HAIL

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 the 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 CVCOG Region. 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

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 three-quarters of an inch in diameter (approximately the size of a penny) or greater is imminent based on radar intensity or seen by observers.

The severity of hail events range based on the size of hail, winds, and structures in the path of a hailstorm. 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 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 amounting into the millions of dollars. Nationwide hail is responsible for over one billion dollars in property and crop damages per year. A scale showing intensity categories was developed by the National Climatic Data Center (NCDC) and is included in Table 7-1.

Table 7-1. 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

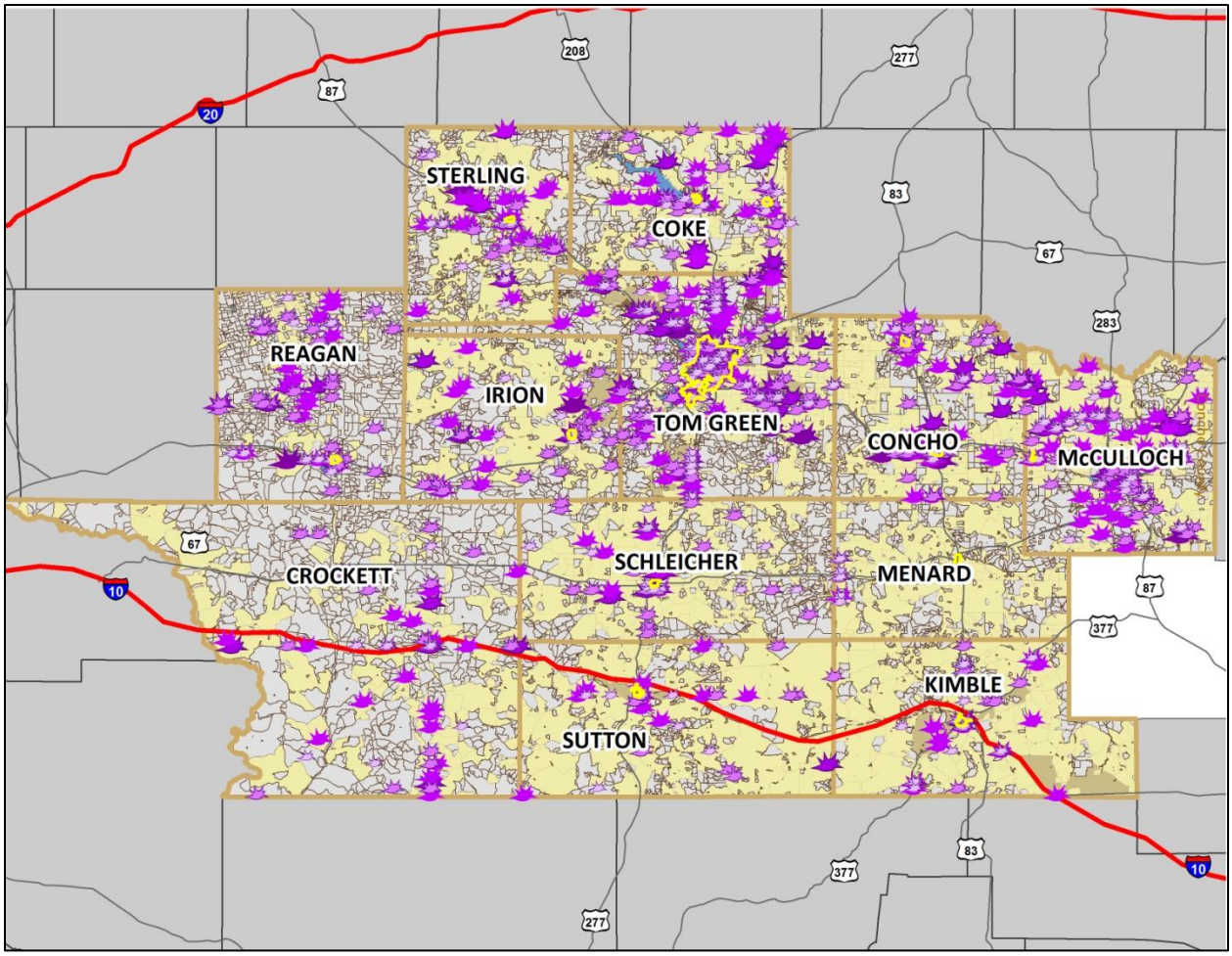
SIZE CODE	INTENSITY CATEGORY	SIZE (DIAMETER INCHES)	DESCRIPTIVE TERM	TYPICAL DAMAGE
H7	Very Destructive	2.4 – 3.0	Golf Ball	Severe roof damage and risk of serious injuries
H8	Very Destructive	3.0 – 3.5	Hen Egg	Severe damage to all structures
H9	Super Hailstorms	3.5 – 4.0	Tennis Ball	Extensive structural 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 CVCOG jurisdictions is anywhere from an H0 to an H10 on the Hail Intensity Scale. Based on the historical occurrences, the area has experienced an H10 event; hailstorms in the region have produced hail larger than 5.0 inches in diameter. All communities in the planning area are equally susceptible to hail events and should mitigate to an extent of an H10 hail event as many jurisdictions have experienced hail larger than 4.0 inches in diameter.

Historical Occurrences

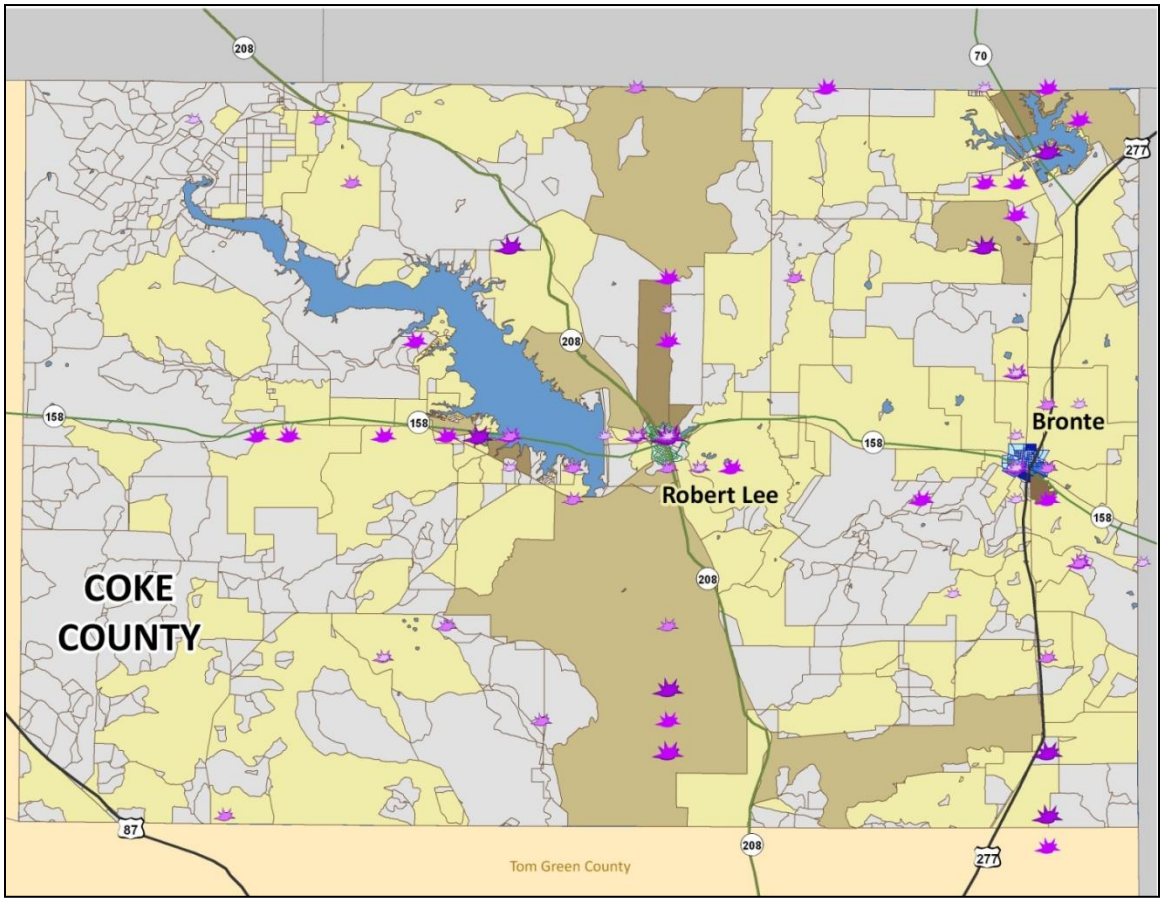
Figure 7-1 shows the historical hail events that have impacted the CVCOG study area from 1950 to 2010, and Figures 7-2 through 7-13 show the historical hail events at the county level that have impacted each jurisdiction. There are no clear distinctive patterns indicating some areas have higher frequencies or magnitudes than others. This is in part due to this reporting system, and the general distribution of hail events as seen on the maps.

