

HAIL

Hazard Description.....	1
Location.....	1
Extent.....	1
Historical Occurrences.....	3
Probability of Future Events.....	13
Impact and Vulnerability.....	13

Hazard Description

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals until they fall as precipitation that is round or irregularly shaped masses of ice greater than 0.75 inches in diameter. The size of hailstones is a direct result of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a byproduct of heating on the Earth’s surface. Higher temperature gradients above Earth’s surface result in increased suspension time and hailstone size.



Location

Hailstorms vary tremendously in terms of size, location, intensity and duration but are considered frequent occurrences throughout the GBRA Basin. It is assumed that all of the jurisdictions are uniformly exposed to hail events just as they are exposed to the thunderstorms that produce the hail events.

Extent

The severity of hail events range based on size of hail, winds, and structures in the path of a hail storm. Storms that produce high winds in addition to hail are most damaging and can result in numerous broken windows and damaged siding. Hailstorms can cause extensive property damage affecting both

SECTION 8: HAIL

urban and rural landscapes. Fortunately, most hailstorms produce marble-size or smaller hailstones. These can cause damage to crops, but they normally do not damage buildings or automobiles. Larger hailstones can destroy crops, livestock and wildlife and can cause extensive damage to buildings, including roofs, windows and outside walls. Vehicles can be total losses. When hail breaks windows, water damage from accompanying rains can also be significant. A major hailstorm can easily cause damage running into the millions of dollars. Nationwide hail is responsible for over \$1 billion in property and crop damages per year. A scale showing intensity categories was developed by the National Climatic Data Center (NCDC) and is included at Table 8-1.

Table 8-1. Hail Intensity and Magnitude

SIZE CODE	INTENSITY CATEGORY	SIZE (DIAMETER INCHES)	DESCRIPTIVE TERM	TYPICAL DAMAGE
H0	Hard Hail	up to 0.33	pea	no damage
H1	Potentially Damaging	0.33-0.60	marble	slight damage to plants and crops
H2	Potentially Damaging	0.60-0.80	dime	significant damage to plants and crops
H3	Severe	0.80-1.20	nickel	severe damage to plants and crops
H4	Severe	1.2-1.6	quarter	widespread glass and auto damage
H5	Destructive	1.6-2.0	half dollar	widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0-2.4	ping pong ball	aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4-3.0	golf ball	severe roof damage and risk of serious injuries
H8	Very Destructive	3.0-3.5	hen egg	severe damage to all structures
H9	Super Hailstorms	3.5-4.0	tennis ball	extensive structural damage could cause fatal injuries
H10	Super Hailstorms	4.0 +	baseball	extensive structural damage could cause fatal injuries

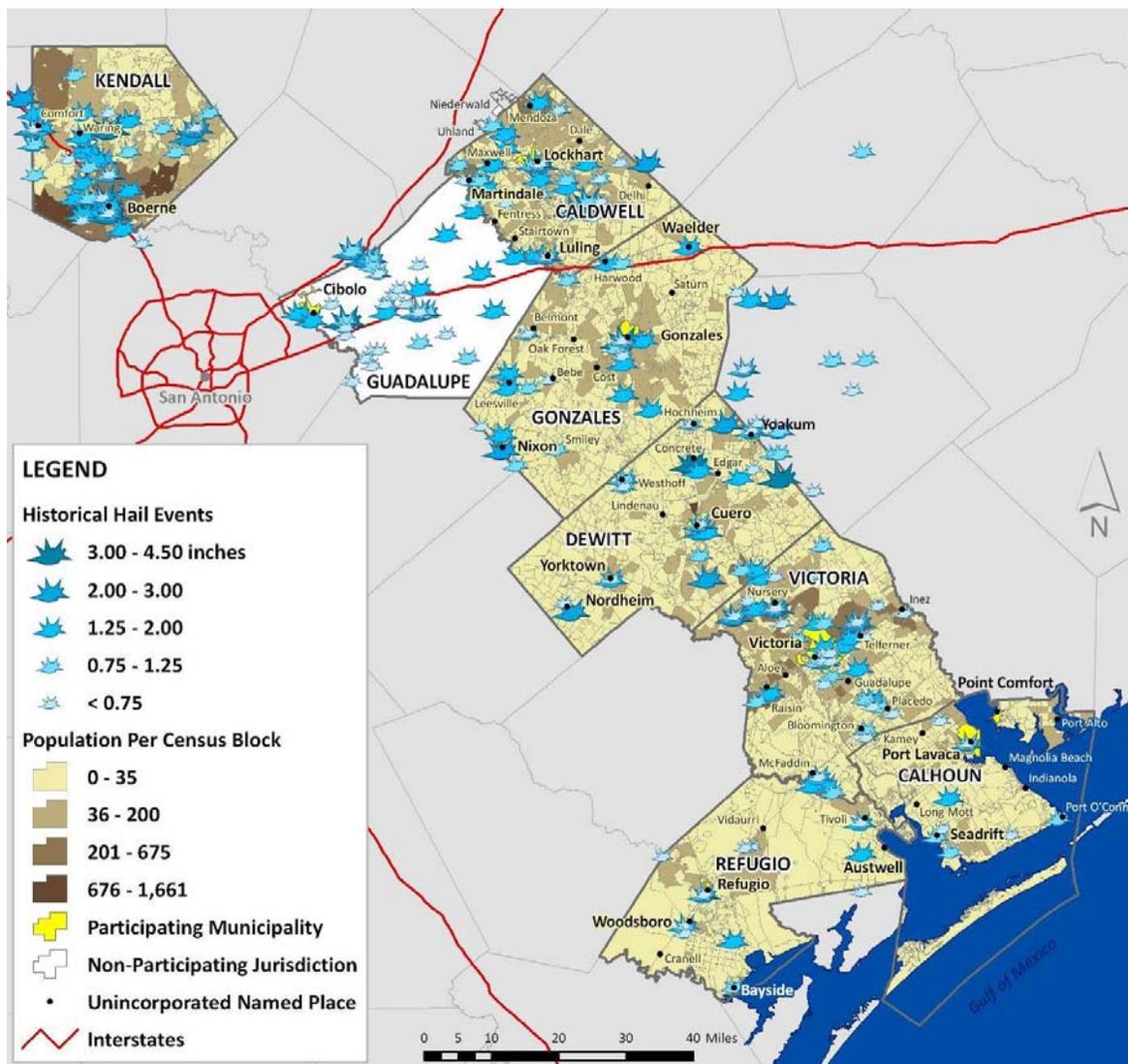
The range of intensity for a hailstorm event for GBRA jurisdictions is anywhere from and H0 to an H8 on the Hail Intensity Scale at Table 8-1. Based on the historical occurrences, the area has not experienced a hail event greater than an H8 event or over 3.0 inches in diameter.

