WHITLASH

LIBERTY COUNTY

The Whitlash site is located four miles south of Whitlash and about twenty-eight miles north-northwest of Chester at 48 51 36 N and 111 14 46 W (Site No. 156 on Map II-1). Elevation at the site is 4,300 feet. This monitoring site is part of the wind monitoring program of the Montana Department of Natural Resources and Conservation.

The site is atop a drainage divide in a rolling grassland area near the Sweet Grass Hills. It has excellent exposure to winds from all directions. The site is indicative of the potential of a drainage divide that runs approximately east and west and is several miles long. The site is right next to a county road, but 28 miles from a paved road. Winter access sometimes is hampered by drifting snow and severe weather conditions.

The site is located in a sparsely populated area near the Canadian border. Most of the land in the area is privately owned. Electrical service in the area is provided by the Marias Electric Cooperative. One 115 kV line runs along the highway 28 miles south from Havre to Cut Bank. There is no commercial airport nearby.

Wind data was collected from November 18, 1983 to July 24, 1985. A Met One anemometer and a Campbell Scientific datalogger were used. The anemometer height was 33 feet.

Data recovery was poor to excellent, ranging from 0.0 percent in October to 99.9 percent in August. Overall data recovery was 76.6 percent.

Average monthly wind speeds ranged from 11.7 miles per hour in March to 15.5 miles per hour in September. The March figure may be inaccurate because of the poor data recovery that month. Average annual wind speed was 13.6 miles per hour.

Average monthly wind power ranged from 129.4 watts/m^2 in July up to 465.0 watts/m^2 in January.

Average wind speed did not vary much between seasons. Average seasonal speeds were 12.7 miles per hour in the summer, 13.2 miles per hour in the autumn, 14.2 miles per hour in the winter, and 14.1 miles per hour in the spring. In the winter, the highest wind speed occurred in mid-afternoon. In the spring, highest winds happened in the late afternoon and early evening. High winds in the summer were somewhat later still in the early evening. In the fall, the highest winds came in the early afternoon. Diurnal range of average wind speeds was greatest in the summer and somewhat less in the autumn and spring. The range was smallest in the winter.

The most common wind direction was from the north. Winds blew about four to nine percent of the time from most other directions; winds from the northeast through east-southeast were fairly uncommon. By direction, average wind speeds ranged from 20.4 miles per hour from the west to 5.6 miles per hour from the east.

