

RISK OVERVIEW

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Hazard Identification

This section begins the risk assessment, which also includes hazard profiles and vulnerability assessments found in Sections 5-18. The purpose of this section is to provide background information for the hazard identification process as well as descriptions for the natural and technological hazards identified.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the GBRA and participating jurisdictions identified 14 hazards that are to be addressed in the Plan Update. These hazards were identified through an extensive process utilizing input from planning team members, research of past disaster declarations, review of the 2005 Plan and a review of the current State of Texas Hazard Mitigation Plan (“State Plan”). Readily available online information from reputable sources such as federal and state agencies was also evaluated to supplement information as needed.

The 14 hazards identified as significant are listed in Table 4-1. These hazards are divided into two main categories: natural and technological. Natural hazards include hazards categorized as atmospheric, hydrologic, and other.

Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards identified as significant from Table 4-1 include: extreme heat; hail; hurricane wind events; thunderstorms; tornadoes; and winter storms. Hydrologic hazards are events or incidents associated with water related damage and account for over 75 percent of Federal disaster declarations in the United States. Hydrologic hazards identified as significant include drought and flooding. For the purposes of the risk assessment, “other” natural hazards consist of wildfire and infectious disease.

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The term “technological hazards” refers to the origins of incidents that can arise from human activities such as the construction and maintenance of dams; the use of gas and oil pipelines; the manufacture, transportation, storage, and use of hazardous materials; and an act of terrorism. These hazards are distinct from natural hazards primarily in that they originate from human activity. While the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-induced.

Table 4-1 provides descriptions for each of the natural and technological hazards included in the Plan Update.

Table 4-1. Hazard Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover ten degrees or more above the average high temperature in a region for an extended period.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant.
Hurricane	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind.
Thunderstorm	A thunderstorm occurs when an observer hears thunder. Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from

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HAZARD	DESCRIPTION
	light to catastrophic depending on the intensity, size and duration of the storm.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.
Flood	The accumulation of water within a water body, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding.
OTHER	
Infectious Disease	Illness due to a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal, or reservoir to a susceptible host, either directly or indirectly through an intermediate plan or animal host, vector, or the inanimate environment.
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
TECHNOLOGICAL	

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HAZARD	DESCRIPTION
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.
Hazardous Materials Release	Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. A hazardous material (HAZMAT) incident involves a substance outside normal safe containment in sufficient concentration to pose a threat to life, property, or the environment.
Pipeline Failure	An estimated 2.2 million miles of pipelines in the United States carry hazardous materials such as oil and natural gas. Pipelines are out of sight and unnoticed, yet have caused fires and explosions that have killed more than 200 people and injured more than 1,000 people nationwide in the last decade.
Terrorism	Terrorism is the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom. Terrorists often use threats to create fear among the public, to try to convince citizens that their government is powerless to prevent terrorism and to get immediate publicity for their causes.

Overview of Hazard Analysis

This risk assessment was conducted using two distinct methodologies: HAZUS-MH (FEMA’s loss estimation software) and a statistical approach. Each approach provides estimates of potential impact by using a common, systematic framework for evaluation.

The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (e.g., damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from the flood and hurricane wind hazards.

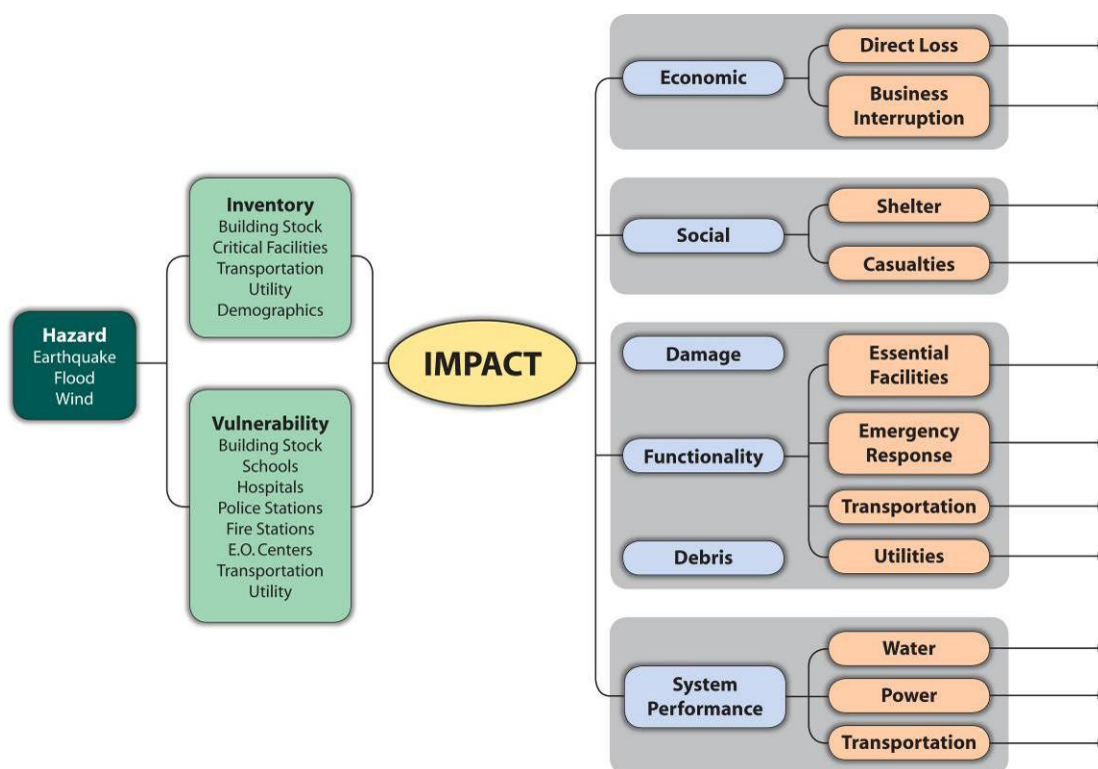
The statistical risk assessment methodology was applied to analyze hazards of concern that were outside the scope of the HAZUS-MH software. Following is a brief description of both approaches.

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HAZUS-MH

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated geographic information system (GIS) platform (Figure 4-1). This risk assessment applies HAZUS-MH to produce regional profiles and estimate losses for two hazards (flood and hurricane wind). At the time this analysis was completed, HAZUS-MH MR4 Patch 1 was used to estimate potential losses using HAZUS-MH default building stock inventory data.

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



Statistical Risk Assessment Methodology

Risks associated with other natural and anthropogenic¹ hazards were analyzed using a statistical assessment methodology developed and used specifically for this effort. Historical data for each hazard was used and statistical evaluations were performed using manual calculations. The general steps used in the statistical risk assessment methodology are summarized below:

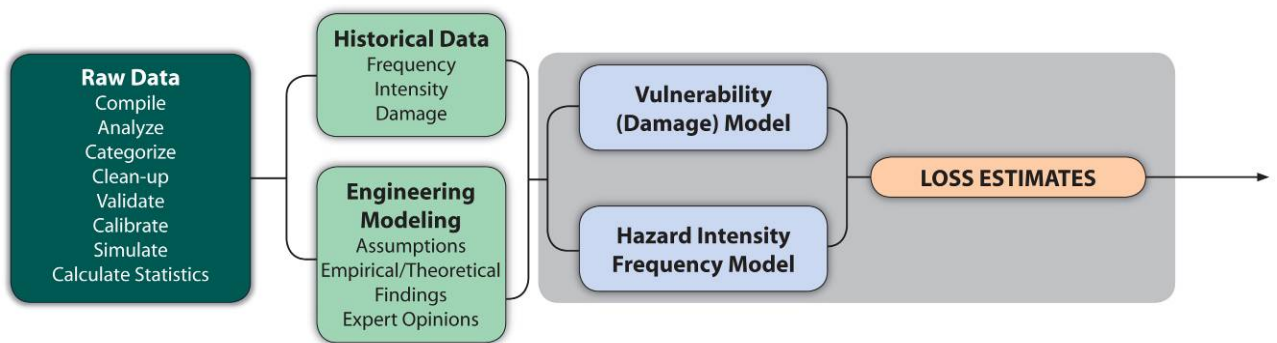
¹ An anthropogenic hazard is one that involves effects, processes, objects or materials that are derived from human activities, as opposed to those occurring in natural environments without human influences.