SECTION 8: HAIL

Historical Occurrences

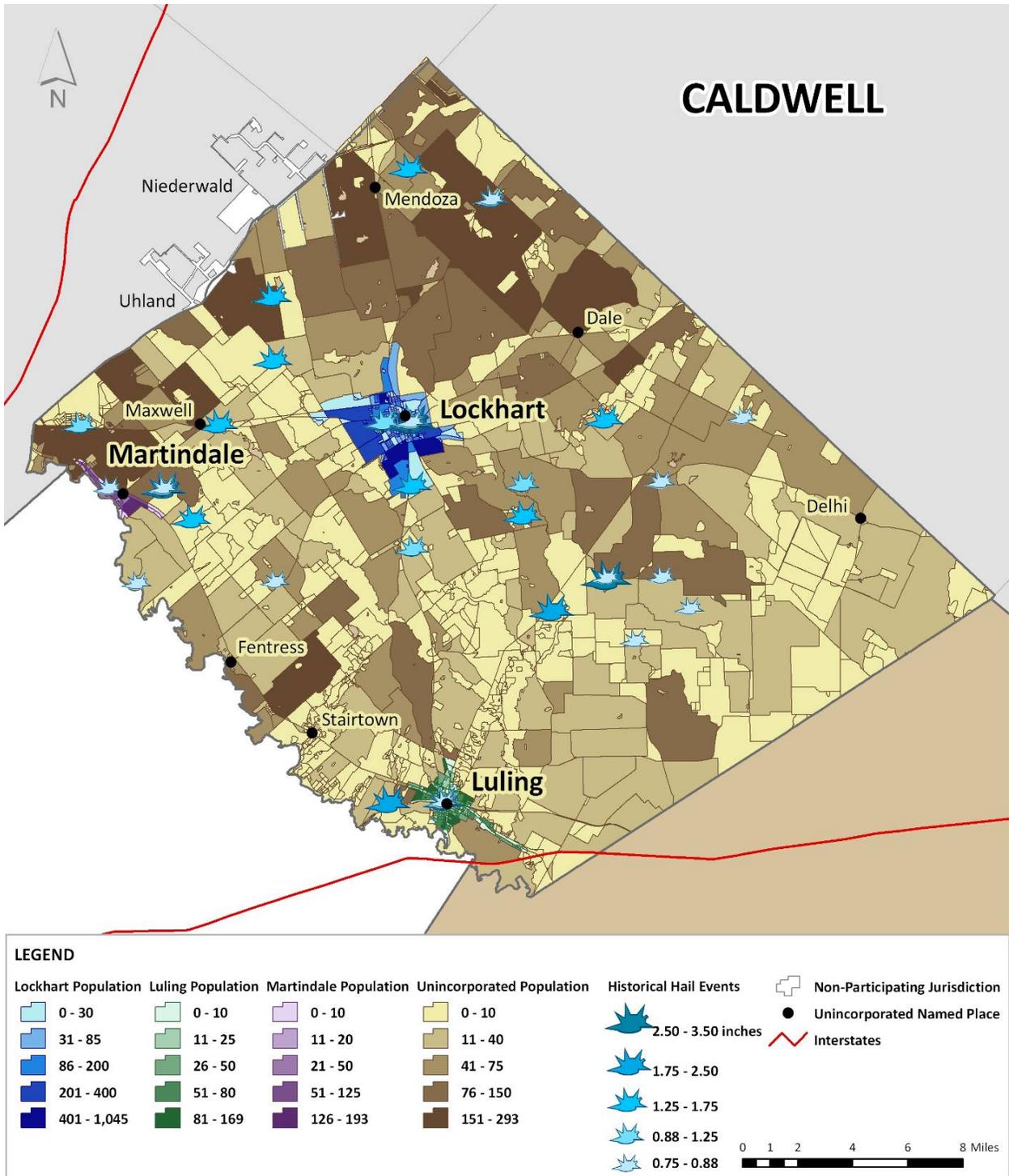
Figure 8-1 shows the historical hail events that have impacted the GBRA study area from 1950 to 2009 (according to NCDC records), and Figure 8-2 through Figure 8-9 show at the county level the historical hail events that have impacted each jurisdiction. All buildings and facilities are considered to be exposed to this hazard and could potentially be impacted because it cannot be predicted where hail may fall. As such, estimated annualized losses cannot be broken down into further categories (residential, commercial, etc.). It is important to note that only hail occurrences that have been reported have been factored into this risk assessment. However, it is likely that a high number of instances have gone unreported.

