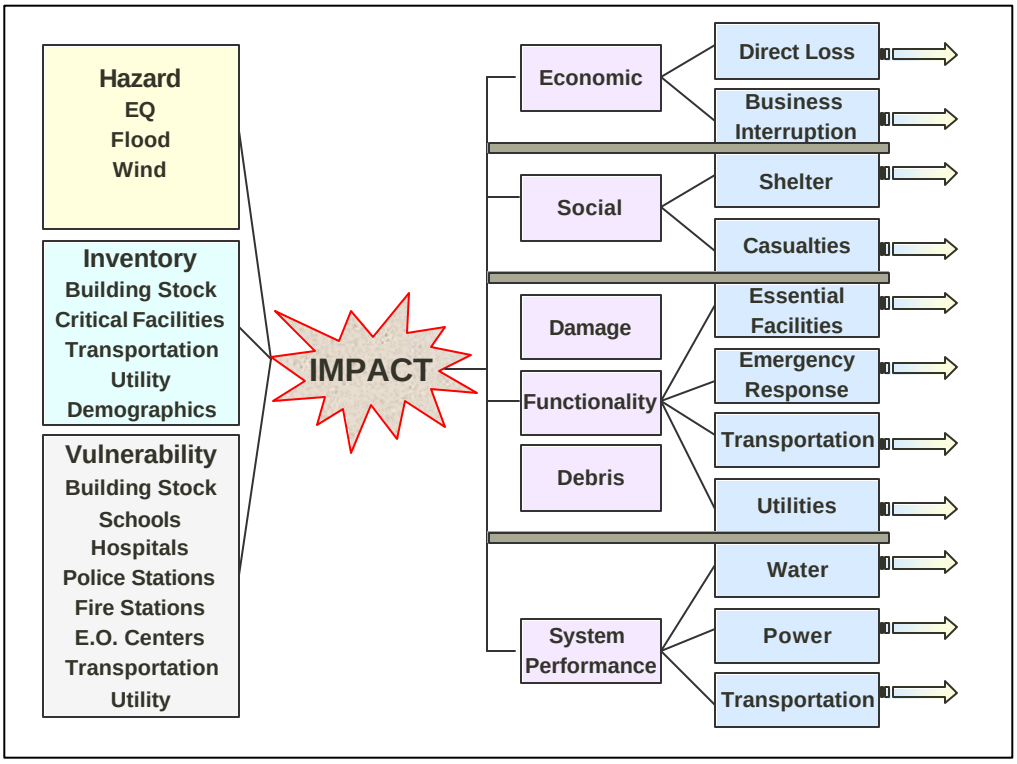
The HAZUS-MH risk-assessment methodology is parametric, in that distinct hazard and inventory parameters (wind speed and building types) are modeled determine the effects (damages and losses) on the built environment. Its statistical approach and mathematical modeling of risk is based on recorded or historic damage information, and predicts a hazard's frequency of occurrence and estimated effects. The HAZUS-MH software was used to estimate losses from wind (hurricane and tornado) and flood hazards.

The statistical risk-assessment methodology was applied to analyze hazards outside the capability of the HAZUS-MH software. A brief description of each approach follows.

HAZUS-MH

HAZUS-MH is FEMA's standardized loss-estimation software built on an integrated Geographic Information System (GIS) platform (Figure 4-1). HAZUS-MH was used in the risk assessment to produce regional profiles and estimate losses from four hazards. At the time the analysis was completed, a new version of HAZUS-MH, scheduled for a summer 2003 release, was under development to better address potential losses from wind, earthquake, and flood hazards and to incorporate updated baseline data. Accordingly, various modules and a beta version of the revised HAZUS-MH software were used in combination to estimate losses from earthquake, wind, and flood hazards.

Figure 4-1. Conceptual Model of HAZUS-MH Methodology



Statistical Risk Assessment Methodology

Risks associated with other natural hazards were analyzed using a statistical assessment methodology developed and used specifically for this project. Its approach is based on the same principles as HAZUS-MH but does not rely on available software. Historical data for each hazard are used and statistics are evaluated using manual calculations. The general steps used in the statistical risk-assessment methodology are summarized below:

- Compile data from national and local sources
- Analyze data statistically to relate historical patterns to existing hazard models (minimum, maximum, average, and standard deviation)
- Categorize hazard parameters for each hazard to be modeled (e.g., tornado)

- Develop model parameters based on analysis of data, existing hazard models, and risk engineering judgment

- Apply hazard model including:
  - Analysis of frequency of hazard occurrence
  - Analysis of intensity and damage parameters of hazard occurrence
  - Development of intensity and frequency tables and curves based on observed data
  - Development of simple damage function to relate hazard intensity to a level of damage *(for example, one flood = $ in estimated damages)*
  - Development of exceedence and frequency curves relating a level of damage for each hazard to an annual probability of occurrence
  - Development of annualized loss estimates.

