

Attachment H

Compiled Meteorological and Climatology Data

(80 pages)

Please Note: The attachment is Section 2.3.1, Meteorological and Climatology Data, Revision 12a, dated March 16, 2007, from the APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

APPENDIX 2.3.1 METEOROLOGICAL AND CLIMATOLOGY DATA

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1.0 COLLECTION OF METEOROLOGICAL DATA

Meteorological data have been collected on the WCS property to meet two primary criteria. First, precipitation and evaporation data have been collected as required for determining a water balance for the proposed Site. Second, air quality data have been collected for analyzing potential releases of airborne radioactivity.

Data were collected from the on-site meteorological station operated by WCS as well as four additional stations in the area for use as a comparative analysis. The data collected by the on-site meteorological station operated by WCS (WCS station) is summarized in conjunction with data collected by the four regional weather stations listed below:

- WCS Station, located on the WCS property approximately ½ mile southwest of the proposed Site. The WCS station data was collected during the period from January 2000 through December 2005. The WCS Station data is tabulated in Tables 25 through 40 and Figures 8 through 17. WCS station has sensors at both the 2-meter (lower) and 10-meter (upper) height intervals.
- Andrews, Texas station located 50 km (31 miles) southeast of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1914–2006, using climate summaries updated on November 2, 2006 (WRCC, 2006). Data for this station are included in Tables 1 through 5 and Figure 1.
- Midland-Odessa Regional Airport, Texas station located 103 km (64 miles) southeast of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1948–2006, using climate summaries updated on November 2, 2006 (WRCC, 2006). Data for this station are provided in Tables 13 through 24 and Figures 2 through 7.
- Hobbs, New Mexico station located 32 km (20 miles) northwest of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1914–2006, using climate summaries updated on July 28, 2006 (WRCC, 2006). Data for this station are provided in Tables 6 through 9. While there are two weather stations for Hobbs, NM, the airport station has only limited data for a drier ten-year period. So the other weather station in Hobbs, NM (ID 29-4026), which has a much longer historical record (at least 70 years of recorded data), was included in the climate summaries.
- Jal, New Mexico station located 39 km (24 miles) southwest of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1919–2006, using climate summaries updated on July 28, 2006 (WRCC, 2006). Data for station are provided in Tables 10 through 12.

The Andrews, Midland, Hobbs, and Jal stations provide a long-term data set to compare against the 6-year data set collected at the WCS station. The Midland-Odessa station is the closest “First-Order” station to the proposed Site and is operated by the National Weather Service.

2.0 TEMPERATURE AND HUMIDITY

On-site measured air temperatures at 2 meters were consistent with an annual pattern of high summer temperatures and low fall (and winter) temperatures as indicated in Table 25 in this appendix. The highest and lowest temperatures recorded on-site between January of 2000 and December of 2005 was 107.9 degrees F and 3.7 degrees F, respectively. The mean monthly average temperatures on-site ranged from 82.0 degrees F in July to 42.2 degrees F in December. The lowest and highest relative humidity values recorded are from 30% in April (lower station) to 84% in October (lower station). The average monthly relative humidity ranged from 50% in April (upper station) to 70% in October (lower station). On-site humidity data for the upper and lower stations are summarized in Tables 27 and 28 respectively in this appendix.

Summaries of the historic record of temperature data, including minimums, maximums, and means, for the Andrews, Hobbs, Jal, and Midland meteorological stations are included in Tables 1, 6, 10, and 13 in this appendix.

3.0 PRECIPITATION

Precipitation data for the WCS station are presented in Table 26 and Table 26A in this appendix. The average annual rainfall at the proposed Site from January 2000 through December 2005 is 15.8 inches. The maximum on-site rainfall amount recorded for a 24-hour period is 4.45 inches. Minimum and maximum monthly rainfall totals recorded for this period were 0.1 and 8.8 inches, respectively. Snow and freezing rain data were not collected at the WCS station.

Summaries of the historic record of rainfall data are presented in Tables 2, 7, 11, and 14 of this appendix for the Andrews, Hobbs, Jal, and Midland meteorological stations. Average annual totals for the respective periods of record were 15.3 inches for Andrews, 16.0 inches for Hobbs, 12.5 inches for Jal, and 14.0 inches for Midland. These tables also present the minimum and maximum monthly totals. The data for all stations clearly demonstrated an annual rainfall in the region of less than 20 inches. The maximum 24-hour maximum rainfall amounts recorded at the four stations were 7.6, 7.5, 5.6, and 4.8 inches for Andrews, Hobbs, Jal, and Midland, respectively. By comparison, the 24-hour, 100-year storm event for the region, as calculated by NOAA, is 6.1 inches (Miller et al., 1973).

Annual snowfall averages were recorded at 3.4, 5.1, 3.5, and 4.1 inches for Andrews, Hobbs, Jal, and Midland, respectively. Summaries of the historic record of snow data, including averages, maximums, and minimums, for the Andrews, Hobbs, Jal, and Midland meteorological stations are included in Tables 3, 8, 12, and 15 in this appendix.

4.0 WIND AND ATMOSPHERIC STABILITY

Wind speed and direction data measured at the WCS station at the 2- (lower) and 10-meter height (upper) are presented in Figures 8 through 12 and 13 through 17 in this appendix, respectively. These data were used to develop joint frequency distributions of wind speed and direction. The data are summarized in Tables 29 through 33 and 35 through 39 in this appendix. Wind direction measured on-site is primarily from the south, south-southeast, and south-southwest, with the greatest percentage from the south. These sectors together account for 28.5 percent of hourly average wind data for the period. The next most frequent wind direction is east-northeast, northeast and east sectors accounting for 17.2%. Average wind speeds varied very little from month to month. The strongest average winds during the monitoring period were from the southerly directions with average wind speeds of 8 to 11.5 mph. The highest one-hour wind speeds occurred during September, blowing from the south-southeast direction. The highest recorded one-hour wind speeds were 32.8 and 43.6 miles per hour at the 2-meter and 10-meter height, respectively.

The Pasquill-Gifford method was used to estimate atmospheric stability at the site using the 2- and 10-meter wind data collected from the WCS station. The joint frequency distributions of wind speed and direction as a function of Pasquill stability class (A-F) are presented in Tables 34 and 40 for the 2-meter and 10-meter stations. Midland-Odessa Station using National Weather Service meteorological data for same joint frequency distributions is presented for the 10-meter height in Table 24. Five years of data (1999 through 2003) from the Midland-Odessa Station were used in comparison to the WCS station data collected between 2000 and 2005.

The most important and potentially adverse condition for atmospheric dispersion, stable (Class F) and low wind speeds 0.4 to 1.3 m/s (1.0 to 3.0 mi/hr) occur 2.2% of the time. The highest occurrences of Pasquill Class F and low wind speeds with respect to wind direction are toward the south. Mixing height limits recorded for Midland reported by Draxler and Heffter, (1981) ranged from 1592 feet in the winter to 2381 feet in the summer, with an annual average of 2014 feet.

5.0 NATURAL HAZARDS AND STORM ACTIVITY

Sand or dust storms typically occur in the winter or early spring when rotors (horizontal vortices) generated by strong westerly winds blowing across the region touch the ground. Most episodes of dust prevail for only six hours or less, when visibility is restricted to less than 0.5 mile. Statistical information is lacking on seasonal distribution intensity and duration of dust storms for the region. Recent data recorded in Lubbock, Texas (110 miles northeast of the site) indicates blowing dust an average of 12 times in the spring and 9 times during the remainder of the year (Bomar, 1995).

Two F2 Class (wind speed from 113 to 157 mph) tornadoes have been recorded in Andrews County, TX from 1880 through 1989 (Grazulis, 1993). According to data reported by NOAA, there has been two F2 Class and eight F1 Class (wind speed from 73 to 112 mph) tornadoes recorded in Andrews County since 1950. The NOAA web search for tornadoes is included as Attachment 5 in this appendix.

The mean number of annual thunderstorm days for Hobbs, NM and Midland, TX is 25.5 and 36.4 days, respectively (Weather Disk Association, Inc., 1990; NOAA, 2004). No records are

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maintained for the frequency of thunderstorms at the proposed Site. However, the actual number of events can be expected to be similar to these regional data.

Information regarding extreme natural events, such as flooding, thunderstorms, high winds, hail, and lightning, are presented in Tables 41 - 43 and Attachments 1 – 4. As previously mentioned, the NOAA web search for tornadoes is included as Attachment 5 in this appendix.

Table 1. Andrews, TX Period of Record Temperature Data (1914–2006)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.8	(44.2)	14.5	(58.1)	-1.0	(30.2)	29.4	(85.0)	-17.8	(0.0)
February	9.2	(48.6)	17.3	(63.2)	1.1	(33.9)	31.7	(89.0)	-18.3	(-1.0)
March	13.2	(55.8)	21.7	(71.1)	4.7	(40.4)	36.1	(97.0)	-13.3	(8.0)
April	18.2	(64.8)	26.9	(80.4)	9.5	(49.1)	37.2	(99.0)	-5.0	(23.0)
May	22.7	(72.9)	30.9	(87.7)	14.5	(58.1)	41.7	(107.0)	0.6	(33.0)
June	26.4	(79.6)	34.2	(93.6)	18.6	(65.5)	45.0	(113.0)	5.0	(41.0)
July	27.5	(81.5)	34.8	(94.6)	20.2	(68.3)	43.9	(111.0)	13.9	(57.0)
August	26.7	(80.1)	33.9	(93.0)	19.6	(67.2)	41.1	(106.0)	12.2	(54.0)
September	23.3	(74.0)	30.4	(86.8)	16.2	(61.1)	40.0	(104.0)	3.3	(38.0)
October	18.3	(64.9)	26.0	(78.8)	10.5	(50.9)	38.3	(101.0)	-5.6	(22.0)
November	11.7	(53.0)	19.2	(66.6)	4.1	(39.4)	33.9	(93.0)	-11.7	(11.0)
December	7.5	(45.5)	15.1	(59.1)	-0.1	(31.9)	27.2	(81.0)	-17.2	(1.0)
Annual	17.6	(63.7)	25.4	(77.8)	9.8	(49.7)	45.0	(113.0)	-18.3	(-1.0)

Source: (WRCC, 2006)

Table 2. Andrews, TX Period of Record Precipitation Data (1914–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.24 (0.49)	1.50 (0.59)	1.70 (0.67)	2.41 (0.95)	4.19 (1.65)	4.88 (1.92)	5.74 (2.26)	4.78 (1.88)	5.72 (2.25)	3.78 (1.49)	1.58 (0.62)	1.35 (0.53)	38.86 (15.30)
Maximum	11.40 (4.49)	6.40 (2.52)	8.46 (3.33)	13.67 (5.38)	14.91 (5.87)	18.06 (7.11)	30.23 (11.90)	14.00 (5.51)	20.17 (7.94)	16.16 (6.36)	8.00 (3.15)	7.80 (3.07)	78.66 (30.97)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.36 (0.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	19.30 (7.60)
Max 24 Hr	5.61 (2.21)	2.54 (1.00)	4.70 (1.85)	6.30 (2.48)	7.62 (3.00)	9.40 (3.70)	19.30 (7.60)	6.10 (2.40)	8.90 (3.50)	5.21 (2.05)	5.33 (2.10)	3.94 (1.55)	19.30 (7.60)

Source: (WRCC, 2006)

Table 3. Andrews, TX Period of Record Snow Data (1914–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	3.33 (1.31)	1.52 (0.60)	0.08 (0.03)	0.15 (0.06)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.08 (0.03)	1.45 (0.57)	1.98 (0.78)	8.59 (3.38)
Maximum	25.40 (10.00)	17.78 (7.00)	2.54 (1.00)	6.35 (2.50)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.54 (1.00)	35.56 (14.00)	13.97 (5.50)	52.07 (20.50)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

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Table 4. Andrews, TX Wind Data (1985–1989)

WIND DIRECTION**	WIND DIRECTION AND WIND SPEED DISTRIBUTION*						
	1 - 3 MPH***	4 - 7 MPH	8 - 12 MPH	13 - 18 MPH	19 - 24 MPH	> 24 MPH	TOTAL
N	0.46	1.69	1.72	1.39	0.50	0.11	5.87
NNE	0.24	0.76	1.29	1.21	0.43	0.12	4.05
NE	0.24	0.72	1.57	1.60	0.55	0.17	4.86
ENE	0.20	0.87	1.71	1.79	0.33	0.06	4.96
E	0.30	1.45	2.79	1.72	0.19	0.03	6.48
ESE	0.30	1.43	2.57	1.15	0.10	0.02	5.56
SE	0.45	2.23	2.88	1.68	0.18	0.02	7.45
SSE	0.63	2.82	3.75	3.19	0.63	0.08	11.10
S	0.91	4.00	6.43	7.29	1.45	0.11	20.19
SSW	0.40	1.77	2.96	1.92	0.21	0.01	7.26
SW	0.26	0.98	2.16	1.50	0.22	0.04	5.17
WSW	0.23	0.83	1.53	1.44	0.42	0.15	4.59
W	0.32	0.77	1.42	1.21	0.42	0.22	4.35
WNW	0.29	0.62	0.65	0.53	0.14	0.07	2.30
NW	0.34	0.88	0.85	0.47	0.12	0.07	2.72
NNW	0.33	1.17	0.84	0.56	0.17	0.04	3.11
SubTotal	5.88	22.98	35.12	28.64	6.05	1.34	100

* average of 5 years of data (1985–1989) available from TNRCC (TCEQ)

** wind is from the indicated direction

*** calms are included in this data range (winds are calm a total of 2.46 percent of the time)

Source: Environmental Analysis for Class C Radioactive Waste Processing and Storage Facility, Table 2.1-3

**Table 5. Andrews, TX Stability Table
(1985–1989)**

STABILITY CLASS	FREQUENCY (% OF TOTAL OCCURRENCE)
A	0.50
B	4.12
C	12.38
D	49.36
E	17.89
F	15.74

Note: Average of 5 years of data (1985–1989) available from TNRCC (TCEQ)

Source: Environmental Analysis for Class C Radioactive Waste Processing and Storage Facility, Table 2.1-4

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Table 6. Hobbs, NM Period of Record Temperature Data (1914–2006)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	5.7	(42.2)	13.6	(56.5)	-2.3	(27.9)	28.3	(83.0)	-21.7	(-7.0)
February	8.3	(47.0)	16.7	(62.0)	0.0	(32.0)	30.6	(87.0)	-18.9	(-2.0)
March	11.8	(53.2)	20.5	(68.9)	3.0	(37.4)	35.0	(95.0)	-17.2	(1.0)
April	16.7	(62.0)	25.4	(77.8)	7.9	(46.2)	36.7	(98.0)	-7.8	(18.0)
May	21.3	(70.4)	29.7	(85.5)	12.9	(55.3)	41.7	(107.0)	1.1	(34.0)
June	25.6	(78.1)	33.8	(92.9)	17.4	(63.4)	45.6	(114.0)	4.4	(40.0)
July	26.8	(80.2)	34.3	(93.8)	19.2	(66.6)	43.3	(110.0)	10.0	(50.0)
August	26.0	(78.8)	33.4	(92.1)	18.7	(65.6)	41.7	(107.0)	8.3	(47.0)
September	22.6	(72.7)	29.9	(85.9)	15.2	(59.4)	40.6	(105.0)	1.1	(34.0)
October	17.1	(62.8)	25.1	(77.1)	9.2	(48.5)	36.7	(98.0)	-11.1	(12.0)
November	10.6	(51.0)	18.4	(65.2)	2.7	(36.8)	31.1	(88.0)	-15.6	(4.0)
December	6.6	(43.9)	14.4	(58.0)	-1.4	(29.5)	28.9	(84.0)	-18.3	(-1.0)
Annual	16.6	(61.9)	24.6	(76.3)	8.6	(47.4)	45.6	(114.0)	-21.7	(-7.0)

Source: (WRCC, 2006)

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Table 7. Hobbs, NM Period of Record Precipitation Data (1914–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.14 (0.45)	1.14 (0.45)	1.40 (0.55)	2.03 (0.80)	5.21 (2.05)	4.78 (1.88)	5.36 (2.11)	6.02 (2.37)	6.60 (2.60)	4.04 (1.59)	1.47 (0.58)	1.42 (0.56)	40.59 (15.98)
Maximum	7.52 (2.96)	6.20 (2.44)	7.57 (2.98)	13.13 (5.17)	35.13 (13.83)	23.62 (9.30)	23.90 (9.41)	23.29 (9.17)	32.99 (12.99)	20.70 (8.15)	11.00 (4.33)	12.90 (5.08)	81.76 (32.19)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.10 (0.04)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	13.41 (5.28)
Max 24 Hr	3.07 (1.21)	3.53 (1.39)	5.08 (2.00)	4.75 (1.87)	13.21 (5.20)	11.23 (4.42)	11.35 (4.47)	11.30 (4.45)	19.05 (7.50)	14.22 (5.60)	9.65 (3.80)	4.72 (1.86)	19.05 (7.50)

Source: (WRCC, 2006)

Table 8. Hobbs, NM Period of Record Snow Data (1914–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	3.53 (1.39)	2.95 (1.16)	1.47 (0.58)	0.56 (0.22)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.28 (0.11)	1.63 (0.64)	2.49 (0.98)	12.90 (5.08)
Maximum	31.75 (12.50)	36.32 (14.30)	25.40 (10.00)	22.86 (9.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.43 (4.50)	41.91 (16.50)	24.13 (9.50)	68.83 (27.10)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

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Table 9. Hobbs, NM Particulate Matter Monitor Summary (2002–2003)

98% PM2.5 μG/m3	ANNUAL MEAN PM2.5 μG/m3	99% PM10 μG/m3	ANNUAL MEAN PM 10 μG/m3	YEAR	COUNTY
18	6.6	57	17	2002	Lea
13	5.5	61	23	2003	Lea

Source: (EPA, 2003b)

Table 10. Jal, NM Period of Record Temperature Data (1919–2006)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.7	(44.0)	15.5	(59.9)	-2.2	(28.1)	29.4	(85.0)	-23.9	(-11.0)
February	9.4	(49.0)	18.6	(65.4)	0.4	(32.7)	31.7	(89.0)	-22.2	(-8.0)
March	13.2	(55.8)	22.7	(72.8)	3.8	(38.8)	36.7	(98.0)	-17.8	(0.0)
April	18.1	(64.6)	27.5	(81.5)	8.7	(47.7)	38.9	(102.0)	-5.6	(22.0)
May	22.8	(73.0)	31.7	(89.0)	13.8	(56.8)	41.7	(107.0)	-2.2	(28.0)
June	26.8	(80.3)	35.2	(95.4)	18.4	(65.2)	44.4	(112.0)	4.4	(40.0)
July	27.9	(82.2)	35.8	(96.5)	20.0	(68.0)	44.4	(112.0)	10.0	(50.0)
August	27.1	(80.8)	34.9	(94.8)	19.3	(66.7)	43.3	(110.0)	10.0	(50.0)
September	23.6	(74.5)	31.5	(88.7)	15.7	(60.3)	42.2	(108.0)	2.8	(37.0)
October	18.1	(64.6)	26.8	(80.3)	9.4	(49.0)	37.8	(100.0)	-6.7	(20.0)
November	11.5	(52.7)	20.2	(68.4)	2.7	(36.8)	31.7	(89.0)	-13.3	(8.0)
December	7.3	(45.2)	16.2	(61.1)	-1.5	(29.3)	28.9	(84.0)	-19.4	(-3.0)
Annual	17.7	(63.9)	26.4	(79.5)	9.1	(48.3)	44.4	(112.0)	-23.9	(-11.0)

Source: (WRCC, 2006)

Table 11. Jal, NM Period of Record Precipitation Data (1919–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.04 (0.41)	1.27 (0.50)	1.02 (0.40)	1.45 (0.57)	3.61 (1.42)	3.48 (1.37)	4.34 (1.71)	4.70 (1.85)	4.88 (1.92)	3.48 (1.37)	1.24 (0.49)	1.22 (0.48)	31.72 (12.49)
Maximum	8.38 (3.30)	6.91 (2.72)	4.47 (1.76)	8.00 (3.15)	20.35 (8.01)	14.88 (5.86)	17.35 (6.83)	21.16 (8.33)	19.41 (7.64)	17.53 (6.90)	10.36 (4.08)	11.05 (4.35)	63.55 (25.02)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	6.22 (2.45)
Max 24 Hr	2.41 (0.95)	4.45 (1.75)	3.05 (1.20)	5.59 (2.20)	8.81 (3.47)	5.97 (2.35)	7.09 (2.79)	10.13 (3.99)	10.16 (4.00)	14.33 (5.64)	5.99 (2.36)	5.74 (2.26)	14.33 (5.64)

Source: (WRCC, 2006)

Table 12. Jal, NM Period of Record Snow Data (1919–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	3.10 (1.22)	1.80 (0.71)	0.74 (0.29)	0.03 (0.01)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.08 (0.03)	1.37 (0.54)	1.85 (0.73)	8.97 (3.53)
Maximum	21.84 (8.60)	17.53 (6.90)	13.97 (5.50)	1.27 (0.50)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.54 (1.00)	40.64 (16.00)	20.32 (8.00)	41.91 (16.50)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