Figure 8-1. Spatial Historical Hail Events in GBRA (NOAA Data 1950–2007)



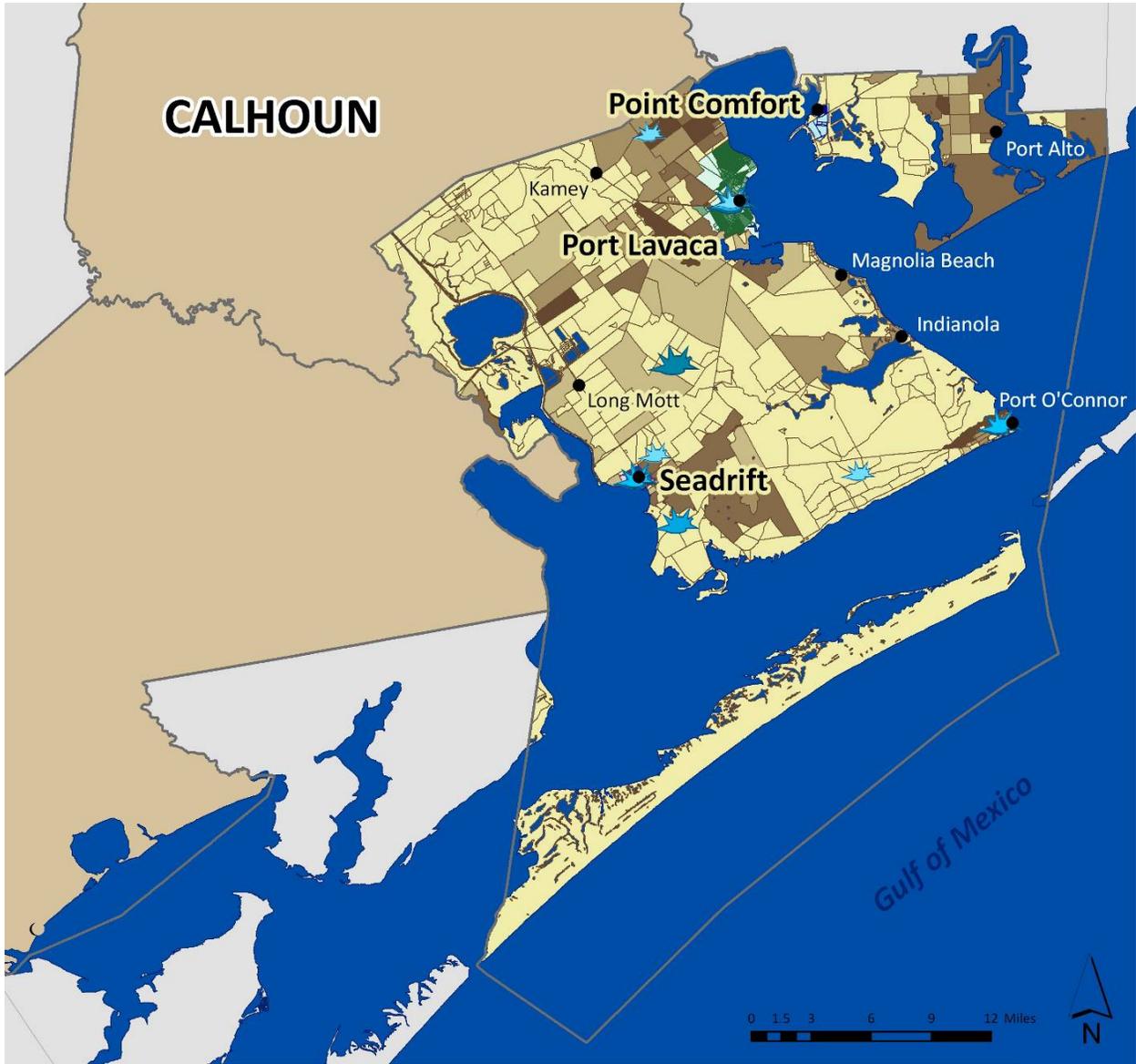
SECTION 8: HAIL

Figure 8-2. Historical Hail Events in Caldwell County



SECTION 8: HAIL

Figure 8-3. Historical Hail Events in Calhoun County

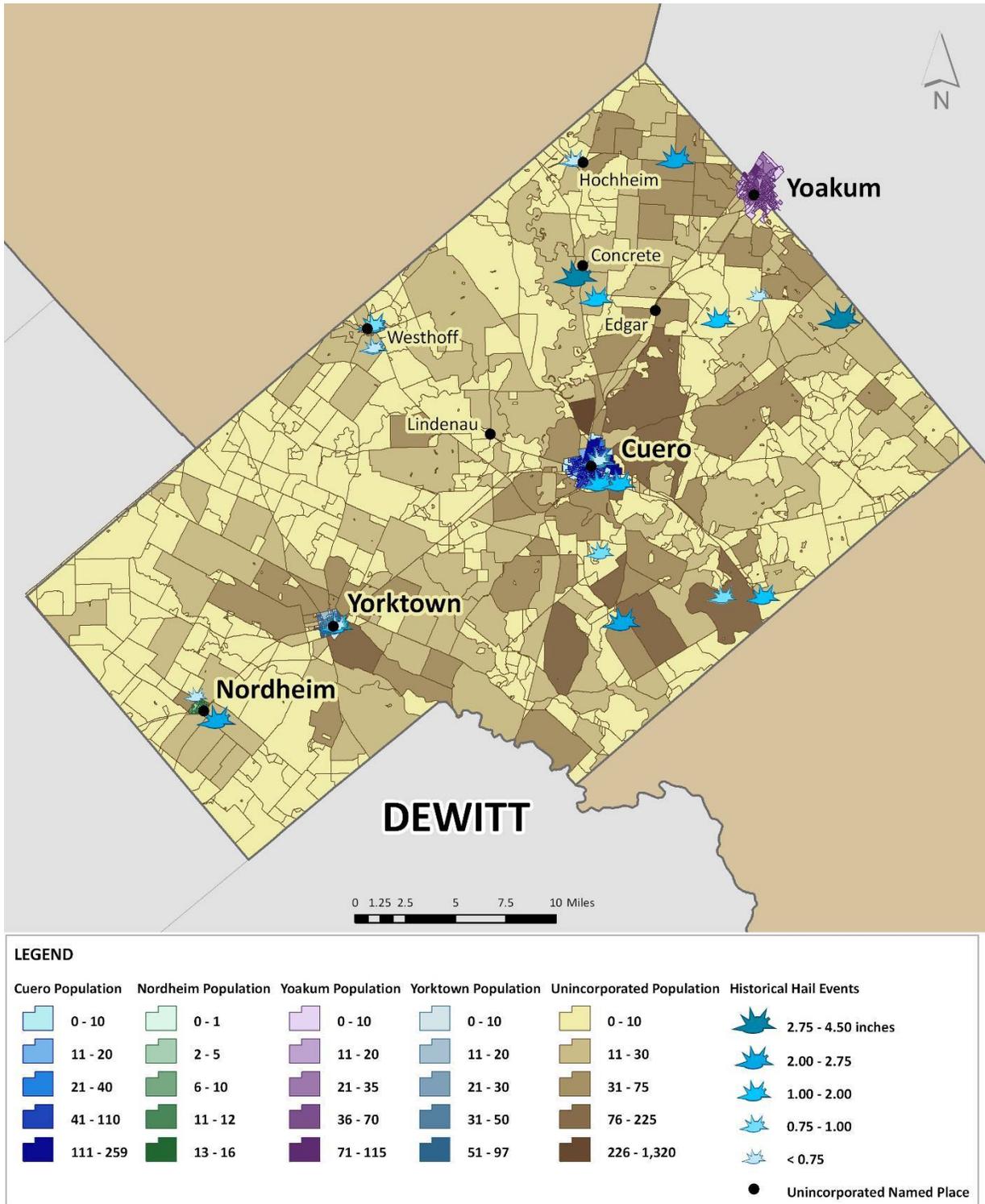


LEGEND

Point Comfort Population	Port Lavaca Population	Seadrift Population	Unincorporated Population	Historical Hail Events
0 - 5	0 - 15	0 - 5	0 - 10	1.00 - 1.75 inches
6 - 30	16 - 40	6 - 10	11 - 25	0.88 - 1.00
31 - 40	41 - 80	11 - 20	26 - 50	0.75 - 0.88
41 - 50	81 - 180	21 - 40	51 - 100	< 0.75
51 - 63	181 - 585	41 - 80	101 - 292	Unincorporated Named Place