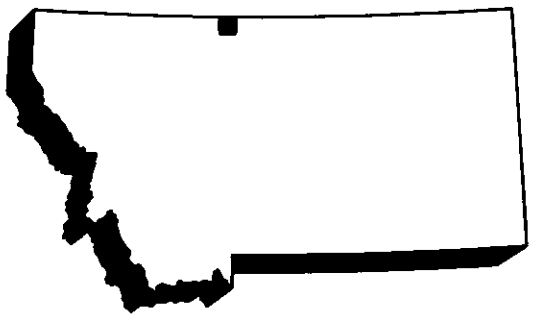


Table IV - 98

Monthly Wind Speed Distribution

LIBERTY COUNTY - WHITLASH

11/18/83 - 07/24/85

SPEED MILES/HOUR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	SPEED METERS/SEC
CALM	1.4	0.0	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.3	CALM
0.1-1.0	0.8	0.1	0.6	0.1	0.0	0.2	0.2	0.0	0.2	0.0	0.9	1.1	0.4	0.1- 0.4
1.1-2.0	1.5	1.3	2.6	0.9	0.7	0.8	0.8	0.5	0.5	0.0	1.9	1.9	1.2	0.5- 0.9
2.1-3.0	2.5	1.5	3.5	1.4	0.7	2.0	2.2	1.9	2.8	0.0	2.5	2.6	2.0	1.0- 1.3
3.1-4.0	5.3	4.6	5.0	3.2	2.4	4.2	3.9	4.3	4.2	0.0	5.1	3.6	4.1	1.4- 1.8
4.1-5.0	5.0	3.6	4.4	3.9	3.8	4.1	4.0	3.9	3.4	0.0	4.4	4.2	4.1	1.9- 2.2
5.1-6.0	5.1	7.1	8.3	4.9	6.1	5.1	6.0	6.3	5.5	0.0	8.2	4.8	6.0	2.3- 2.7
6.1-7.0	3.7	5.5	5.7	3.5	5.3	5.1	5.8	5.8	4.4	0.0	6.0	5.4	5.1	2.8- 3.1
7.1-8.0	5.5	6.0	6.0	4.8	6.0	7.0	7.7	7.7	5.1	0.0	9.1	6.5	6.5	3.2- 3.6
8.1-9.0	3.5	4.3	5.1	4.1	4.7	4.4	6.1	5.8	5.1	0.0	7.6	4.6	5.0	3.7- 4.0
9.1-10.0	4.5	6.4	6.6	6.4	5.5	6.3	6.9	7.8	6.2	0.0	6.8	5.5	6.2	4.1- 4.5
10.1-11.0	5.3	4.6	4.4	3.0	5.0	4.5	6.3	5.7	4.9	0.0	5.3	6.3	5.0	4.6- 4.9
11.1-12.0	4.9	6.3	5.5	4.4	5.9	5.6	6.9	4.7	4.1	0.0	5.5	6.9	5.6	5.0- 5.4
12.1-13.0	3.0	4.3	3.4	4.1	6.0	4.3	4.7	5.0	2.8	0.0	4.3	4.7	4.4	5.5- 5.8
13.1-14.0	3.8	5.7	5.5	4.8	4.1	4.9	6.8	4.7	3.7	0.0	5.0	5.1	5.0	5.9- 6.3