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Table 13. Midland, TX Period of Record Temperature Data (1948–2006)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.5	(43.7)	14.1	(57.3)	-1.1	(30.1)	28.9	(84.0)	-22.2	(-8.0)
February	8.9	(48.1)	16.7	(62.0)	1.2	(34.1)	32.2	(90.0)	-23.9	(-11.0)
March	12.9	(55.2)	21.0	(69.8)	4.8	(40.6)	35.0	(95.0)	-12.8	(9.0)
April	17.9	(64.2)	26.0	(78.8)	9.7	(49.5)	38.3	(101.0)	-6.7	(20.0)
May	22.7	(72.9)	30.4	(86.7)	15.1	(59.1)	42.2	(108.0)	1.1	(34.0)
June	26.7	(80.0)	33.9	(93.0)	19.4	(66.9)	46.7	(116.0)	8.3	(47.0)
July	27.7	(81.9)	34.7	(94.5)	20.8	(69.4)	44.4	(112.0)	11.7	(53.0)
August	27.2	(80.9)	34.1	(93.3)	20.3	(68.5)	41.7	(107.0)	12.2	(54.0)
September	23.6	(74.4)	30.3	(86.6)	16.7	(62.1)	41.7	(107.0)	2.2	(36.0)
October	18.2	(64.7)	25.3	(77.6)	10.9	(51.7)	37.8	(100.0)	-4.4	(24.0)
November	11.4	(52.5)	18.8	(65.9)	3.9	(39.1)	32.2	(90.0)	-10.6	(13.0)
December	7.3	(45.2)	14.9	(58.8)	-0.2	(31.7)	29.4	(85.0)	-18.3	(-1.0)
Annual	17.6	(63.6)	25.0	(77.0)	10.1	(50.2)	46.7	(116.0)	-23.9	(-11.0)

Source: (WRCC, 2006)

Table 14. Midland, TX Period of Record Precipitation Data (1948–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.35 (0.53)	1.63 (0.64)	1.32 (0.52)	1.83 (0.72)	4.85 (1.91)	3.96 (1.56)	4.45 (1.75)	4.14 (1.63)	4.95 (1.95)	4.11 (1.62)	1.68 (0.66)	1.27 (0.50)	35.56 (14.00)
Maximum	9.30 (3.66)	6.48 (2.55)	7.26 (2.86)	6.20 (2.44)	19.38 (7.63)	10.06 (3.96)	21.59 (8.50)	11.25 (4.43)	24.64 (9.70)	18.92 (7.45)	13.77 (5.42)	8.38 (3.30)	81.61 (32.13)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 (0.02)	0.03 (0.01)	0.00 (0.00)	0.13 (0.05)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.68 (4.60)
Max 24 Hr	2.84 (1.12)	3.10 (1.22)	5.49 (2.16)	4.11 (1.62)	12.07 (4.75)	7.80 (3.07)	10.41 (4.10)	6.12 (2.41)	8.36 (3.29)	9.12 (3.59)	4.50 (1.77)	3.15 (1.24)	12.07 (4.75)

Source: (WRCC, 2006)

Table 15. Midland, TX Period of Record Snow Data (1948–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	4.04 (1.59)	1.93 (0.76)	0.84 (0.33)	0.13 (0.05)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.03 (0.01)	0.94 (0.37)	2.44 (0.96)	10.34 (4.07)
Maximum	22.86 (9.00)	9.91 (3.90)	14.99 (5.90)	5.08 (2.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.52 (0.60)	18.29 (7.20)	24.89 (9.80)	30.73 (12.10)
Max 24 Hr	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Source: (WRCC, 2006)

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Table 16. Midland, TX Six-Year Temperature Data (2000–2005)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	7.6	(45.7)	14.5	(58.1)	0.6	(33.1)	28.3	(83.0)	-17.8	(0.0)
February	8.9	(48.0)	15.8	(60.4)	1.9	(35.5)	28.9	(84.0)	-18.3	(-1.0)
March	13.0	(55.4)	20.4	(68.7)	5.6	(42.0)	31.1	(88.0)	-13.3	(8.0)
April	18.6	(65.5)	26.6	(79.8)	10.6	(51.1)	35.6	(96.0)	-5.0	(23.0)
May	24.0	(75.2)	31.7	(89.0)	16.3	(61.4)	42.2	(108.0)	0.6	(33.0)
June	27.2	(81.0)	33.9	(93.1)	20.4	(68.7)	40.6	(105.0)	5.0	(41.0)
July	28.5	(83.3)	35.2	(95.3)	21.8	(71.3)	41.1	(106.0)	13.9	(57.0)
August	27.8	(82.0)	34.3	(93.8)	21.2	(70.1)	41.1	(106.0)	12.2	(54.0)
September	24.3	(75.8)	31.1	(88.0)	17.5	(63.5)	40.0	(104.0)	3.3	(38.0)
October	18.2	(64.8)	24.3	(75.7)	12.1	(53.8)	38.3	(101.0)	-5.6	(22.0)
November	11.1	(51.9)	17.5	(63.5)	4.6	(40.3)	30.6	(87.0)	-11.7	(11.0)
December	6.7	(44.1)	13.9	(57.1)	-0.5	(31.1)	28.3	(83.0)	-17.2	(1.0)
Annual	18.0	(64.4)	24.9	(76.9)	11.0	(51.8)	42.2	(108.0)	-18.3	(-1.0)

Source: (NOAA, 2006)

Table 17. Midland, TX Six-Year Precipitation Data (2000–2005)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.14 (0.45)	2.26 (0.89)	1.85 (0.73)	1.04 (0.41)	3.07 (1.21)	3.48 (1.37)	2.79 (1.10)	3.78 (1.49)	3.15 (1.24)	5.54 (2.18)	3.56 (1.40)	0.71 (0.28)	32.36 (12.74)
Maximum	1.75 (0.69)	3.84 (1.51)	3.38 (1.33)	4.78 (1.88)	7.98 (3.14)	7.98 (3.14)	6.40 (2.52)	8.74 (3.44)	13.49 (5.31)	9.50 (3.74)	13.77 (5.42)	2.67 (1.05)	57.02 (22.45)
Minimum	0.20 (0.08)	0.00 (0.00)	0.43 (0.17)	0.00 (0.00)	0.25 (0.10)	0.03 (0.01)	0.00 (0.00)	0.15 (0.06)	0.00 (0.00)	0.08 (0.03)	0.03 (0.01)	0.00 (0.00)	23.75 (9.35)
Max 24 Hr	0.89 (0.35)	1.57 (0.62)	1.80 (0.71)	3.38 (1.33)	4.72 (1.86)	2.67 (1.05)	4.04 (1.59)	5.74 (2.26)	3.15 (1.24)	2.95 (1.16)	3.94 (1.55)	2.13 (0.84)	5.74 (2.26)

Source: (NOAA, 2006)

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Table 18. Midland, TX Wind Data (1999)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002352	0.011441	0.012083	0.010372	0.003529	0.001390	0.041168
NNE	0.002352	0.008234	0.010158	0.013045	0.004812	0.000962	0.039564
NE	0.001604	0.005881	0.013794	0.017216	0.006737	0.001390	0.046621
ENE	0.001711	0.008982	0.015719	0.018392	0.005346	0.000535	0.050684
E	0.001604	0.010051	0.018071	0.012725	0.002459	0.000214	0.045124
ESE	0.002139	0.011976	0.017964	0.012725	0.002673	0.000428	0.047904
SE	0.004812	0.018499	0.025663	0.020958	0.004812	0.001925	0.076668
SSE	0.003101	0.028336	0.040740	0.039991	0.012404	0.003956	0.128529
S	0.002887	0.022883	0.053144	0.063195	0.013901	0.001604	0.157613
SSW	0.001818	0.015932	0.037639	0.028122	0.003315	0.000214	0.087040
SW	0.002139	0.014542	0.028978	0.013259	0.001925	0.000535	0.061377
WSW	0.001925	0.008661	0.013580	0.013473	0.004919	0.002139	0.044696
W	0.001604	0.006630	0.008768	0.009196	0.005133	0.003529	0.034859
WNW	0.002139	0.007699	0.007592	0.007378	0.001497	0.001283	0.027588
NW	0.001497	0.007378	0.011441	0.005453	0.001176	0.001069	0.028015
NNW	0.002566	0.009089	0.009303	0.008340	0.004384	0.002780	0.036463
Total	0.036249	0.196215	0.324636	0.293841	0.079021	0.023952	

Frequency of Calm Winds: 4.61%
Average Wind Speed: 10.15 Knots
Source: (NOAA, 2004)

Table 19. Midland, TX Wind Data (2000)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002100	0.009494	0.013968	0.008855	0.002739	0.001461	0.038616
NNE	0.001552	0.009951	0.012781	0.016250	0.005112	0.002282	0.047928
NE	0.001278	0.007029	0.013968	0.019810	0.007029	0.002921	0.052036
ENE	0.001278	0.006208	0.023827	0.020267	0.005204	0.000639	0.057422
E	0.001369	0.011137	0.024192	0.012598	0.001643	0.000822	0.051762
ESE	0.001187	0.013968	0.017710	0.009220	0.001187	0.000548	0.043820
SE	0.002556	0.021727	0.029487	0.024283	0.003834	0.000822	0.082710
SSE	0.002465	0.024557	0.047563	0.056053	0.014241	0.002100	0.146978
S	0.001917	0.016067	0.049023	0.071207	0.015246	0.003834	0.157294
SSW	0.001917	0.016706	0.034873	0.031313	0.003469	0.000365	0.088643
SW	0.002282	0.014241	0.020449	0.011959	0.001004	0.000183	0.050119
WSW	0.001735	0.009312	0.012142	0.010316	0.002647	0.001826	0.037977
W	0.001461	0.007395	0.010590	0.012142	0.005934	0.005386	0.042907
WNW	0.001095	0.005204	0.006025	0.005204	0.002556	0.001735	0.021819
NW	0.001187	0.005934	0.006664	0.004382	0.001187	0.000274	0.019628
NNW	0.000913	0.005843	0.007395	0.004656	0.001278	0.000091	0.020175
Total	0.026292	0.184773	0.330655	0.318514	0.074311	0.025288	

Frequency of Calm Winds: 4.02%
Average Wind Speed: 10.36 Knots
Source: (NOAA, 2004)

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Table 20. Midland, TX Wind Data (2001)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002898	0.011311	0.009067	0.005141	0.001309	0.000841	0.030566
NNE	0.002056	0.009534	0.011124	0.009628	0.004206	0.001776	0.038325
NE	0.002150	0.007665	0.010376	0.018415	0.005982	0.002150	0.046738
ENE	0.001122	0.008506	0.014395	0.015050	0.003178	0.000561	0.042812
E	0.002243	0.014115	0.023930	0.015984	0.002337	0.000280	0.058890
ESE	0.003459	0.018321	0.025425	0.016826	0.001215	0.000654	0.065900
SE	0.003178	0.023930	0.039914	0.031221	0.005422	0.000280	0.103945
SSE	0.003646	0.030566	0.053842	0.057581	0.011404	0.003178	0.160217
S	0.002617	0.019069	0.050757	0.067396	0.013460	0.001963	0.155263
SSW	0.001870	0.016732	0.032156	0.022715	0.001963	0.000280	0.075715
SW	0.003178	0.012245	0.019630	0.013274	0.000748	0.000093	0.049168
WSW	0.001402	0.009815	0.012245	0.012713	0.004206	0.001028	0.041410
W	0.001402	0.007945	0.009254	0.009908	0.005609	0.003646	0.037764
WNW	0.001402	0.007198	0.006824	0.003739	0.001402	0.000467	0.021032
NW	0.003365	0.008132	0.006169	0.003646	0.001215	0.000000	0.022528
NNW	0.001496	0.008974	0.007758	0.003926	0.001122	0.000467	0.023743
Total	0.037484	0.214059	0.332866	0.307160	0.064778	0.017667	

Frequency of Calm Winds: 2.60%

Average Wind Speed: 9.86 Knots

Source: (NOAA, 2004)

Table 21. Midland, TX Wind Data (2002)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002551	0.008534	0.014911	0.008927	0.002452	0.000883	0.038258
NNE	0.002158	0.006867	0.011674	0.014518	0.004414	0.003630	0.043261
NE	0.001864	0.009123	0.015990	0.018737	0.007259	0.002747	0.055719
ENE	0.001570	0.007063	0.021581	0.015597	0.003531	0.000589	0.049931
E	0.002354	0.011379	0.027663	0.013341	0.001079	0.000294	0.056111
ESE	0.001471	0.014224	0.028840	0.018344	0.000785	0.000000	0.063665
SE	0.002158	0.017265	0.033843	0.026879	0.004316	0.000490	0.084952
SSE	0.003041	0.021679	0.038748	0.049147	0.012556	0.002943	0.128115
S	0.003041	0.017756	0.050226	0.067098	0.012851	0.000785	0.151756
SSW	0.001668	0.015107	0.034040	0.031685	0.002943	0.000098	0.085541
SW	0.003041	0.016676	0.023641	0.014420	0.002158	0.000000	0.059937
WSW	0.003139	0.012655	0.013047	0.010202	0.003531	0.001766	0.044340
W	0.003041	0.011477	0.007455	0.006867	0.003728	0.002452	0.035021
WNW	0.002649	0.004512	0.005690	0.004709	0.001373	0.000196	0.019129
NW	0.002060	0.008240	0.007750	0.005297	0.001275	0.000196	0.024819
NNW	0.001471	0.007357	0.008142	0.007259	0.002158	0.000785	0.027173
Total	0.037277	0.189916	0.343241	0.313027	0.066412	0.017854	

Frequency of Calm Winds: 3.23%

Average Wind Speed: 10.00 Knots

Source: (NOAA, 2004)

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Table 22. Midland, TX Wind Data (2003)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.001680	0.009985	0.010825	0.009052	0.001960	0.000933	0.034434
NNE	0.001306	0.008212	0.014838	0.010452	0.004479	0.001680	0.040967
NE	0.001773	0.009052	0.018384	0.017077	0.008492	0.001027	0.055804
ENE	0.001027	0.012598	0.026876	0.016424	0.003546	0.000653	0.061124
E	0.001773	0.017077	0.024449	0.010918	0.001680	0.000560	0.056458
ESE	0.002053	0.015398	0.022116	0.012598	0.001960	0.000840	0.054965
SE	0.002053	0.018570	0.030702	0.021183	0.004199	0.000467	0.077174
SSE	0.002986	0.022583	0.042087	0.047032	0.008492	0.000840	0.124020
S	0.001680	0.019130	0.051232	0.055898	0.007186	0.001866	0.136991
SSW	0.001866	0.019970	0.041900	0.025196	0.002240	0.000373	0.091545
SW	0.002800	0.012785	0.027996	0.014838	0.001866	0.000280	0.060564
WSW	0.002800	0.012505	0.013811	0.011758	0.005412	0.001493	0.047779
W	0.001773	0.010825	0.011665	0.014091	0.006906	0.005039	0.050299
WNW	0.001400	0.007559	0.006906	0.004853	0.002146	0.002240	0.025103
NW	0.002240	0.006626	0.005692	0.004479	0.001960	0.001120	0.022116
NNW	0.001213	0.006066	0.005226	0.004386	0.001493	0.001213	0.019597
Total	0.030422	0.208940	0.354703	0.280235	0.064016	0.020623	

Frequency of Calm Winds: 4.11%

Average Wind Speed: 9.86 Knots

Source: (NOAA, 2004)

Table 23. Midland, TX Wind Data (1999–2003)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002312	0.010132	0.012155	0.008418	0.002369	0.001098	0.036483
NNE	0.001868	0.008591	0.012174	0.012771	0.004604	0.002080	0.042089
NE	0.001734	0.007782	0.014505	0.018280	0.007108	0.002061	0.051470
ENE	0.001329	0.008668	0.020611	0.017144	0.004141	0.000597	0.052491
E	0.001868	0.012829	0.023770	0.013118	0.001830	0.000443	0.053858
ESE	0.002061	0.014851	0.022441	0.013908	0.001541	0.000501	0.055303
SE	0.002909	0.020072	0.032053	0.024984	0.004507	0.000771	0.085295
SSE	0.003043	0.025504	0.044766	0.050256	0.011808	0.002562	0.137940
S	0.002408	0.018877	0.050815	0.065011	0.012501	0.002042	0.151655
SSW	0.001830	0.016932	0.036098	0.027777	0.002774	0.000270	0.085680
SW	0.002697	0.014062	0.024001	0.013542	0.001522	0.000212	0.056035
WSW	0.002196	0.010614	0.012944	0.011654	0.004122	0.001637	0.043168
W	0.001849	0.008880	0.009593	0.010517	0.005490	0.004045	0.040374
WNW	0.001714	0.006414	0.006588	0.005124	0.001811	0.001194	0.022845
NW	0.002080	0.007243	0.007435	0.004623	0.001368	0.000520	0.023269
NNW	0.001502	0.007416	0.007512	0.005625	0.002023	0.001021	0.025099
Total	0.033401	0.198867	0.337462	0.302751	0.069519	0.021054	

Frequency of Calm Winds: 3.69%

Average Wind Speed: 10.04 Knots

Source: (NOAA, 2004)

Table 24. Midland, TX Stability Table (1999–2003)

STABILITY	1999	2000	2001	2002	2003	1999–2003
A	0.2%	0.6%	0.9%	0.4%	0.3%	0.48%
B	13.7%	12.2%	12.1%	12.3%	12.5%	12.53%
C	19.9%	19.4%	19.2%	19.0%	18.7%	19.24%
D	46.1%	42.4%	42.1%	43.2%	41.7%	43.02%
E	12.9%	15.4%	16.0%	16.3%	16.6%	15.51%
F	7.1%	10.1%	9.7%	8.8%	10.1%	9.22%

Source: (NOAA, 2004)

Table 25. WCS Lower Six-Year Temperature Data (2000–2005)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAXIMUM TEMPERATURE		MEAN DAILY MINIMUM TEMPERATURE		HIGHEST DAILY MAXIMUM TEMPERATURE		LOWEST DAILY MINIMUM TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.4	(43.5)	22.3	(72.1)	-5.7	(21.7)	27.6	(81.6)	-11.3	(11.7)
February	8.0	(46.4)	24.0	(75.2)	-4.7	(23.5)	28.8	(83.8)	-11.4	(11.4)
March	12.1	(53.8)	26.9	(80.4)	-1.7	(28.9)	32.0	(89.6)	-11.3	(11.6)
April	17.8	(64.1)	31.9	(89.4)	4.7	(40.5)	36.3	(97.4)	-0.6	(30.9)
May	22.7	(72.8)	36.7	(98.0)	9.9	(49.9)	40.8	(105.4)	3.8	(38.9)
June	25.3	(77.6)	38.7	(101.6)	10.2	(50.4)	41.9	(107.4)	-2.7	(27.1)
July	27.8	(82.0)	39.1	(102.3)	18.1	(64.6)	42.1	(107.7)	15.4	(59.7)
August	26.8	(80.2)	38.5	(101.4)	17.4	(63.2)	42.2	(107.9)	14.8	(58.7)
September	23.6	(74.4)	36.5	(97.8)	13.0	(55.5)	40.9	(105.6)	2.6	(36.6)
October	17.3	(63.1)	30.5	(86.9)	6.0	(42.7)	38.6	(101.5)	-0.7	(30.7)
November	9.8	(49.7)	24.5	(76.2)	-2.4	(27.6)	29.8	(85.7)	-10.3	(13.5)
December	5.7	(42.2)	21.2	(70.1)	-7.2	(19.0)	26.4	(79.6)	-15.7	(3.7)
Annual	16.8	(62.2)	30.9	(87.6)	4.8	(40.6)	42.2	(107.9)	-15.7	(3.7)

Source: (WCS, 2005)

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Table 26. WCS Lower Six-Year Precipitation Data (2000–2005)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.28	2.62	3.53	2.46	1.63	3.96	3.66	4.29	6.31	6.21	3.38	0.75	40.08
	(0.51)	(1.03)	(1.39)	(0.97)	(0.64)	(1.56)	(1.44)	(1.69)	(2.48)	(2.45)	(1.33)	(0.29)	(15.78)
Maximum	2.13	7.21	7.75	10.39	5.79	10.13	3.96	7.70	22.38	12.27	11.35	1.93	76.28
	(0.84)	(2.84)	(3.05)	(4.09)	(2.28)	(3.99)	(1.56)	(3.03)	(8.81)	(4.83)	(4.47)	(0.76)	(30.03)
Minimum	0.76	0.18	0.61	0.30	0.25	0.33	3.15	0.53	1.73	0.23	0.25	0.15	12.83
	(0.30)	(0.07)	(0.24)	(0.12)	(0.10)	(0.13)	(1.24)	(0.21)	(0.68)	(0.09)	(0.10)	(0.06)	(5.05)
Max 24 Hr	1.55	3.78	4.45	5.31	3.18	4.95	3.30	7.11	11.30	4.80	3.78	1.32	11.30
	(0.61)	(1.49)	(1.75)	(2.09)	(1.25)	(1.95)	(1.30)	(2.80)	(4.45)	(1.89)	(1.49)	(0.52)	(4.45)

Source: (WCS, 2005)

Table 26A. WCS Six-Year Precipitation Duration (2000–2005)