Figure 7-1. Spatial Historical Hail Events in CVCOG, 1950–2010[1]



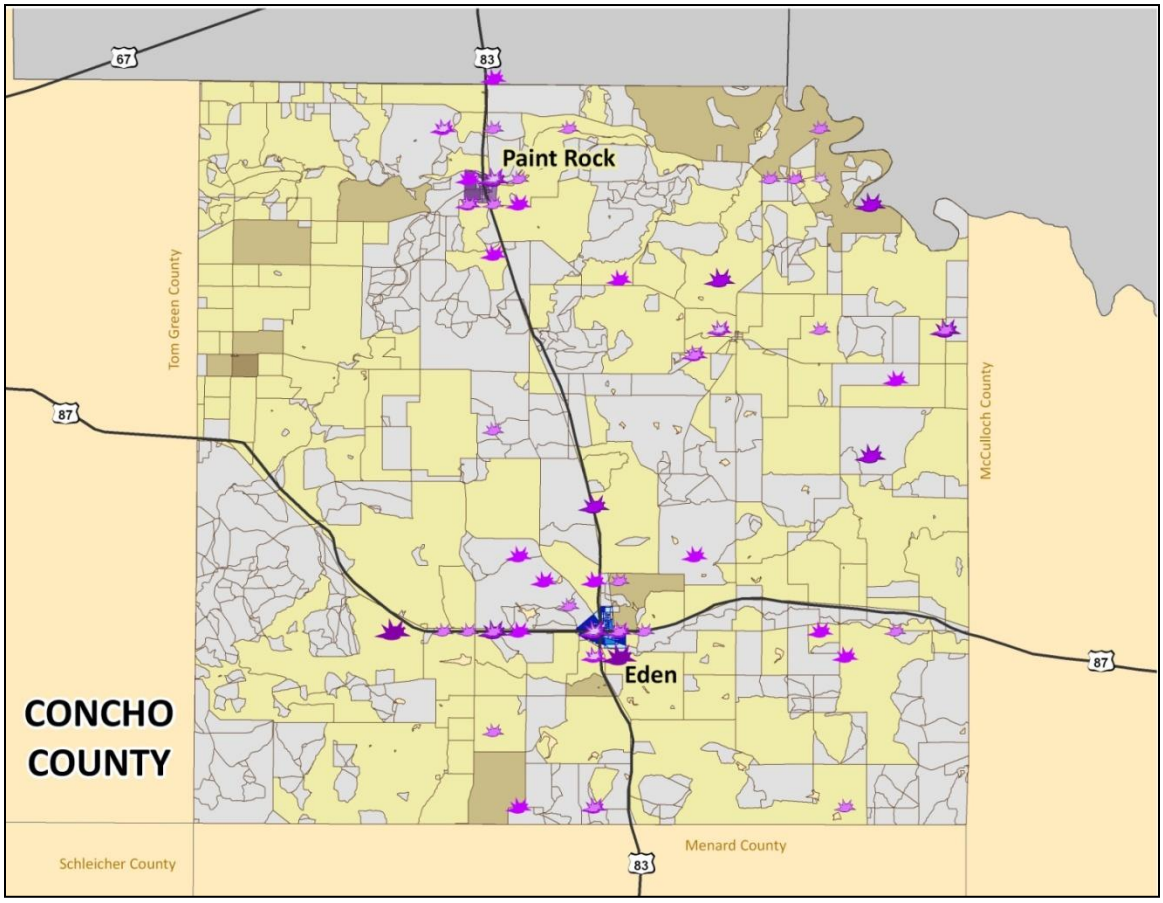
[1] Source: NOAA/NCDC Records

Figure 7-2. Historical Hail Events in Coke County[2]