Figure 4-2 shows a conceptual model of the statistical risk-assessment methodology as applied to the Guadalupe-Blanco River Basin.

The economic loss results are presented in this Plan using two interrelated risk indicators:

- The Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., county),

- The Annualized Loss Ratio (ALR), which expresses estimated annualized loss as a fraction of the building inventory replacement value.

The estimated Annualized Loss (AL) addresses the two key components of risk: the probability of the hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL gives a balanced presentation of the risk because historic patterns of frequent smaller events with infrequent but larger events are factored in.

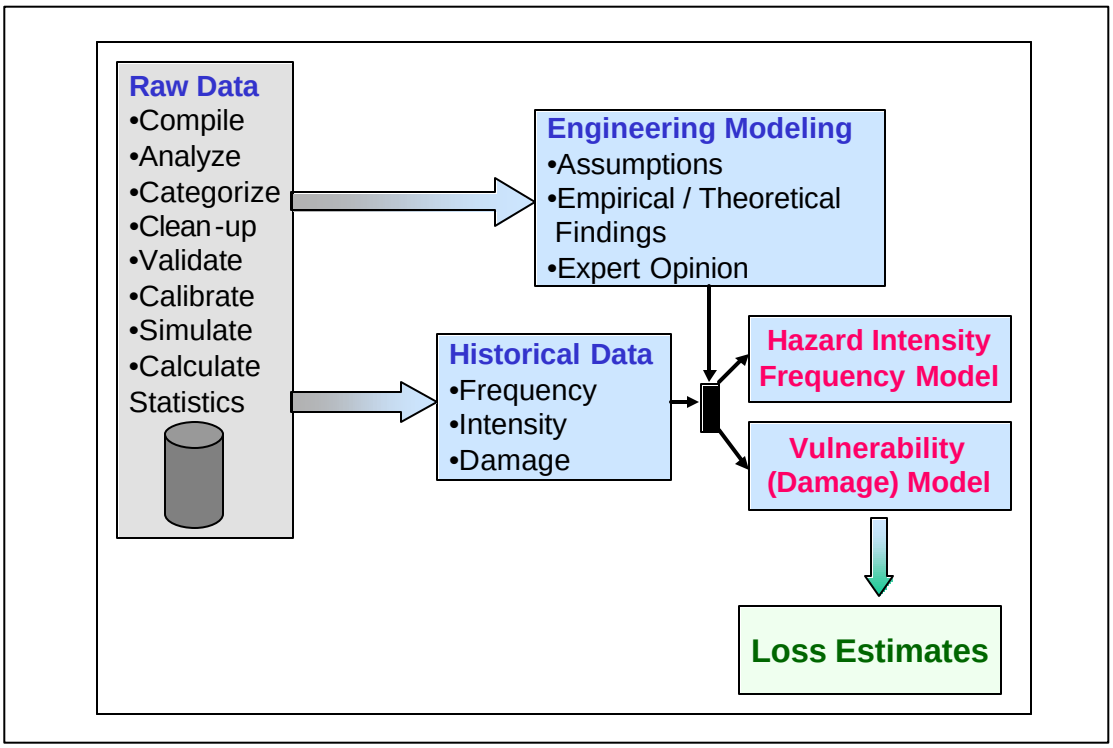
The Annualized Loss Ratio (ALR) represents the AL as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula:

$$ALR = \text{Annualized Losses} / \text{Total Exposure at Risk}$$

The annualized loss ratio gauges the relationship between average annualized loss and building replacement value. This ratio can be used as a measure of relative risk and, since it calculates

replacement value, enables direct comparisons among different geographic units such as metropolitan areas, towns, or counties.