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1. Compile data from the following sources:
 - a. Local
 - b. National
2. Clean up data:
 - a. Remove duplication
 - b. Update losses (for inflation)
3. Identify patterns in:
 - a. Frequency
 - b. Intensity
 - c. Vulnerability
 - d. Loss
4. Statistically and probabilistically extrapolate the patterns
5. Produce meaningful results:
 - a. Development of annualized loss estimates

Figure 4-2 illustrates a conceptual model of the statistical risk assessment methodology, as applied to the GBRA study area.

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



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The economic loss results are presented in this assessment follow two interrelated risk indicators:

- 1) The Annualized Loss (AL), which is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (e.g., county or municipality).
- 2) The Annualized Loss Ratio (ALR), which expresses estimated annualized loss normalized by property replacement value.

The AL addresses the key idea of risk: the probability of the loss occurring in the study area (largely a function of building construction type and quality). By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

The ALR represents the AL as a fraction of the replacement value of the local inventory. This ratio is calculated using the following formula:

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

The ALR gauges the relationship between average annualized loss and replacement value. This ratio can be used as a measure of vulnerability in the areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.

Loss Estimates

Loss estimates are presented in terms of annualized losses, where possible. In general, presenting results in the annualized form is highly useful on three fronts:

- Contribution of potential losses from all future disasters is accounted for with this approach;
- Results in this form from different hazards are readily comparable and hence easier to rank; and
- When evaluating mitigation alternatives, use of annualized losses is the most objective approach for this purpose.

Annualized losses for the hazards where the parametric approach is utilized are computed in a three-step process:

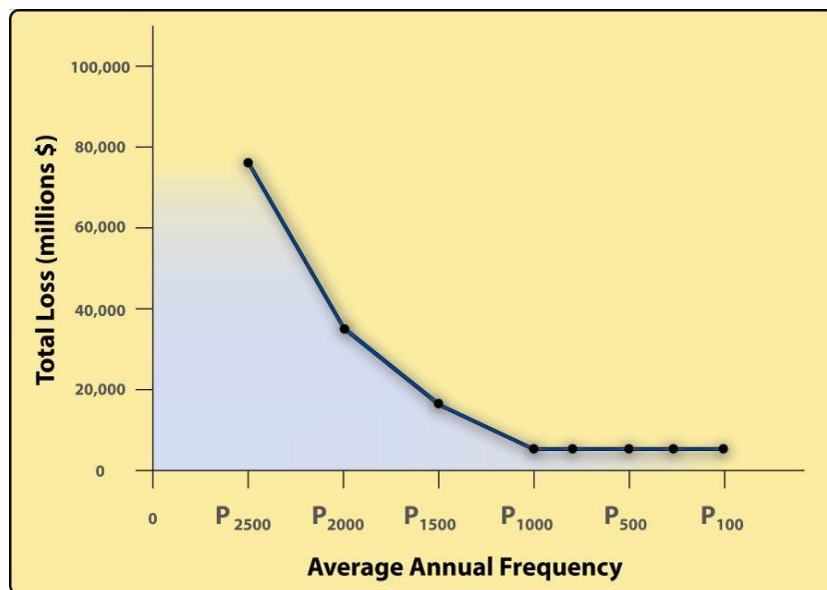
- Compute/estimate losses for a number of scenario events with different return periods (e.g., 10-year, 100-year, 200-year, 500-year, etc.);
- Approximate the Probability versus Loss Curve through curve fitting; and
- Calculate the area under the fitted curve to obtain annualized losses.

This approach is illustrated graphically in Figure 4-3.

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For other hazards where the statistical approach was used, the computations are based primarily on the observed historical losses.

Figure 4-3. Graphical Representation of the Annualized Loss Methodology



Vulnerability- Essential Facilities, Infrastructure and Existing Buildings

The following tables present vulnerability in terms of the number and types of existing buildings that are potentially at risk in the GBRA area². Table 4-2 displays the estimated potential vulnerability for buildings for each jurisdiction in the GBRA area while Table 4-3 provides information on the infrastructure and lifelines for each county, including oil and gas pipelines, highways, railroads and hazardous material sites. Figures 4-4 shows approximate locations of critical facilities in the GBRA Region, while Figures 4-5 through 4-12 provide detail by county. Critical facilities are also listed in detail in Appendix D.

² Although participating in the planning effort, Woodsboro ISD is not listed separately than the Town of Woodsboro for the purposes of the risk assessment as the school district is located within the jurisdictional limits of Woodsboro and critical facilities for Woodsboro ISD were taken into account in measuring the potential vulnerability of Woodsboro overall.

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Table 4-2. Estimated Building Distribution by Key Occupancy by Jurisdiction³

JURISDICTION	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		ESSENTIAL FACILITIES	
	Num.	Value	Num.	Value	Num.	Value	Num.	Value
Caldwell Co.	6,107	\$531,566,000	218	\$43,405,000	74	\$13,764,000	10	\$23,277,000
Lockhart	3,893	\$474,538,000	230	\$79,459,000	43	\$10,551,000	11	\$50,987,000
Luling	2,387	\$196,890,000	136	\$47,944,000	31	\$7,738,000	4	\$14,041,000
Martindale	411	\$34,042,000	9	\$6,315,000	2	\$81,000	0	\$0
Calhoun County	5,242	\$486,122,000	119	\$43,594,000	51	\$64,267,000	3	\$305,000
Point Comfort	424	\$52,760,000	16	\$7,501,000	14	\$16,513,000	3	\$2,235,000
Port Lavaca	4,958	\$499,874,000	271	\$91,042,000	62	\$27,204,000	18	\$74,876,000
Seadrift	918	\$54,269,000	21	\$5,201,000	5	\$432,000	2	\$4,893,000
DeWitt County	4,122	\$408,529,000	127	\$22,314,000	62	\$21,936,000	4	41,741,000
Cuero	3,267	\$269,738,000	207	\$92,793,000	53	\$18,496,000	19	\$37,547,000
Nordheim	170	\$21,023,000	7	\$1,571,000	2	\$134,000	1	\$914,000
Yoakum	3,048	\$259,109,000	186	\$68,442,000	33	\$22,746,000	8	\$27,154,000
Yorktown	1,209	\$99,614,000	66	\$17,240,000	11	\$4,916,000	3	\$7,500,000
Gonzales Co.	5,419	\$375,664,000	100	\$46,358,000	36	\$11,628,000	5	\$23,013,000
Gonzales	3,344	\$280,908,000	204	\$82,546,000	33	\$11,703,000	9	\$35,033,000
Nixon	1,269	\$75,442,000	42	\$11,576,000	3	\$3,663,000	5	\$11,049,000
Waelder	560	\$33,877,000	8	\$2,172,000	1	\$250,000	0	\$0
Cibolo (Guadalupe Co.)	1,242	\$165,972,000	68	\$27,759,000	19	\$17,845,000	0	\$0

³ Table 3 provides information for participating jurisdictions. Refer to Appendix D for a more complete and detailed listing of essential facilities in the GBRA study area. Additionally, there are 32 critical facilities in Kendall County that were not included in this risk assessment as they were unavailable in georeferenced format. These facilities are also provided in Appendix D, and it is recommended that they be included in the next plan update following georeferencing.