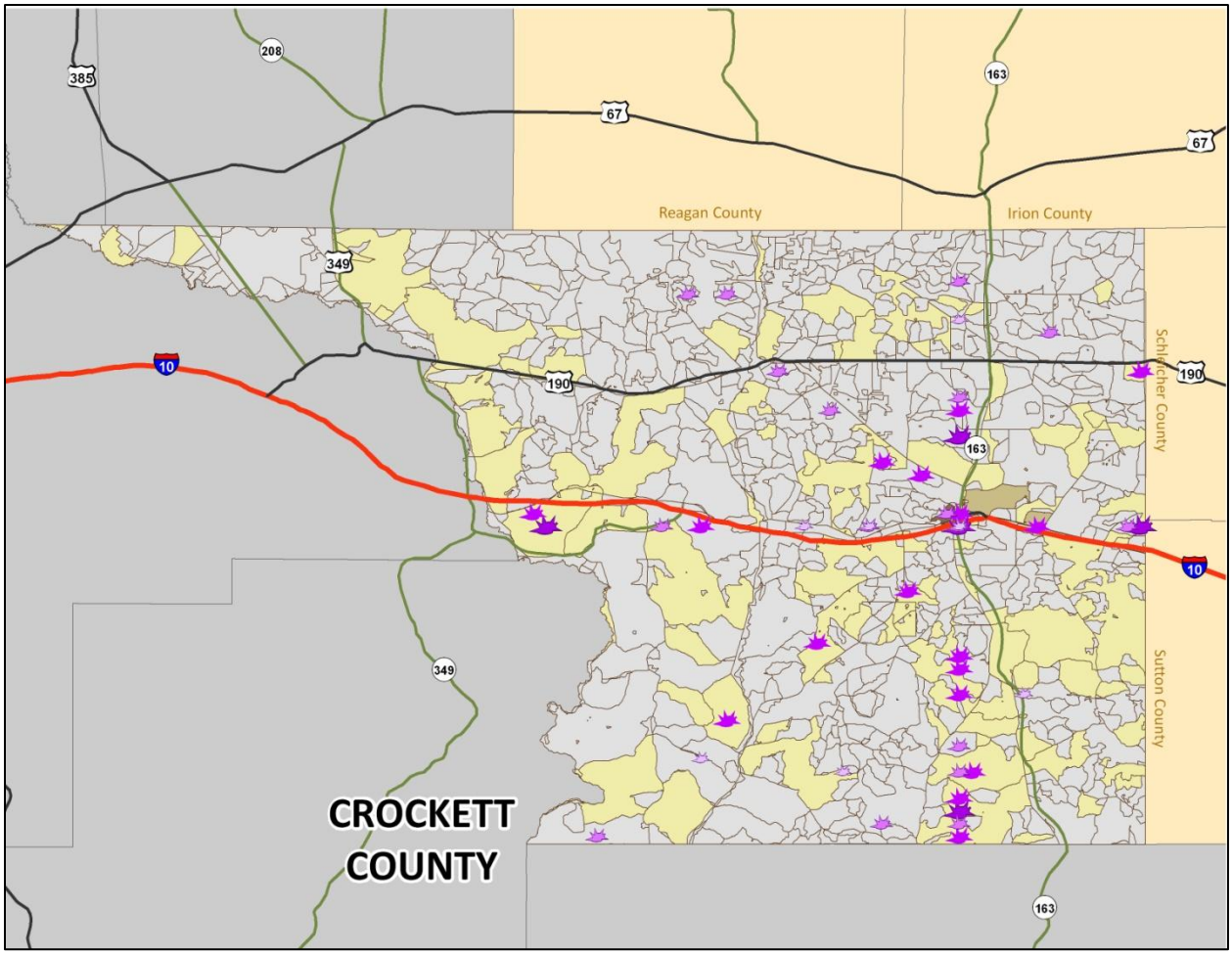
[2] Source: NOAA/NCDC Records

Figure 7-3. Historical Hail Events in Concho County[3]



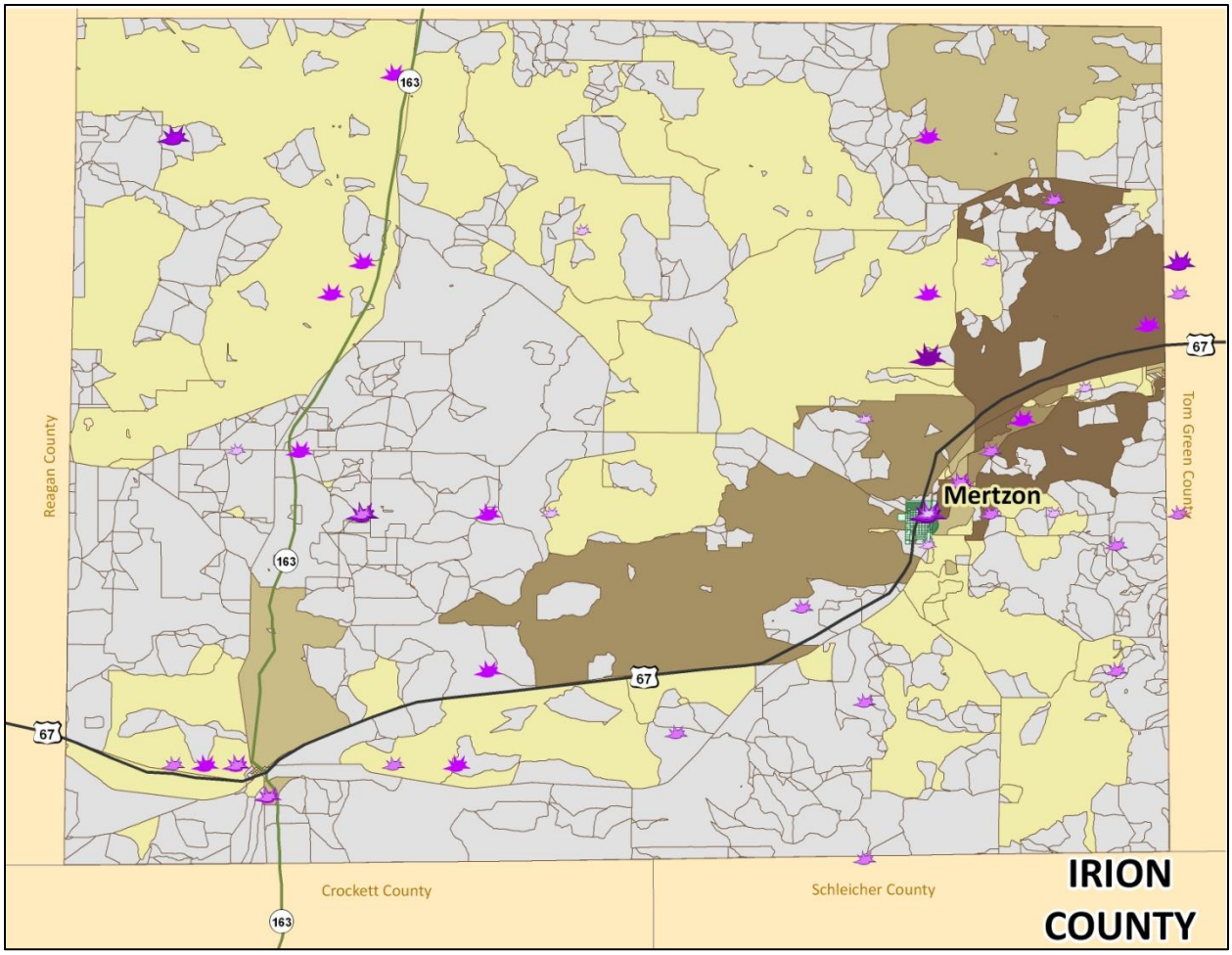
[3] Source: NOAA/NCDC Records

Figure 7-4. Historical Hail Events in Crockett County[4]