14.1-15.0	3.6	3.7	3.4	3.9	3.8	3.3	3.8	5.5	2.6	0.0	2.2	3.7	3.6	6.4- 6.7
15.1-16.0	2.6	3.0	3.8	3.1	3.4	3.8	4.1	3.2	3.5	0.0	2.1	3.5	3.3	6.8- 7.2
16.1-17.0	2.8	4.1	3.2	3.3	3.9	4.9	4.4	4.8	2.3	0.0	2.6	2.3	3.6	7.3- 7.6
17.1-18.0	2.3	2.4	2.3	3.2	2.4	4.0	2.7	2.3	2.5	0.0	1.5	2.4	2.6	7.7- 8.0
18.1-19.0	2.6	3.3	3.5	4.2	3.8	4.3	4.9	3.2	3.5	0.0	2.5	2.0	3.5	8.1- 8.5
19.1-20.0	1.8	1.7	2.3	3.7	3.8	2.9	3.5	1.5	2.3	0.0	0.8	1.3	2.5	8.6- 8.9
20.1-25.0	8.4	10.3	6.1	17.1	11.1	10.6	5.5	10.0	12.0	0.0	6.9	9.4	9.8	9.0-11.2
25.1-30.0	8.3	5.4	4.5	6.5	6.7	5.8	2.2	3.2	9.3	0.0	4.6	4.9	5.5	11.3-13.4
30.1-35.0	5.9	2.9	2.5	3.8	4.1	1.0	0.5	0.9	4.4	0.0	2.7	3.4	2.9	13.5-15.6
35.1-40.0	3.0	0.6	0.0	1.4	0.7	0.4	0.0	0.4	3.0	0.0	1.2	2.0	1.1	15.7-17.9
>40.0	2.8	0.9	0.0	0.1	0.0	0.4	0.0	0.8	1.6	0.0	0.0	1.5	0.7	>17.9
AVERAGE SPEED (MPH)	15.3	13.6	11.7	15.3	14.4	13.4	11.9	12.7	15.5	ND	11.9	13.7	13.6	
AVERAGE SPEED (M/SEC)	6.8	6.1	5.2	6.8	6.4	6.0	5.3	5.7	6.9	ND	5.3	6.1	6.1	
AVERAGE WIND POWER (WATTS/M**2)	465.0	272.6	173.9	313.8	261.1	208.6	129.4	188.0	377.3	ND	196.6	312.2	259.6	
PERCENT DATA RECOVERY	73.7	72.5	46.0	72.7	99.5	99.8	98.5	99.9	78.8	0.0	94.2	66.5	76.6	

ANEMOMETER HEIGHT = 10 METERS = 33 FEET
NUMBER OF OBSERVATIONS = 11310
PERCENTAGE DATA RECOVERY = 76.6

SOURCE: GEORESEARCH, INC.