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JURISDICTION	RESIDENTIAL		COMMERCIAL		INDUSTRIAL		ESSENTIAL FACILITIES	
	Num.	Value	Num.	Value	Num.	Value	Num.	Value
Kendall County	7,573	\$953,491,000	372	\$142,677,000	146	\$40,234,000	11	\$41,464,000
Boerne	2,634	\$336,372,000	266	\$108,149,000	59	\$24,059,000	9	\$64,348,000
Refugio County	1,304	\$132,044,000	26	\$5,932,000	16	\$5,446,000	4	\$1,934,000
Austwell	157	\$11,532,000	5	\$653,000	2	\$521,000	0	\$0
Bayside	293	\$24,090,000	4	\$682,000	2	\$179,000	0	\$0
Refugio	1,665	\$135,815,000	94	\$30,309,000	20	\$8,009,000	7	\$16,050,000
Woodsboro	784	\$64,016,000	20	\$3,776,000	10	1,402,000	4	\$6,283,000
Victoria County	9,063	\$1,001,520,000	366	\$97,444,000	152	\$38,106,000	20	\$26,055,000
Victoria	22,221	\$2,927,528,000	1,583	\$731,433,000	334	\$93,264,000	36	\$389,250,000
TOTALS	93,684	\$9,906,345,000	4,771	\$1,818,287,000	1276	\$465,087,000	196	\$899,949,000

Table 4-3. Infrastructure, Lifelines, and Hazardous Materials by Jurisdiction

JURISDICTION	INFRASTRUCTURE AND LIFELINES				HAZARDOUS MATERIALS FACILITIES
	Oil Pipe (km)	Gas Pipe (km)	Highway ⁴ (km)	Railroad (km)	Number of Sites
Caldwell County	188.58	397.85	55.29	45.86	20
Lockhart	0	7.85	8.16	7.35	2
Luling	3.40	4.45	11.47	3.76	6
Martindale	0	0	0	0	0
Calhoun County	196.98	1,192.95	12.45	42.57	61
Point Comfort	11.12	53.06	0	2.72	1
Port Lavaca	4.19	4.02	3.93	3.46	5
Seadrift	0	0	0	0	0
DeWitt County	0	1,168.84	111.97	41.28	139
Cuero	0	0.84	7.05	10.50	4
Nordheim	0	0.20	0	0	0
Yoakum	0	3.06	2.46	6.16	1

⁴ For the purposes of this risk assessment, highways include Interstates and U.S. highways.

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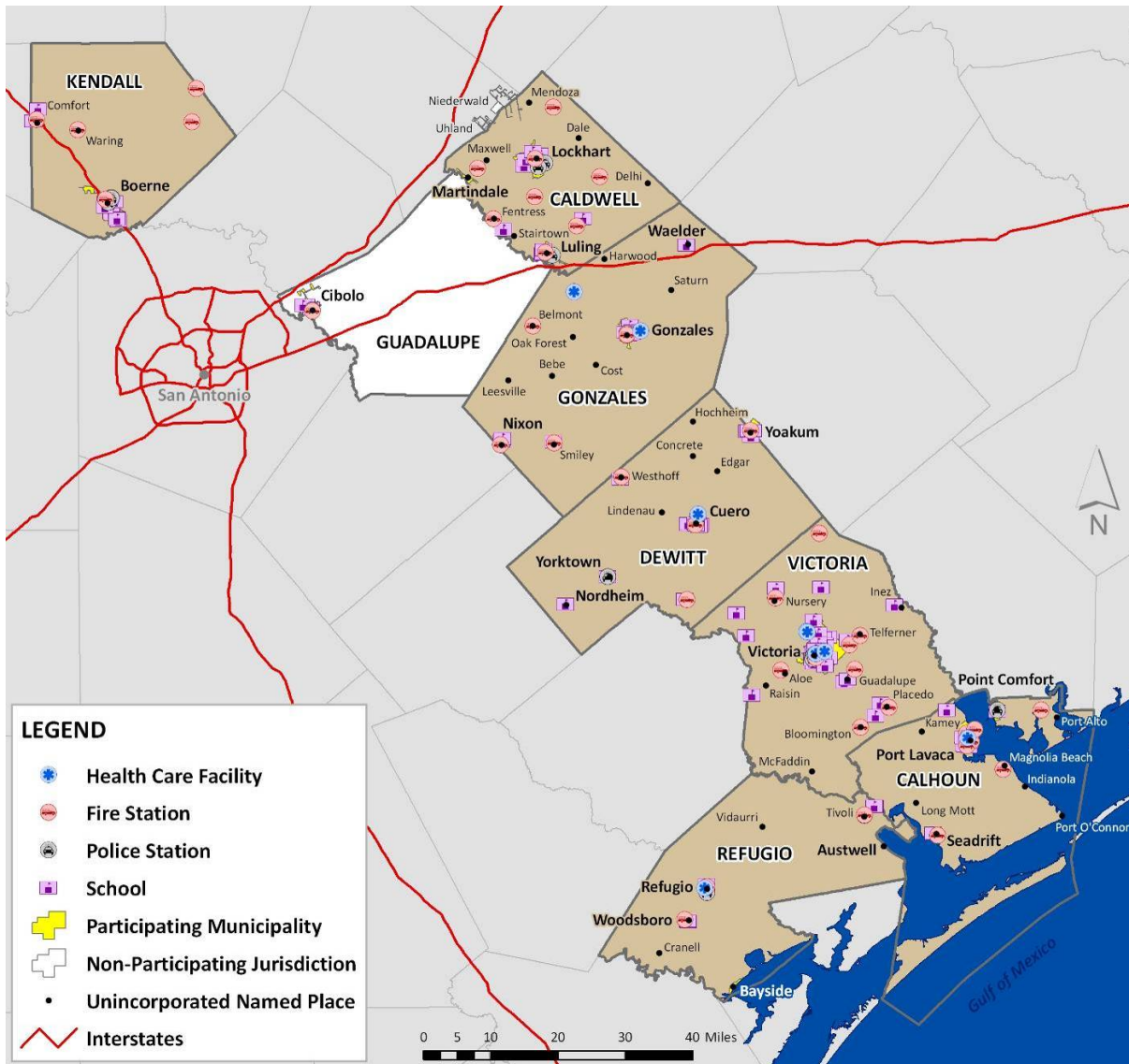
JURISDICTION	INFRASTRUCTURE AND LIFELINES				HAZARDOUS MATERIALS FACILITIES
	Oil Pipe (km)	Gas Pipe (km)	Highway ⁴ (km)	Railroad (km)	Number of Sites
Yorktown	0	0.73	0	0	1
Gonzales County	140.96	351.17	220.81	51.55	61
Gonzales	0	19.43	17.35	5.13	10
Nixon	0	0	1.77	0	2
Waelder	0	0	1.83	1.83	2
Cibolo (Guadalupe County)	0	4.93	0	3.50	0
Kendall County	0	58.96	78.87	0	15
Boerne	0	0	13.49	0	3
Refugio County	469.52	1,681.19	123.51	55.73	53
Austwell	0	0	0	0	0
Bayside	0.27	0	0	0	0
Refugio	0	1.89	7.76	2.46	2
Woodsboro	0.23	0.85	2.28	1.19	1
Victoria County	150.73	1,739.81	233.76	139.20	55
Victoria	0	69.21	66.01	27.25	0
TOTALS FOR STUDY AREA	1,165.98	6,761.29	980.22	451.5	444

Source: Railroad Commission of Texas

Figure 4-3 shows the essential facilities in the seven counties forming the overall GBRA study area generated by HAZUS-MH MR4. Figure 4-4 through Figure 4-12 show these essential facilities in greater detail at the county level.