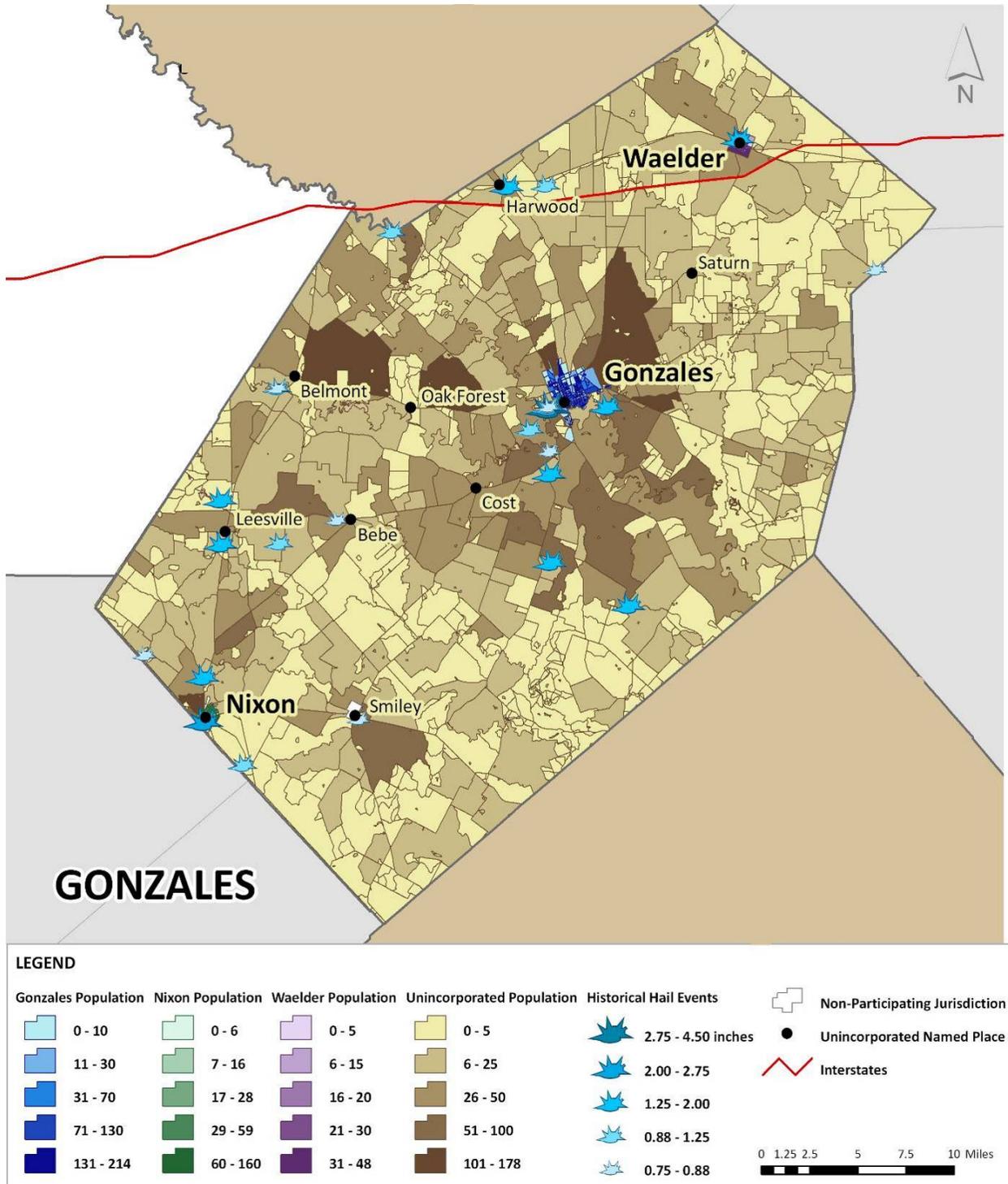
SECTION 8: HAIL

Figure 8-4. Historical Hail Events in DeWitt County



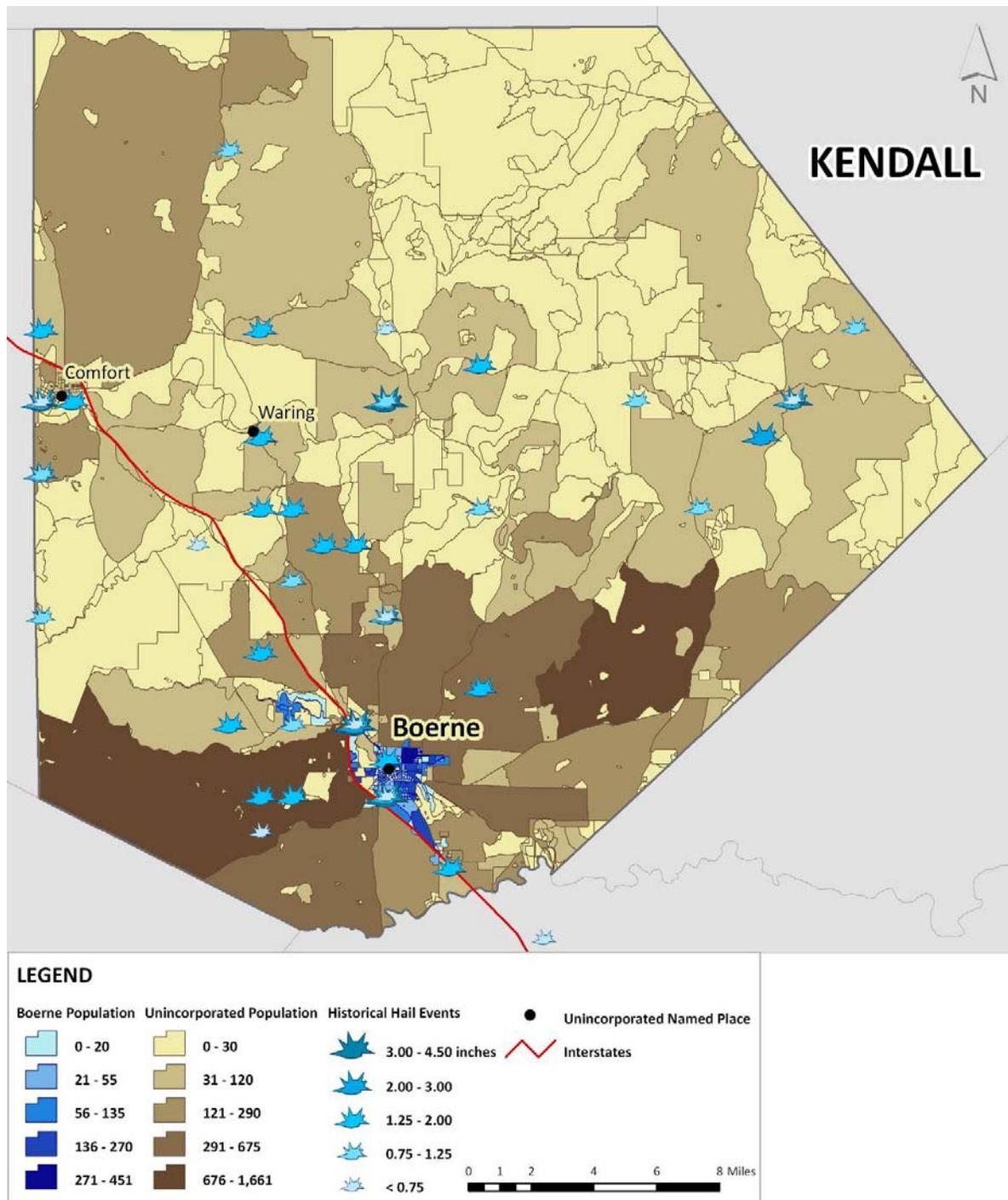
SECTION 8: HAIL

Figure 8-5. Historical Hail Events in Gonzales County



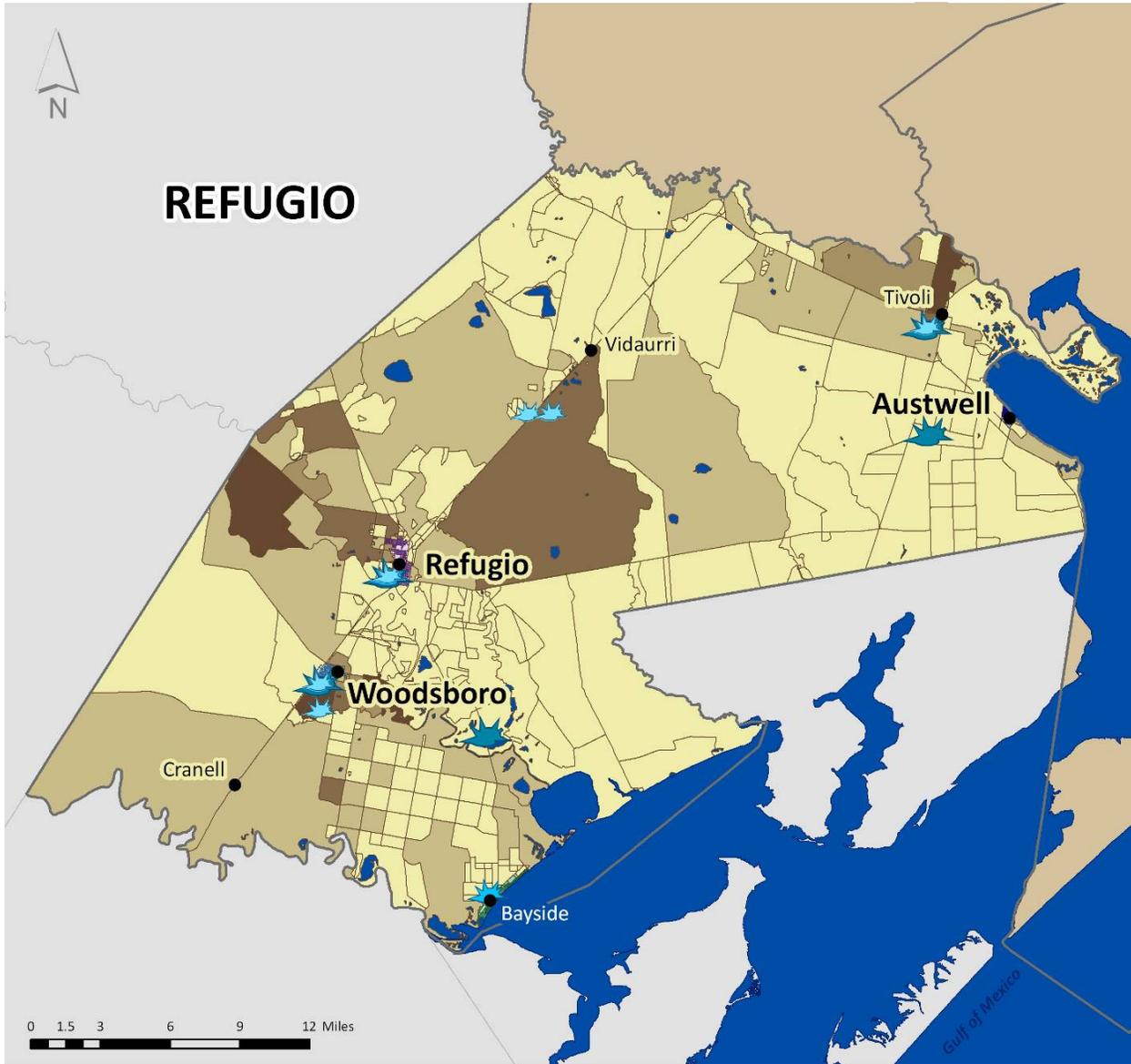
SECTION 8: HAIL

