THUNDERSTORM

Hazard Description

Thunderstorms are generally considered a common occurrence in the CVCOG Region. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. Despite the short time span, thunderstorms can be extremely dangerous, as they are often strong and fast in their approach and can be accompanied by flash flooding, lightning, hail, tornadoes, and high winds.

Location

Thunderstorms are geographically random, making it impossible to predict where they will strike. Thus, it is assumed that the CVCOG Region is uniformly exposed to the threat of thunderstorms.

Extent

A thunderstorm is measured in terms of intensity based on the strength of the wind speeds or significant winds associated with the thunderstorm event. Table 6-1 depicts intensity for thunderstorms according to wind magnitude published by the World Meteorological Organization (WMO).

Table 6-1. Beaufort Wind Scale[1]

FORCE	WIND (KNOTS)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

A thunderstorm event is typically defined by the National Climatic Data Center (NCDC) based on the intensity and magnitude of wind events associated with the thunderstorm, which can affect the planning area randomly. Because the magnitude of a thunderstorm does not take into account wind speeds from a tornado (for specific information on tornado, see Section 8), but specifically significant winds, the extent to which it can affect the planning area is a range from a Force 10 to a Force 12. On average, an intense wind event to be mitigated for each of the jurisdictions could have wind speeds over 50 miles per hour, a Force 9 from the Beaufort Wind Scale. Since the greatest wind speed recorded for the area is 87 knots (See Table 6-2), in preparation for a thunderstorm, the extent to be mitigated is a Force 12.

[1] Source: World Meteorological Organization

Historical Occurrences

Table 6-2 lists previous thunderstorm events as compiled by the NCDC. It is important to note that only thunderstorm events that have been reported have been factored into this risk assessment, and in most cases NCDC data is limited to severe thunderstorm events that are noteworthy for specific reasons (high winds, deaths, injuries, property or crop damages, lightning strikes). It is likely that a high number of thunderstorm occurrences have gone unreported over the past 50 years. Records retrieved from NCDC are reported for the jurisdiction named in Table 6-2. Remaining NCDC records for a county were considered in the total for county events and maximum recorded wind speed.

Table 6-2. Historical Thunderstorm Events by Jurisdiction, 1950-2010

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM WIND SPEED (KNOTS)
Coke County	**47**	**76**
Bronte	8	52
Robert Lee	23	76
Uninc. Coke County	16	-
Concho County	**36**	**65**
Eden	10	61
Paint Rock	7	61
Uninc. Concho County	19	-
Crockett County	**23**	**70**
(No Incorporated Cities)	23	70
Irion County	**21**	**80**
Mertzon	11	80
Uninc. Irion County	10	-
Kimble County	**26**	**84**
Junction	10	61
Uninc. Kimble County	16	-
McCulloch County	**55**	**70**
Melvin	3	61
Uninc. McCulloch County	52	-
Menard County	**22**	**87**
Menard	0	0
Uninc. Menard County	22	-
Reagan County	**19**	**70**

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM WIND SPEED (KNOTS)
Big Lake	4	52
Uninc. Reagan County	15	-
Schleicher County	**25**	**65**
Eldorado	20	65
Uninc. Schleicher County	5	-
Sterling County	**18**	**61**
Sterling City	11	61
Uninc. Sterling County	7	-
Sutton County	**11**	**80**
Sonora	4	55
Uninc. Sutton County	7	-
Tom Green County	**195**	**81**
San Angelo	55	75
Uninc. Tom Green County	140	-
TOTALS FOR STUDY AREA	**498**	**87**

Significant Past Events

29 May 1996 – Irion County
The storm brought wind, hail and a small tornado to the Town of Mertzon. Nearly every building was battered; 50 percent of all homes and 25 businesses were damaged in this 778-person town. Two homes were completely destroyed. There were no serious injuries other than people being cut by glass.

20 February 1997 – Tom Green County
Strong winds occurred in the San Angelo area during a heavy rain and flash flood event. A wind gust of 56 knots (65 mph) was recorded at Mathis Field and a gust of 69 mph was reported at Highland Range near O.C. Fisher Lake. The damaging winds then spread north from the City of San Angelo to the rural communities of Quail Valley and Grape Creek, where a gust of 65 mph was reported at Quail Valley. Storm damage in and around the City of San Angelo included downed fences, signs, and tree limbs. The drive-through section of a bank was severely damaged, and ATM machines destroyed, when the ceiling of the carport fell. Several other businesses suffered roof damage. There were also some power outages in the area.