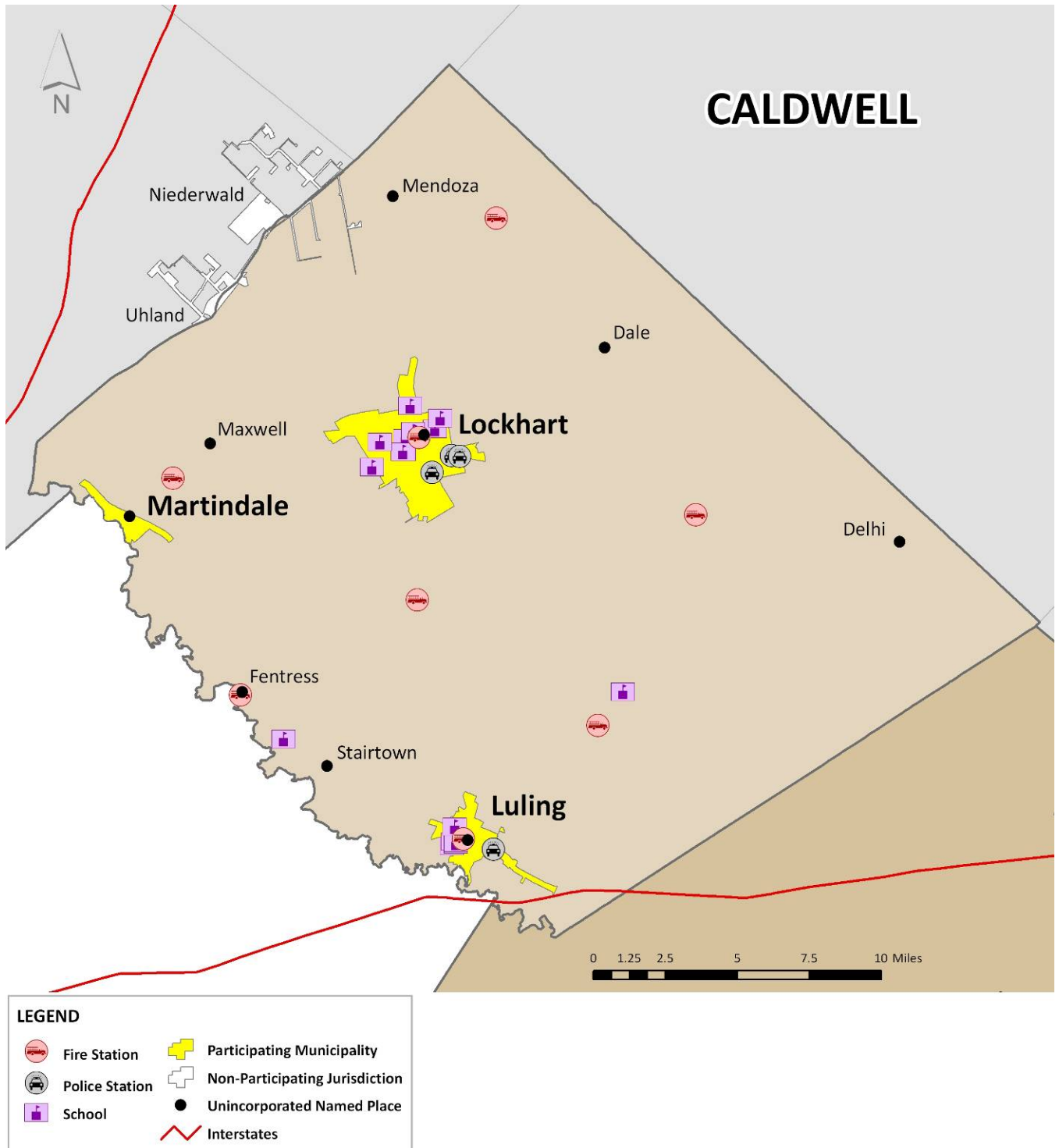
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Figure 4-4. Estimated Essential Facilities Placement in GBRA



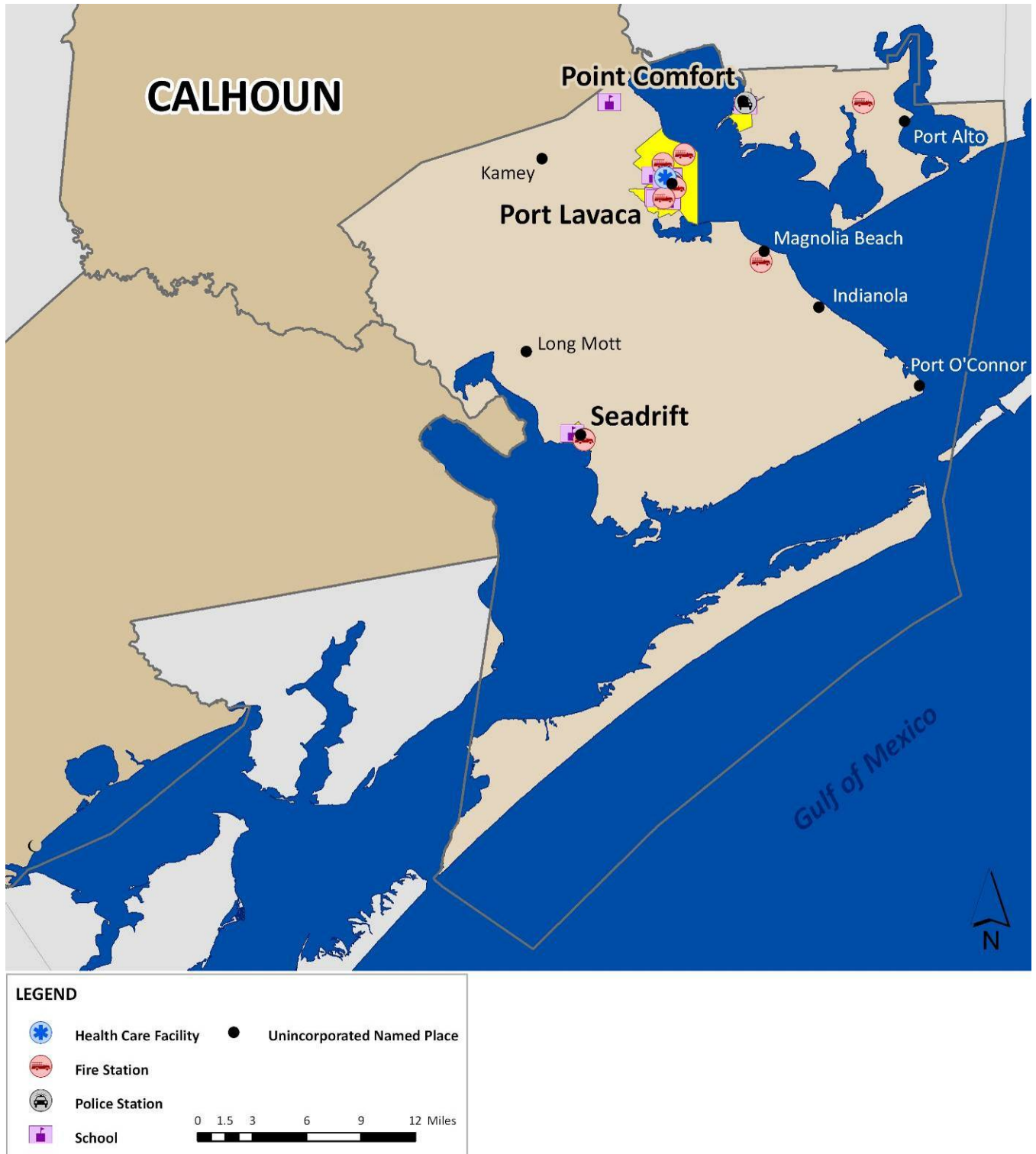
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Figure 4-5. Estimated Essential Facilities Placement in Caldwell County



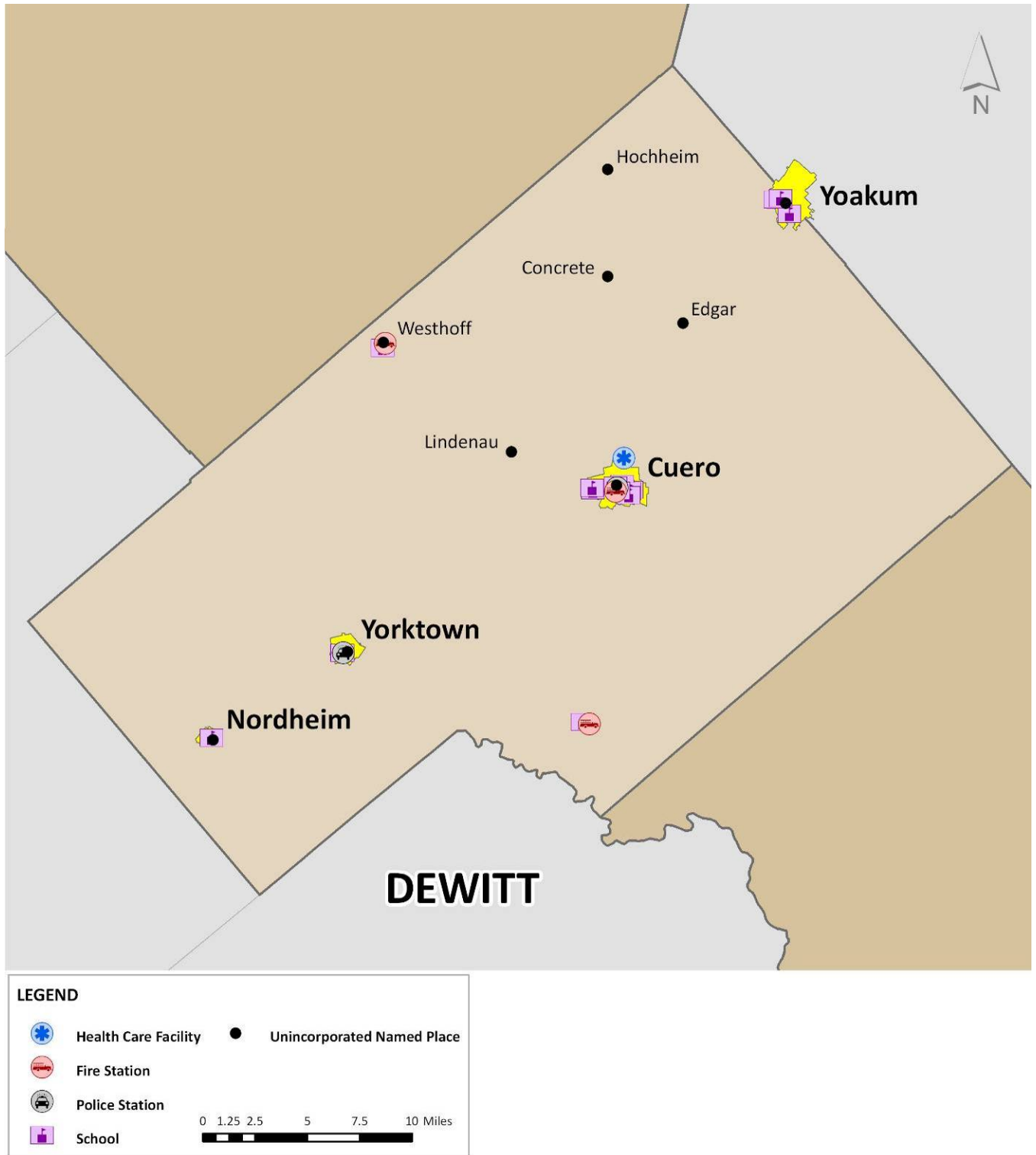
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Figure 4-6. Estimated Essential Facilities Placement in Calhoun County