Table IV - 99

Percentage Frequency Summary for Wind Speed

LIBERTY COUNTY - WHITLASH

(WINTER)

11/18/83 - 07/24/85

		WIND SPEED (MPH)																	
		CALM	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1-14.0	14.1-16.0	16.1-18.0	18.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1-40.0	>40.0		
		WIND SPEED (METERS/SECOND)																	
		CALM	0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9	AV SPEED (MPH)	AV SPEED (M/SEC)
	1	0.0	1.6	7.8	10.9	10.9	10.9	11.6	8.5	6.2	4.7	3.9	8.5	7.0	4.7	2.3	0.8	14.0	6.3
	2	1.6	0.8	7.0	12.4	13.2	9.3	6.2	10.1	5.4	5.4	5.4	10.9	5.4	4.7	2.3	0.0	13.8	6.2
	3	1.6	0.0	8.5	8.5	18.6	7.0	7.8	9.3	7.8	4.7	5.4	10.9	3.1	5.4	0.8	0.8	13.4	6.0
	4	1.6	0.0	10.9	11.6	10.9	9.3	14.0	6.2	3.1	8.5	2.3	10.1	3.9	6.2	0.0	1.6	13.4	6.0
	5	0.0	3.1	7.0	15.5	10.9	7.8	10.1	7.0	5.4	2.3	9.3	11.6	3.1	3.1	1.6	2.3	13.7	6.1
	6	0.0	2.3	5.4	10.9	10.1	11.6	10.9	5.4	7.8	5.4	10.9	7.8	3.1	3.1	1.6	3.9	14.6	6.5
	7	0.0	3.9	7.0	12.4	11.6	6.2	10.1	11.6	8.5	2.3	3.1	11.6	2.3	3.9	0.8	4.7	14.2	6.4
	8	0.0	2.3	4.7	14.0	11.6	9.3	11.6	10.1	5.4	3.1	7.8	5.4	5.4	5.4	0.8	3.1	14.3	6.4
H	9	0.0	3.1	9.4	9.4	10.2	10.9	10.2	12.5	5.5	3.9	3.1	7.0	7.8	3.1	2.3	1.6	13.8	6.2
	10	0.0	3.9	9.4	11.7	10.9	7.0	8.6	9.4	7.0	6.3	3.1	8.6	6.3	3.9	1.6	2.3	13.8	6.2
O	11	0.8	6.3	9.4	10.2	7.0	7.8	14.8	8.6	3.9	3.9	6.3	11.7	3.1	4.7	0.8	0.8	13.2	5.9
	12	3.2	4.0	8.1	7.3	12.1	13.7	4.8	7.3	5.6	8.9	1.6	9.7	6.5	4.8	0.8	1.6	13.5	6.0
U	13	1.5	4.6	5.4	9.2	10.8	8.5	10.8	6.2	10.8	5.4	0.0	13.8	3.8	6.2	0.8	2.3	14.6	6.5
	14	2.3	2.3	3.8	6.9	7.7	10.0	13.8	12.3	8.5	3.8	1.5	9.2	6.2	7.7	2.3	1.5	15.4	6.9
R	15	0.8	2.3	3.1	4.6	7.7	13.8	15.4	8.5	4.6	6.2	0.8	15.4	5.4	8.5	1.5	1.5	15.9	7.1
	16	1.5	1.5	1.5	6.2	12.3	8.5	11.5	8.5	6.9	7.7	5.4	16.2	3.1	6.2	2.3	0.8	15.6	7.0
	17	0.0	2.3	7.8	7.0	5.4	8.5	13.2	9.3	6.2	10.9	4.7	15.5	3.1	2.3	2.3	1.6	14.9	6.7
	18	0.0	0.8	12.4	7.0	7.0	10.9	13.2	9.3	8.5	4.7	3.9	12.4	3.9	3.9	0.8	1.6	14.0	6.3
	19	0.0	3.1	11.8	5.5	11.0	10.2	15.0	9.4	5.5	3.1	3.1	11.0	4.7	3.1	2.4	0.8	13.5	6.1
	20	0.0	1.6	5.5	15.0	11.8	6.3	13.4	4.7	8.7	7.1	2.4	9.4	4.7	5.5	3.1	0.8	14.4	6.4
	21	0.0	0.0	4.7	11.0	10.2	11.0	10.2	7.9	8.7	7.1	5.5	10.2	5.5	4.7	3.1	0.0	14.8	6.6
	22	0.0	0.8	3.1	12.6	13.4	10.2	11.0	7.9	7.1	4.7	4.7	13.4	3.9	5.5	1.6	0.0	14.4	6.4
	23	0.0	0.8	5.6	8.7	14.3	10.3	8.7	11.9	6.3	4.8	6.3	11.1	5.6	3.2	1.6	0.8	14.1	6.3
	24	0.0	3.2	3.2	10.3	10.3	8.7	15.9	9.5	8.7	6.3	1.6	11.9	4.0	4.8	0.8	0.8	14.2	6.3
ALL HOURS		0.6	2.3	6.8	9.9	10.8	9.5	11.4	8.8	6.8	5.5	4.3	11.0	4.6	4.8	1.6	1.5	14.2	6.4