Figure 4-2. Conceptual Model of the Statistical Risk Assessment Methodology

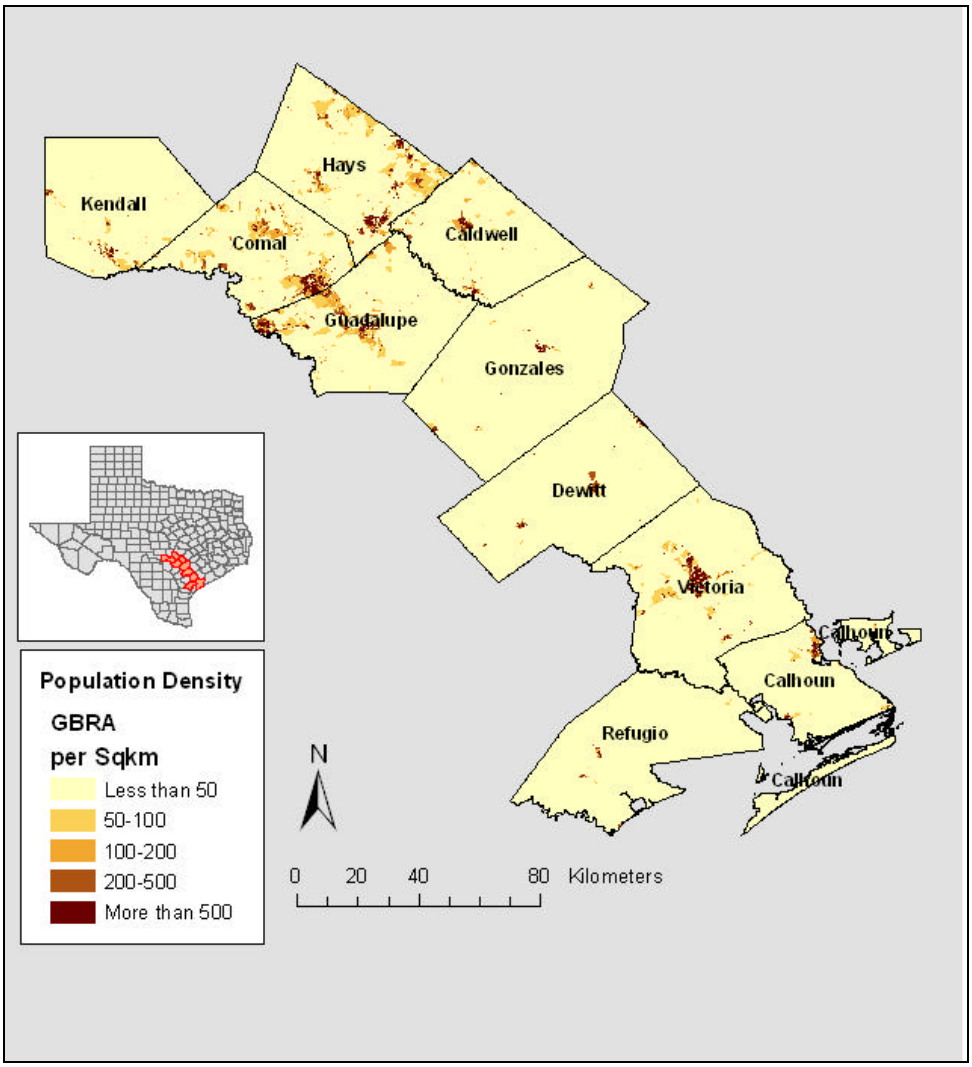


People and Property at Risk

Hazard identification requires defining the study area in terms of scale and coverage and collecting and compiling a list of prevalent hazards to help narrow the focus of the analysis.

Figure 4-3 below shows the extent of the study area, as well as the population density distribution at the county level (based on Census 2000) for the seven counties forming the Guadalupe River Basin planning area. Ten counties are included in the risk assessment to provide a comprehensive overview of the basin as a whole. These counties include: Hays, Comal, Guadalupe, Kendall, Caldwell, DeWitt, Gonzales, Calhoun, Refugio, and Victoria. Three of these counties (Hays, Comal and Guadalupe), however, are not covered by this Plan but are covered under other hazard mitigation action plans.

Figure 4-3. Risk Assessment Study Area and Population Density Distribution, by County, in the Guadalupe River Basin



Tables 4-1 and 4-2 give a numeric breakdown by county of the population and estimated dollar exposure on which the risk assessment was based. This information was derived from HAZUS-MH (March 2003). For purposes of this Plan, critical facilities include schools, hospitals, fire stations, police stations, and airports.

Table 4-1. Population Distribution by Key Occupancy (2002 Valuations)

Jurisdiction	Population (2000)	Residential Buildings		Commercial Buildings		Critical Facilities
		Number	Value ($)	Number	Value ($)	Number
Caldwell	32,194	11,374	2,387,436,000	60	285,885,000	33
Calhoun	20,647	9,835	2,171,890,000	78	281,066,000	75
Comal	78,021	42,027	10,237,572,000	214	927,348,000	70
DeWitt	20,013	6,983	1,530,674,000	50	249,433,000	33
Gonzales	18,628	6,510	1,315,844,000	45	208,323,000	26
Guadalupe	89,023	39,668	8,760,265,000	232	950,030,000	77
Hays	97,589	45,837	12,655,070,000	333	1,433,860,000	64
Kendall	23,743	12,844	3,164,217,000	85	391,066,000	23
Refugio	7,828	2,953	640,396,000	11	54,484,000	22
Victoria	84,088	36,206	9,418,849,000	348	1,548,383,000	69
TOTALS	**471,774**	**214,237**	**52,282,213,000**	**1,456**	**6,329,878,000**	**492**