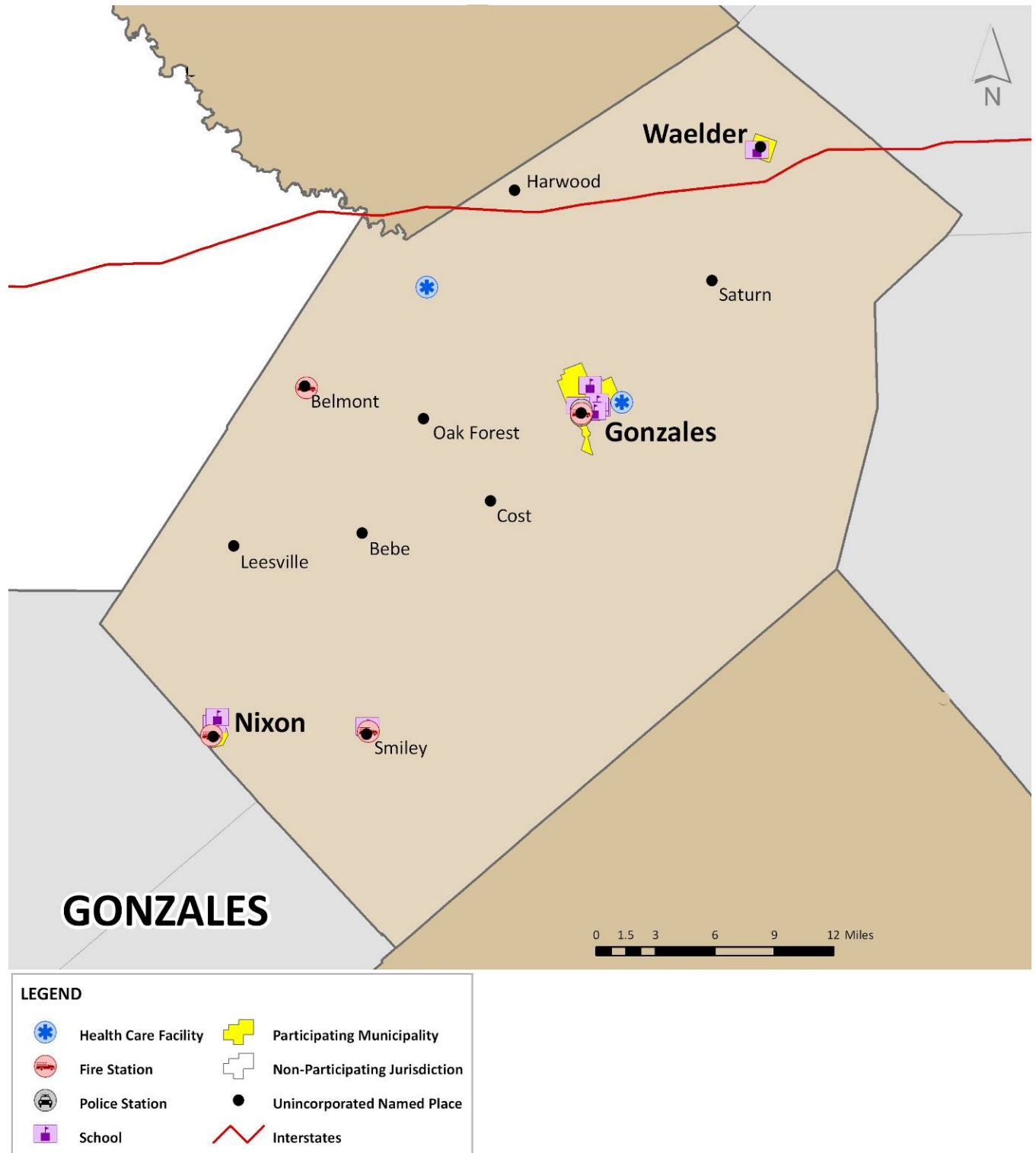
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Figure 4-7. Estimated Essential Facilities Placement in DeWitt County



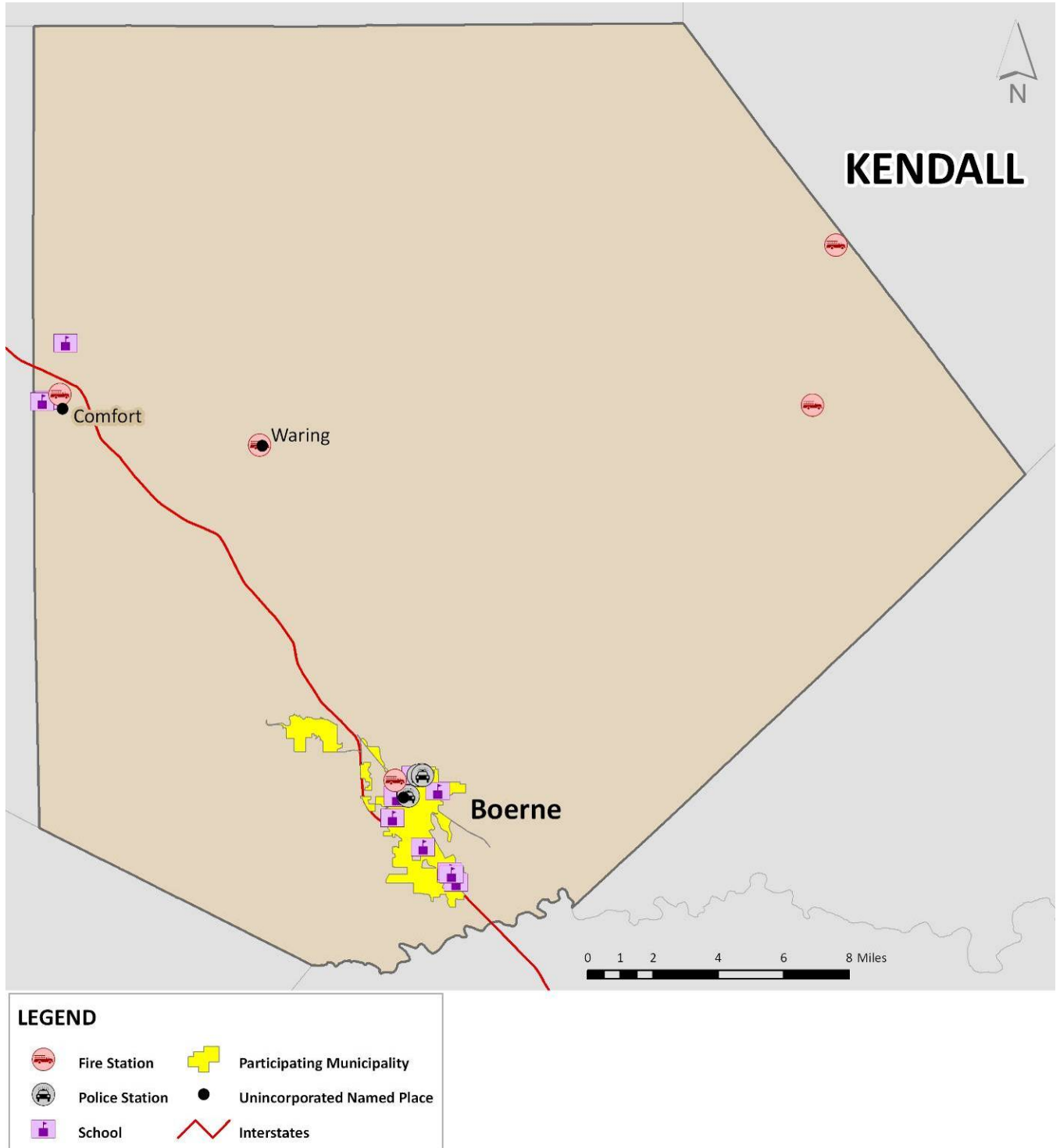
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Figure 4-8. Estimated Essential Facilities Placement in Gonzales County