Figure 8-6. Historical Hail Events in Kendall County



SECTION 8: HAIL

Figure 8-7. Historical Hail Events in Refugio County

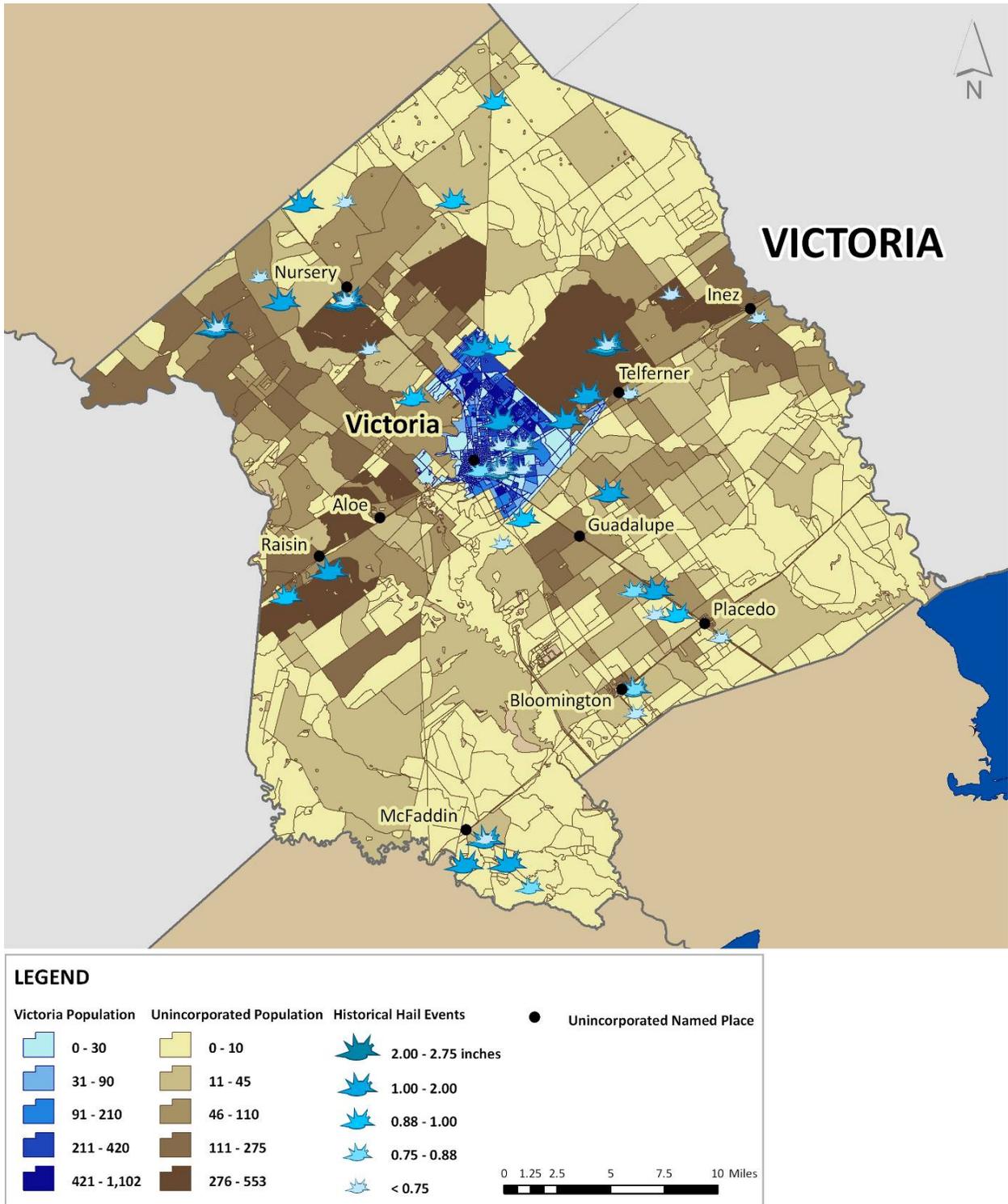


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Austwell Population	Bayside Population	Refugio Population	Woodsboro Population	Unincorporated Population	Historical Hail Events
0 - 1	0 - 1	0 - 6	0 - 6	0 - 7	1.00 - 1.75 inches
2 - 5	2 - 5	7 - 20	7 - 15	8 - 25	0.88 - 1.00
6 - 8	6 - 10	21 - 40	16 - 25	26 - 50	0.75 - 0.88
9 - 10	11 - 15	41 - 60	26 - 35	51 - 100	< 0.75
11 - 17	16 - 27	61 - 110	36 - 52	101 - 183	Unincorporated Named Place