DURATION MINUTES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
Average	21	36	33	31	43	50	41	41	55	46	36	22	36
Maximum	135	525	210	300	240	240	210	240	315	345	180	255	525
Minimum	15	15	15	15	15	15	15	15	15	15	15	15	15
EVENT INTENSITY CM/EVENT (INCHES/EVENT)													
Average	0.06	0.12	0.18	0.23	0.21	0.50	0.66	0.41	0.61	0.36	0.15	0.07	0.19
	(0.02)	(0.05)	(0.07)	(0.09)	(0.08)	(0.20)	(0.26)	(0.16)	(0.24)	(0.14)	(0.06)	(0.03)	(0.07)
Maximum	0.94	3.20	3.96	3.99	1.45	4.78	3.15	7.09	4.67	4.80	2.36	0.84	7.09
	(0.37)	(1.26)	(1.56)	(1.57)	(0.57)	(1.88)	(1.24)	(2.79)	(1.84)	(1.89)	(0.93)	(0.33)	(2.79)
Minium	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
OCCURRENCES # OF EVENTS													
Average	26	22	20	11	8	8	10	11	13	17	22	16	163
Maximum	67	38	44	27	17	22	26	22	27	25	63	25	342
Minimum	5	2	9	2	3	2	3	2	7	4	1	4	80

Source: (WCS, 2005)

Table 27. WCS Lower Six-Year Humidity Data (2000–2005)

RELATIVE HUMIDITY (%)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	62.81	59.49	56.67	49.81	51.44	56.20	56.03	59.52	61.13	70.28	68.73	59.92	59.10
00 LST	74.83	70.68	70.59	67.32	70.28	75.68	72.64	75.06	76.71	84.46	82.19	72.30	74.14
06 LST	71.42	69.41	67.22	58.84	61.66	64.13	65.91	67.64	70.30	77.78	74.66	66.87	67.78
12 LST	44.82	42.61	38.07	29.59	30.59	36.00	36.96	39.86	41.05	49.43	48.72	40.50	39.66
18 LST	60.04	55.27	50.82	43.49	43.15	49.00	48.59	55.29	56.46	69.44	69.33	60.00	54.79

Source: (WCS, 2005)

Table 28. WCS Upper Six-Year Humidity Data (2000–2005)

RELATIVE HUMIDITY (%)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	59.96	55.79	54.51	47.93	50.28	55.73	54.61	57.82	55.97	64.83	62.23	53.74	55.98
00 LST	70.00	66.44	66.32	62.88	66.44	72.25	68.35	70.77	68.39	76.82	73.61	63.29	68.63
06 LST	68.69	61.92	65.45	57.67	61.38	65.74	65.19	66.89	65.50	72.83	69.01	60.87	64.99
12 LST	45.34	42.98	38.64	30.29	32.00	37.67	38.38	40.91	39.57	47.38	45.64	38.44	39.66
18 LST	55.72	51.82	47.64	40.90	41.24	47.27	56.52	52.51	50.43	62.28	60.62	52.36	50.58

Source: (WCS, 2005)

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Table 29. WCS Lower Wind Data (2000)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.006450	0.011439	0.009002	0.002695	0.000430	0.000000	0.030015
NNE	0.004587	0.014449	0.016627	0.009346	0.000430	0.000000	0.045439
NE	0.009546	0.024683	0.018061	0.004673	0.000029	0.000000	0.056992
ENE	0.018806	0.024769	0.020555	0.006794	0.000057	0.000000	0.070982
E	0.021157	0.024913	0.018892	0.002379	0.000000	0.000000	0.067341
ESE	0.021415	0.026862	0.011324	0.000631	0.000000	0.000000	0.060232
SE	0.024282	0.037641	0.021816	0.001319	0.000000	0.000000	0.085058
SSE	0.015710	0.046127	0.053925	0.005103	0.000000	0.000000	0.120865
S	0.012872	0.040766	0.047388	0.002551	0.000029	0.000000	0.103606
SSW	0.010407	0.028209	0.030015	0.002064	0.000029	0.000000	0.070724
SW	0.010607	0.021530	0.017946	0.004358	0.000057	0.000000	0.054498
WSW	0.009116	0.010349	0.010378	0.008285	0.001233	0.000201	0.039562
W	0.009116	0.006938	0.009747	0.008228	0.002379	0.000229	0.036638
WNW	0.009632	0.007998	0.007798	0.003526	0.000946	0.000029	0.029929
NW	0.013503	0.011381	0.008400	0.003612	0.000258	0.000000	0.037154
NNW	0.010235	0.009116	0.005705	0.002064	0.000143	0.000000	0.027263
Total	0.207442	0.347170	0.307580	0.067628	0.006020	0.000459	1

Frequency of Calm Winds: 6.60%

Average Wind Speed: 6.06 Knots

Source: (WCS, 2004)

Table 30. WCS Lower Wind Data (2001)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.007078	0.011615	0.008134	0.002026	0.000086	0.000000	0.028938
NNE	0.006707	0.016267	0.015468	0.005451	0.000228	0.000029	0.044150
NE	0.012557	0.024743	0.013841	0.003539	0.000057	0.000000	0.054737
ENE	0.019892	0.026398	0.015953	0.003881	0.000542	0.000000	0.066667
E	0.019549	0.025999	0.021318	0.003710	0.000000	0.000000	0.070576
ESE	0.018037	0.031992	0.014412	0.002369	0.000057	0.000000	0.066866
SE	0.021062	0.042666	0.025171	0.001484	0.000000	0.000000	0.090382
SSE	0.018807	0.048716	0.038242	0.004880	0.000029	0.000000	0.110674
S	0.015439	0.042951	0.040953	0.004309	0.000228	0.000000	0.103881
SSW	0.013128	0.027711	0.021946	0.001998	0.000029	0.000086	0.064897
SW	0.009389	0.019635	0.015811	0.003796	0.000029	0.000000	0.048659
WSW	0.007677	0.011558	0.011358	0.006621	0.000171	0.000029	0.037414
W	0.008333	0.006992	0.012015	0.008248	0.002055	0.000599	0.038242
WNW	0.009618	0.007677	0.007734	0.003082	0.000371	0.000086	0.028567
NW	0.012300	0.011929	0.005993	0.001769	0.000114	0.000000	0.032106
NNW	0.010360	0.009989	0.003567	0.001855	0.000200	0.000000	0.025970
Total	0.209932	0.366838	0.271918	0.059018	0.004195	0.000828	1

Frequency of Calm Winds: 8.90%

Average Wind Speed: 5.83 Knots

Source: (WCS, 2004)

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Table 31. WCS Lower Wind Data (2002)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.006507	0.007714	0.010170	0.006766	0.000431	0.000000	0.031588
NNE	0.005042	0.014393	0.020728	0.009696	0.001207	0.000000	0.051067
NE	0.008877	0.018660	0.013402	0.006723	0.000172	0.000000	0.047835
ENE	0.016677	0.023917	0.014911	0.006162	0.000129	0.000000	0.061797
E	0.015342	0.024305	0.014221	0.001077	0.000215	0.000000	0.055161
ESE	0.013833	0.039173	0.014135	0.000905	0.000000	0.000000	0.068046
SE	0.017410	0.039560	0.021030	0.001939	0.000086	0.000000	0.080026
SSE	0.018229	0.055333	0.051928	0.004913	0.000000	0.000000	0.130403
S	0.019651	0.054945	0.058393	0.000991	0.000000	0.000000	0.133980
SSW	0.015729	0.034303	0.032622	0.003103	0.000000	0.000000	0.085757
SW	0.013144	0.016591	0.019608	0.009007	0.000043	0.000000	0.058393
WSW	0.009308	0.007455	0.010558	0.008317	0.000690	0.000000	0.036328
W	0.008016	0.007800	0.010774	0.005818	0.000215	0.000000	0.032622
WNW	0.008920	0.005430	0.004180	0.001767	0.000474	0.000043	0.020814
NW	0.013402	0.006206	0.004999	0.000991	0.000431	0.000086	0.026115
NNW	0.011592	0.005732	0.003534	0.004008	0.000646	0.000000	0.025512
Total	0.201681	0.361517	0.305193	0.072183	0.004740	0.000129	1

Frequency of Calm Winds: 5.50%
Average Wind Speed: 6.04 Knots
Source: (WCS, 2004)

Table 32. WCS Lower Wind Data (2003)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.005508	0.007363	0.006421	0.004595	0.000428	0.000143	0.024458
NNE	0.003168	0.013984	0.015953	0.008105	0.000542	0.000000	0.041752
NE	0.008076	0.019463	0.017123	0.006621	0.000143	0.000000	0.051427
ENE	0.016124	0.026370	0.030565	0.006450	0.000057	0.000000	0.079566
E	0.027797	0.050970	0.023830	0.001684	0.000000	0.000000	0.104281
ESE	0.015268	0.031678	0.018522	0.001199	0.000029	0.000000	0.066695
SE	0.014098	0.024486	0.017323	0.002768	0.000000	0.000000	0.058676
SSE	0.015097	0.032021	0.028881	0.004595	0.000029	0.000000	0.080622
S	0.015240	0.038984	0.035131	0.002997	0.000342	0.000000	0.092694
SSW	0.014583	0.029680	0.027854	0.002540	0.000029	0.000000	0.074686
SW	0.012500	0.023687	0.025143	0.008619	0.000257	0.000029	0.070234
WSW	0.009361	0.011387	0.014384	0.011558	0.002397	0.000171	0.049258
W	0.007934	0.006621	0.010103	0.013042	0.003881	0.000428	0.042009
WNW	0.007135	0.006564	0.006792	0.003539	0.000485	0.000114	0.024629
NW	0.010217	0.010873	0.005993	0.003196	0.001370	0.000000	0.031650
NNW	0.009332	0.006279	0.004167	0.003253	0.000656	0.000057	0.023744
Total	0.191438	0.340411	0.288185	0.084760	0.010645	0.000942	1

Frequency of Calm Winds: 8.40%
Average Wind Speed: 6.29 Knots
Source: (WCS, 2004)

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Appendix 2.3.1: Meteorological and Climatology Data**

Table 32A. WCS Lower Wind Data (2004)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.009045	0.012132	0.011067	0.003831	0.000532	0	0.036607
NNE	0.009684	0.016388	0.014898	0.007024	0.000319	0	0.048313
NE	0.017878	0.024795	0.015537	0.002448	0	0	0.060658
ENE	0.026391	0.025114	0.019581	0.005534	0.000106	0	0.076727
E	0.02139	0.021709	0.011599	0.002341	0	0	0.057039
ESE	0.01724	0.017346	0.005427	0.000851	0.000106	0	0.040971
SE	0.022135	0.019794	0.009578	0.001383	0	0	0.052889
SSE	0.022986	0.044163	0.029371	0.001596	0	0	0.098116
S	0.021709	0.055975	0.032031	0.001277	0	0	0.110993
SSW	0.020645	0.032564	0.023731	0.000851	0	0	0.077791
SW	0.019261	0.026391	0.015005	0.003086	0.000106	0	0.06385
WSW	0.013089	0.011493	0.013196	0.00564	0.001064	0.000319	0.044802
W	0.007981	0.007981	0.009045	0.006917	0.002022	0.000213	0.03416
WNW	0.008194	0.007343	0.004895	0.000851	0	0	0.021283
NW	0.012983	0.009578	0.004257	0.003193	0.000426	0.000213	0.030648
NNW	0.011387	0.009471	0.005427	0.004682	0	0	0.030967
Total	0.261999	0.342237	0.224646	0.051506	0.004682	0.000745	1

Frequency of Calm Winds: 11.42%
Average Wind Speed: 5.31 Knots
Source: (WCS, 2005)

Table 32B. WCS Lower Wind Data (2005)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.008789	0.009930	0.005022	0.001598	0.000342	0.000000	0.025682
NNE	0.011072	0.014154	0.008218	0.003310	0.000000	0.000000	0.036754
NE	0.015295	0.018605	0.011072	0.001826	0.000000	0.000000	0.046798
ENE	0.024198	0.025568	0.012556	0.001141	0.000000	0.000000	0.063463
E	0.024312	0.024769	0.008903	0.000342	0.000000	0.000000	0.058327
ESE	0.030362	0.020089	0.006392	0.000114	0.000000	0.000000	0.056957
SE	0.027851	0.028878	0.008789	0.000571	0.000000	0.000000	0.066088
SSE	0.024769	0.035384	0.017464	0.000571	0.000000	0.000000	0.078187
S	0.019176	0.039493	0.016551	0.000799	0.000000	0.000000	0.076019
SSW	0.015181	0.026367	0.010958	0.000913	0.000000	0.000000	0.053419
SW	0.011300	0.017920	0.010501	0.001141	0.000000	0.000000	0.040863
WSW	0.007762	0.008903	0.009816	0.003995	0.000114	0.000000	0.030590
W	0.010729	0.007990	0.009702	0.007077	0.001826	0.000114	0.037439
WNW	0.008447	0.006620	0.007876	0.004223	0.001027	0.000342	0.028536
NW	0.010045	0.007990	0.005022	0.002968	0.000342	0.000000	0.026367
NNW	0.010501	0.009930	0.003995	0.002169	0.000342	0.000000	0.026938
Total	0.259788	0.302591	0.152836	0.032759	0.003995	0.000457	1

Frequency of Calm Winds: 24.76%
Average Wind Speed: 4.21 Knots
Source: (WCS, 2006)

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Table 33. WCS Lower Wind Data (2000–2005)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.008920	0.011068	0.008149	0.002753	0.000441	0.000000	0.031331
NNE	0.010352	0.015308	0.011673	0.005231	0.000165	0.000000	0.042729
NE	0.016629	0.021805	0.013380	0.002147	0.000000	0.000000	0.053962
ENE	0.025329	0.025384	0.016189	0.003414	0.000055	0.000000	0.070371
E	0.022796	0.023182	0.010297	0.001377	0.000000	0.000000	0.057651
ESE	0.023567	0.018666	0.005892	0.000496	0.000055	0.000000	0.048676
SE	0.024888	0.024173	0.009196	0.000991	0.000000	0.000000	0.059248
SSE	0.023842	0.039921	0.023622	0.001101	0.000000	0.000000	0.088486
S	0.020483	0.048015	0.024558	0.001046	0.000000	0.000000	0.094103
SSW	0.018006	0.029569	0.017565	0.000881	0.000000	0.000000	0.066021
SW	0.015418	0.022301	0.012830	0.002147	0.000055	0.000000	0.052750
WSW	0.010517	0.010242	0.011563	0.004846	0.000606	0.000165	0.037938
W	0.009306	0.007984	0.009361	0.006993	0.001927	0.000165	0.035736
WNW	0.008315	0.006993	0.006332	0.002478	0.000496	0.000165	0.024778
NW	0.011563	0.008810	0.004625	0.003084	0.000385	0.000110	0.028578
NNW	0.010958	0.009691	0.004735	0.003469	0.000165	0.000000	0.029018
Total	0.260889	0.323110	0.189968	0.042454	0.004350	0.000606	1

Frequency of Calm Winds: 17.86%
Average Wind Speed: 4.78 Knots
Source: (WCS, 2006)

Table 34. WCS Lower Stability Table (2000–2005)

LOWER STABILITY	2000	2001	2002	2003	2004	2005	2000–2005
A	6%	7%	8%	7%	7%	7%	7%
B	5%	5%	5%	5%	5%	5%	5%
C	13%	13%	14%	12%	13%	13%	13%
D	70%	70%	66%	71%	70%	69%	69%
E	2%	3%	4%	3%	3%	3%	3%
F	2%	2%	2%	2%	2%	2%	2%

Source: (WCS, 2004)

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Table 35. WCS Upper Wind Data (2000)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002343	0.006671	0.012018	0.009041	0.001433	0.000827	0.032334
NNE	0.002343	0.005954	0.013782	0.016291	0.006257	0.001323	0.045951
NE	0.003060	0.011384	0.021308	0.016456	0.005734	0.000965	0.058906
ENE	0.003060	0.012652	0.024808	0.016815	0.003473	0.000358	0.061167
E	0.003170	0.019957	0.026352	0.010723	0.000662	0.000028	0.060891
ESE	0.003473	0.018358	0.027262	0.004934	0.000055	0.000000	0.054082
SE	0.004355	0.030294	0.048569	0.018468	0.001020	0.000055	0.102762
SSE	0.005182	0.026738	0.054606	0.043497	0.003583	0.000551	0.134158
S	0.007691	0.023044	0.046695	0.033298	0.001020	0.000331	0.112079
SSW	0.008876	0.020784	0.029798	0.016677	0.000441	0.000055	0.076630
SW	0.009372	0.020894	0.017890	0.011991	0.001709	0.000276	0.062131
WSW	0.007277	0.014637	0.010723	0.008545	0.004107	0.001792	0.047081
W	0.005541	0.011136	0.007112	0.008683	0.004052	0.002646	0.039170
WNW	0.004052	0.012239	0.009179	0.006450	0.001599	0.000965	0.034484
NW	0.004052	0.012322	0.014113	0.006175	0.001351	0.000358	0.038370
NNW	0.003335	0.007139	0.008628	0.005072	0.000827	0.000276	0.025277
Total	0.077182	0.254204	0.372843	0.233116	0.037323	0.010805	1

Frequency of Calm Winds: 1.50%

Average Wind Speed: 8.63 Knots

Source: (WCS, 2004)

Table 36. WCS Upper Wind Data (2001)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.003533	0.007066	0.012877	0.007014	0.000811	0.000157	0.031459
NNE	0.003507	0.008139	0.014473	0.015049	0.003769	0.001492	0.046429
NE	0.003795	0.015311	0.019917	0.011908	0.002931	0.000419	0.054280
ENE	0.003324	0.018791	0.022822	0.011961	0.001596	0.000680	0.059175
E	0.003664	0.020754	0.028946	0.011568	0.000995	0.000288	0.066215
ESE	0.003507	0.020152	0.033421	0.007642	0.001282	0.000052	0.066058
SE	0.004868	0.029600	0.049753	0.016907	0.000602	0.000026	0.101756
SSE	0.006595	0.028501	0.051035	0.031197	0.004083	0.000445	0.121856
S	0.008558	0.028109	0.047371	0.027847	0.001701	0.000419	0.114005
SSW	0.010312	0.024628	0.029312	0.010783	0.000497	0.000183	0.075715
SW	0.008768	0.017221	0.017090	0.009396	0.001413	0.000079	0.053966
WSW	0.007537	0.012484	0.011149	0.010312	0.003376	0.000497	0.045356
W	0.006962	0.012248	0.009239	0.012458	0.003900	0.002722	0.047528
WNW	0.007014	0.013400	0.010024	0.005915	0.001675	0.000393	0.038420
NW	0.005104	0.015965	0.013819	0.003900	0.001309	0.000157	0.040252
NNW	0.003769	0.007930	0.008872	0.003167	0.000995	0.000262	0.024994
Total	0.090816	0.280300	0.380120	0.197022	0.030935	0.008270	1

Frequency of Calm Winds: 1.30%

Average Wind Speed: 8.19 Knots

Source: (WCS, 2004)

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Table 37. WCS Upper Wind Data (2002)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002084	0.004806	0.009017	0.013101	0.003063	0.001191	0.033262
NNE	0.001361	0.007741	0.013994	0.019056	0.006508	0.003998	0.052658
NE	0.002254	0.013952	0.016206	0.010634	0.005615	0.000510	0.049171
ENE	0.002807	0.017780	0.019736	0.011357	0.003275	0.000425	0.055381
E	0.003488	0.018248	0.028158	0.007061	0.000468	0.000298	0.057720
ESE	0.003148	0.016929	0.039983	0.008337	0.000510	0.000085	0.068992
SE	0.004211	0.023267	0.041131	0.023054	0.002722	0.000383	0.094768
SSE	0.005189	0.028073	0.057975	0.048065	0.004679	0.000043	0.144024
S	0.007784	0.032454	0.056231	0.038069	0.000468	0.000000	0.135006
SSW	0.007784	0.029264	0.034964	0.017482	0.000468	0.000043	0.090004
SW	0.007826	0.018843	0.013952	0.015483	0.003701	0.000170	0.059974
WSW	0.006848	0.010846	0.007826	0.011740	0.003445	0.000978	0.041684
W	0.006210	0.010506	0.007146	0.009911	0.001999	0.000255	0.036027
WNW	0.005530	0.011144	0.004849	0.003105	0.001106	0.000595	0.026329
NW	0.004594	0.011527	0.006635	0.003530	0.001021	0.000468	0.027775
NNW	0.003871	0.006380	0.004977	0.004424	0.001659	0.000723	0.022033
Total	0.074989	0.261761	0.362782	0.244407	0.040706	0.010166	1

Frequency of Calm Winds: 0.52%

Average Wind Speed: 8.72 Knots

Source: (WCS, 2004)

Table 38. WCS Upper Wind Data (2003)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.001910	0.004903	0.007012	0.007439	0.001625	0.000855	0.023743
NNE	0.002280	0.004789	0.007439	0.011487	0.001853	0.000114	0.027961
NE	0.001311	0.006185	0.010945	0.010290	0.003107	0.000228	0.032066
ENE	0.001511	0.008950	0.011629	0.008209	0.002138	0.000428	0.032864
E	0.001739	0.011145	0.010261	0.005701	0.002195	0.001340	0.032379
ESE	0.001739	0.006271	0.008209	0.006328	0.002480	0.000656	0.025681
SE	0.002166	0.008579	0.007867	0.011316	0.000941	0.000057	0.030926
SSE	0.002822	0.009549	0.018327	0.010518	0.000770	0.000029	0.042013
S	0.008294	0.027648	0.034688	0.010347	0.000684	0.000114	0.081775
SSW	0.024256	0.070773	0.059144	0.017928	0.002394	0.000798	0.175294
SW	0.015734	0.071030	0.105176	0.029102	0.004446	0.001368	0.226856
WSW	0.005444	0.014423	0.046545	0.033691	0.003221	0.000599	0.103922
W	0.005102	0.008494	0.008893	0.035714	0.004789	0.001026	0.064018
WNW	0.003705	0.008066	0.006955	0.012342	0.003819	0.000599	0.035486
NW	0.003762	0.009292	0.009377	0.005986	0.003819	0.001425	0.033662
NNW	0.002765	0.005359	0.005815	0.003905	0.002508	0.000741	0.021092
Total	0.084540	0.275453	0.358283	0.220300	0.040788	0.010375	1