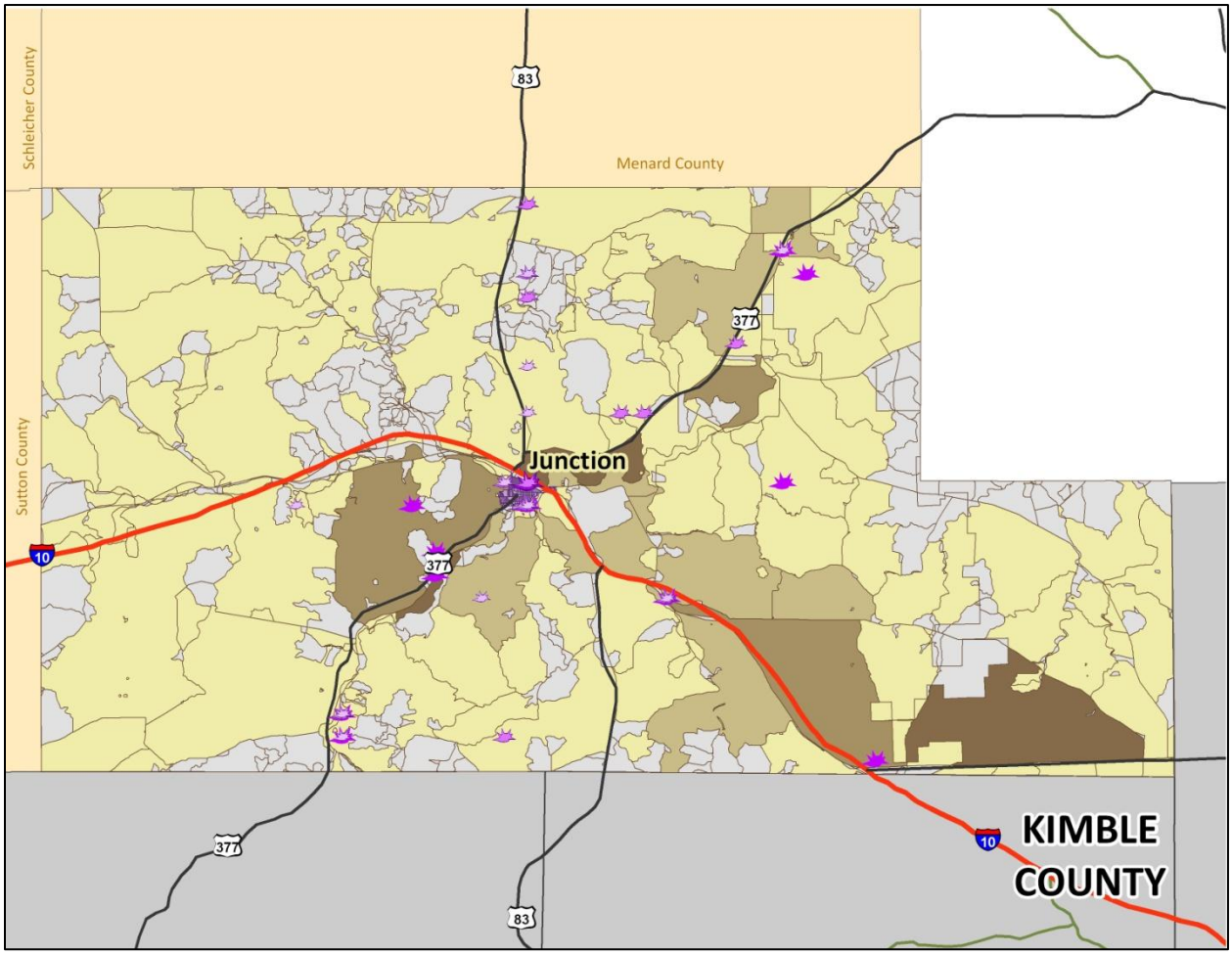
[4] Source: NOAA/NCDC Records

Figure 7-5. Historical Hail Events in Irion County[5]



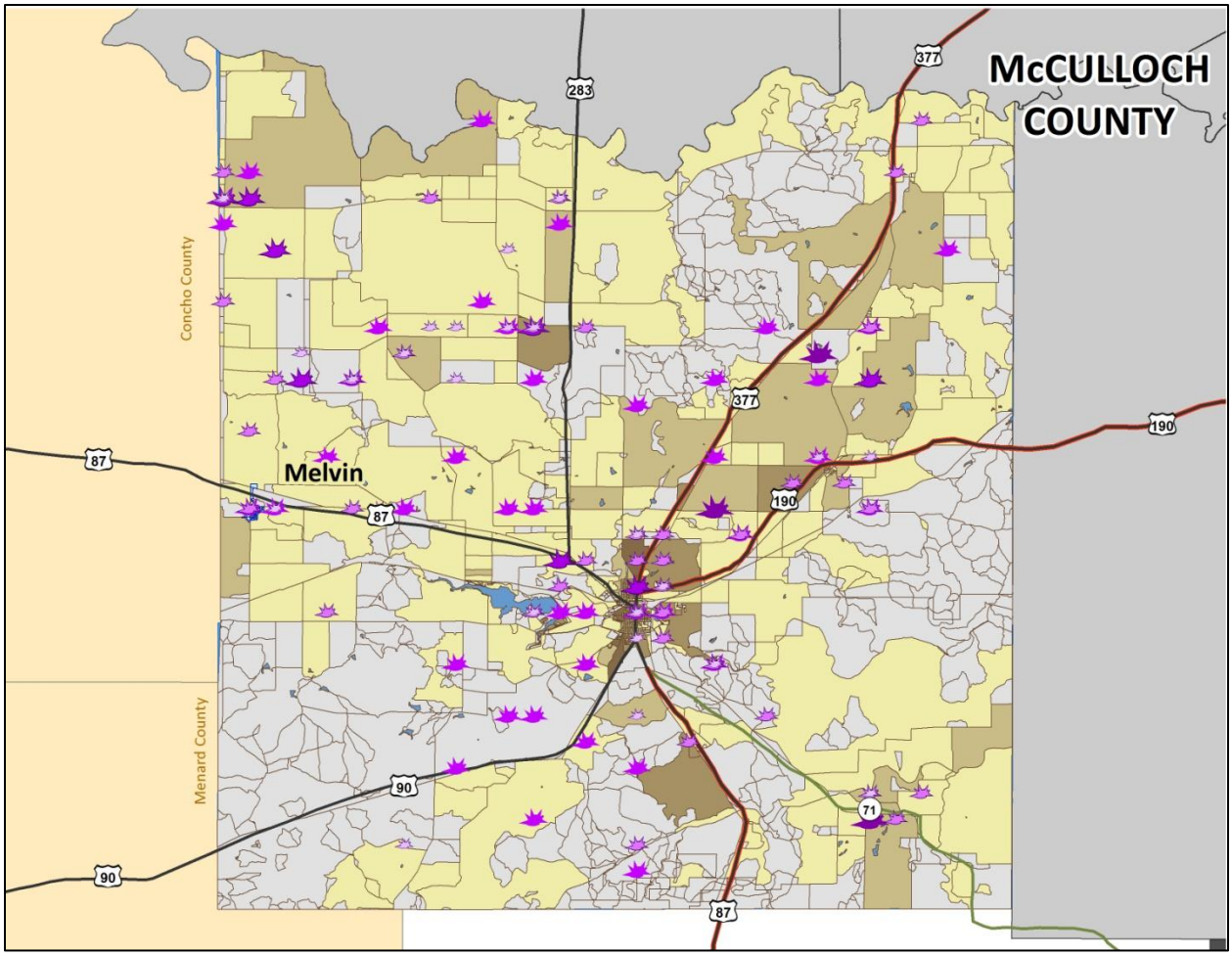
[5] Source: NOAA/NCDC Records

Figure 7-6. Historical Hail Events in Kimble County[6]