Table 4-2. Building Distribution by Type

Jurisdiction	Infrastructure and Lifelines				Hazardous Materials Facilities	
	Oil Pipe (km)	Gas Pipe (km)	Highway (km)	Railroad (km)	Number of Sites	Number of Materials
Caldwell	211	83	142	65	1	3
Calhoun	62	151	170	56	6	107
Comal	-	46	153	87	7	16
DeWitt	89	223	213	52		
Gonzales	138	1	329	65	3	8
Guadalupe	170	92	224	69	6	14
Hays	38	21	227	67	6	6
Kendall	-	46	139	-		
Refugio	380	838	147	65		
Victoria	302	680	223	157	5	43
TOTALS	**1,391**	**2,181**	**1,967**	**684**		

Hazards of Concern

Based on input such as historical data, public perception, and technical requirements, the following 14 hazards (listed alphabetically) were considered for analysis:

- Coastal Flooding
- Dam Failure
- Drought
- Earthquake
- Flood
- Fuel Pipeline Breach
- Hail Storm
- Hazardous Materials Release
- Hurricane Wind
- Riverine Flooding
- Severe Winter Storm
- Terrorism
- Tornado
- Urban and Wildland Fires

These hazards were identified by reviewing reports, Federal and State disaster databases, plans and flood ordinances. A search was conducted of the internet as well to obtain data on disaster events. Consultations with experts at the State and Federal levels also occurred.

Earthquake risks were found to be negligible and are therefore not addressed in the mitigation actions.

Historical Disaster Declarations

Of the 1,037 major disaster declarations in the 50 states, the District of Columbia, and nine U.S. territories between 1972 and 2000, the State of Texas, at 51, claims the highest number of presidential disaster declarations for any state or territory. Presidential disaster declarations and Small Business Administration declarations in the Guadalupe River Basin are identified in Table 4-3 below. From 1972 through 2003, ten Presidential and thirteen Small Business Administration disaster declarations have been issued for the Guadalupe River Basin counties. Of the thirteen

separate events covered by the declarations, nine have been for floods; two were for hurricanes; one was for a tornado; and one was for heavy rain and high salinity.

Table 4-3. Disaster Declarations in the Guadalupe-Blanco River Basin

Lower Basin

Date	Disaster Number	Type	Presidential Declaration	SBA Declaration
Calhoun County				
1961	OEP 118 DR	Hurricane	Yes	Yes
1971	OEP 313 DR	Hurricane	Yes	Yes
1980	627 DR	Hurricane	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1993		Rain/salinity		Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
2003	1479 DR	Hurricane	Yes	
Refugio County				
1961	OEP 118 DR	Hurricane	Yes	Yes
1967	OEP 232 DR	Hurricane	Yes	Yes
1968	OEP 246 DR	Flood	Yes	Yes
1970	OEP 292 DR	Hurricane	Yes	Yes
1971	OEP 313 DR	Hurricane	Yes	Yes
1979		Tornado		Yes
1980	627 DR	Hurricane	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2003	1479 DR	Hurricane	Yes	
Victoria County				
1961	OEP 118 DR	Hurricane	Yes	Yes
1967	OEP 232 DR	Hurricane	Yes	Yes
1991	900 DR	Flood	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1994	1041 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
2003	1479 DR	Hurricane	Yes	

Middle Basin

Date	Disaster Number	Type	Presidential Declaration	SBA Declaration
Caldwell County				
1972	OEP 333 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
DeWitt County				
1967	OEP 232 DR	Hurricane	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1994	1041 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
2003	1479 DR	Hurricane	Yes	
Gonzales County				
1967	OEP 232 DR	Hurricane	Yes	Yes
1972	OEP 333 DR	Flood	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes

Upper Basin

Date	Disaster Number	Type	Presidential Declaration	SBA Declaration
Comal County*				
1972	OEP 333 DR	Flood	Yes	Yes
1991	930 DR	Flood	Yes	Yes
1997	1179 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms - flood	Yes	Yes
Guadalupe County*				
1972	OEP 333 DR	Flood	Yes	Yes
1973		Flood		Yes
1997	1179 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
Hays County*				
1970		Tornado		Yes
1970	OEP 286 DR	Flood	Yes	Yes
1970	OEP 286 DR1	Tornado	Yes	Yes
1972	OEP 333 DR	Flood	Yes	Yes
1980	627 DR	Hurricane	Yes	Yes

Date	Disaster Number	Type	Presidential Declaration	SBA Declaration
1991	930 DR	Flood	Yes	Yes
1997		Flood		Yes
1997	1179 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes
Kendall County				
1964		Flood		Yes
1978	561 DR	Flood	Yes	Yes
1997	1179 DR	Flood	Yes	Yes
1998	1257 DR	Flood	Yes	Yes
2002	1425 DR	Severe storms-flood	Yes	Yes

* Not in the Guadalupe River Basin Hazard Mitigation Action Plan area.