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Figure 4-9. Estimated Essential Facilities Placement in Kendall County



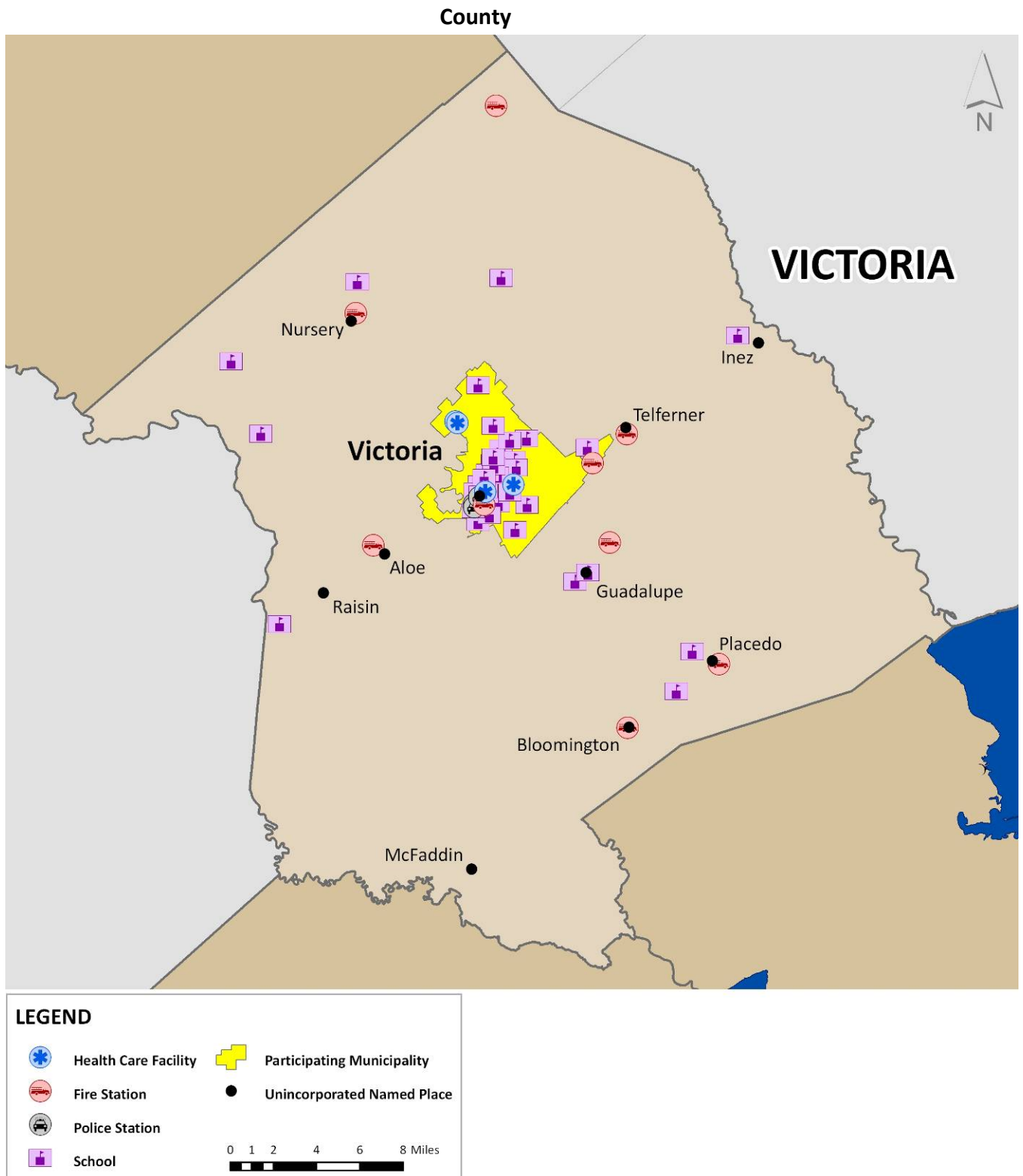
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Figure 4-10. Estimated Essential Facilities Placement in Refugio County



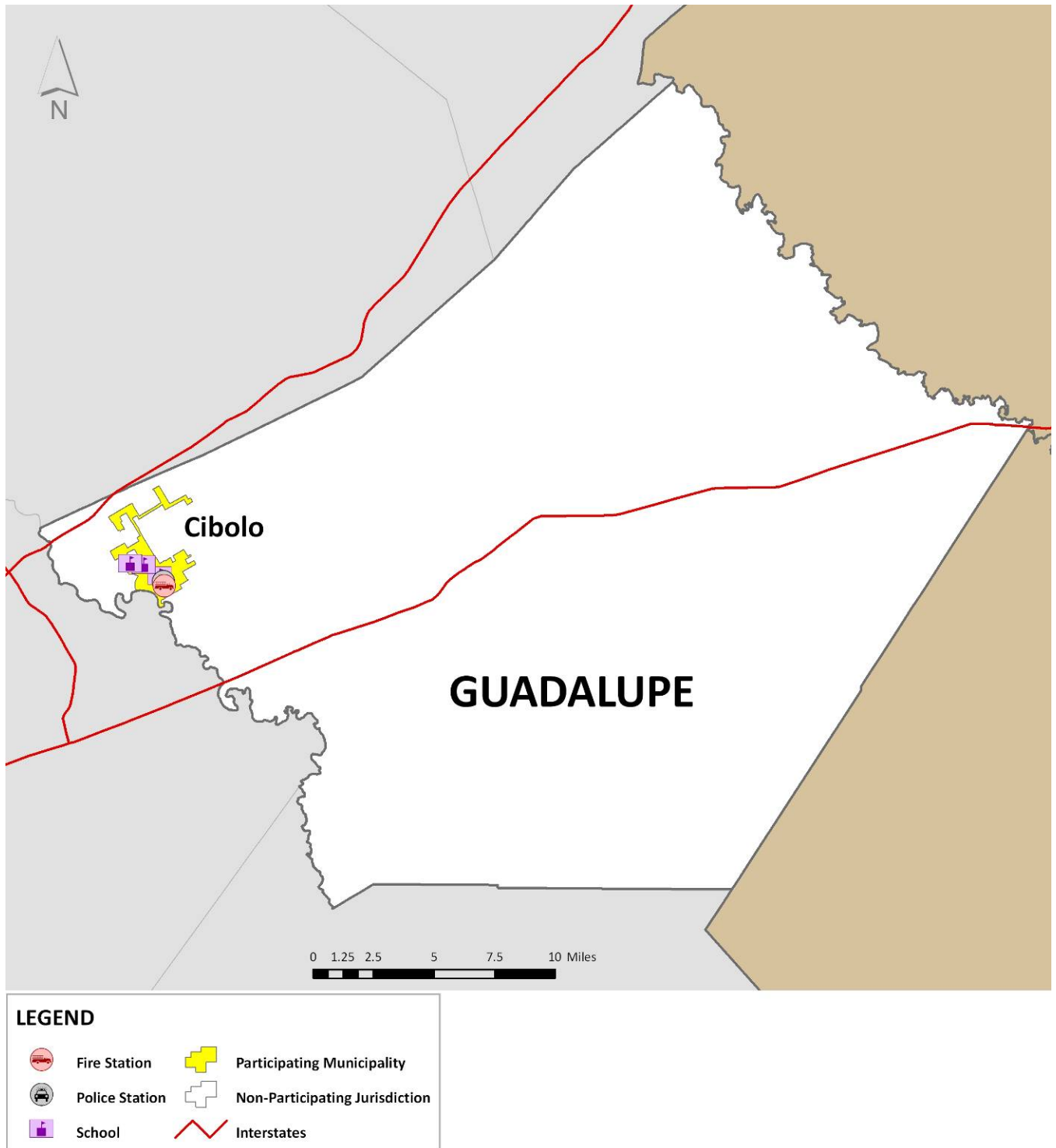
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Figure 4-11. Estimated Essential Facilities Placement in Victoria County