SOURCE: GEORESEARCH, INC.

Table IV - 100

Percentage Frequency Summary for Wind Speed

LIBERTY COUNTY - WHITLASH

(SPRING)

11/18/83 - 07/24/85

		WIND SPEED (MPH)																	
		CALM	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1-14.0	14.1-16.0	16.1-18.0	18.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1-40.0	>40.0		
		WIND SPEED (METERS/SECOND)																AV SPEED (MPH)	AV SPEED (M/SEC)
		CALM	0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9		
	1	0.0	1.5	6.7	12.6	9.6	15.6	5.9	7.4	8.1	5.2	3.7	14.1	4.4	4.4	0.7	0.0	13.5	6.1
	2	0.0	0.7	5.9	14.8	10.4	8.1	8.1	10.4	8.1	5.9	7.4	13.3	3.0	3.7	0.0	0.0	13.3	6.0
	3	0.0	1.5	6.7	12.6	10.4	11.9	5.9	8.1	11.9	6.7	6.7	11.1	4.4	1.5	0.7	0.0	13.2	5.9
	4	0.0	2.2	5.2	13.4	14.2	9.7	10.4	9.7	5.2	7.5	6.0	9.7	5.2	1.5	0.0	0.0	12.5	5.6
	5	0.8	0.8	6.0	9.0	20.3	10.5	11.3	7.5	6.8	4.5	7.5	11.3	2.3	1.5	0.0	0.0	12.2	5.4
	6	0.8	0.8	5.3	19.5	14.3	11.3	9.8	3.8	5.3	6.0	8.3	9.0	1.5	4.5	0.0	0.0	12.2	5.5
	7	0.8	2.3	6.8	17.3	10.5	13.5	6.8	8.3	3.0	5.3	9.0	9.0	3.0	4.5	0.0	0.0	12.4	5.5
	8	1.5	1.5	8.3	19.5	9.0	7.5	6.0	6.0	7.5	8.3	8.3	9.0	4.5	3.0	0.0	0.0	12.5	5.6
H	9	1.5	3.0	9.0	9.0	11.3	3.0	12.0	12.8	6.8	3.8	6.8	13.5	5.3	0.8	1.5	0.0	13.1	5.9
	10	1.5	1.5	5.3	13.5	6.0	12.0	9.0	8.3	6.0	6.8	6.8	16.5	2.3	3.8	0.8	0.0	13.8	6.2
O	11	0.8	1.5	1.5	10.7	13.0	6.9	13.7	8.4	3.1	6.9	8.4	14.5	5.3	5.3	0.0	0.0	14.5	6.5
	12	0.8	0.8	0.8	5.5	10.2	14.1	9.4	11.7	6.3	7.0	7.8	13.3	4.7	7.8	0.0	0.0	15.4	6.9
U	13	0.7	1.5	1.5	2.2	11.9	11.9	8.9	10.4	12.6	4.4	10.4	11.1	7.4	4.4	0.7	0.0	15.4	6.9
	14	0.7	0.7	3.7	5.9	6.7	11.1	11.1	10.4	9.6	10.4	8.9	8.9	7.4	3.0	0.7	0.7	15.1	6.8
R	15	0.7	1.5	3.7	2.2	8.1	13.3	7.4	13.3	8.9	8.9	3.7	14.8	8.1	3.0	2.2	0.0	15.6	7.0
	16	0.7	0.7	0.7	4.4	9.6	11.9	9.6	13.3	6.7	3.0	8.9	20.0	3.7	5.2	1.5	0.0	16.0	7.1
	17	0.0	0.7	2.2	9.6	5.2	8.1	10.4	9.6	11.9	8.1	5.2	16.3	5.2	7.4	0.0	0.0	15.9	7.1
	18	0.0	0.0	5.2	4.4	5.9	10.4	12.6	10.4	6.7	5.9	8.9	17.8	5.2	5.9	0.7	0.0	15.9	7.1
	19	0.0	0.7	3.7	10.4	5.9	9.6	8.9	12.6	3.7	8.1	8.1	16.3	5.9	5.2	0.7	0.0	15.5	6.9
	20	0.0	1.5	4.4	8.9	8.9	11.1	10.4	7.4	6.7	8.1	5.9	14.8	5.9	5.9	0.0	0.0	14.8	6.6
	21	0.0	1.5	3.7	8.1	15.6	11.1	9.6	10.4	5.9	3.0	8.9	16.3	3.7	1.5	0.7	0.0	13.8	6.2
	22	0.0	1.5	3.0	12.7	10.4	10.4	12.7	9.7	4.5	4.5	7.5	14.9	3.7	4.5	0.0	0.0	14.0	6.3
	23	0.0	2.2	6.0	8.2	11.2	9.7	10.4	9.0	5.2	8.2	5.2	15.7	5.2	3.0	0.7	0.0	14.0	6.3
	24	0.0	1.5	9.0	9.0	11.9	11.9	8.2	7.5	9.7	2.2	8.2	12.7	4.5	3.7	0.0	0.0	13.4	6.0
ALL HOURS		0.5	1.3	4.8	10.1	10.4	10.6	9.5	9.4	7.1	6.2	7.3	13.5	4.7	4.0	0.5	0.0	14.1	6.3

SOURCE: GEORESEARCH, INC.

Table IV - 101

Percentage Frequency Summary for Wind Speed

LIBERTY COUNTY - WHITLASH

(SUMMER)