Frequency of Calm Winds: 1.00%

Average Wind Speed: 8.51 Knots

Source: (WCS, 2004)

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Table 38A. WCS Upper Wind Data (2004)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.005534	0.008407	0.01128	0.008301	0.002022	0.000639	0.036182
NNE	0.003512	0.012025	0.014898	0.012132	0.003831	0.001596	0.047994
NE	0.003831	0.015218	0.021177	0.013834	0.001383	0.000426	0.055869
ENE	0.005853	0.020006	0.023199	0.01543	0.003831	0.000319	0.068639
E	0.007556	0.023731	0.023518	0.010748	0.000851	0.000213	0.066617
ESE	0.006811	0.016388	0.017665	0.002767	0.000319	0.000532	0.044482
SE	0.007875	0.025753	0.019261	0.009045	0.000532	0.000106	0.062573
SSE	0.009258	0.026923	0.043737	0.028626	0.000958	0	0.109503
S	0.012983	0.030861	0.058636	0.029158	0.000745	0	0.132383
SSW	0.014686	0.032457	0.036075	0.009578	0.000319	0	0.093115
SW	0.013941	0.025008	0.020645	0.01011	0.000851	0	0.070554
WSW	0.012451	0.017346	0.013515	0.00979	0.001596	0.001277	0.055975
W	0.010961	0.008194	0.008088	0.009684	0.003512	0.002554	0.042992
WNW	0.007024	0.011599	0.006704	0.003937	0	0	0.029265
NW	0.007556	0.014579	0.00713	0.002767	0.000532	0.000851	0.033415
NNW	0.00564	0.011493	0.008088	0.005321	0.000639	0	0.03118
Total	0.135469	0.299989	0.333617	0.181228	0.021922	0.008513	1

Frequency of Calm Winds: 193%

Average Wind Speed: 8.08 Knots

Source: (WCS, 2005)

Table 38B. WCS Upper Wind Data (2005)

FREQUENCY DISTRIBUTION (NORMALIZED)							
WIND DIRECTION (BLOWING FROM)	WIND SPEED (KNOTS)						TOTAL
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.004680	0.007191	0.009131	0.003310	0.001256	0.000571	0.026139
NNE	0.003310	0.008789	0.014268	0.006849	0.002625	0.000571	0.036411
NE	0.004680	0.014039	0.020774	0.013811	0.003310	0.000913	0.057528
ENE	0.005935	0.019062	0.025796	0.012670	0.001141	0.000000	0.064604
E	0.007305	0.026823	0.026024	0.007876	0.000228	0.000000	0.068257
ESE	0.008104	0.030248	0.025340	0.005593	0.000114	0.000000	0.069398
SE	0.007990	0.041776	0.040178	0.011414	0.000342	0.000000	0.101701
SSE	0.012442	0.036069	0.048054	0.021573	0.000571	0.000000	0.118708
S	0.014382	0.031389	0.042803	0.016208	0.000457	0.000228	0.105467
SSW	0.016665	0.028650	0.026709	0.007762	0.000571	0.000114	0.080470
SW	0.014953	0.022600	0.018149	0.007876	0.000913	0.000114	0.064604
WSW	0.013012	0.013925	0.009588	0.008561	0.002739	0.000114	0.047940
W	0.009246	0.011757	0.009017	0.010387	0.002283	0.002625	0.045314
WNW	0.008218	0.009588	0.008218	0.005593	0.002739	0.001484	0.035841
NW	0.007191	0.012556	0.010844	0.003310	0.001598	0.000114	0.035612
NNW	0.005365	0.009474	0.009930	0.002968	0.000457	0.000342	0.028536
Total	0.143477	0.323936	0.344824	0.145760	0.021345	0.007191	1

Frequency of Calm Winds: 1.35%

Average Wind Speed: 7.79 Knots

Source: (WCS, 2006)

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data**

Table 39. WCS Upper Wind Data (2000–2005)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.004180	0.006493	0.010207	0.007310	0.001361	0.000564	0.030115
NNE	0.003519	0.008263	0.013998	0.012151	0.003519	0.001303	0.042751
NE	0.003791	0.013609	0.018411	0.012442	0.002800	0.000661	0.051714
ENE	0.005191	0.017167	0.020802	0.011898	0.002119	0.000544	0.057721
E	0.005696	0.021755	0.022319	0.007738	0.000739	0.000311	0.058557
ESE	0.005716	0.020647	0.022688	0.004724	0.000758	0.000233	0.054766
SE	0.006552	0.029959	0.032117	0.012404	0.000778	0.000097	0.081906
SSE	0.009273	0.027879	0.044715	0.026421	0.001614	0.000214	0.110115
S	0.012520	0.029609	0.046426	0.022221	0.000680	0.000175	0.111632
SSW	0.019072	0.034839	0.033789	0.010751	0.000661	0.000214	0.099325
SW	0.015592	0.029881	0.031242	0.011626	0.001808	0.000350	0.090499
WSW	0.010712	0.012481	0.017925	0.011917	0.002566	0.000894	0.056496
W	0.009312	0.009332	0.008593	0.014095	0.003266	0.002002	0.046601
WNW	0.007252	0.010518	0.007213	0.006105	0.001614	0.000583	0.033283
NW	0.006377	0.012753	0.009818	0.003752	0.001380	0.000525	0.034605
NNW	0.005113	0.008671	0.007077	0.004063	0.000972	0.000467	0.026362
Total	0.129868	0.293855	0.347338	0.179618	0.026635	0.009137	1

Frequency of Calm Winds: 1.36%

Average Wind Speed: 8.23 Knots

Source: (WCS, 2006)

Table 40. WCS Upper Stability Table (2000–2005)

UPPER STABILITY	2000	2001	2002	2003	2004	2005	2000–2005
A	0%	0%	1%	0%	0%	0%	0%
B	8%	8%	8%	9%	8%	8%	8%
C	14%	15%	16%	15%	15%	15%	15%
D	65%	62%	63%	61%	63%	63%	63%
E	5%	6%	6%	6%	6%	6%	6%
F	8%	8%	6%	9%	8%	8%	8%

Source: (WCS, 2004)

**Table 41. Flood Occurrences for Andrews County
(1993–2004)**

FLOOD OF 12 OCCURRENCES			
YEARLY OCCURRENCES		FREQUENCY BY MONTH	
1993	0	Jan	0%
1994	0	Feb	0%
1995	0	Mar	8%
1996	2	Apr	8%
1997	1	May	25%
1998	1	Jun	17%
1999	0	Jul	17%
2000	4	Aug	17%
2001	0	Sep	0%
2002	1	Oct	8%
2003	2	Nov	0%
2004	1	Dec	0%
Yearly Average		1.0	

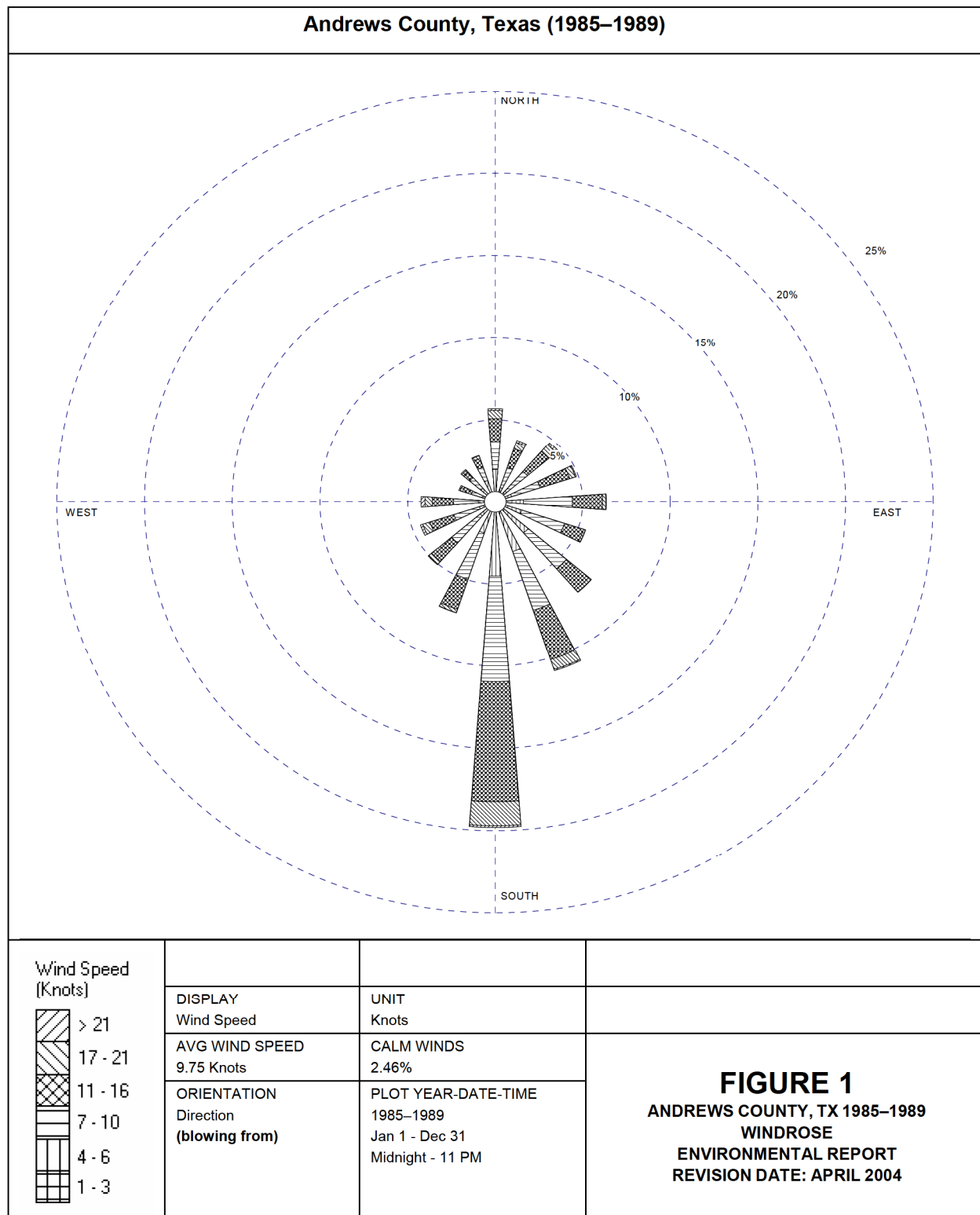
**Table 42. Thunderstorm and High Wind Occurrences for
Andrews County (1993–2004)**

THUNDERSTORM & HIGH WIND OF 38 OCCURRENCES			
YEARLY OCCURRENCES		FREQUENCY BY MONTH	
1993	6	Jan	3%
1994	2	Feb	3%
1995	5	Mar	5%
1996	3	Apr	16%
1997	2	May	21%
1998	3	Jun	16%
1999	3	Jul	5%
2000	2	Aug	11%
2001	0	Sep	16%
2002	6	Oct	3%
2003	5	Nov	0%
2004	1	Dec	3%
Yearly Average		3.2	

Table 43. Hail Occurrences for Andrews County (1993–2004)

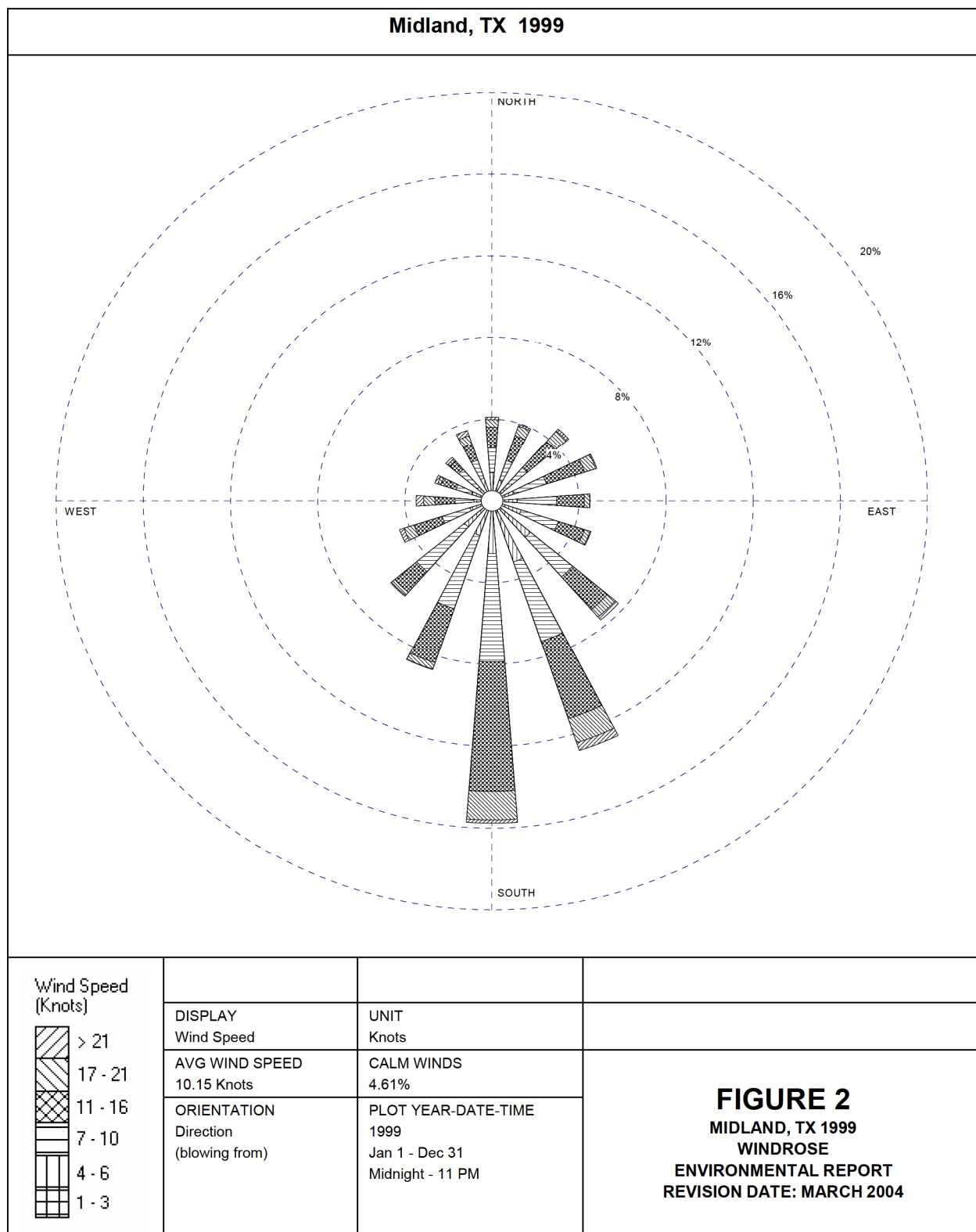
HAIL OF 74 OCCURRENCES				
YEARLY OCCURRENCES		FREQUENCY BY MONTH		AVERAGE INCHES BY MONTH
1993	2	Jan	0%	0.00
1994	2	Feb	0%	0.00
1995	22	Mar	5%	0.91
1996	1	Apr	12%	1.17
1997	10	May	26%	1.48
1998	9	Jun	39%	1.69
1999	9	Jul	1%	0.75
2000	2	Aug	1%	0.75
2001	3	Sep	8%	1.38
2002	6	Oct	7%	1.03
2003	6	Nov	0%	0.00
2004	2	Dec	0%	0.00
Yearly Average		6.2		

Figure 1. Andrews, TX Windrose Data (1985–1989)



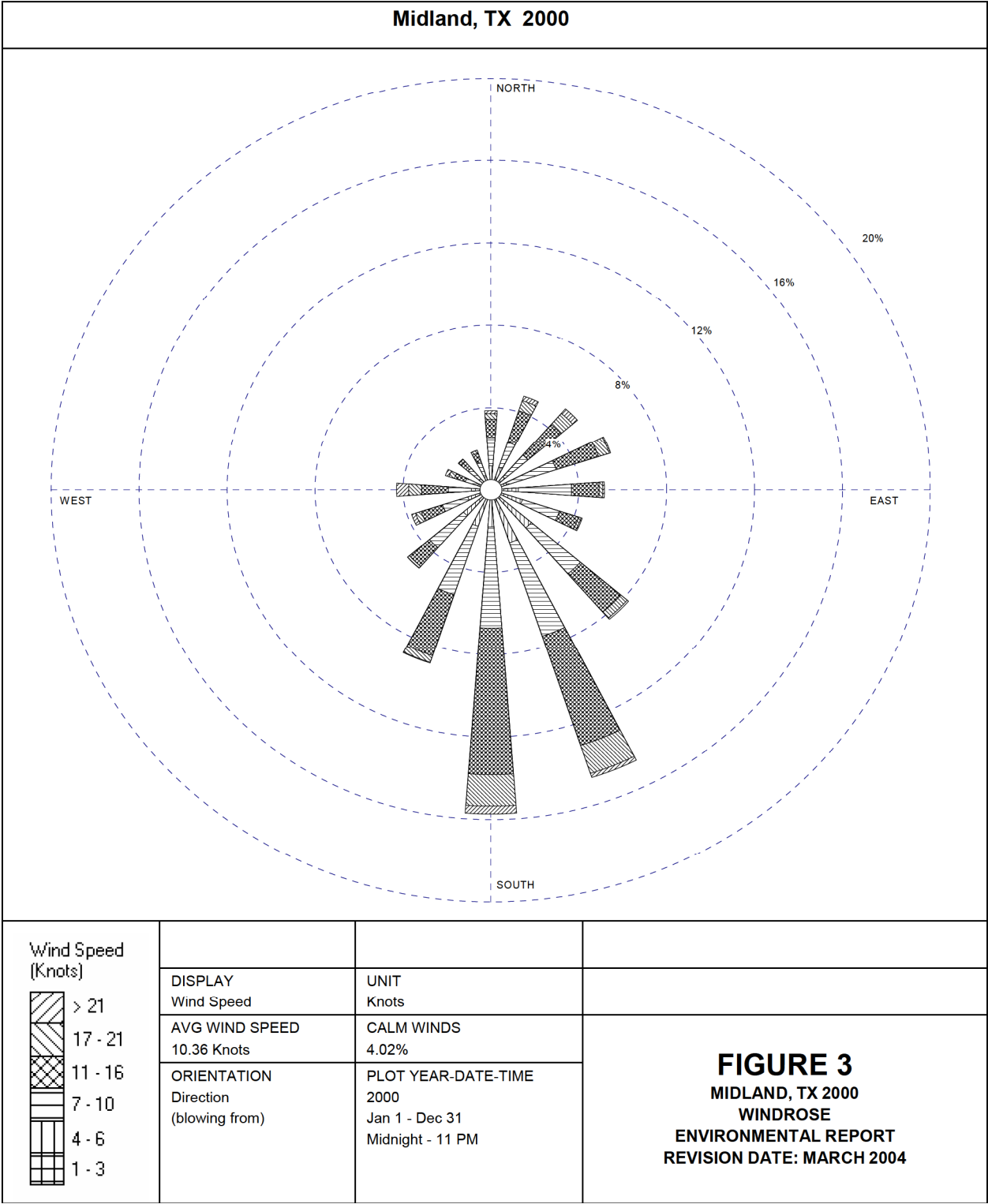
Source: (NOAA, 2004)

Figure 2. Midland, TX Windrose Data (1999)