Economic and Social Losses

Risk (vulnerability) assessments are presented, whenever possible, in terms of annualized losses. The annualized data are useful for three reasons:

- Potential losses from all future disasters are accounted for with this approach.
- Results from different hazards are readily comparable and, hence, easier to rank.
- Annualized losses are presented objectively and enable evaluation of mitigation alternatives.

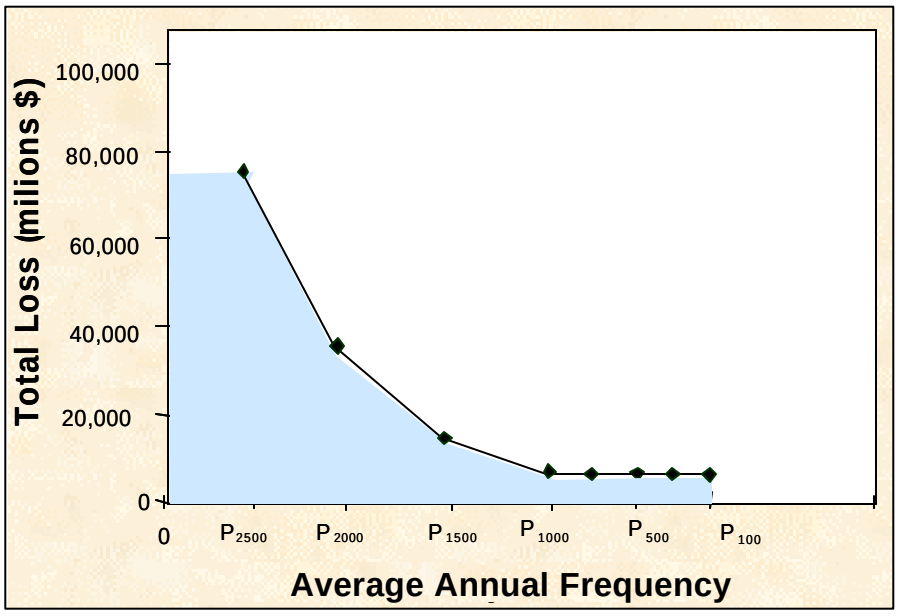
The parametric approach computes annualized losses in a three-step process:

- Compute / estimate losses from several scenario events having different return periods (e.g., 10-year, 100-year, 200-year, 500-year),
- Approximate the probability versus loss curve through curve fitting, and
- Calculate the area under the fitted curve to obtain annualized losses.

This approach is illustrated graphically in Figure 4-4 below.

Computations of loss predictions from the other hazards that used a statistical approach are based primarily on observed historical losses.

Figure 4-4. Graphic Representation of the Annualized Loss Methodology



Economic Impact

Results of the assessments of potential losses from the hazards profiled above are summarized in Tables 4-4 and 4-5 below.

The economic loss results are presented using two interrelated risk indicators:

1. The annualized loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., county), and

2. The annualized loss ratio (ALR), which expresses estimated annualized losses as a fraction of the building inventory replacement value.

How the AL and ALR are derived is described on page 4-4 above.

Table 4-4. Summary of Annualized Loss Estimates

	Estimated Annualized Losses Losses [$]						
County	Hail	Tornado	Thunderstorm	Wind	Drought	Earthquake	Flood
Caldwell	82,731.0	11,413	219,330	851,503	71,485	Negligible	1,222,000
Calhoun	39,423.5	10,870	285,496	7,258,197	57,504	Negligible	1,101,400
Comal	97,082.9	10,870	511,487	3,442,066	49,380	Negligible	4,948,000
DeWitt	69,044.6	435	544,278	1,026,694	150,934	Negligible	836,000
Gonzales	68,453.7	109,130	147,122	540,649	191,238	Negligible	2,757,000
Guadalupe	105,039.3	652	650,643	2,410,603	93,715	Negligible	3,485,400
Hays	108,130.6	95,826	606,648	3,642,970	80,438	Negligible	3,944,000
Kendall	85,293.5	11,957	107,553	504,581	87,692	Negligible	1,378,000
Refugio	82,143.3	3,636	142,743	2,058,418	148,258	Negligible	613,000
Victoria	114,705.2	14,896	407,082	16,537,975	123,452	Negligible	1,320,000
Total	**852,048**	**269,685**	**3,622,383**	**38,273,654**	**1,054,096**	**Negligible**	**21,604,800**