11/18/83 - 07/24/85

		WIND SPEED (MPH)																	
		CALM	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1-14.0	14.1-16.0	16.1-18.0	18.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1-40.0	>40.0		
		WIND SPEED (METERS/SECOND)																AV SPEED (MPH)	AV SPEED (M/SEC)
		CALM	0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9		
	1	0.0	2.1	13.7	9.6	11.6	6.8	7.5	11.6	6.2	8.9	7.5	9.6	4.1	0.7	0.0	0.0	12.1	5.4
	2	0.0	4.1	8.9	8.2	14.4	6.8	9.6	8.9	10.3	6.8	8.9	8.9	3.4	0.7	0.0	0.0	12.2	5.4
	3	0.0	1.4	8.2	13.0	8.9	14.4	10.3	8.9	6.8	11.0	4.8	7.5	4.1	0.0	0.7	0.0	12.1	5.4
	4	0.0	1.4	8.9	12.3	13.0	13.0	15.1	6.2	7.5	8.9	2.1	10.3	0.7	0.7	0.0	0.0	11.3	5.1
	5	0.0	1.4	15.1	11.6	12.3	13.0	10.3	11.0	5.5	6.2	5.5	7.5	0.0	0.0	0.7	0.0	10.6	4.7
	6	0.0	0.7	8.2	17.1	17.8	14.4	9.6	6.8	7.5	4.8	4.8	6.8	0.7	0.0	0.0	0.7	10.6	4.7
	7	0.0	2.1	10.3	14.4	18.5	11.0	10.3	7.5	6.8	2.7	9.6	6.2	0.0	0.7	0.0	0.0	10.5	4.7
	8	0.0	3.4	11.6	17.1	12.3	10.3	9.6	9.6	6.2	2.1	11.0	6.2	0.7	0.0	0.0	0.0	10.4	4.6
H	9	0.0	0.7	11.6	11.0	15.8	14.4	10.3	6.8	4.1	4.1	7.5	10.3	2.7	0.7	0.0	0.0	11.5	5.2
	10	0.0	0.7	9.0	9.0	14.5	11.7	10.3	9.7	7.6	7.6	7.6	7.6	3.4	0.7	0.7	0.0	12.3	5.5
O	11	0.0	0.0	4.1	10.3	10.3	14.5	11.7	15.9	8.3	5.5	6.9	9.0	2.1	0.7	0.0	0.7	12.8	5.7
	12	0.0	0.0	2.1	9.7	9.7	16.6	11.7	12.4	10.3	7.6	4.1	12.4	2.1	0.0	0.7	0.7	13.3	6.0
U	13	0.0	0.7	0.7	5.5	15.2	12.4	13.8	9.7	8.3	9.7	8.3	9.7	4.8	0.7	0.7	0.0	13.9	6.2
	14	0.0	0.0	2.8	6.9	9.7	9.0	17.9	10.3	9.0	10.3	10.3	7.6	5.5	0.7	0.0	0.0	13.8	6.2
R	15	0.0	0.7	0.0	11.0	6.2	13.1	9.0	15.2	9.0	12.4	7.6	11.7	2.1	1.4	0.7	0.0	14.1	6.3
	16	0.0	0.0	3.4	7.6	9.7	12.4	10.3	11.0	6.9	13.1	7.6	13.1	2.1	2.1	0.0	0.7	14.2	6.3
	17	0.0	0.0	3.4	4.1	11.7	10.3	11.0	11.7	8.3	12.4	6.9	12.4	5.5	2.1	0.0	0.0	14.6	6.5
	18	0.0	0.0	1.4	4.2	15.3	11.8	11.8	10.4	6.9	6.3	7.6	16.0	5.6	2.8	0.0	0.0	14.7	6.6
	19	0.0	0.0	1.4	9.7	9.0	11.1	8.3	11.1	7.6	9.0	9.7	13.2	5.6	2.1	0.0	2.1	15.1	6.8
	20	0.0	0.0	2.8	7.6	13.2	7.6	13.2	9.7	10.4	9.7	6.3	13.9	2.1	2.1	1.4	0.0	14.2	6.3
	21	0.0	0.0	2.8	6.3	18.1	18.1	12.5	7.6	6.3	9.0	6.9	9.0	2.8	0.0	0.7	0.0	12.6	5.6
	22	0.0	0.7	4.9	6.3	16.7	15.3	16.7	5.6	11.8	6.3	4.2	7.6	2.8	1.4	0.0	0.0	12.3	5.5
	23	0.0	0.0	5.6	11.1	13.2	11.8	13.2	11.1	6.9	9.0	6.3	8.3	1.4	1.4	0.7	0.0	12.5	5.6
	24	0.0	2.1	6.3	9.9	12.7	12.0	8.5	15.5	7.0	5.6	9.9	6.3	2.8	1.4	0.0	0.0	12.4	5.5
ALL HOURS		0.0	0.9	6.1	9.7	12.9	12.2	11.4	10.2	7.7	7.9	7.2	9.6	2.8	0.9	0.3	0.2	12.7	5.7

SOURCE: GEORESEARCH, INC.