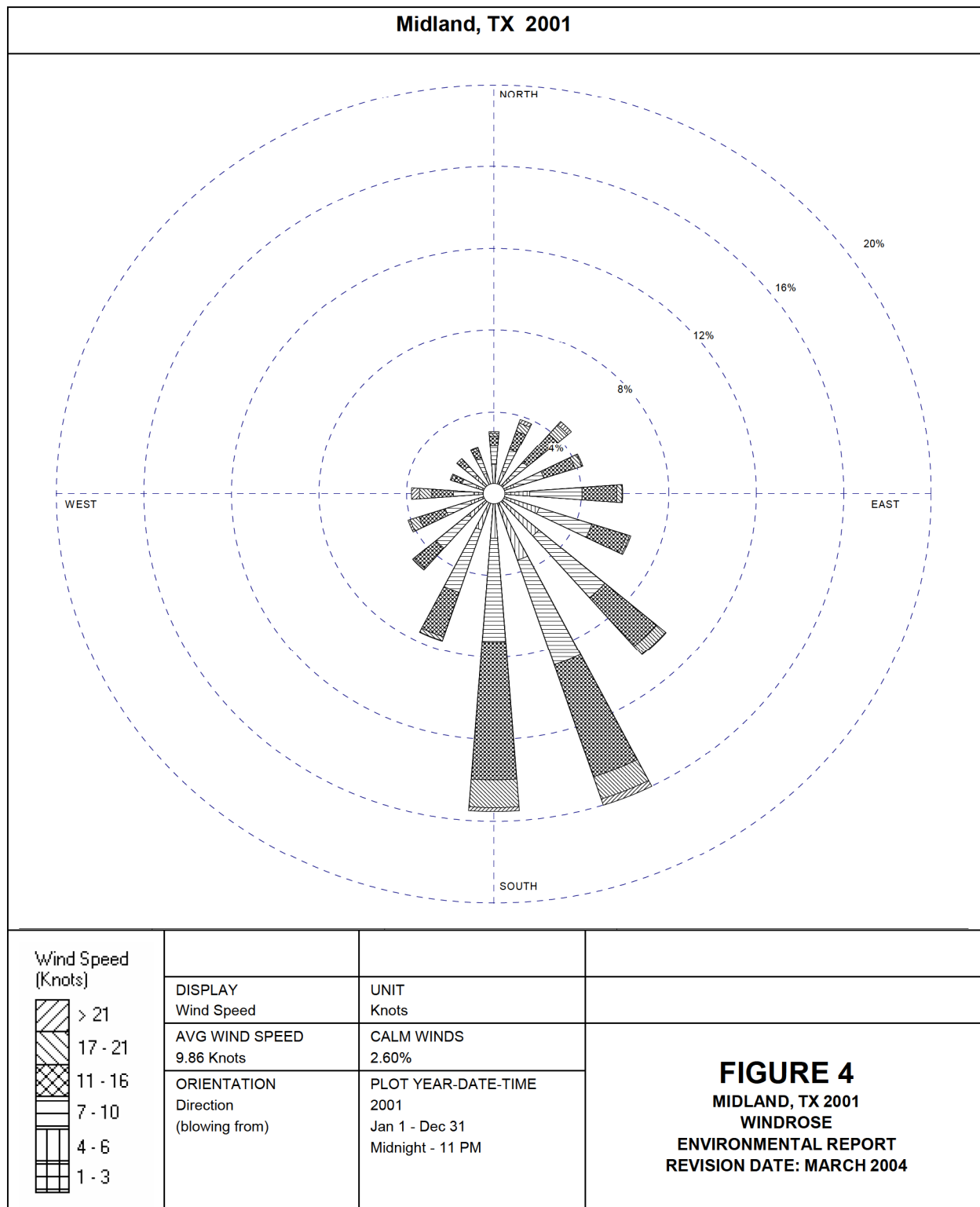
Source: (NOAA, 2004)

Figure 3. Midland, TX Windrose Data (2000)



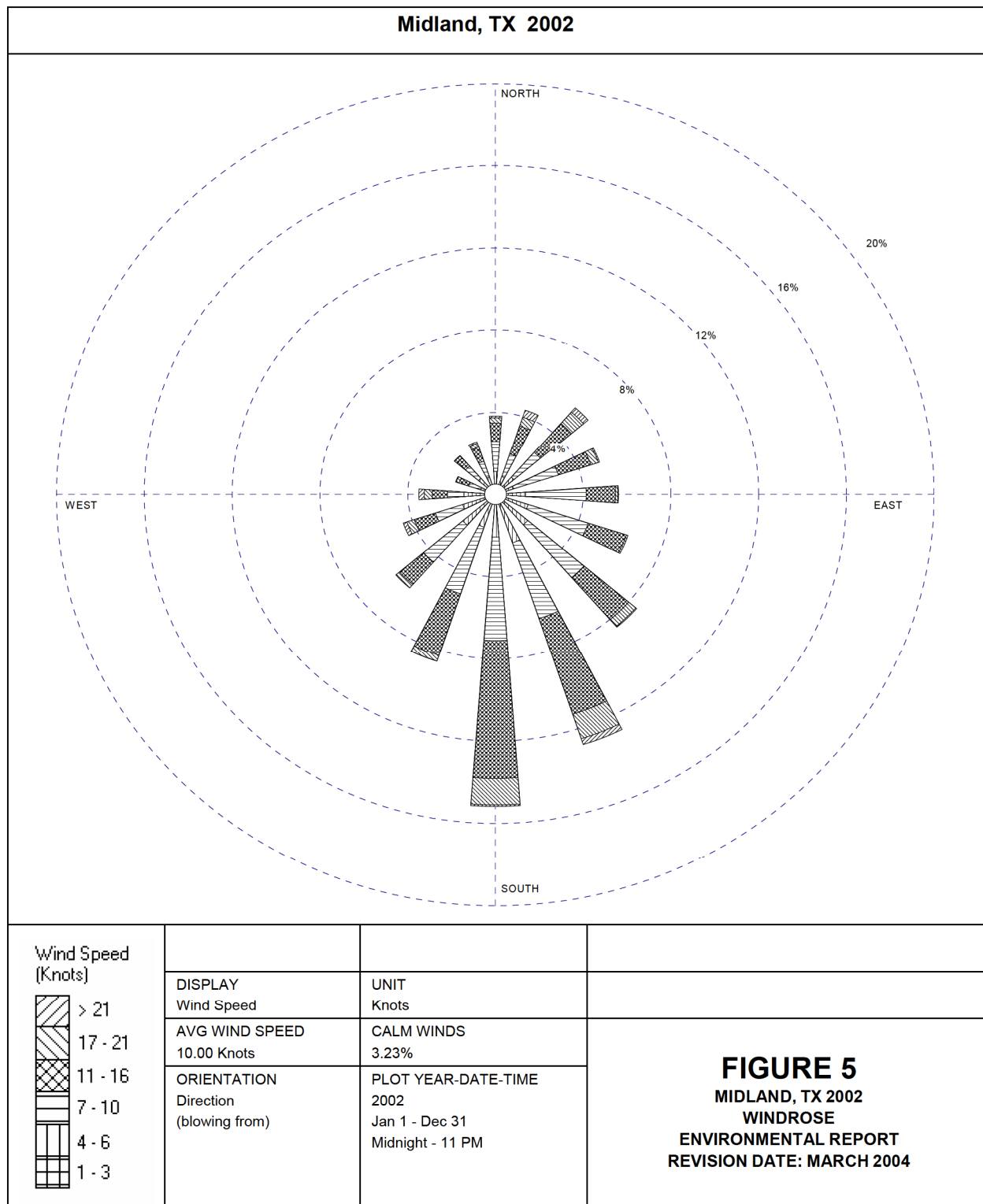
Source: (NOAA, 2004)

Figure 4. Midland, TX Windrose Data (2001)



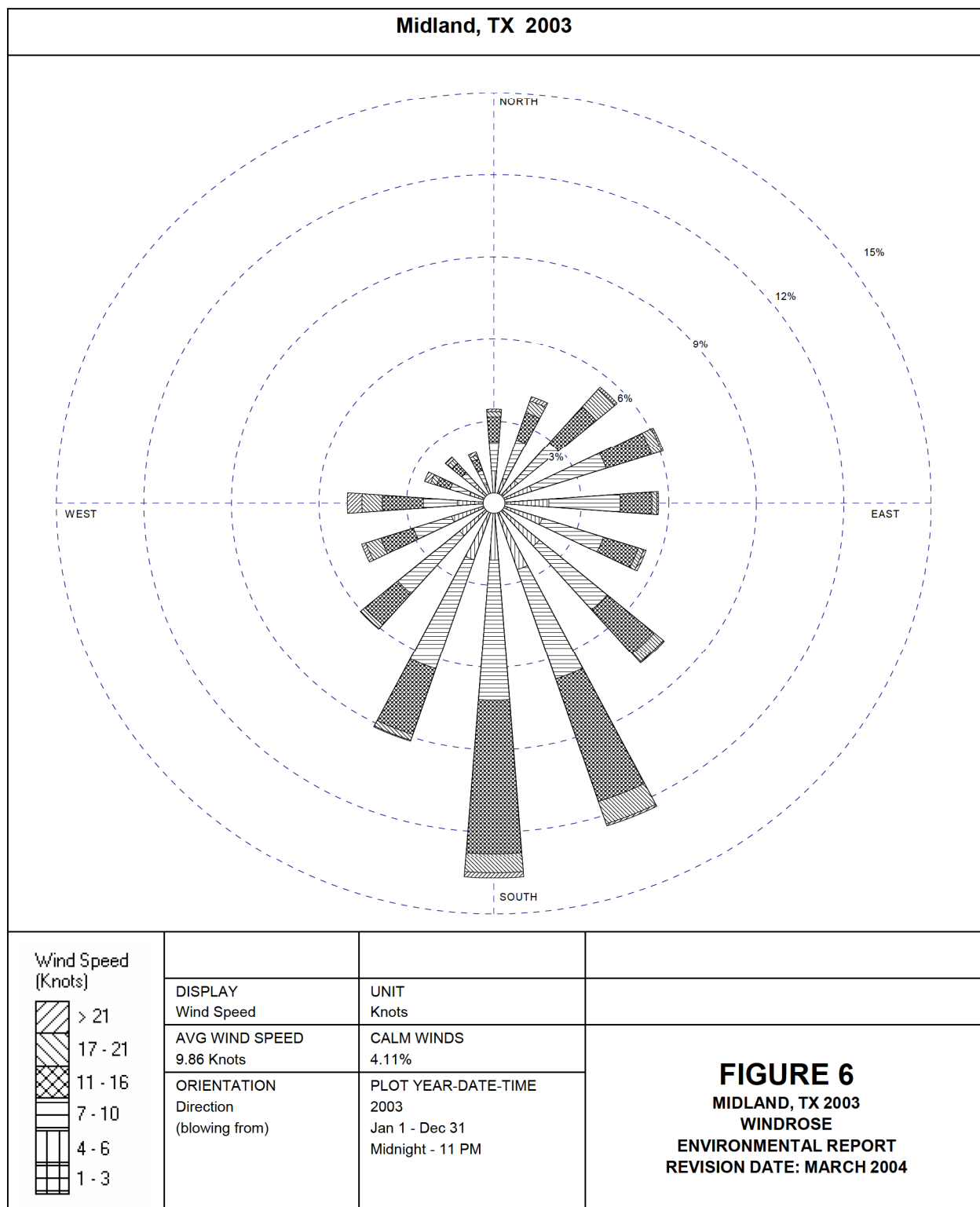
Source: (NOAA, 2004)

Figure 5. Midland, TX Windrose Data (2002)



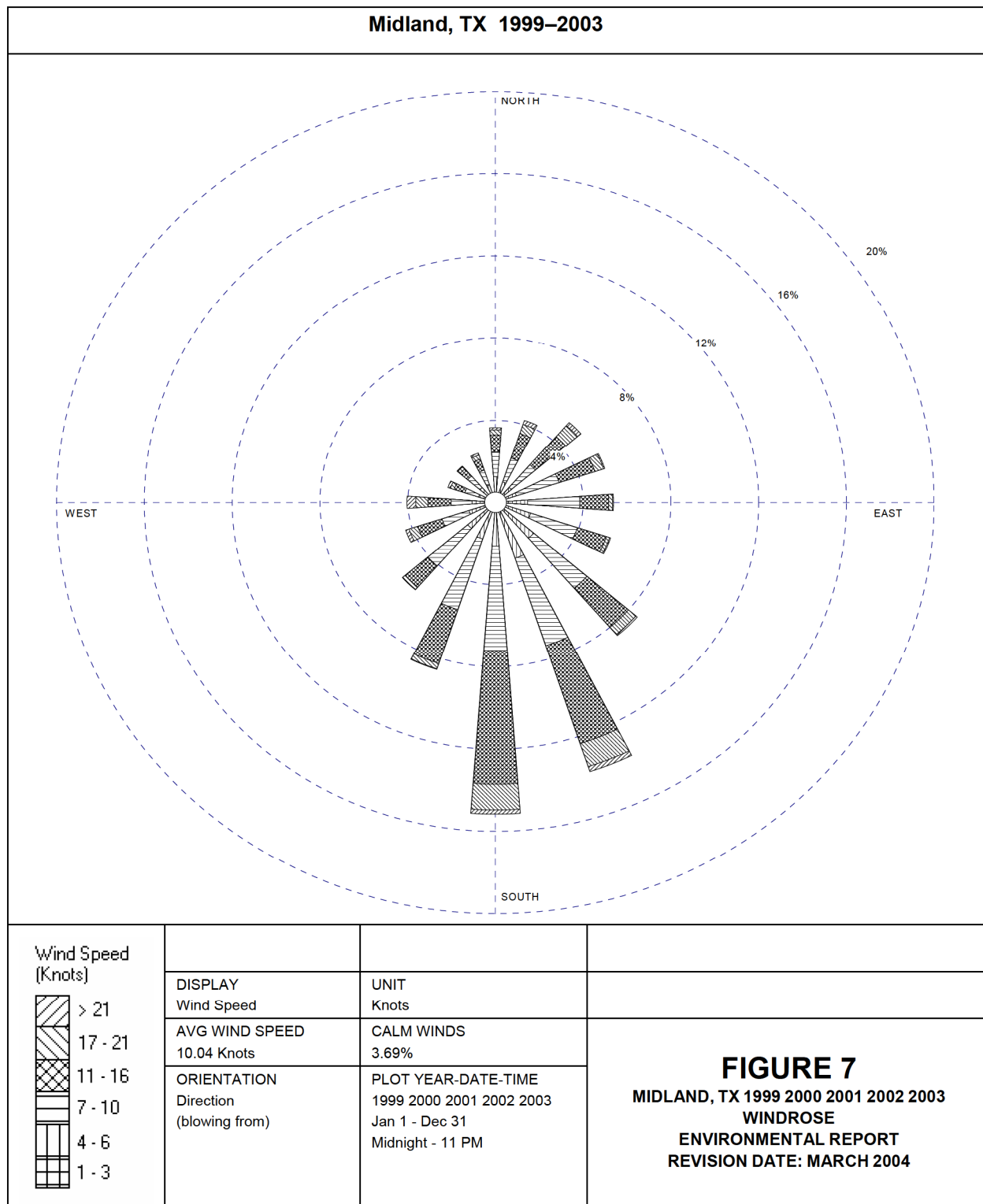
Source: (NOAA, 2004)

Figure 6. Midland, TX Windrose Data (2003)



Source: (NOAA, 2004)

Figure 7. Midland, TX Windrose Data (1999–2003)



Source: (NOAA, 2004)

Figure 8. WCS Lower Windrose Data (2000)

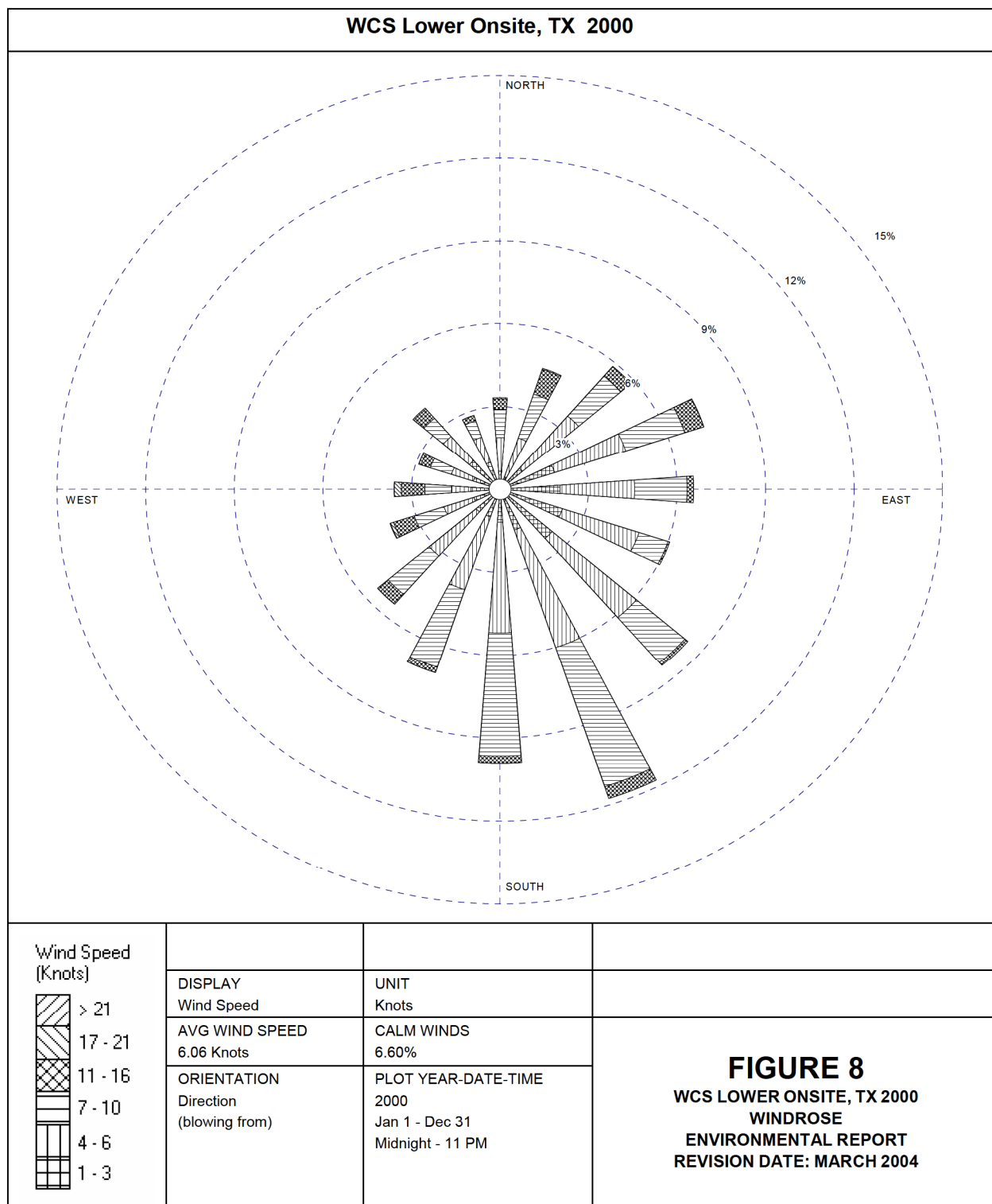


Figure 9. WCS Lower Windrose Data (2001)

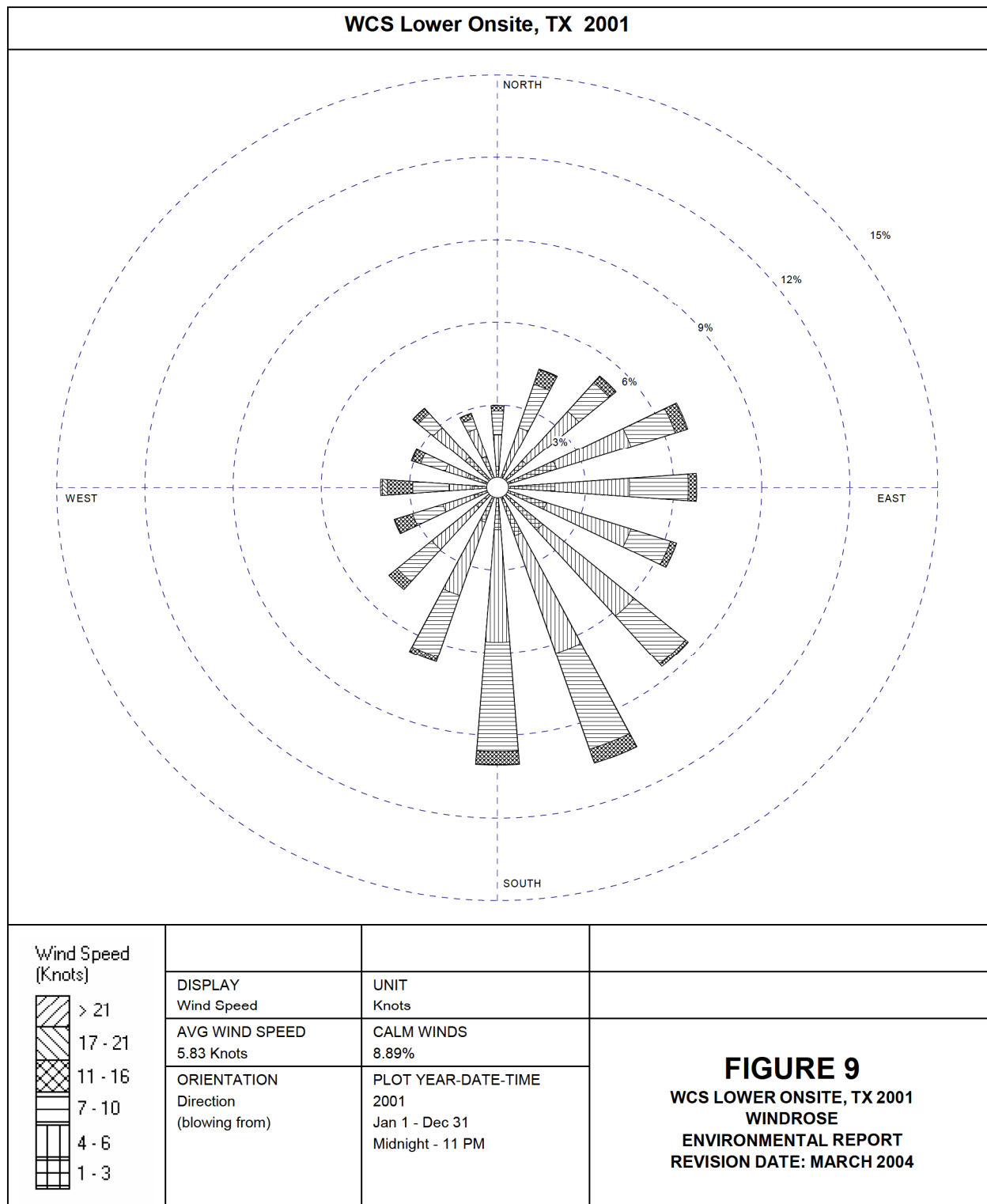


Figure 10. WCS Lower Windrose Data (2002)