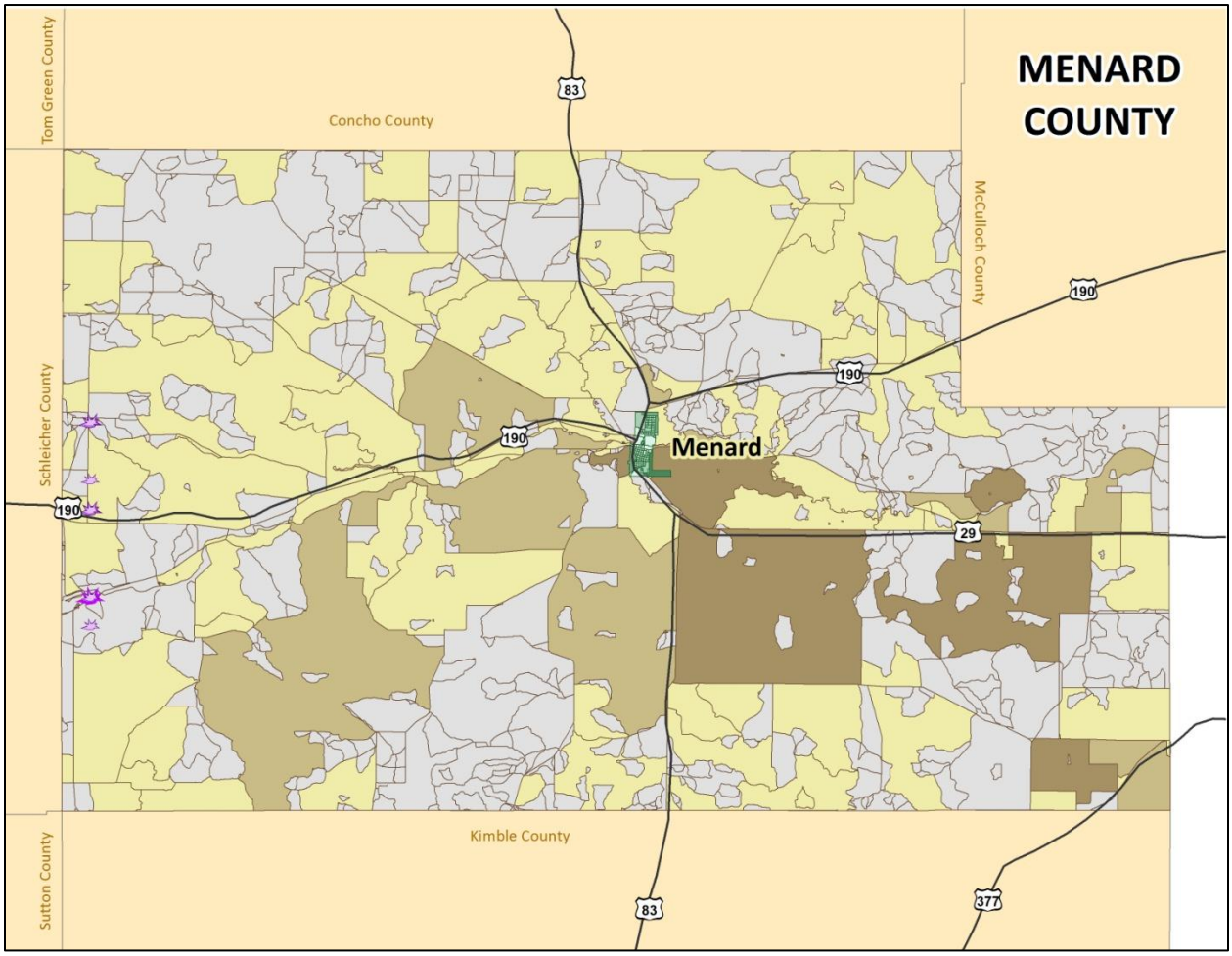
[6] Source: NOAA/NCDC Records

Figure 7-7. Historical Hail Events in McCulloch County[7]



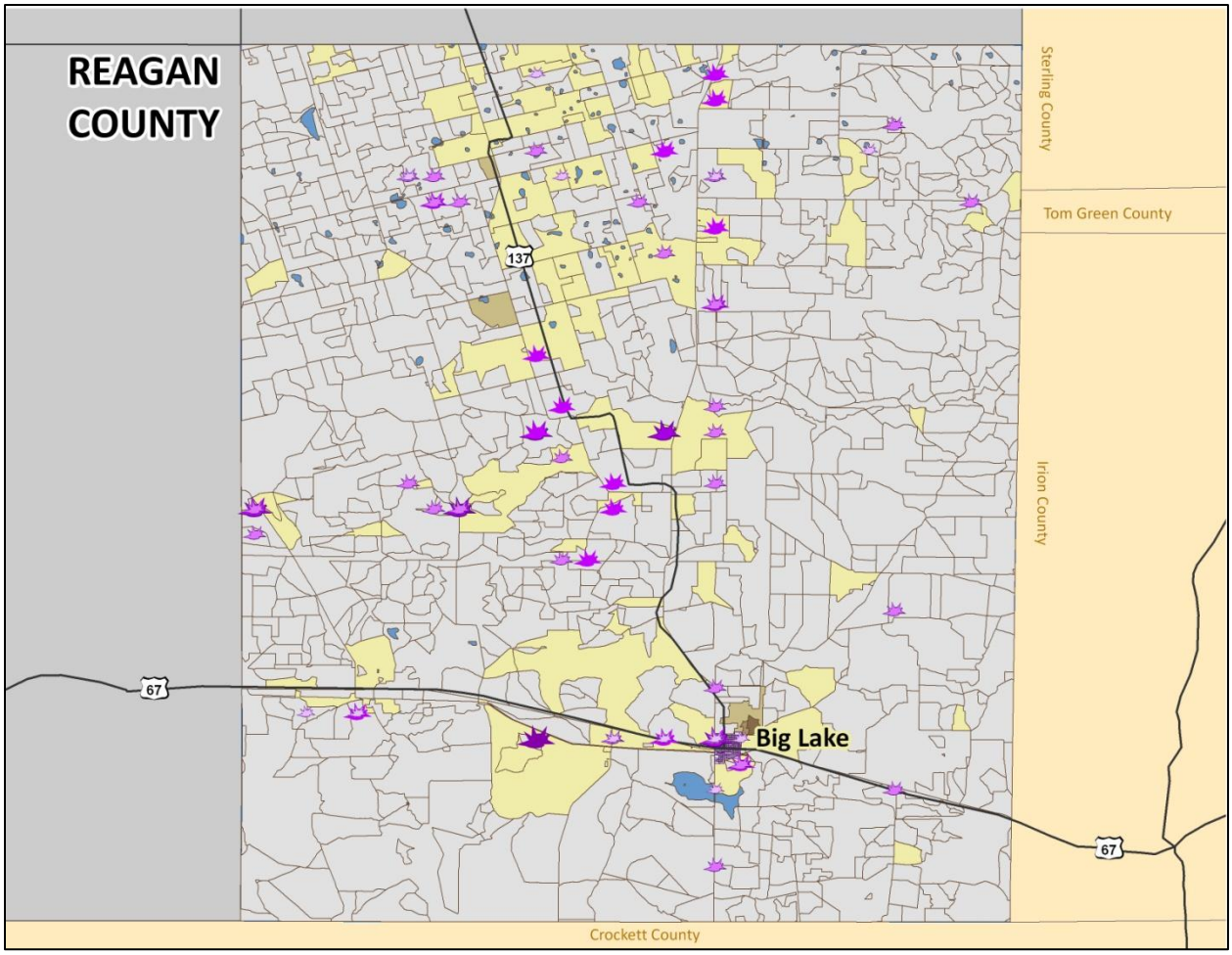
[7] Source: NOAA/NCDC Records

Figure 7-8. Historical Hail Events in Menard County[8]