Table IV - 102

Percentage Frequency Summary for Wind Speed

LIBERTY COUNTY - WHITLASH

(AUTUMN)

11/18/83 - 07/24/85

		WIND SPEED (MPH)																	
		CALM	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1-14.0	14.1-16.0	16.1-18.0	18.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1-40.0	>40.0		
		WIND SPEED (METERS/SECOND)																AV SPEED (MPH)	AV SPEED (M/SEC)
		CALM	0.1-0.9	0.9-1.8	1.8-2.7	2.7-3.6	3.6-4.5	4.5-5.4	5.4-6.3	6.3-7.2	7.2-8.0	8.1-8.9	9.0-11.2	11.2-13.4	13.5-15.6	15.7-17.9	>17.9		
	1	1.5	1.5	4.6	13.8	10.8	12.3	7.7	10.8	4.6	7.7	6.2	7.7	3.1	7.7	0.0	0.0	13.2	5.9
	2	1.5	0.0	4.6	13.8	13.8	12.3	3.1	13.8	7.7	4.6	6.2	7.7	1.5	7.7	1.5	0.0	13.6	6.1
	3	1.5	0.0	7.7	7.7	12.3	20.0	9.2	7.7	6.2	3.1	3.1	7.7	7.7	4.6	1.5	0.0	13.6	6.1
	4	0.0	1.5	4.6	10.8	10.8	13.8	18.5	10.8	3.1	1.5	3.1	9.2	9.2	1.5	1.5	0.0	13.4	6.0
	5	0.0	1.5	3.1	16.9	13.8	21.5	6.2	7.7	1.5	1.5	1.5	13.8	3.1	6.2	1.5	0.0	13.0	5.8
	6	0.0	0.0	7.7	10.8	21.5	15.4	9.2	4.6	6.2	1.5	3.1	6.2	7.7	4.6	1.5	0.0	12.8	5.7
	7	0.0	1.5	10.8	13.8	16.9	15.4	3.1	7.7	4.6	3.1	0.0	7.7	10.8	1.5	1.5	1.5	12.7	5.7
	8	0.0	9.2	7.7	10.8	10.8	18.5	6.2	7.7	4.6	1.5	1.5	10.8	7.7	1.5	1.5	0.0	12.1	5.4
H	9	0.0	1.6	6.3	17.5	17.5	15.9	6.3	6.3	3.2	0.0	3.2	15.9	3.2	0.0	3.2	0.0	12.2	5.5
	10	0.0	0.0	15.9	9.5	15.9	12.7	9.5	3.2	6.3	3.2	1.6	15.9	3.2	1.6	1.6	0.0	12.3	5.5
O	11	0.0	0.0	14.3	7.9	14.3	17.5	9.5	3.2	1.6	4.8	6.3	11.1	4.8	0.0	4.8	0.0	12.9	5.8
	12	0.0	3.4	3.4	8.6	15.5	10.3	13.8	12.1	1.7	3.4	1.7	12.1	5.2	3.4	3.4	1.7	14.2	6.4
U	13	0.0	0.0	9.1	6.1	16.7	10.6	9.1	6.1	4.5	6.1	4.5	9.1	9.1	6.1	1.5	1.5	15.1	6.8
	14	0.0	1.5	4.5	7.6	13.6	10.6	7.6	10.6	4.5	7.6	1.5	15.2	3.0	9.1	1.5	1.5	15.6	7.0
R	15	0.0	1.5	4.5	12.1	7.6	10.6	12.1	9.1	3.0	4.5	9.1	9.1	9.1	3.0	3.0	1.5	15.2	6.8
	16	0.0	4.5	7.6	6.1	12.1	4.5	16.7	9.1	0.0	9.1	6.1	12.1	4.5	7.6	0.0	0.0	14.2	6.4
	17	0.0	3.0	7.6	13.6	3.0	12.1	12.1	7.6	12.1	3.0	6.1	12.1	3.0	3.0	1.5	0.0	13.3	5.9
	18	0.0	6.1	9.1	7.6	13.6	9.1	9.1	10.6	6.1	6.1	4.5	9.1	4.5	4.5	0.0	0.0	12.8	5.7
	19	0.0	0.0	9.2	16.9	7.7	10.8	16.9	3.1	12.3	4.6	1.5	7.7	3.1	4.6	1.5	0.0	12.7	5.7
	20	0.0	0.0	10.8	13.8	7.7	12.3	13.8	7.7	7.7	6.2	7.7	4.6	3.1	3.1	1.5	0.0	12.4	5.5
	21	0.0	1.6	1.6	14.3	12.7	14.3	9.5	14.3	9.5	4.8	4.8	7.9	0.0	4.8	0.0	0.0	12.5	5.6
	22	0.0	3.2	7.9	6.3	19.0	17.5	6.3	9.5	1.6	3.2	6.3	14.3	1.6	3.2	0.0	0.0	12.3	5.5
	23	0.0	1.6	7.9	9.5	12.7	11.1	14.3	11.1	0.0	7.9	3.2	14.3	1.6	4.8	0.0	0.0	12.8	5.7
	24	0.0	5.3	7.0	14.0	12.3	8.8	14.0	5.3	5.3	5.3	8.8	8.8	3.5	1.8	0.0	0.0	11.8	5.3
ALL HOURS		0.2	2.0	7.4	11.2	13.0	13.3	10.1	8.3	4.9	4.4	4.2	10.4	4.7	4.0	1.4	0.3	13.2	5.9