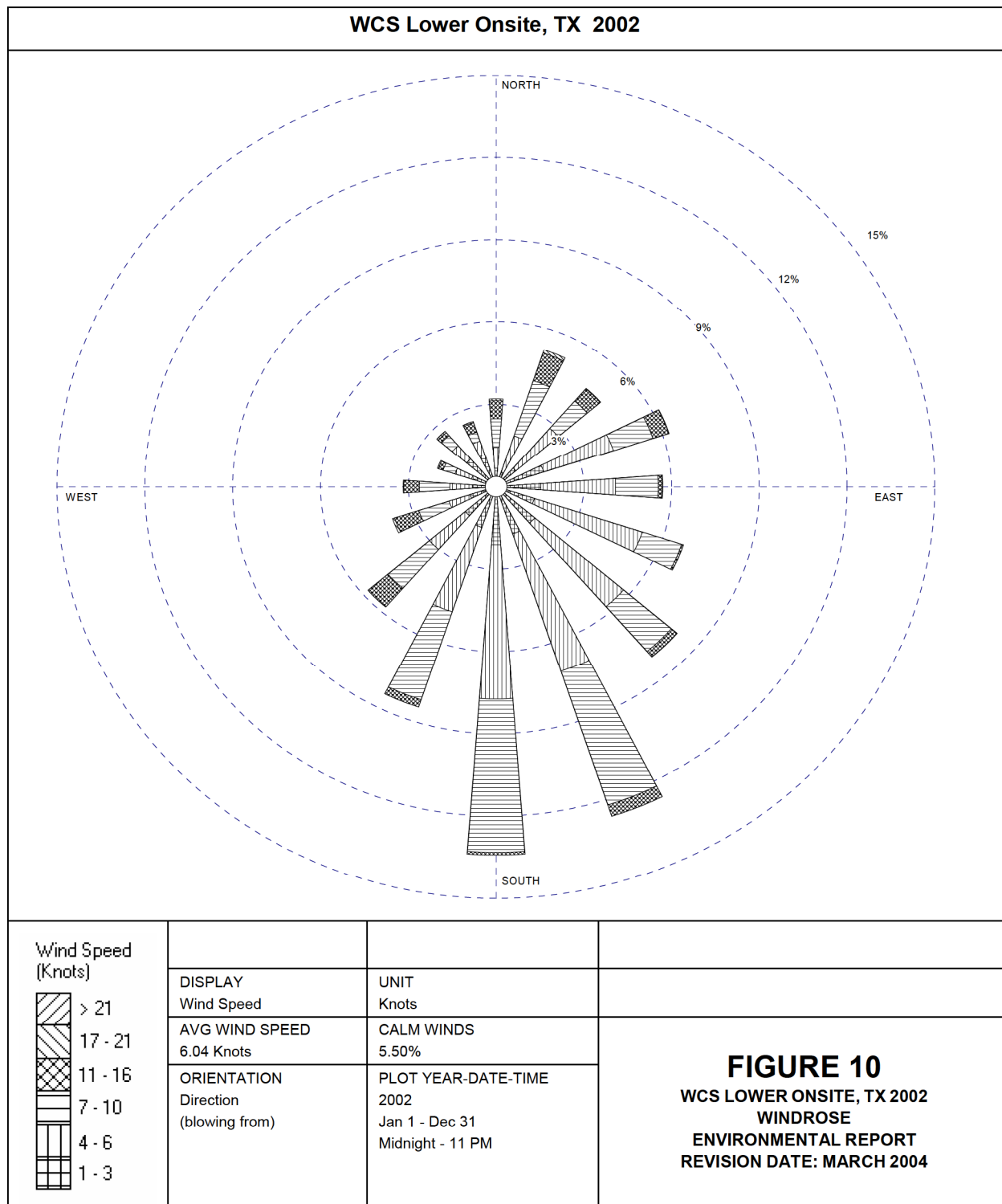
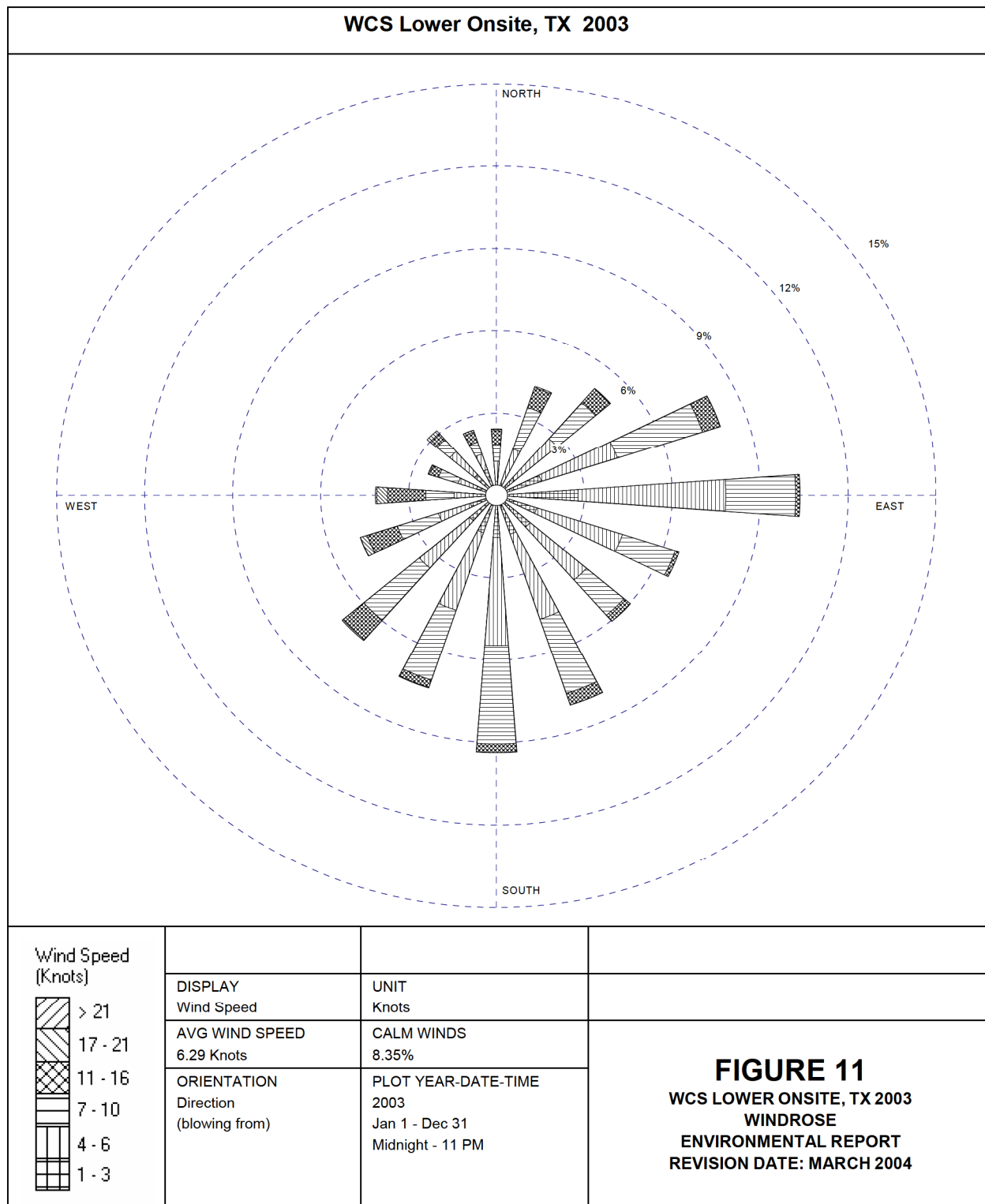


Figure 11. WCS Lower Windrose Data (2003)



WCS Lower Onsite, TX 2004

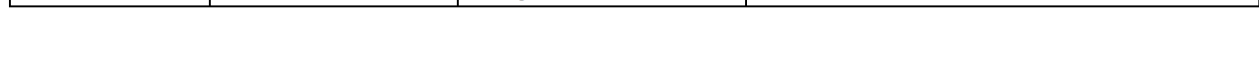


Figure 11B. WCS Lower Windrose Data (2005)

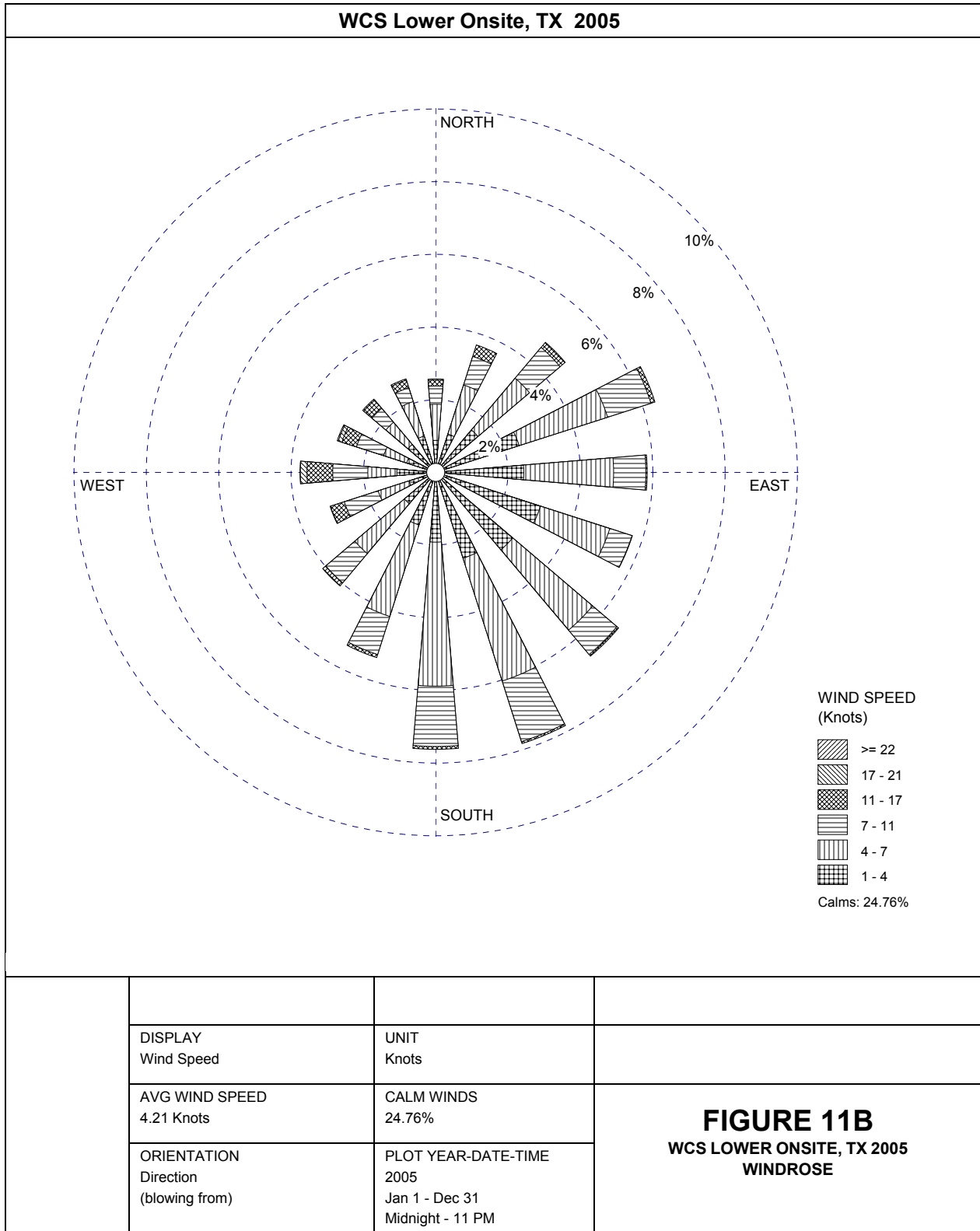


Figure 12. WCS Lower Windrose Data (2000–2005)

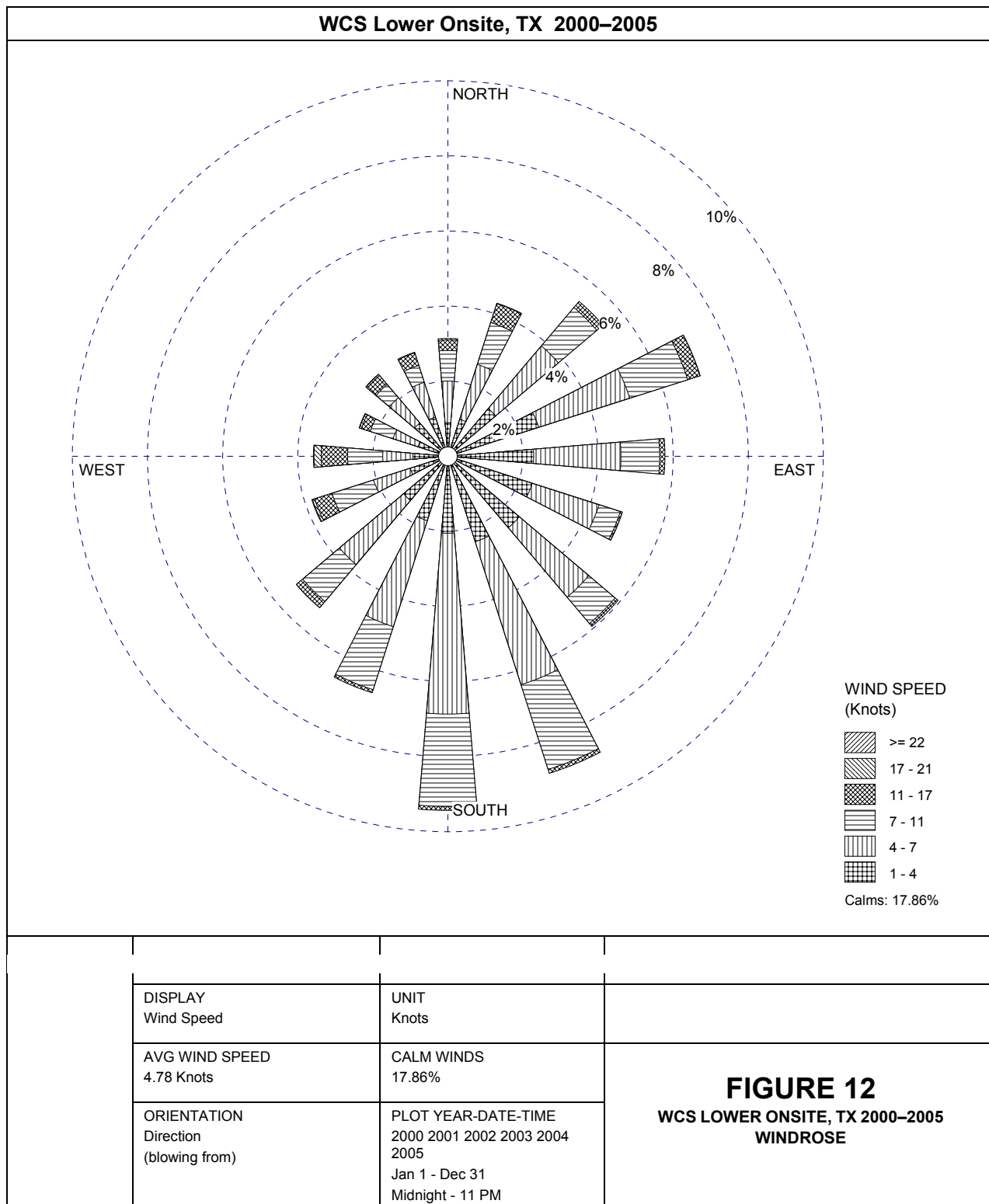


Figure 13. WCS Upper Windrose Data (2000)

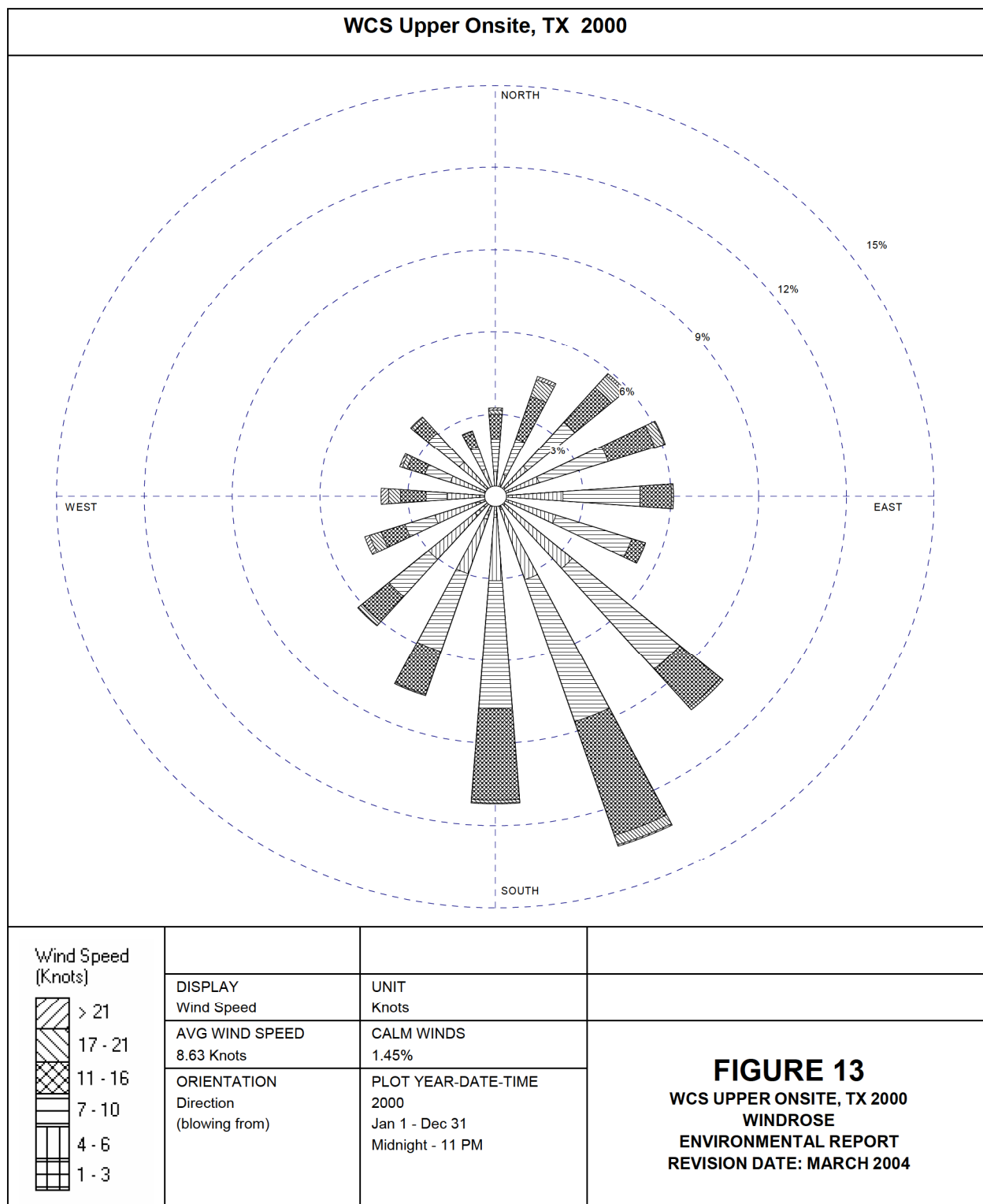


Figure 14. WCS Upper Windrose Data (2001)