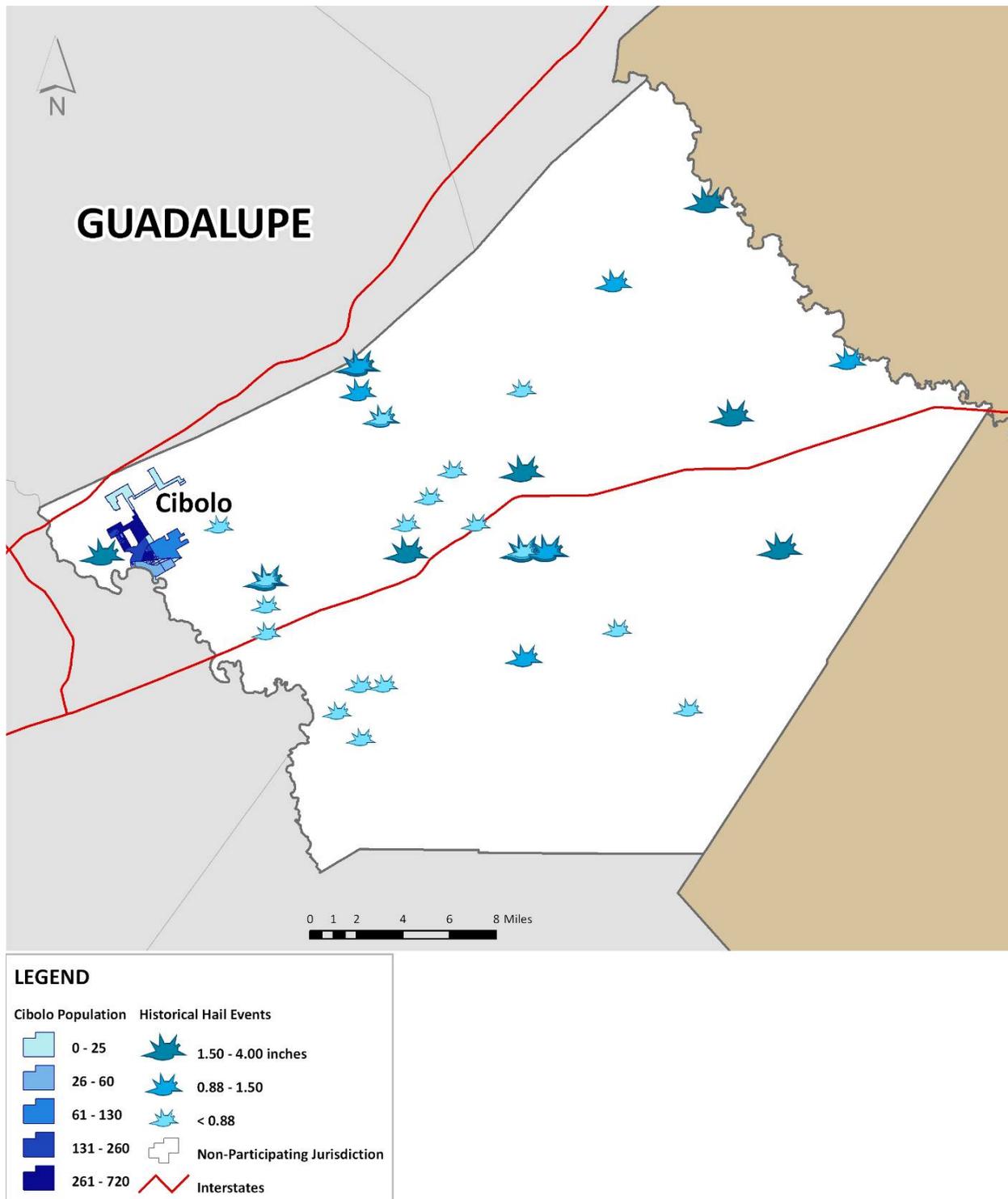
SECTION 8: HAIL

Figure 8-8. Historical Hail Events in Victoria County



SECTION 8: HAIL

Figure 8-9. Historical Hail Events in Cibolo (in Guadalupe County)



SECTION 8: HAIL

Table 8-2 provides a breakdown of historical hail impact by jurisdiction consisting of the number of reported events (based on NCDC records) and the maximum recorded size of the hail in each area.

Table 8-2. Historical Hail Impact by Jurisdiction

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM HAIL SIZE (INCHES)
Caldwell County	30	3.50
Lockhart	14	2.75
Luling	9	1.75
Martindale	1	0.75
Calhoun County	7	1.75
Point Comfort	0	N/A
Port Lavaca	4	1.75
Seadrift	3	1.00
DeWitt County	19	4.50
Cuero	10	2.00
Nordheim	0	N/A
Yoakum	2	1.50
Yorktown	2	1.75
Gonzales County	27	4.50
Gonzales	0	N/A
Nixon	2	2.75
Waelder	1	1.50
Cibolo (Guadalupe County)	0	N/A
Kendall County	52	4.25
Boerne	9	4.00
Refugio County	16	1.75
Austwell	0	N/A
Bayside	0	N/A
Refugio	0	N/A
Woodsboro	0	N/A
Victoria County	49	2.75
Victoria	34	2.00
TOTALS FOR STUDY AREA	291	4.50

SECTION 8: HAIL

Probability of Future Events

Based on the past history for the area, hail events are highly likely, meaning that an event is probable within the next year. Most hailstorms occur during the spring (March, April and May) and in the fall during the month of September. Warning time for a hailstorm is generally minimal or there is no warning. The National Weather Service classifies a storm as severe if hail of ¼ of an inch in diameter (approximately the size of a penny) or greater is imminent based on radar intensity or seen by observers.

Impact and Vulnerability

The severity of a hailstorm impact is considered to be limited since they generally result in injuries treatable with first aid, shut down critical facilities and services for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage. Phenomena in nature cross jurisdictional boundaries. All existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported hail events with georeferenced point data have been factored into this vulnerability assessment¹.