Table 4-5. Summary of the Annualized Loss Ratios (ALR) (Calculated as annualized losses divided by the total exposure at risk)

County	Hail	Tornado	Thunderstorm	Wind	Drought	Flood
Caldwell	0.0029%	0.0004%	0.0078%	0.0303%	0.0025%	0.044%
Calhoun	0.0015%	0.0004%	0.0106%	0.2707%	0.0021%	0.041%
Comal	0.0008%	0.0001%	0.0044%	0.0296%	0.0004%	0.043%
DeWitt	0.0034%	0.0000%	0.0269%	0.0508%	0.0075%	0.041%
Gonzales	0.0042%	0.0067%	0.0090%	0.0330%	0.0117%	0.168%
Guadalupe	0.0010%	0.0000%	0.0063%	0.0232%	0.0009%	0.034%
Hays	0.0007%	0.0006%	0.0041%	0.0247%	0.0005%	0.027%
Kendall	0.0023%	0.0003%	0.0029%	0.0135%	0.0024%	0.037%
Refugio	0.0111%	0.0005%	0.0193%	0.2779%	0.0200%	0.083%
Victoria	0.0010%	0.0001%	0.0036%	0.1448%	0.0011%	0.012%
Average	**0.0014%**	**0.0004%**	**0.0059%**	**0.0619%**	**0.0017%**	**0.035%**

Results presented in Tables 4-7 and 4-8 can be used either in the aggregate for the whole region or individually for the different counties forming GBRA. Note that the ALR is more appropriately used to compare the relative risk among these counties.

Social Impact

The number of people at risk from various hazards is summarized in Table 4-6 below and detailed in sections 5 through 16.

Table 4-6. Social Vulnerability: The number of People at Risk from Weather Events

Jurisdiction	Wind	Flood*	Hail	Tornado	Thunderstorm	Drought
Caldwell	32,194	1253	32,194	32,194	32,194	32,194
Calhoun	20,647	8648	20,647	20,647	20,647	20,647
Comal	78,021	2140	78,021	78,021	78,021	78,021
DeWitt	20,013	1307	20,013	20,013	20,013	20,013
Gonzales	18,628	2215	18,628	18,628	18,628	18,628
Guadalupe	89,023	4006	89,023	89,023	89,023	89,023
Hays	97,589	4271	97,589	97,589	97,589	97,589
Kendall	23,743	832	23,743	23,743	23,743	23,743
Refugio	7,828	1108	7,828	7,828	7,828	7,828
Victoria	84,088	3888	84,088	84,088	84,088	84,088
TOTALS	**471,774**	**29,667**	**471,774**	**471,774**	**471,774**	**471,774**

* Number of people in the 100- and 500-year floodplains identified on FEMA Flood Insurance Rate Maps

Table 4-7. Social Vulnerability: The Number of People At Risk from Non-Weather Events

Jurisdiction	Oil Pipeline*	Gas Pipeline*	Dam Failure**
Caldwell	3,663	1,020	53
Calhoun	5	919	79
Comal	-	1,606	n/a
DeWitt	244	788	2
Gonzales[1]	643	-	6
Guadalupe	5,288	2,097	n/a
Hays	537	509	n/a
Kendall	-	526	64
Refugio	490	904	1
Victoria	5,873	10,010	432
TOTALS	16,743	18,379	4,584

* Number of people within a one-mile radius surrounding a pipeline equal to or greater than 20 inches in diameter.

** Number of people located within 10 miles downstream of a high-hazard dam listed on FEMA's National Dam Inventory.

Summary of Risks by County

Based on the outputs (AL and ALR) of the methodologies described in the beginning of this section, the risk in each county in the Guadalupe River Basin can be rated on a scale of Low, Medium, or High for each identified hazard (see Table 4-7). The risk ranking is developed by taking the annualized loss ratio, multiplying it by 50,000 x 500 to get a proxy 500-year loss and x 100 to get a percentage number. "Low risk" equals 0 to 5 percent, "Medium risk" equals 6 to 20 percent, and "High risk" is any percentage over 20.

[1] The Gonzales County building official estimates that 135 people also live within a one-mile radius surrounding a 6-inch pipeline that traverses the county from northwest to southeast.

It should be noted that a hazard event is possible even in counties that are at medium or low risk, and that such an occurrence (e.g., an F-5 tornado or a Category 5 hurricane) has the potential for great impact and extremely high losses.