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Figure 4-12. Estimated Essential Facilities Placement in Cibolo (in Guadalupe County)



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Potential Dollar Losses

Using the statistical risk assessment methodology, loss estimates were obtained for seven of the hazards profiled in the risk assessment⁵. The economic results are summarized in Table 4-4 and Table 4-5. The economic loss results are presented here using 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 (e.g., county or municipality). The estimated 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 factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

Table 4-4. Summary of Annualized Loss (AL) Estimates

JURISDICTION	DROUGHT ⁶	FLOODING	HAIL	HURRICANE	THUNDER-STORM	TORNADOES	WINTER STORM
Caldwell Co.	\$58,667	\$3,611,000	Negligible	Negligible	\$20,303	\$1,151,799	Negligible
Lockhart	-	\$578,000	Negligible	Negligible	\$18,387	Negligible	-
Luling	-	\$130,000	Negligible	Negligible	\$19,763	Negligible	-
Martindale	-	\$872,000	Negligible	Negligible	\$262,958	Negligible	-
Calhoun Co.	Negligible	\$1,952,000	Negligible	\$244,000	Negligible	\$8,460	Negligible
Point Comfort	-	Negligible	Negligible	\$54,000	Negligible	Negligible	-
Port Lavaca	-	\$744,000	Negligible	\$54,000	Negligible	\$15,479	-
Seadrift	-	\$292,000	Negligible	Negligible	Negligible	Negligible	-
DeWitt Co.	\$58,667	\$2,145,000	\$170,506	\$12,000	\$171,599	Negligible	Negligible
Cuero	-	\$996,000	Negligible	\$9,000	\$10,695	Negligible	-
Nordheim	-	Negligible	Negligible	Negligible	Negligible	Negligible	-
Yoakum	-	\$94,000	Negligible	\$10,000	Negligible	Negligible	-
Yorktown	-	\$705,000	Negligible	Negligible	Negligible	Negligible	-
Gonzales Co.	\$58,667	\$4,474,000	Negligible	Negligible	Negligible	\$142,597	Negligible
Gonzales	-	\$275,000	Negligible	Negligible	\$19,176	Negligible	-
Nixon	-	Negligible	Negligible	Negligible	Negligible	Negligible	-

⁵ Annualized losses were not estimated for man-made/technological hazards. Since the AL is based on losses to building stock rather than land, estimates are not available for wildfire. Loss estimates are not provided for extreme heat as this hazard affects people instead of property.

⁶ For drought, the numbers presented are based upon the annualized expected agriculture product market value exposure. Exposure was estimated at the county level due to data limitations.

Note: Negligible is less than \$5,000

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JURISDICTION	DROUGHT ⁶	FLOODING	HAIL	HURRICANE	THUNDER-STORM	TORNADOES	WINTER STORM
Waelder	-	\$195,000	Negligible	Negligible	Negligible	Negligible	-
Cibolo (Guadalupe County)	N/A	\$391,000	Negligible	Negligible	\$13,938	Negligible	-
Kendall Co.	\$139,348	\$5,775,000	Negligible	Negligible	\$6,765	\$184,205	\$14,703
Boerne	-	\$5,765,000	Negligible	Negligible	\$5,520	Negligible	-
Refugio Co.	Negligible	\$1,215,000	Negligible	\$14,000	Negligible	\$5,058	Negligible
Austwell	-	Negligible	Negligible	Negligible	Negligible	Negligible	-
Bayside	-	Negligible	Negligible	Negligible	Negligible	Negligible	-
Refugio	-	\$78,000	Negligible	\$22,000	Negligible	Negligible	-
Woodsboro	-	Negligible	Negligible	Negligible	Negligible	Negligible	-
Victoria Co.	Negligible	\$5,648,000	\$5,301	\$64,000	Negligible	\$20,625	Negligible
Victoria	-	\$4,075,000	Negligible	\$112,000	Negligible	\$30,799	-

**Table 4-5. Summary of Annualized Loss Ratios (ALRs)
(Calculated as Annualized Losses Divided by Total Exposure⁷)**

JURISDICTION	DROUGHT ⁸	FLOODING	HAIL	HURRICANE WIND	THUNDER-STORM	TORNADOES	WINTER STORM
Caldwell Co.	1.40%	0.61%	0.00%	0.02%	0.00%	0.19%	0.00%
Lockhart	-	0.10%	0.00%	0.02%	0.00%	0.00%	-
Luling	-	0.05%	0.00%	0.02%	0.01%	0.00%	-
Martindale	-	2.16%	0.00%	0.02%	0.65%	0.00%	-
Calhoun Co.	0.00%	0.33%	0.00%	0.60%	0.00%	0.00%	0.00%
Point Comfort	-	0.00%	0.00%	0.45%	0.00%	0.00%	-
Port Lavaca	-	0.12%	0.00%	0.41%	0.00%	0.00%	-
Seadrift	-	0.49%	0.00%	0.51%	0.00%	0.00%	-
DeWitt Co.	2.57%	0.47%	0.00%	0.09%	0.04%	0.00%	0.00%
Cuero	-	0.26%	0.00%	0.08%	0.00%	0.00%	-
Nordheim	-	0.00%	0.00%	0.09%	0.00%	0.00%	-
Yoakum	-	0.03%	0.00%	0.07%	0.00%	0.00%	-
Yorktown	-	0.58%	0.00%	0.09%	0.00%	0.00%	-
Gonzales Co.	0.27%	1.03%	0.00%	0.04%	0.00%	0.03%	0.00%
Gonzales	-	0.07%	0.00%	0.02%	0.00%	0.00%	-

⁷ The drought and winter storm hazards were analyzed at the county level and the results for these two hazards are shown beside the county's name.

⁸ For drought, the numbers presented are based upon the annualized expected agriculture product market value exposure. Exposure was estimated at the county level due to data limitations.

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JURISDICTION	DROUGHT ^s	FLOODING	HAIL	HURRICANE WIND	THUNDER-STORM	TORNADES	WINTER STORM
Nixon	-	0.00%	0.00%	0.03%	0.00%	0.00%	-
Waelder	-	0.54%	0.00%	0.04%	0.00%	0.00%	-
Cibolo (Guadalupe County)	N/A	0.18%	0.00%	0.02%	0.01%	0.00%	-
Kendall Co.	14.37%	0.51%	0.00%	0.01%	0.00%	0.02%	0.00%
Boerne	-	1.23%	0.00%	0.01%	0.00%	0.00%	-
Refugio Co.	0.00%	0.85%	0.00%	0.47%	0.00%	0.00%	0.00%
Austwell	-	0.00%	0.00%	0.24%	0.00%	0.00%	-
Bayside	-	0.01%	0.00%	0.54%	0.00%	0.00%	-
Refugio	-	0.04%	0.00%	0.35%	0.00%	0.00%	-
Woodsboro	-	0.00%	0.00%	0.48%	0.00%	0.00%	-
Victoria Co.	0.00%	0.50%	0.00%	0.27%	0.00%	0.00%	0.00%
Victoria	-	0.11%	0.00%	0.16%	0.00%	0.00%	-

Hazard Ranking

The ability to quantify the risk to all hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in the GBRA study area.

Hazard ranking depends on the severity, area of impact and probability of occurrence (return period). Table 4-6 provides the hazard ranking by jurisdiction for each hazard. For each jurisdiction, each hazard was given a rating of high (H), moderate (M), low (L) very low (VL), or not applicable (N/A) based on how vulnerable they are to that hazard or how probable that hazard is to impact the jurisdiction. The rating of N/A was used if the results for loss or potential impacts were zero. The rating is based on a combination of factors such as population and building exposure annualized loss (or ALRs, when available), and in some cases the jurisdiction's location to a known hazard area.