Table 8-3 shows potential annualized losses by jurisdiction. “Negligible” indicates that the annualized expected property losses are less than \$5,000.

Table 8-3. Potential Annualized Losses by Jurisdiction (Hail)

JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)	ANNUALIZED LOSS RATIO (ALR)
Caldwell County	\$605,797,000	Negligible	0.00%
Lockhart	\$618,183,000	Negligible	0.00%
Luling	\$264,373,000	Negligible	0.00%
Martindale	\$40,522,000	Negligible	0.00%
Calhoun County	\$609,016,000	Negligible	0.00%
Point Comfort	\$80,897,000	Negligible	0.00%
Port Lavaca	\$651,340,000	Negligible	0.00%
Seadrift	\$62,036,000	Negligible	0.00%
DeWitt County	\$469,085,000	\$170,506	0.00%
Cuero	\$412,893,000	Negligible	0.00%

¹ It is possible that additional hail events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

SECTION 8: HAIL

JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)	ANNUALIZED LOSS RATIO (ALR)
Nordheim	\$25,111,000	Negligible	0.00%
Yoakum	\$370,136,000	Negligible	0.00%
Yorktown	\$127,049,000	Negligible	0.00%
Gonzales County	\$457,255,000	Negligible	0.00%
Gonzales	\$401,785,000	Negligible	0.00%
Nixon	\$94,690,000	Negligible	0.00%
Waelder	\$37,972,000	Negligible	0.00%
Cibolo (Guadalupe County) ²	\$221,273,000	Negligible	0.00%
Kendall County	\$1,181,519,000	Negligible	0.00%
Boerne	\$494,789,000	Negligible	0.00%
Refugio County	\$ 149,487,000	Negligible	0.00%
Austwell	\$28,397,000	Negligible	0.00%
Bayside	\$26,026,000	Negligible	0.00%
Refugio	\$186,843,000	Negligible	0.00%
Woodsboro	\$78,606,000	Negligible	0.00%
Victoria County	\$1,174,737,000	\$5,301	0.00%
Victoria	\$3,942,383,000	Negligible	0.00%
TOTALS FOR STUDY AREA³	\$12,812,200,000	\$175,807	-

Sources: HAZUS-MH MR4 (exposure values) and NCDC (property losses)

² On March 27, 1994, a hailstorm caused \$7,351,867 in property damage and \$73,519 in crop damage near Cibolo (in 2009 dollars). However, the NCDC data is insufficient to determine the exact coordinates of the damage to appropriately assign a percentage of the loss to Cibolo versus other communities and portions of Guadalupe County and the surrounding area.

³ Totals for the study area may include values less than \$5,000 for amounts that are classified as “negligible” in the table.