Table 4-8. Risk by County and by Hazard for the GBRA Region

County	Hail	Tornado	Thunderstorm	Wind	Drought	Earthquake	Flood
Caldwell	Medium	Medium	High	High	High	Low	High
Calhoun	Medium	Medium	High	High	High	Low	High
Comal	Medium	Medium	High	High	High	Low	High
DeWitt	Medium	Medium	High	High	High	Low	High
Gonzales	Medium	Medium	High	High	High	Low	High
Guadalupe	Medium	Medium	High	High	High	Low	High
Hays	Medium	Medium	High	High	High	Low	High
Kendall	Medium	Medium	High	High	High	Low	High
Refugio	Medium	Medium	High	High	High	Low	High
Victoria	Medium	Medium	High	High	High	Low	High
Overall	Medium	Medium	High	High	High	Low	High

Impact on Critical and Essential Facilities and Infrastructure

Hazard mitigation plans often focus on critical facilities vulnerable to hazards simply because it is usually most cost-effective to mitigate assets that are the most important to the community. These could be facilities critical to emergency operations, or ones that house important government functions or vulnerable populations, or those simply deemed important to the community for their economic or cultural value. Consequently, these facilities are considered high-priority when evaluating structures for the purpose of increasing their disaster resistance.

Critical and essential facilities include:

- Facilities critical to normal and emergency response operations in the area (fire stations, police stations, and the EOC)
- Infrastructure and facilities critical to community survivability or continuity of community services (transportation facilities, post offices, radio stations and other communication

facilities, electrical transmission and distribution plants, water and wastewater treatment areas),

- Facilities needed to assist vulnerable populations during and after a disaster (schools, hospitals, residential care facilities), and
- Facilities in which key government functions take place (sheriff's office, county courthouse, town halls).

The potential for significant damage from most of the hazards addressed in this study exists primarily at critical facilities in flood-prone areas. Critical facilities in a tornado path or near energy pipelines also could sustain considerable damage should a disaster occur.

Whenever possible, in calculating potential dollar losses from hazards, this risk assessment included losses from both residential and commercial facilities as well as critical facilities and some infrastructure elements. Efforts will be made during the five-year update process to collect additional data to estimate dollar losses more precisely.

As part of the five-year Plan update, a review will be undertaken for each hazard of the type and number of **existing** and **future** buildings, infrastructure and critical facilities within each hazard area. The initial focus will be on identifying critical facilities located in identified hazard areas. The vulnerability of critical facilities and infrastructure will also be estimated in terms of potential dollar losses from each hazard.

Impact on GBRA Property

GBRA's significant property could also be affected by the hazards identified in this Plan. GBRA's property at risk of disaster is mostly in the form of structures, parks, dams, and water and waterwater treatment plants. Below is a listing of the major GBRA properties that could be affected by disaster. It is not an all-encompassing list, but addresses the major properties.

GBRA has three parks. These include:

- Nolte Island Park (near Seguin) -- It contains three group picnic areas with two restrooms and a pavilion at one site. --Cost approx. $250,000

- Lakewood Park (near Gonzales) -- It contains 16 RV sites with water, electric and sewer. Also contains a boat ramp and office building ---Cost approx $300,000

- Coleto Creek (near Victoria) -- It contains 61 RV sites with water & electricity, fishing pier, 2 group pavilions, boat ramp, 4 camping cabins and an office. Cost approx $2,200,000

The costs above are estimates only and do not include land costs.

In addition, GBRA owns the dams listed below which can be impacted by disaster. GBRA owns and operates all of the facilities at the six dam sites. Facilities would include earthen dams, powerhouse, concrete spillway structure, spill gates, substation, generators, turbines, and other items such as access roads. No estimate is available on the replacement costs of the GBRA dams.

- Dunlap TP1 Dam (Lake Dunlap) TX - 1602
- Dunlap hydroelectric plant
- Abbott TP-3 Dam and hydroelectric plant (Lake McQueeney) TX-1601
- TP-4 Dam and hydroelectric plant (Lake Pacid) TX - 1600
- Nolte Dam (Meadow Lake) TX –1599
- Nolte hydroelectric plant
- H-4 Dam and hydroelectric plant (Lake Gonzales) TX - 1912
- H-5 Dam and hydroelectric plant (Woodlake) TX 1913
- Canyon Hydroelectric plant (plant only)

Wastewater treatment plants GBRA owns are listed below. There is no estimate available of replacement costs for the plants.

- GUADCO No 1 WWTP
- Springshill WWTP
- Dunlap WWTP
- Canyon Park WWTP
- Victoria Regional WWTP
- Lockhart FM20 WWTP

Water Treatment plants and conveyances facilities owned by GBARA are listed below.