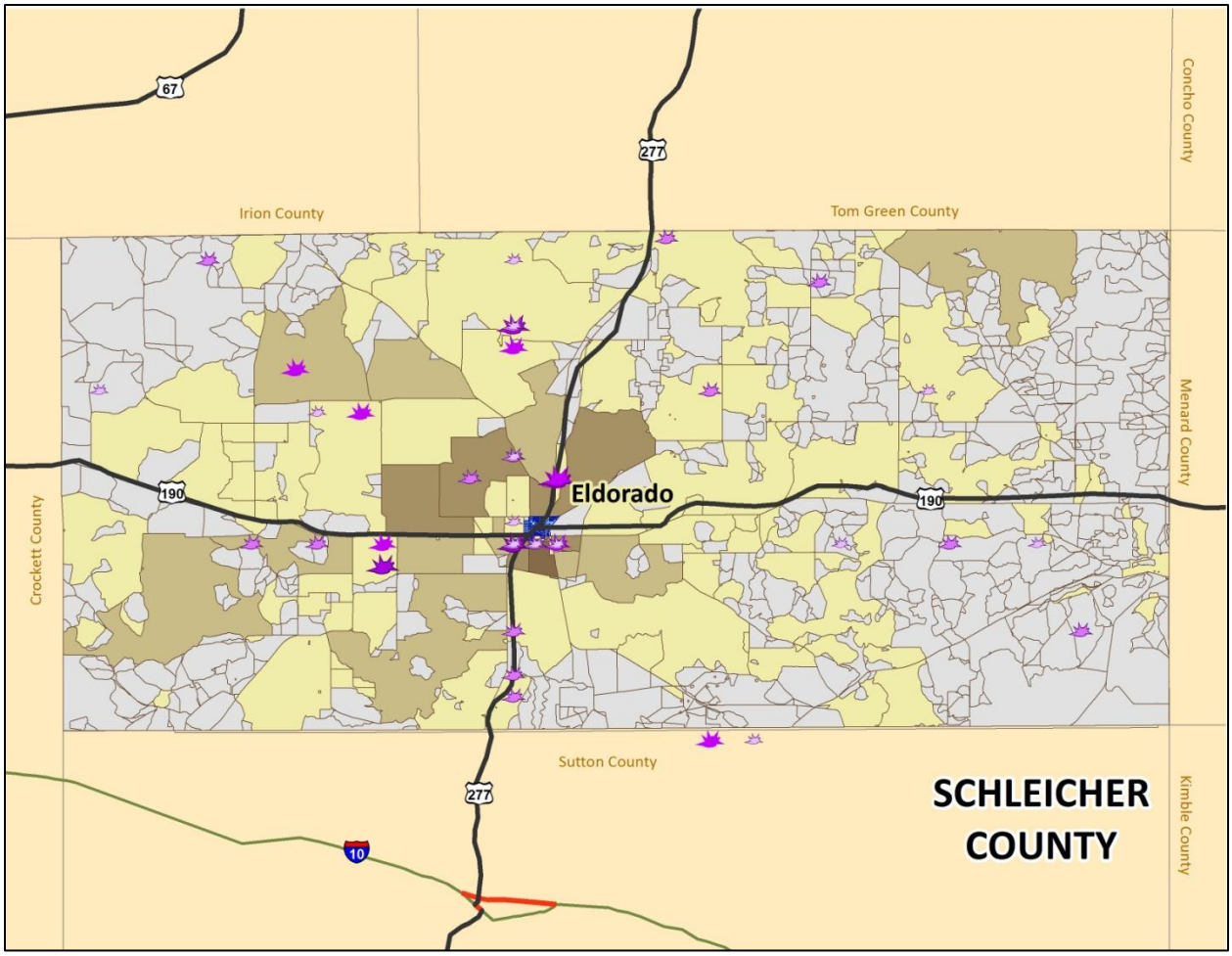
[8] Source: NOAA/NCDC Records

Figure 7-9. Historical Hail Events in Reagan County[9]



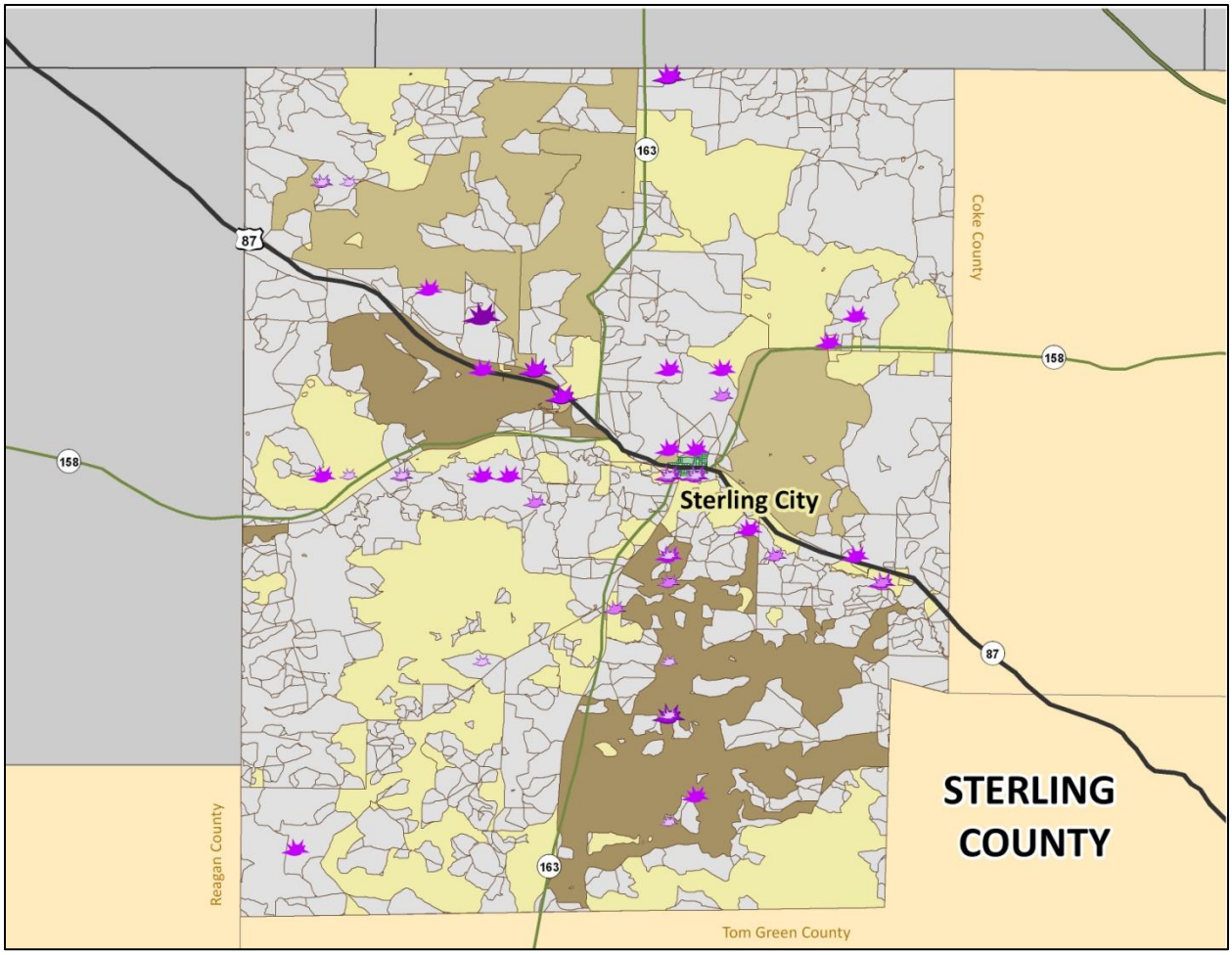
[9] Source: NOAA/NCDC Records

Figure 7-10. Historical Hail Events in Schleicher County[10]