Hazards ranked as high (H) indicate that hazards can occur with little warning time, great frequency and result in multiple deaths or the complete shutdown of critical facilities for over 30 days. Hazards ranked as moderate (M) occur with less frequency and impact than high hazards, but can have warning times up to 12 hours, result in injuries, illness or permanent disability and shut down critical facilities for at least two weeks. Low (L) ranking hazards usually last less than 24 hours, result in injuries, but not permanent disability, occur with typically 12 to 24 hours notice and can shutdown facilities for one week. Very low (VL) hazards usually last less than six hours, but have a warning time of over 24 hours. Although

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illnesses and injury can occur, they can be treated with first aid and any shutdown of facilities would last less than one day. If hazards are ranked as not applicable (N/A), no historic occurrences have occurred and no critical facilities are at threat.

The hazard ratings were developed, based on the following criteria:

- Dam Failure: the number of high or significant dams and value of property exposure that could be impacted
- Drought: the ALRs and the value of agricultural product exposure
- Flood: the ALRs
- Hail, thunderstorm, tornado and winter storm hazards: the ALRs
- Hurricane wind: the ALRs, the average wind speeds for the 100-year return period and the jurisdictions proximal location to the coastline
- HAZMAT (fixed and mobile) incidents: the potential population that could be impacted within 500 meters of the incident, as a percent of the total population
- Oil and gas pipeline failures: the potential population that could be impacted within 500 meters of the incident, as a percent of the total population

Table 4-6. Hazard Risk Ranking by Jurisdiction⁹

JURISDICTION	DAM FAILURE	DROUGHT	INLAND FLOODING	HAIL	HAZMAT	HURRICANE	OIL AND GAS PIPELINES	THUNDERSTORM	TORNADOES	WILDFIRE	WINTER STORM
Caldwell Co.	M	L	H	VL	L	M	L	L	M	M	VL
Lockhart	L	-	M	VL	M	M	L	L	VL	H	VL
Luling	M	-	L	VL	M	M	M	M	VL	L	VL
Martindale	N/A	-	H	VL	N	M	M	M	VL	L	VL
Calhoun Co.	L	L	M	VL	VL	H	M	VL	L	L	VL
Point Comfort	N/A	-	VL	VL	M	H	M	VL	VL	L	VL
Port Lavaca	N/A	-	M	VL	M	H	L	VL	L	VL	VL
Seadrift	N/A	-	H	VL	VL	H	VL	VL	VL	H	VL
DeWitt Co.	M	M	H	VL	M	H	M	M	VL	L	VL
Cuero	M	-	M	VL	M	H	L	L	VL	H	VL
Nordheim	N/A	-	VL	VL	N	H	M	VL	VL	H	VL

⁹ Risk Ranking through HAZUS is not available for Extreme Heat, Infectious Disease or Terrorism as these hazards have no geographic boundary or annualized losses.

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JURISDICTION	DAM FAILURE	DROUGHT	INLAND FLOODING	HAIL	HAZMAT	HURRICANE	OIL AND GAS PIPELINES	THUNDERSTORM	TORNADOES	WILDFIRE	WINTER STORM
Yoakum	M	-	L	VL	M	H	VL	VL	VL	VL	VL
Yorktown	M	-	H	VL	L	H	M	VL	VL	H	VL
Gonzales Co.	M	M	H	VL	M	M	L	VL	M	L	VL
Gonzales	L	-	L	VL	L	M	M	L	VL	H	VL
Nixon	N/A	-	VL	VL	M	M	N/A	VL	VL	VL	VL
Waelder	N/A	-	H	VL	H	M	M	VL	VL	H	VL
Cibolo (Guadalupe County)	N/A	N/A	M	VL	L	M	M	M	VL	L	VL
Kendall Co.	M	M	H	VL	M	M	L	L	M	H	L
Boerne	M	-	H	VL	L	M	N/A	L	VL	H	L
Refugio Co.	L	L	H	VL	L	H	M	VL	L	M	VL
Austwell	N/A	-	VL	VL	N	H	M	VL	VL	N/A	VL
Bayside	N/A	-	VL	VL	N	H	N/A	VL	VL	L	VL
Refugio	N/A	-	VL	VL	M	H	M	VL	VL	H	VL
Woodsboro ¹⁰	N/A	-	VL	VL	M	H	L	VL	VL	H	VL
Victoria Co.	M	L	H	L	M	H	M	VL	L	M	VL
Victoria	N/A	-	M	VL	M	H	M	VL	L	M	VL

In addition to the hazard ranking based on the ALRs and exposure, each participating jurisdiction in the Guadalupe Basin Plan Update also developed a hazard ranking using the same ratings, high, moderate, low, very low or not applicable. This provided an opportunity for planning participation amongst team members and the ability to compare and contrast the rankings with those provided by the economic loss study. In addition, team members were able to rank each of the 14 hazards included in the Plan using the frequency of occurrence and probable impact as a guide in developing the rating. The results of the rankings are depicted in Table 4-7.

¹⁰ Woodsboro ISD is not listed separately from the Town of Woodsboro, as the rankings are the same for the school district and Woodsboro.

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Table 4-7. Individual Ranking per Jurisdiction ¹¹

JURISDICTION	DAM FAILURE	DROUGHT	FLOODING	EXTREME HEAT	HAIL	HAZMAT	HURRICANE	OIL AND GAS PIPELINES	THUNDERSTORM	TORNADOES	WILDFIRE	WINTER STORM	INFECTIOUS DISEASE	TERRORISM
Caldwell Co.	M	M	M	M	VL	M	M	M	M	VL	M	VL	L	VL
Lockhart	N/A	H	M	H	H	L	H	L	H	H	H	L	L	N/A
Luling	M	M	M	M	VL	M	M	M	M	VL	M	VL	L	VL
Martindale	N/A	M	L	M	L	M	M	M	M	M	M	VL	M	M
Calhoun Co.	N/A	M	L	H	L	H	H	M	M	L	M	VL	L	M
Point Comfort	N/A	L	L	L	L	M	H	L	M	M	L	L	VL	VL
Port Lavaca	N/A	M	L	M	L	H	H	L	L	VL	VL	VL	L	L
Seadrift	N/A	L	L	L	L	M	H	L	M	M	L	L	VL	VL
DeWitt Co.	VL	M	HM	M	M	M	H	L	M	L	M	M	M	L
Cuero	N/A	L	H	L	L	VL	L	M	L	H	M	L	L	N/A
Nordheim	N/A	L	N/A	L	L	VL	L	M	L	H	N/A	L	L	N/A
Yoakum	VL	M	M	L	L	M	L	L	L	L	M	VL	L	L
Yorktown	VL	M	M	L	L	M	L	L	L	L	M	VL	L	L
Gonzales Co.	M	H	H	H	M	H	N/A	H	H	M	H	M	L	M
Gonzales	M	H	H	M	L	L	M	M	H	M	L	L	L	L
Nixon	N/A	H	M	H	H	L	H	L	H	H	H	L	L	N/A
Waelder	N/A	M	H	M	M	H	M	H	L	M	M	VL	VL	L
Cibolo (Guadalupe County)	N/A	M	M	M	M	L	N/A	L	L	M	M	L	VL	VL
Kendall Co.	N/A	M	M	M	L	L	N/A	L	L	M	M	L	L	L
Boerne	M	M	M	M	L	L	N/A	L	L	L	M	L	L	VL
Refugio Co.	VL	H	H	H	M	H	H	H	H	H	H	H	M	L
Austwell	N/A	M	M	M	VL	L	M	L	L	L	L	L	VL	VL
Bayside	N/A	M	M	VL	VL	VL	N/A	N/A	L	N/A	N/A	N/A	N/A	N/A
Refugio	N/A	M	M	M	VL	L	M	L	L	L	L	L	VL	VL
Woodsboro	N/A	M	M	M	VL	L	M	L	L	L	L	L	VL	VL
Victoria Co.	VL	H	H	M	M	M	H	M	M	M	M	L	M	L
Victoria	VL	H	H	M	M	M	H	M	M	M	M	L	M	L

¹¹ Table 4-7 includes the additional hazards of Extreme Heat, Infectious Disease and Terrorism as this table reflects ranking selections by each participating jurisdiction.