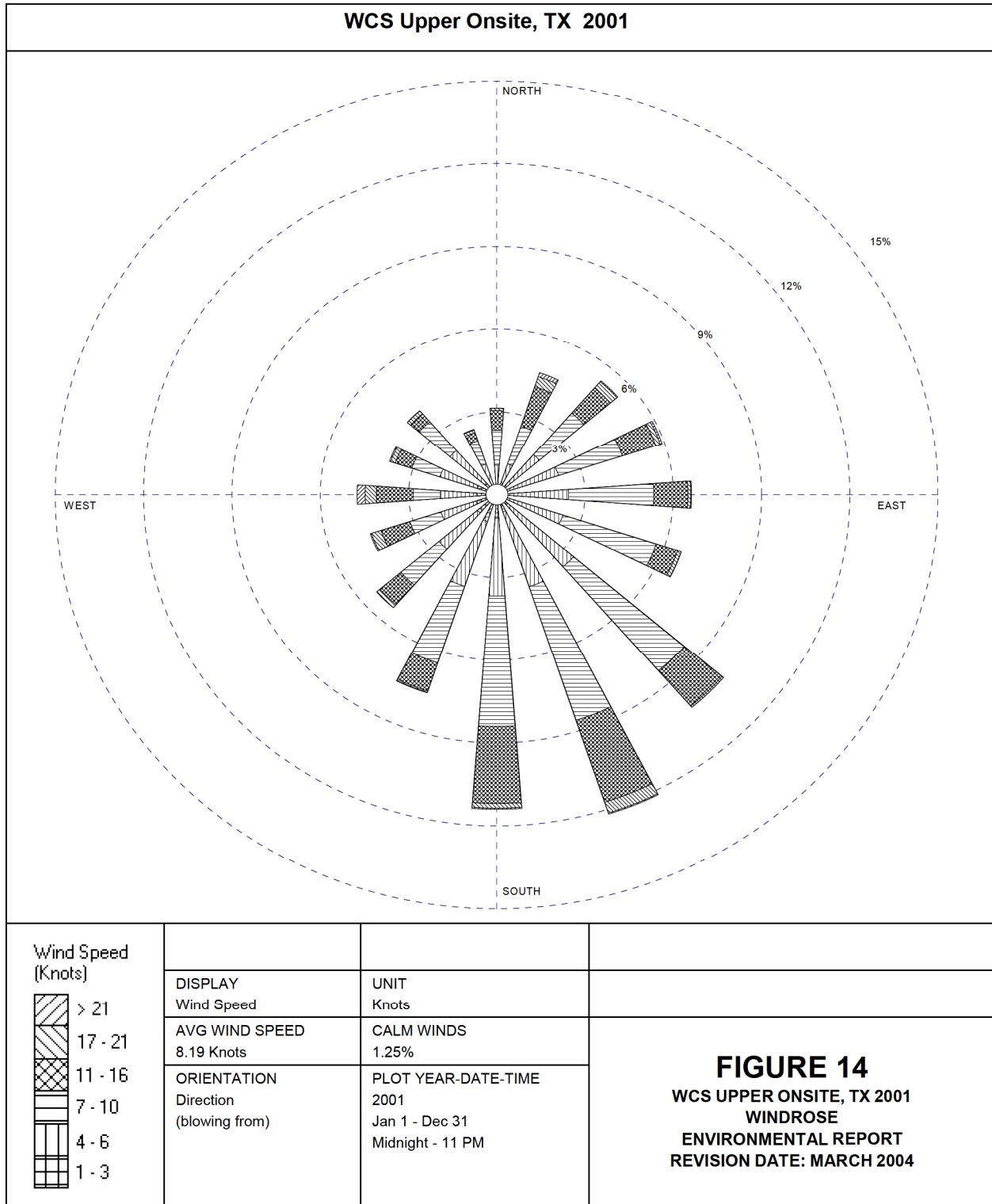


Figure 15. WCS Upper Windrose Data (2002)

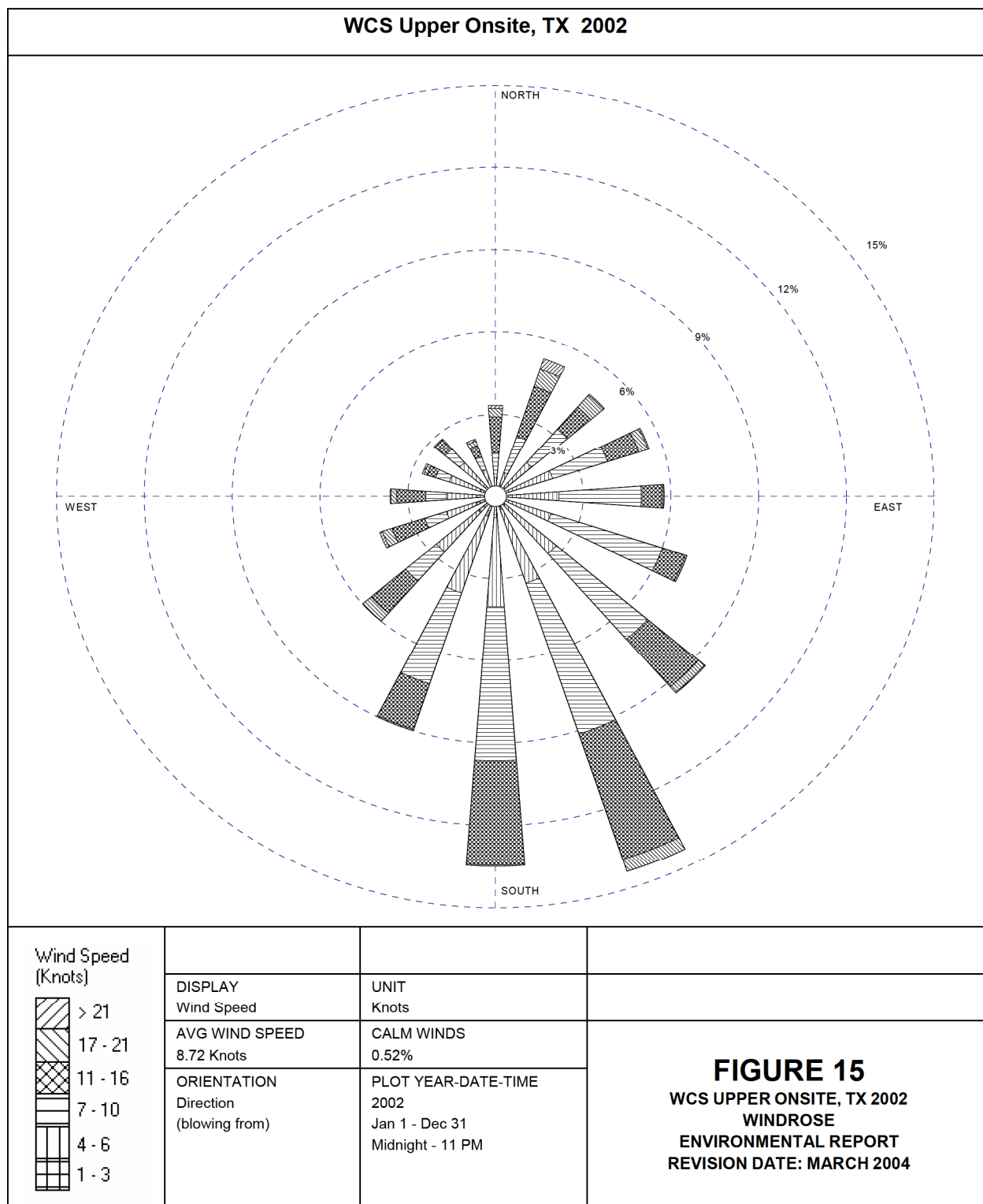


Figure 16. WCS Upper Windrose Data (2003)

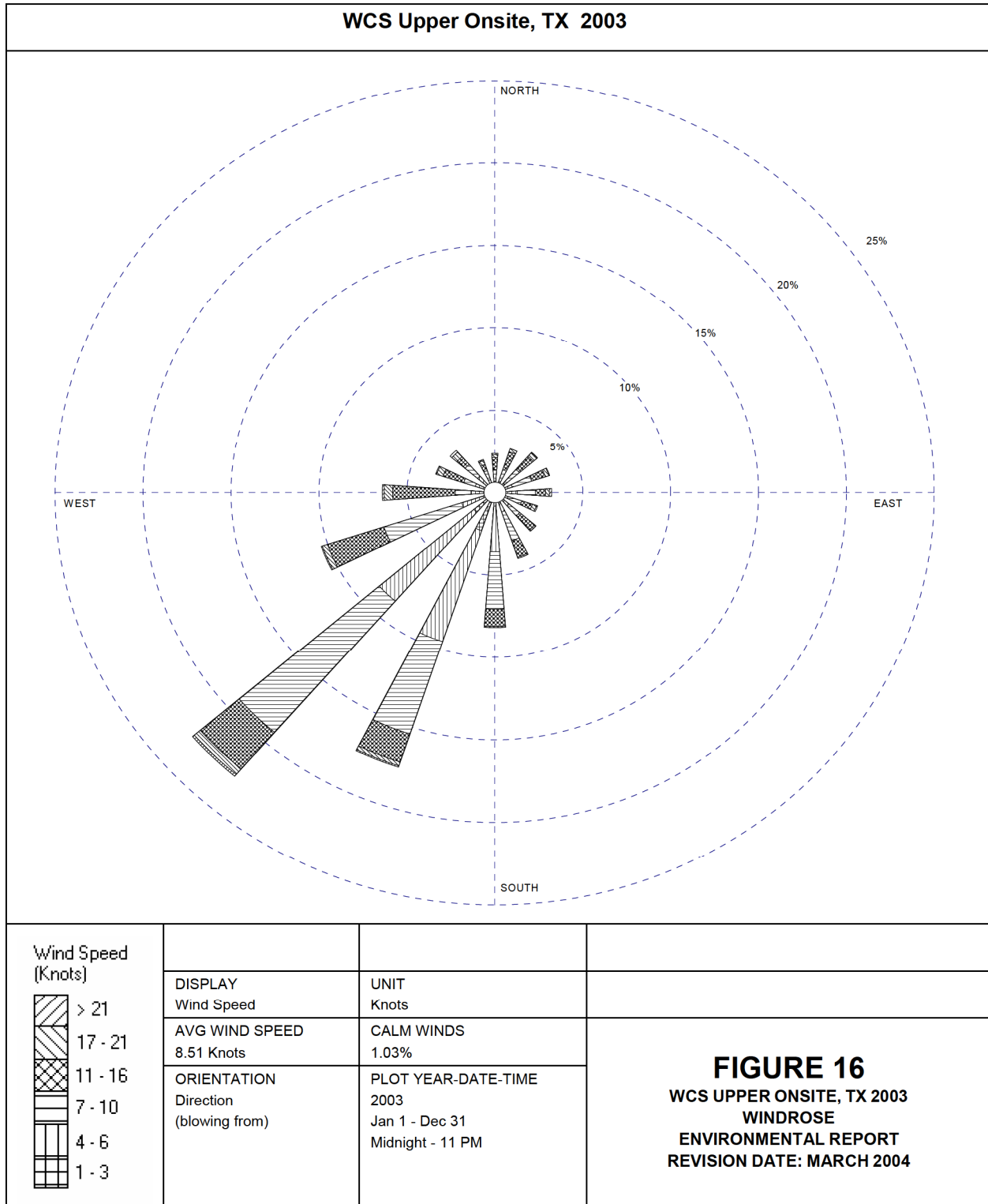


Figure 16A. WCS Upper Windrose Data (2004)

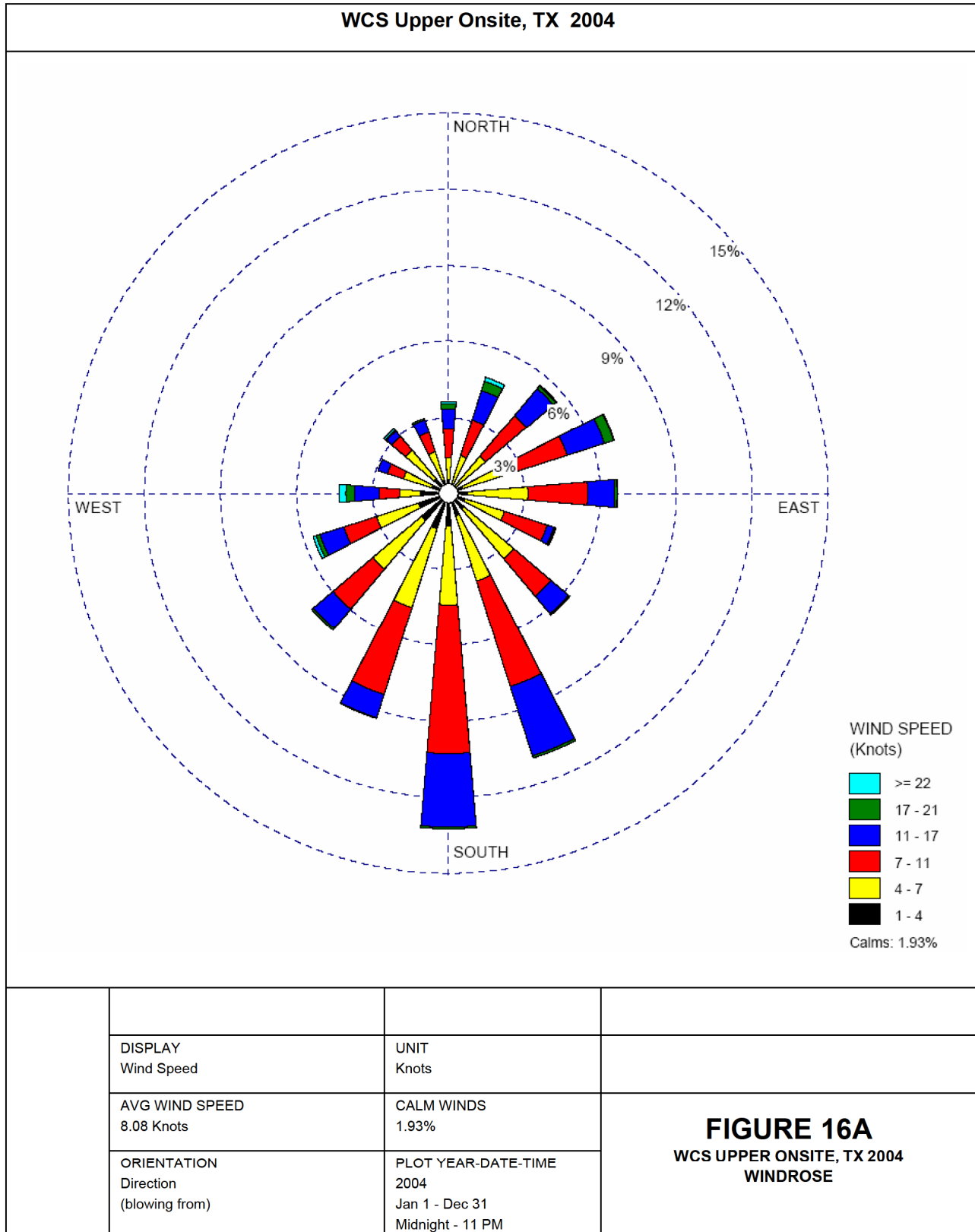


Figure 16B. WCS Upper Windrose Data (2005)

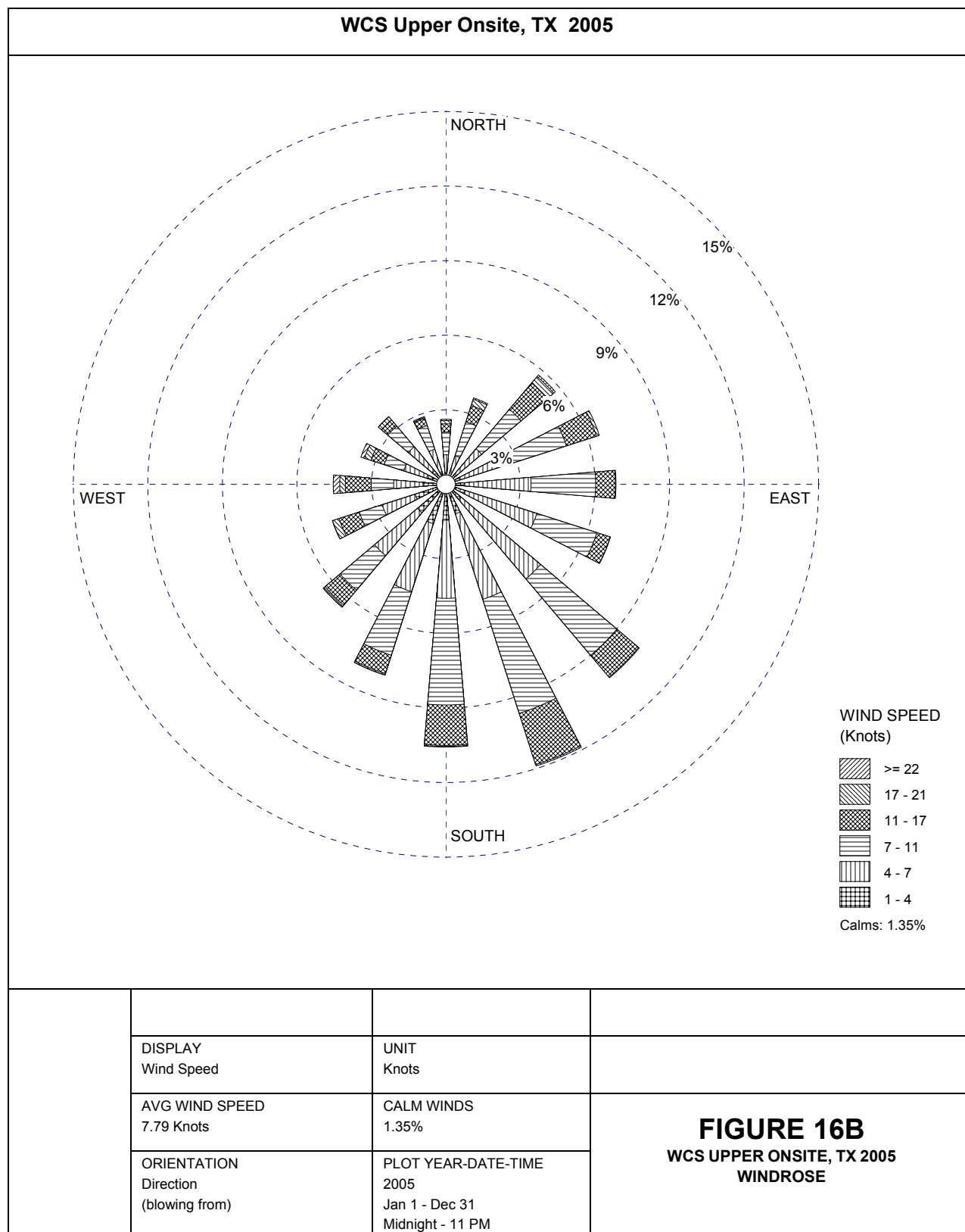
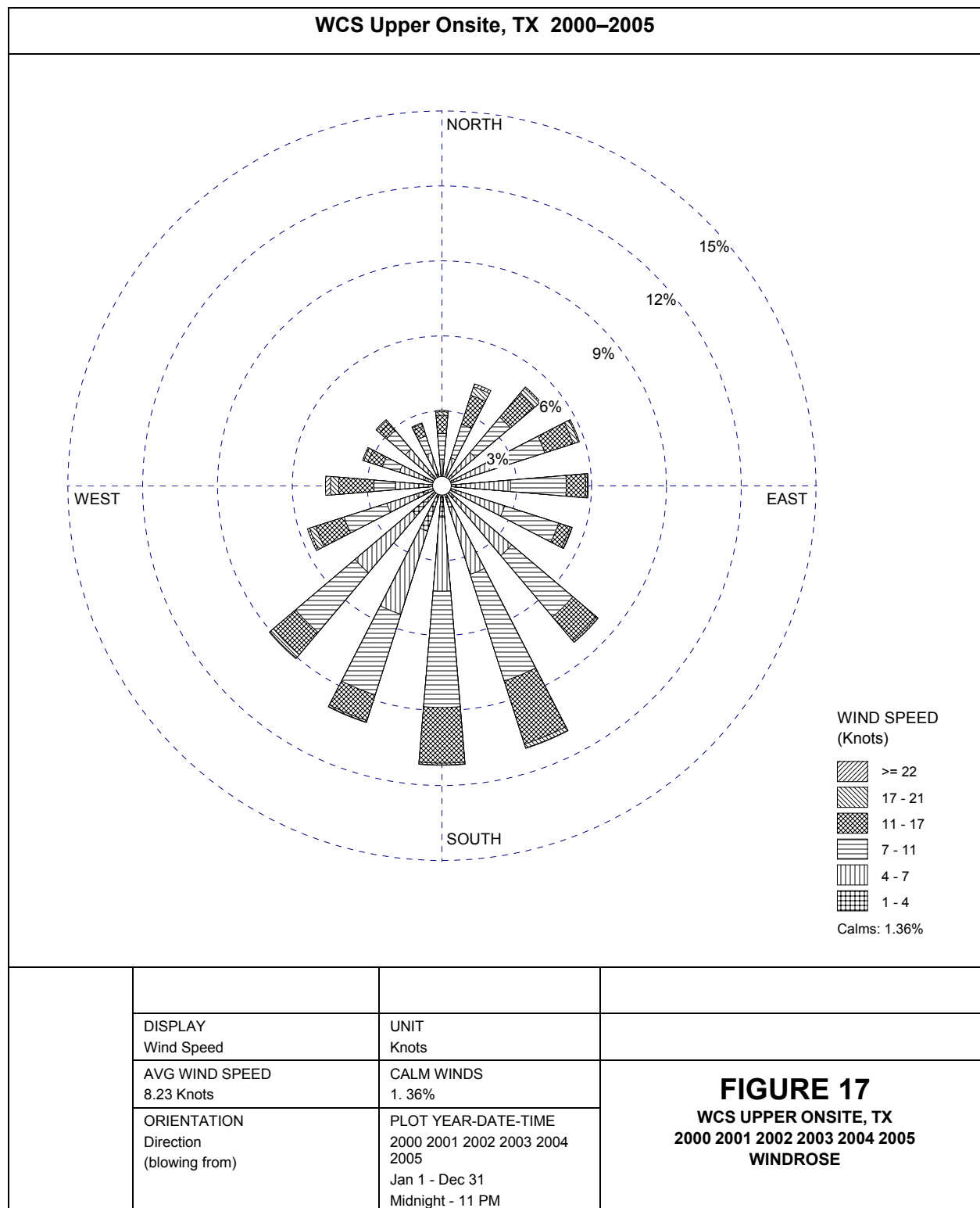


Figure 17. WCS Upper Windrose Data (2000–2005)



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**ATTACHMENT 1: FLOOD EVENTS REPORTED IN ANDREWS
COUNTY**

APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Hail/Andrews%20TX%20Flash%2...