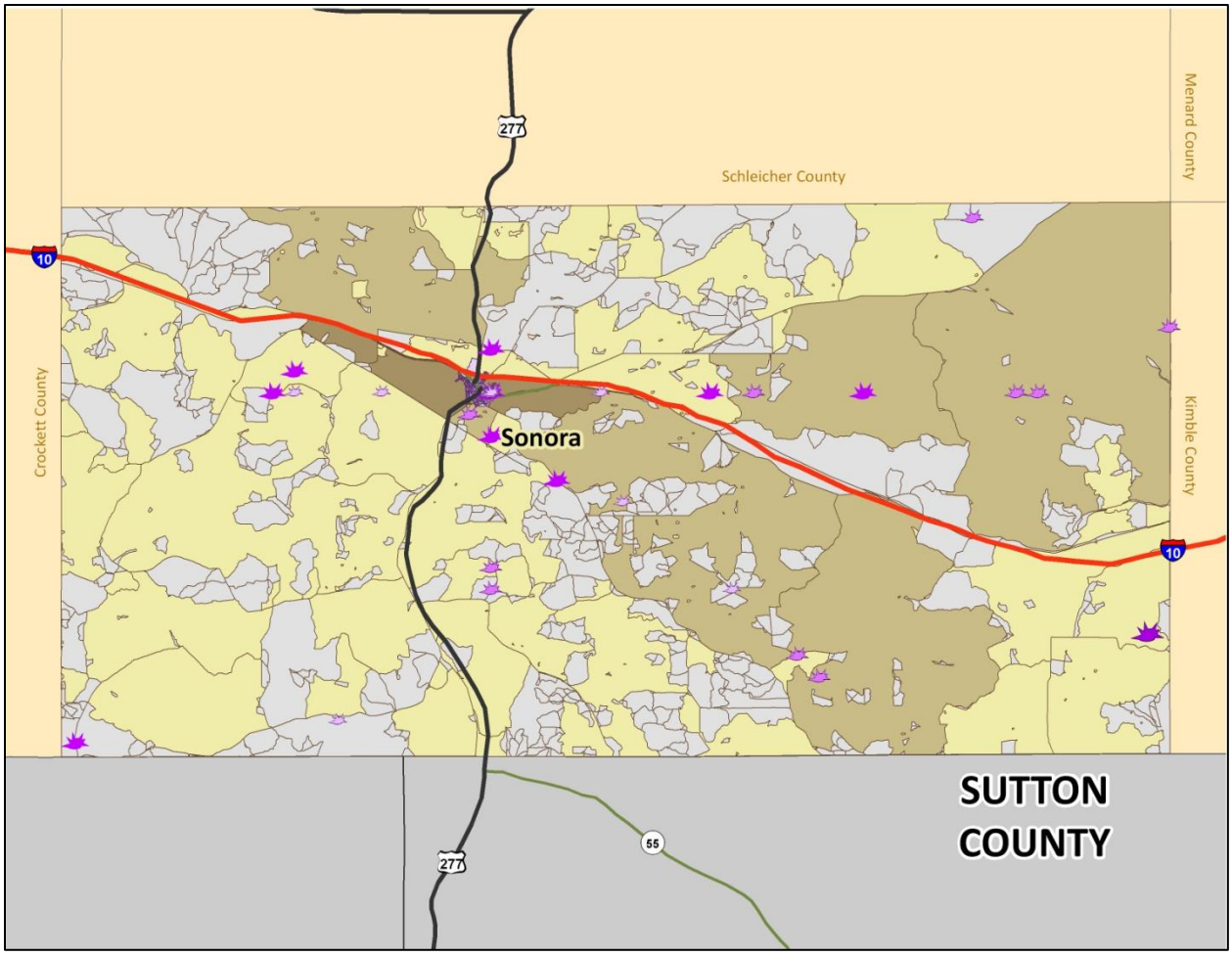
[10] Source: NOAA/NCDC Records

Figure 7-11. Historical Hail Events in Sterling County[11]



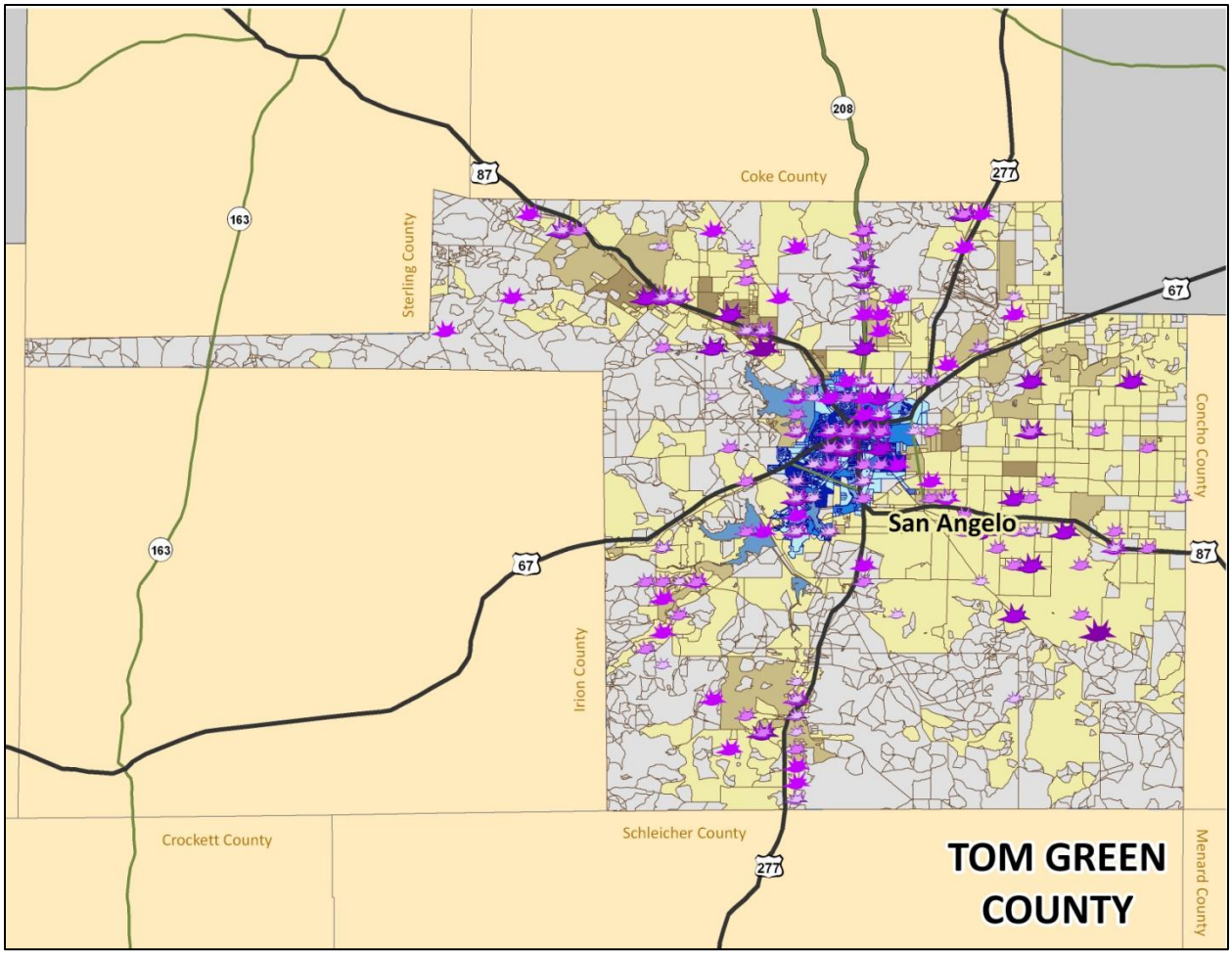
[11] Source: NOAA/NCDC Records

Figure 7-12. Historical Hail Events in Sutton County[12]



[12] Source: NOAA/NCDC Records

Figure 7-13. Historical Hail Events in Tom Green County[13]



[13] Source: NOAA/NCDC Records

Table 7-2 below, provides a breakdown of the historical hail impacts by jurisdiction consisting of the number of events reported to the NCDC and the maximum recorded size of the hail in each area. 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.