- Port Lavaca Water Treatment Plant
- Calhoun County Rural Water System
- Calhoun Canal System
- Luling Water Treatment Plant
- San Marcos Raw Water Pump Station and Pipeline
- Guadalupe Power Partners Pump Station and Pipeline

GBRA also has a central office in Seguin that is valued at approximately $9 million. The central office is located at 933 East Court Street, Seguin, Texas 78155

Hazard Ranking

The basin-wide risk ranking of the top six hazards presented in this report, based on economic loss ratios and other communities' values, is as follows:

1. Hurricanes
2. Flooding
3. Thunderstorms
4. Drought
5. Hail
6. Tornadoes

Unique Hazards

Members of the planning team compared the specific risks their jurisdictions face with the regional risks identified in the risk assessment. Participating jurisdictions reported the following unique risks (in addition to the common risks) that their jurisdictions face and that must be taken into account in developing mitigation actions. If a jurisdiction is not listed in the table below, they conducted a review of their risks in comparison to regional risks and concluded that they did not have any risks that varied from the region as a whole.

Jurisdiction	Unique Hazard	Hazard Location or Boundaries
Lower Basin		
Calhoun County		
Calhoun County	Nuclear power plant located in Matagorda County, with the possibility of radiation exposure.	Power plant is approximately 40 miles away.
Refugio County		
Refugio County	Transportation of hazardous materials by rail or truck.	Along Highway 77 and the railroad, putting approximately 6,000 people at risk, including those living in Refugio,

Jurisdiction	Unique Hazard	Hazard Location or Boundaries
		Woodsboro and Tivoli.
Victoria County		
Victoria County	Transportation of hazardous materials.	Between 60,000 and 80,000 county residents are at risk from this hazard, located around highways and railroad routes.
	Guadalupe as the primary water supply for residents of the County.	
City of Victoria	Transportation of hazardous materials, terrorism directed at water supplies, food poisoning, and chemical fires and explosions contaminating the air.	
Middle Basin		
Caldwell County		
Caldwell County	Railroad traffic	Railroad traffic travels through the cities of Luling, Lockhart and Maxwell., putting approximately 20,000 people at risk.
Luling	Railroad traffic	Railroad traffic travels through the center of the city of Luling, putting the entire population, including special populations in nursing homes and hospitals at risk.
DeWitt County		
DeWitt County	Transportation of hazardous materials by truck and/or rail.	Highways and rail lines, including US 183, 77A, 87, State Highway 72.
Yoakum	Freight trains, meat packing production and freezers utilizing ammonia-based refrigerant	Railroad rights of way and downtown lots.
Cuero	Railroad trains carrying chemicals going through town.	City Hall, Fire Department and the Police Department are all located next to railroad tracks downtown.
Gonzales County		
Gonzales County	Possibility of a dust explosion from	This hazard is confined to the

Jurisdiction	Unique Hazard	Hazard Location or Boundaries
	Southern Clay Products plant and from four feed lots.	plant boundary. More than 100 people are at risk.
Waelder	Risk of a railroad derailment.	This risk affects the entire community of Waelder.
Upper Basin		
None reported in Upper Basin		

Conclusions

The hazard-event profiles relevant to the Guadalupe River Basin planning area reveal historic hazard trends and provide a reference point for understanding the potential effects of future hazard events. A review of historic data helps to evaluate hazard-event profiles and answer questions: How often may a particular disaster occur? Who and where are most likely to be affected? How bad can it get?

Sections 5 through 16 of this Plan contain reviews of the historical frequency of occurrence and/or loss and damage estimates, by hazard, in the Guadalupe River Basin. Each section discusses why the hazard is a threat, profiles the hazard, identifies areas at risk to hazards that have distinct geographic boundaries, identifies the people and property at risk, and summarizes the history of hazard events and potential damages and losses.

The results of this study are useful in at least three ways:

1. Improving our understanding of the risks associated with natural hazards in the Guadalupe River Basin through knowledge of the complexities and dynamics of the risks, enabling measurement and comparison of levels of risk and the myriad factors that influence risk. Understanding these relationships is critical in making balanced and informed decisions about managing the risks.

2. Providing a baseline for developing policy and comparing mitigation alternatives. The data collected and used for this analysis present a current picture of risk in the Guadalupe River Basin. Updating this risk "snapshot" with future data will enable comparison of the changes

in risk with time. Baselines of this type can support the objective analyses of policy and program options for risk reduction in the region.

3. Comparing the risks among the natural hazards addressed. The ability to quantify the risks to all these hazards relative to one another helps in a balanced, multi-hazard approach to managing the risk at each level of governing authority. The risk ranking supports comparisons and enables the setting of priorities for dealing with the disparate natural hazards present in the Guadalupe River Basin. This final step in the risk assessment gives necessary information to support the Authority in crafting a mitigation strategy that focuses resources on the hazards that pose the greatest threat to the Basin.