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Query Results

12 FLOOD event(s) were reported in Andrews County,
Texas between 01/01/1993 and 05/31/2004.

Click on *Location or County* to display Details.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	06/25/1996	08:07 PM	Flash Flood	N/A	0	0	0	0
2 Andrews	08/28/1996	03:10 PM	Flash Flood	N/A	0	0	0	0
3 Andrews	07/08/1997	06:15 PM	Flash Flood	N/A	0	0	0	0
4 West Portion	05/26/1998	04:30 PM	Flash Flood	N/A	0	0	0	0
5 Andrews	03/22/2000	02:00 AM	Flash Flood	N/A	0	0	0	0
6 Andrews	06/28/2000	11:45 PM	Flood	N/A	0	0	0	0
7 Andrews	07/01/2000	08:10 AM	Flash Flood	N/A	0	0	0	0
8 Andrews	10/24/2000	03:40 PM	Flash Flood	N/A	0	0	0	0
9 Andrews	08/01/2002	10:55 PM	Flash Flood	N/A	0	0	0	0
10 Andrews	05/24/2003	07:20 PM	Flash Flood	N/A	0	0	0	0
11 Andrews	05/24/2003	09:00 PM	Flash Flood	N/A	0	0	0	0
12 Frankel City	04/04/2004	12:45 PM	Flash Flood	N/A	0	0	0	0
TOTALS:					0	0	0	0

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ATTACHMENT 2: THUNDERSTORM AND HIGH WIND EVENTS REPORTED IN ANDREWS COUNTY

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Thunderstorm/Andrews%20TX%20...

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Query Results

38 THUNDERSTORM & HIGH WIND event(s) were
reported in **Andrews County, Texas** between **01/01/1993**
and **05/31/2004**.

*Click on **Location** or **County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Thunderstorm/Andrews%20TX%20...

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	04/27/1993	1855	Thunderstorm Winds	N/A	0	0	5K	0
2 Andrews	04/27/1993	1920	Thunderstorm Winds	N/A	0	0	50K	0
3 Andrews	05/01/1993	1620	Thunderstorm Winds	N/A	0	0	5K	5K
4 Andrews	08/24/1993	2300	Thunderstorm Winds	N/A	0	0	1K	0
5 Andrews	08/24/1993	2346	Thunderstorm Winds	N/A	0	0	0	0
6 Andrews	12/12/1993	1530	Thunderstorm Winds	N/A	0	0	0	0
7 Andrews	05/26/1994	2057	Thunderstorm Winds	N/A	0	0	0	0
8 Andrews	07/13/1994	1830	Thunderstorm Winds	N/A	0	0	50K	1K
9 Permian Basin	04/17/1995	1300	High Winds	0 kts.	0	0	0	0
10 TXZ045>047 - 050>052 - 058>063 - 067>069	04/19/1995	1300	High Winds	0 kts.	0	0	0	0
11 Loop	06/04/1995	1548	Thunderstorm Winds	N/A	0	0	0	0
12 Frankel City	09/24/1995	2140	Thunderstorm Wind	N/A	0	0	0	0
13 Andrews	09/24/1995	2210	Thunderstorm Winds	N/A	0	0	5K	0
14 TXZ050	01/17/1996	12:20 PM	High Wind	79 kts.	0	0	0	0
15 Andrews	06/02/1996	10:34 PM	Tstm Wind	61 kts.	0	0	0	0
16 Andrews	09/02/1996	04:30 PM	Tstm Wind	52 kts.	0	0	0	0
17 Andrews	05/28/1997	04:17 PM	Tstm Wind	52 kts.	0	0	0	0
18 Andrews	06/11/1997	05:40 PM	Tstm Wind	52 kts.	0	0	10K	0

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Thunderstorm/Andrews%20TX%20...

19 Andrews	05/26/1998	05:00 PM	Tstm Wind	0 kts.	0	0	10K	0
20 Andrews	06/22/1998	06:15 PM	Tstm Wind	0 kts.	0	0	2K	0
21 Andrews	07/16/1998	03:30 PM	Tstm Wind	0 kts.	0	0	1K	0
22 Andrews	04/30/1999	02:33 PM	Tstm Wind	59 kts.	0	0	0	0
23 Andrews	05/29/1999	12:05 AM	Tstm Wind	52 kts.	0	0	0	0
24 Floreys	05/29/1999	12:12 AM	Tstm Wind	0 kts.	0	0	3K	0
25 Andrews	03/07/2000	12:30 PM	Tstm Wind	0 kts.	0	0	10K	0
26 Frankel City	03/22/2000	12:25 AM	Tstm Wind	60 kts.	0	0	0	0
27 Andrews	05/10/2002	07:50 PM	Tstm Wind	52 kts.	0	0	0	0
28 Andrews	05/29/2002	06:00 PM	Tstm Wind	57 kts.	0	0	0	0
29 Andrews	08/01/2002	08:25 PM	Tstm Wind	61 kts.	0	0	50K	0
30 Floreys	08/21/2002	06:30 PM	Tstm Wind	52 kts.	0	0	0	0
31 Andrews	09/13/2002	05:52 PM	Tstm Wind	52 kts.	0	0	0	0
32 Frankel City	10/01/2002	06:05 PM	Tstm Wind	52 kts.	0	0	0	0
33 TXZ050 - 074 - 258	04/15/2003	11:00 AM	High Wind	86 kts.	0	0	35K	0
34 Andrews	06/13/2003	09:46 PM	Tstm Wind	52 kts.	0	0	0	0
35 Andrews	06/22/2003	06:55 PM	Tstm Wind	61 kts.	0	0	30K	0
36 Andrews	09/07/2003	04:10 PM	Tstm Wind	65 kts.	0	0	20K	0
37 Andrews	09/08/2003	12:20 AM	Tstm Wind	70 kts.	0	0	75K	0
38 TXZ045 - 050 - 074 - 258	02/19/2004	03:00 AM	High Wind	82 kts.	0	0	35K	0
TOTALS:					0	0	396K	6K

APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data

NCDC: Query Output

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**ATTACHMENT 3: HAIL EVENTS REPORTED IN ANDREWS
COUNTY**

NCDC: Query Output

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Query Results

74 HAIL event(s) were reported in **Andrews County,**
Texas between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE
Appendix 2.3.1: Meteorological and Climatology Data**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Hail/Andrews%20TX%20Hail%20...

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	04/28/1993	2050	Hail	1.50 in.	0	0	0	1K
2 Andrews	08/24/1993	2300	Hail	0.75 in.	0	0	0	0
3 Andrews	05/10/1994	2147	Hail	1.75 in.	0	0	0	0
4 Andrews	05/10/1994	2235	Hail	1.75 in.	0	0	0	0
5 Andrews	06/04/1995	0730	Hail	1.75 in.	0	0	0	0
6 Gaines	06/04/1995	1342	Hail	0.75 in.	0	0	0	0
7 Seagraves	06/04/1995	1425	Hail	0.75 in.	0	0	0	0
8 Loop	06/04/1995	1455	Hail	0.75 in.	0	0	0	0
9 Loop	06/04/1995	1506	Hail	1.75 in.	0	0	0	0
10 Loop	06/04/1995	1524	Hail	2.75 in.	0	0	0	0
11 Loop	06/04/1995	1545	Hail	4.50 in.	0	0	0	0
12 Loop	06/04/1995	1616	Hail	1.75 in.	0	0	0	0
13 Loop	06/04/1995	1700	Hail	4.50 in.	0	0	0	0
14 Andrews	06/04/1995	2010	Hail	0.75 in.	0	0	0	0
15 Andrews	06/04/1995	2114	Hail	1.75 in.	0	0	0	0
16 Andrews	06/04/1995	2133	Hail	2.50 in.	0	0	0	0
17 Andrews	06/04/1995	2134	Hail	3.50 in.	0	0	6.0M	0
18 Andrews	06/04/1995	2137	Hail	2.75 in.	0	0	0	0
19 Andrews	06/04/1995	2153	Hail	0.75 in.	0	0	0	0
20 Andrews	06/04/1995	2200	Hail	0.75 in.	0	0	0	0
21 Andrews	06/10/1995	1708	Hail	1.75 in.	0	0	500K	0
22 Andrews	06/27/1995	0015	Hail	0.75 in.	0	0	0	0
23 Frankel City	09/24/1995	2140	Hail	1.75 in.	0	0	0	0
24 Andrews	09/24/1995	2200	Hail	0.75 in.	0	0	0	0
25 Andrews	09/24/1995	2210	Hail	1.75 in.	0	0	0	0
26 Andrews	10/02/1995	1318	Hail	0.75 in.	0	0	0	0
27 Frankel City	09/17/1996	07:50 PM	Hail	2.25 in.	0	0	0	0
28 Florey	04/09/1997	09:20 PM	Hail	1.00 in.	0	0	0	0
29 Andrews	04/24/1997	11:18 PM	Hail	1.00 in.	0	0	0	0
30 Andrews	05/14/1997	07:23 PM	Hail	1.50 in.	0	0	0	0

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
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Appendix 2.3.1: Meteorological and Climatology Data**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Hail/Andrews%20TX%20Hail%20...

31	Andrews	05/28/1997	04:17 PM	Hail	0.75 in.	0	0	0	0
32	Andrews	05/28/1997	04:20 PM	Hail	0.88 in.	0	0	0	0
33	Andrews	05/28/1997	06:10 PM	Hail	1.75 in.	0	0	0	0
34	Frankel City	05/29/1997	07:33 PM	Hail	0.75 in.	0	0	0	0
35	Andrews	05/29/1997	07:47 PM	Hail	1.00 in.	0	0	0	0
36	Andrews	06/11/1997	05:06 PM	Hail	1.75 in.	0	0	0	0
37	Andrews	06/11/1997	05:30 PM	Hail	1.00 in.	0	0	0	0
38	Andrews	05/14/1998	10:35 PM	Hail	1.75 in.	0	0	0	0
39	Andrews	05/26/1998	03:00 PM	Hail	1.75 in.	0	0	0	0
40	Andrews	05/26/1998	03:28 PM	Hail	2.75 in.	0	0	0	0
41	Andrews	05/26/1998	04:30 PM	Hail	1.75 in.	0	0	0	0
42	Andrews	06/22/1998	06:15 PM	Hail	1.75 in.	0	0	0	0
43	Andrews	06/22/1998	06:57 PM	Hail	1.25 in.	0	0	0	0
44	Andrews	07/16/1998	03:30 PM	Hail	0.75 in.	0	0	0	0
45	Andrews	10/27/1998	05:45 PM	Hail	0.75 in.	0	0	0	0
46	Andrews	10/30/1998	10:02 PM	Hail	0.88 in.	0	0	0	0
47	Andrews	04/28/1999	06:53 PM	Hail	0.75 in.	0	0	0	0
48	Andrews	04/28/1999	08:43 PM	Hail	1.75 in.	0	0	5.0M	0
49	Frankel City	05/01/1999	08:30 PM	Hail	1.00 in.	0	0	0	0
50	Andrews	05/26/1999	07:10 PM	Hail	1.75 in.	0	0	0	0
51	Andrews	06/06/1999	06:10 PM	Hail	0.75 in.	0	0	0	0
52	Andrews	06/09/1999	07:50 PM	Hail	1.00 in.	0	0	0	0
53	Andrews	06/09/1999	07:58 PM	Hail	1.00 in.	0	0	0	0
54	Andrews Co Arpt	06/09/1999	08:12 PM	Hail	1.00 in.	0	0	0	0
55	Frankel City	06/11/1999	05:25 PM	Hail	2.25 in.	0	0	0	0
56	Frankel City	03/22/2000	12:25 AM	Hail	1.00 in.	0	0	0	0
57	Frankel City	03/22/2000	12:55 AM	Hail	1.00 in.	0	0	0	0
58	Andrews	05/10/2001	08:18 AM	Hail	1.00 in.	0	0	0	0
59	Florey	05/11/2001	02:52 PM	Hail	1.00 in.	0	0	0	0
60	Andrews	05/11/2001	03:10 PM	Hail	1.75 in.	0	0	0	0
61	Andrews	04/19/2002	04:57 PM	Hail	1.75 in.	0	0	0	0

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10/12/2004 4:33 PM

**APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
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Appendix 2.3.1: Meteorological and Climatology Data**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Hail/Andrews%20TX%20Hail%20...

62	Andrews	04/19/2002	05:05 PM	Hail	1.00 in.	0	0	0	0
63	Andrews	04/19/2002	06:40 PM	Hail	0.75 in.	0	0	0	0
64	Andrews	05/27/2002	02:45 PM	Hail	1.75 in.	0	0	0	0
65	Andrews	05/27/2002	09:00 AM	Hail	1.75 in.	0	0	0	0
66	Frankel City	10/01/2002	06:05 PM	Hail	1.00 in.	0	0	0	0
67	Andrews	04/28/2003	05:10 PM	Hail	1.00 in.	0	0	0	0
68	Andrews	06/07/2003	06:22 PM	Hail	0.88 in.	0	0	0	0
69	Andrews	06/22/2003	06:45 PM	Hail	1.75 in.	0	0	0	0
70	Andrews	09/07/2003	04:10 PM	Hail	0.75 in.	0	0	0	0
71	Andrews	09/08/2003	12:25 AM	Hail	1.00 in.	0	0	0	0
72	Andrews	10/05/2003	06:40 PM	Hail	1.75 in.	0	0	0	0
73	Frankel City	03/03/2004	09:55 PM	Hail	0.88 in.	0	0	0	0
74	Andrews	03/20/2004	05:15 PM	Hail	0.75 in.	0	0	0	0
TOTALS:						0	0	11.500M	500

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**ATTACHMENT 4: LIGHTNING EVENTS REPORTED IN
ANDREWS COUNTY**

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Lightning/Andrews%20TX%20Ligh...

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Query Results

0 LIGHTNING event(s) were reported in **Andrews County, Texas** between
01/01/1993 and **05/31/2004**.

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**ATTACHMENT 5: TORNADO EVENTS REPORTED IN
ANDREWS COUNTY**

APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
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Appendix 2.3.1: Meteorological and Climatology Data

NCDC: Query Output

file:///G:/WCS/CurrentEnvData/Hail/Andrews%20TX%20Tornado...

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Query Results

2 TORNADO(s) were reported in **Andrews County,**
Texas between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	05/26/1994	2046	Tornado	F0	0	0	0	0
2 Andrews	05/08/1997	07:26 PM	Tornado	F1	0	0	0	0
TOTALS:					0	0	0	0

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NCDC: Query Output

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Query Results

22 TORNADO(s) were reported in **Andrews County,**
Texas between **01/01/1950** and **12/31/2003**.

Click on Location or County to display Details.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 ANDREWS	05/29/1954	1722	Tornado	F1	0	9	0K	0
2 ANDREWS	05/07/1956	1835	Tornado	F1	0	1	25K	0
3 ANDREWS	05/15/1959	0115	Tornado	F0	0	0	0K	0
4 ANDREWS	05/31/1960	1900	Tornado	F0	0	0	0K	0
5 ANDREWS	06/16/1962	1915	Tornado	F2	0	0	0K	0
6 ANDREWS	05/13/1965	1445	Tornado	F1	0	0	3K	0
7 ANDREWS	04/10/1969	2300	Tornado	F0	0	0	0K	0
8 ANDREWS	05/05/1969	1457	Tornado	F0	0	0	0K	0
9 ANDREWS	05/05/1969	1500	Tornado	F0	0	0	0K	0
10 ANDREWS	05/05/1969	1500	Tornado	F0	0	0	0K	0
11 ANDREWS	06/13/1969	1955	Tornado	F0	0	0	0K	0
12 ANDREWS	06/07/1980	2130	Tornado	F1	0	0	25K	0
13 ANDREWS	05/12/1982	0235	Tornado	F2	0	0	0K	0
14 ANDREWS	10/02/1986	1553	Tornado	F1	0	0	250K	0
15 ANDREWS	05/30/1987	1915	Tornado	F1	0	0	0K	0
16 ANDREWS	04/16/1988	1548	Tornado	F1	0	0	0K	0
17 ANDREWS	04/16/1988	1617	Tornado	F0	0	0	0K	0
18 ANDREWS	04/16/1988	1620	Tornado	F0	0	0	0K	0
19 ANDREWS	05/19/1988	1705	Tornado	F0	0	0	0K	0
20 ANDREWS	06/06/1992	1558	Tornado	F0	0	0	0K	0
21 Andrews	05/26/1994	2046	Tornado	F0	0	0	0	0

APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE
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NCDC: Query Output

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEven...>

22 Andrews	05/08/1997	07:26 PM	Tornado	F1	0	0	0	0
TOTALS:					0	10	303K	0

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NCDC: Event Details

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~ShowEven...>

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Event Record Details

Event: Tornado	State: Texas
Begin Date: 12 May 1982, 0235 CST	Map of Counties
Begin Location: Not Known	County: Andrews
Begin LAT/LON: 32°25'N / 102°45'W	
End Location: Not Known	
End LAT/LON: 32°32'N / 102°43'W	
Length: 6 Miles	
Width: 100 Yards	
Magnitude: F2	
Fatalities: 0	
Injuries: 0	
Property Damage: \$ 0.3K	
Crop Damage: \$ 0.0	

Description:
None Reported

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NCDC: Event Details

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Event Record Details

Event: Tornado	State: Texas
Begin Date: 16 Jun 1962, 1915 CST	Map of Counties
Begin Location: Not Known	County: Andrews
Begin LAT/LON: 32°28'N / 102°14'W	
End Location: Not Known	
Length: 1 Mile	
Width: 20 Yards	
Magnitude: F2	
Fatalities: 0	
Injuries: 0	
Property Damage: \$ 0.0K	
Crop Damage: \$ 0.0	

Description:
None Reported

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The Fujita Tornado Scale



Wind speeds in tornadoes range from values below that of hurricane speeds to more than 300 miles per hour! Unlike hurricanes, which produce wind speeds of similar values over relatively widespread areas (when compared to tornadoes), the maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. The tales of complete destruction of one house next to one that is totally undamaged are true and well documented.

In 1971, Dr. T. Theodore Fujita of the University of Chicago devised a six-category scale to classify U.S. tornadoes into six intensity categories, named F0-F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") has subsequently become the definitive scale for estimating wind speeds within tornadoes based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornadoes (all tornadoes are now assigned an F scale), and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornadoes.

The Fujita scale bridges the gap between the Beaufort Wind Speed Scale and Mach numbers (ratio of the speed of an object to the speed of sound) by connecting Beaufort Force 12 with Mach 1 in twelve steps. The equation relating the wind velocities (V in mph) with the F scale (F) is $V = 14.1 * ((F+2) \text{ to the } 1.5 \text{ power})$.

F1 on the Fujita scale is equal to B12 (73 mph) on the Beaufort scale, which is the minimum windspeed required to upgrade a tropical storm to a hurricane. F12 on the Fujita scale is equal to M1 (738 mph) on the Mach numbers. Though the Fujita scale itself ranges up to F12, the strongest tornadoes max out in the F5 range (261 to 318 mph).

The Fujita Tornado Scale

Maximum Wind Speeds	Equivalent Saffir-Simpson Scale*	Typical Effects
<i>F0 Category Tornado</i>		
40-72 mph (35-62 kt)	NA	Gale Tornado. Light Damage: Some damage to chimneys; breaks twigs and branches off trees; pushes over shallow-rooted trees; damages signboards; some windows broken; hurricane wind speed

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NCDC: Satellite Events Art Gallery: Educational Topics

<http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/fujit...>

		begins at 73 mph.
<i>F1 Category Tornado</i>		
73-112 mph (63-97 kt)	Cat 1/2/3	Moderate Tornado. Moderate damage: Peels surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
<i>F2 Category Tornado</i>		
113-157 mph (98-136 kt)	Cat 3/4/5	Significant Tornado. Considerable damage: Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
<i>F3 Category Tornado</i>		
158-206 mph (137-179 kt)	Cat 5	Severe Tornado. Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
<i>F4 Category Tornado</i>		
207-260 mph (180-226 kt)	Cat 5?	Devastating Tornado. Devastating damage: Well constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away.
<i>F5 Category Tornado</i>		
261-318 mph (227-276 kt)	NA	Incredible Tornado. Incredible damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 ft (100 m); trees debarked; incredible phenomena will occur.
<i>F6-F12 Category Tornadoes</i>		
Gtr than 319 mph (277 kt)	NA	The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

* The [Saffir-Simpson Scale](#) is a five-category wind speed / storm surge classification scale used to classify Atlantic hurricane intensities. The Saffir-Simpson values range from Category 1 to Category 5. The strongest SUSTAINED hurricane wind speeds correspond to a strong F3 (Severe Tornado) or possibly a weak F4 (Devastating Tornado) value. Whereas the highest wind gusts in Category 5 hurricanes correspond to moderate F4 tornado values, F5 tornado wind speeds are not reached in hurricanes.

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NCDC: Satellite Events Art Gallery: Educational Topics

<http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/fujit...>

Reference:

1987: Fujita, T. Theodore, "U.S. Tornadoes Part 1 70-Year Statistics," Satellite and Mesometeorology Research Project (SMRP) Research Paper Number 218, University of Chicago, 122 pp.



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ATTACHMENT 6: SOURCE PRECIPITATION DATA CD