According to NCDC records, nearly 1,200 events were reported in the 60 year reporting period resulting in a frequency of return at over 20 events annually in the 12-county region. Each county averages a return period of one to two hail events per year.

Table 7-2. Historical Hail Impact by Jurisdiction

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM HAIL SIZE (INCHES)
Coke County	**110**	**4.25**
Bronte	7	1.75
Robert Lee	19	4.25
Uninc. Coke County	84	4.25
Concho County	**123**	**4.50**
Eden	18	3.00
Paint Rock	17	2.75
Uninc. Concho County	88	4.50
Crockett County	**64**	**3.00**
(No Incorporated Cities)	64	3.00
Irion County	**65**	**4.25**
Mertzon	0	0
Uninc. Irion County	65	4.25
Kimble County	**52**	**2.75**
Junction	13	1.75
Uninc. Kimble County	39	2.75
McCulloch County	**175**	**4.50**
Melvin	5	1.75
Uninc. McCulloch County	170	4.50
Menard County	**53**	**3.00**
Menard	0	0
Uninc. Menard County	53	3.00
Reagan County	**86**	**4.00**
Big Lake	15	3.00

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM HAIL SIZE (INCHES)
Uninc. Reagan County	71	4.00
Schleicher County	**59**	**5.00**
Eldorado	47	2.75
Uninc. Schleicher County	12	5.00
Sterling County	**72**	**4.00**
Sterling City	5	1.75
Uninc. Sterling County	67	4.00
Sutton County	**45**	**2.50**
Sonora	35	2.00
Uninc. Sutton County	10	2.50
Tom Green County	**353**	**5.00**
San Angelo	136	4.50
Uninc. Tom Green County	217	5.00
TOTALS FOR STUDY AREA[14]	**1,192**	**5.00**

Significant Past Events

5 May 1993 – Tom Green County
A severe thunderstorm moved over San Angelo and pounded the city with hail larger than baseball-size. There were numerous reports of damage of vehicles, roofs, windows, and aircraft at Mathis Field. The storm damaged over 800 vehicles and nearly 1,000 roofs, mainly in the southwestern part of the city. Insurance adjusters estimated the total damage at around $10 million. Fortunately, no injuries resulted from the storm.

4 May 2006 – Irion County
A hail swath with hail sizes ranging from golf ball to softball size hail formed and tracked across the Town of Mertzon and produced considerable damage to roofs and vehicles. Some of the larger hailstones penetrated roofs and severely damaged vehicles. A Mertzon resident was driving home when the hailstones hit her car as big as baseballs just outside of town. The large hail smashed a hole in her back windshield, punched holes in the hood, ripped the license plate off one of its screws and destroyed both side-view mirrors. At least 250 homes had roof damage.

[14] Totals for the study area may include values less than $5,000 for dollar amounts that are classified as "Negligible" in the table.

14 May 2008 – Concho County
A frontal boundary draped across West Central Texas, combined with an upper level storm system approaching from the west and a surface dry line triggered thunderstorms across the western Concho Valley and Big Country. As one supercell tracked east into Nolan County, storm spotters reported brief tornadoes. This storm continued east dropping hail the size of golf balls. Baseball size hail was reported just southeast of Abilene near the Town of Potosi. This storm continued to produce baseball size hail as it continued east into Callahan County. Another supercell developed just west of San Angelo dropping quarter size hail in Knickerbocker and at San Angelo Mathis Field. As this storm moved east, hail increased to golf ball size across Concho County. Wind gusts to 69 mph were recorded at the Brady Airport before equipment lost power. There was widespread tree and power line damage in Brady. A National Weather Service Storm Survey revealed an EF0 tornado caused damage to storage buildings, trees, and vegetation on the southeast side of Brady Lake.

Probability of Future Events

Based on the reported past history for the CVCOG Region, hail events are highly likely, meaning that an event is probable within the next year.

Vulnerability and Impact

Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping can also be damaged by hail.

On average, each county in the planning area can expect annual damages from hail events to total $4,000 or more. Loss estimates reported over the 60 year period were adjusted for inflation to 2009 dollars, and summarized in Table 7-3.

Table 7-3. Historic Loss Estimates, 1950-2010[15]

JURISDICTION	NUMBER OF REPORTED EVENTS	REPORTED LOSSES	ANNUALIZED LOSS (AL)
Coke County	**110**	**$291,393,000**	**$4,918 (negligible)**
Bronte	7	$54,912,000	$0
Robert Lee	19	$70,672,000	$1,008 (negligible)
Uninc. Coke County	84	$165,809,000	$3,910(negligible)

[15] Source: HAZUS-MH MR4 (exposure values) and NCDC (property and crop losses)

JURISDICTION	NUMBER OF REPORTED EVENTS	REPORTED LOSSES	ANNUALIZED LOSS (AL)
Concho County	**123**	**$187,173,000**	**$2,435(negligible)**
Eden	18	$92,364,000	$0
Paint Rock	17	$11,315,000	$914 (negligible)
Uninc. Concho County	88	$73,494,000	$1,521 (negligible)
Crockett County	**64**	**$264,006,000**	**$601 (negligible)**
(No Incorporated Cities)			
Irion County	**65**	**$112,315,000**	**$658 (negligible)**
Mertzon	0	$38,576,000	$0
Uninc. Irion County	65	$73,739,000	$658 (negligible)
Kimble County	**52**	**$345,134,000**	**$30 (negligible)**
Junction	13	$152,827,000	$0
Uninc. Kimble County	39	$195,307,000	$30 (negligible)
McCulloch County	**175**	**$459,543,000**	**$2,399 (negligible)**
Melvin	5	$8,875,000	$0
Uninc. McCulloch County	170	$450,68,000	$2,399 (negligible)
Menard County	**53**	**$148,418,000**	**$1,423 (negligible)**
Menard	0	$75,051,000	$0
Uninc. Menard County	53	$73,397,000	$1,423 (negligible)
Reagan County	**86**	**$178,789,000**	**$582 (negligible)**
Big Lake	15	$146,223,000	$0
Uninc. Reagan County	71	$27,827,743	$582 (negligible)
Schleicher County	**59**	**$163,684,000**	**$244 (negligible)**
Eldorado	47	$95,802,000	$244 (negligible)
Uninc. Schleicher County	12	$66,277,606	$0
Sterling County	**72**	**$89,092,000**	**$119 (negligible)**
Sterling City	5	$66,795,000	$0
Uninc. Sterling County	67	$18,645,655	$119 (negligible)
Sutton County	**45**	**$259,042,000**	**$2,485 (negligible)**
Sonora	35	$158,154,000	$2,485 (negligible)
Uninc. Sutton County	10	$19,012,957	$0
Tom Green County	**353**	**$6,412,709,000**	**$36,624**
San Angelo	136	$5,615,423,000	$31,105
Uninc. Tom Green County	217	$701,041,341	$5,519

JURISDICTION	NUMBER OF REPORTED EVENTS	REPORTED LOSSES	ANNUALIZED LOSS (AL)
TOTALS FOR STUDY AREA[16]	**1,192**	**$8,903,862,000**	**$52,488**

The severity of a hailstorms' impact is considered to be limited since these storms generally result in injuries treatable with first aid, critical facilities and services shut down for 24 hours or less, and less than ten percent of affected properties are destroyed or suffer major damage. Importantly, while the impact for hail may be considered limited, the entire region and assets are equally vulnerable. All existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted.

[16] Totals for the study area may include values less than $5,000 for dollar amounts that are classified as "Negligible" in the table.