27 May 2002- Coke County
The second severe thunderstorm of the day that moved across Robert Lee produced winds up to 80 mph causing damage to numerous houses and carports. Numerous severe thunderstorms formed over the Big Country, Concho Valley and the Heartland. Especially hard hit was the City of Robert Lee. Two severe thunderstorms moved through Robert Lee causing damage to homes and vehicles. The city, as well as other portions of Coke County, was without power for much of the night. There were several reports of high winds accompanied by hail to the size of tennis balls over eastern portions of the Concho Valley. There was also a tornado near the upper end of E.V. Spence reservoir. The tornado remained over open country and produced no damage.

Probability of Future Events

Available data was evaluated in order to provide an expected frequency of thunderstorms, potential loss estimates, a description of vulnerability, and a statement of impact of thunderstorm events.

The probability of occurrence for future thunderstorms in the CVCOG Region is highly likely, meaning it is likely of a storm event occurring within the next year. According to the NCDC reported historical occurrences, counties within the CVCOG Region experience a severe storm eight times a year. Given this regular frequency of occurrence, it can be expected that future thunderstorms will continue to threaten life and property throughout the planning area.

Vulnerability and Impact

Vulnerability is difficult to evaluate since thunderstorms can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of this event, all existing and future structures and facilities in the planning region could potentially be impacted and remain vulnerable to possible injury and/or property loss from lightning, hail and strong winds associated with thunderstorms.

Lightning damage can result in electrocution of humans and animals; vaporization of materials along the path of the strike; fire caused by the high temperature produced by the strike; and sudden power surges that can damage electrical and electronic equipment. Millions of dollars of direct and indirect damages result from lightning strikes on electric utility substations and distribution lines. While property damage is the major hazard associated with lightning, it should be noted that

lightning strikes kill nearly 100 people each year in the United States[2].

Impact quantified by reported thunderstorm events were estimated as described in Section 4, Risk Overview. Table 6-3 below summarizes the total reported property and crop losses by jurisdiction. Total losses reported when considered over the 60 year recording period provides an expected annual loss ranging from zero to over $1.6 million in damages sustained annually by one jurisdiction.

Table 6-3. Potential Annualized Losses by Jurisdiction[3]

JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)
Coke County	**$291,393,000**	**$21,838**
Bronte	$54,912,000	$372
Robert Lee	$70,672,000	$1,898
Uninc. Coke County	$165,809,000	$19,567
Concho County	**$187,173,000**	**$4,575**
Eden	$92,364,000	$3,048
Paint Rock	$11,315,000	$99
Uninc. Concho County	$73,494,000	$1,428
Crockett County	**$264,006,000**	**$1,634**
(No Incorporated Cities)		
Irion County	**$112,315,000**	**$253,255**
Mertzon	$38,576,000	$253,255
Uninc. Irion County	$73,739,000	$0
Kimble County	**$345,134,000**	**$5,560**
Junction	$152,827,000	$2,452
Uninc. Kimble County	$195,307,000	$3,108
McCulloch County	**$459,543,000**	**$15,597**
Melvin	$8,875,000	$176
Uninc. McCulloch County	$450,668,000	$15,421
Menard County	**$148,418,000**	**$9,948**
Menard	$75,051,000	$0
Uninc. Menard County	$73,397,000	$9,948
Reagan County	**$178,789,000**	**$83**
Big Lake	$146,223,000	$42

[2] National Weather Service

[3] Source: HAZUS-MH MR4 (exposure values) and NCDC (property and crop losses), values are in 2009 dollars

JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)
Uninc. Reagan County	$27,827,743	$40
Schleicher County	**$163,684,000**	**$17,401**
Eldorado	$95,802,000	$17,401
Uninc. Schleicher County	$66,277,606	$0
Sterling County	**$89,092,000**	**$1,564**
Sterling City	$66,795,000	$1,564
Uninc. Sterling County	$18,645,655	$0
Sutton County	**$259,042,000**	**$1,706**
Sonora	$158,154,000	$1,706
Uninc. Sutton County	$19,012,957	$0
Tom Green County	**$6,412,709,000**	**$1,600,319**
San Angelo	$5,615,423,000	$1,589,801
Uninc. Tom Green County	$701,041,341	$10,518
TOTALS FOR STUDY AREA	**$8,903,862,000**	**$1,933,479**

According to the available data for previous occurrences, high winds are common to the CVCOG area when accompanied by thunderstorms. Impact of thunderstorms in the region can be major; leaving more than 25 percent of property destroyed and the shutdown of critical facilities for two weeks. If another Beaufort event of Force 12 or higher were to occur, the area would be susceptible to widespread violence and destruction, that would include structural damage to structural facilities, especially roofs and windows. Injuries may also occur as a result of debris that is carried by strong gusts or twigs and branches that are broken off from the force of the wind. Traffic disruptions may also occur as traffic lights could be damaged or flying debris could cause accidents on the road. This would hinder the ability of critical services staff to travel to and from work.