SOURCE: GEORESEARCH, INC.

Table IV - 103

Annual Wind Rose Distribution

LIBERTY COUNTY - WHITLASH

11/18/83 - 07/24/85

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION
SPEED (MPH)																		SPEED (M/SEC)
0.1- 1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1- 0.4
1.1- 2.0	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.2	0.5- 0.9
2.1- 3.0	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	2.0	1.0- 1.3 S
3.1- 4.0	0.4	0.4	0.3	0.2	0.3	0.2	0.4	0.5	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.2	4.1	1.4- 1.8 P
S 4.1- 5.0	0.5	0.3	0.2	0.2	0.1	0.2	0.4	0.6	0.5	0.3	0.2	0.1	0.2	0.2	0.1	0.2	4.1	1.9- 2.2 E
P 5.1- 6.0	0.7	0.6	0.4	0.3	0.1	0.1	0.4	1.0	0.7	0.4	0.3	0.2	0.2	0.1	0.2	0.3	6.0	2.3- 2.7 E
E 6.1- 7.0	0.7	0.5	0.4	0.2	0.1	0.1	0.4	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.2	0.2	5.1	2.8- 3.1 D
E 7.1- 8.0	1.1	0.8	0.3	0.2	0.1	0.2	0.4	0.8	0.6	0.4	0.4	0.3	0.3	0.1	0.2	0.3	6.5	3.2- 3.6
D 8.1- 9.0	0.7	0.6	0.3	0.1	0.0	0.1	0.4	0.5	0.5	0.4	0.5	0.2	0.2	0.2	0.2	0.2	5.0	3.7- 4.0 M
9.1-10.0	1.0	0.8	0.3	0.1	0.0	0.1	0.4	0.7	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.3	6.2	4.1- 4.5 E
M 10.1-11.0	0.8	0.9	0.2	0.1	0.0	0.1	0.4	0.4	0.4	0.2	0.3	0.3	0.2	0.3	0.1	0.2	5.0	4.6- 4.9 T
I 11.1-12.0	0.8	0.8	0.1	0.1	0.0	0.1	0.4	0.6	0.5	0.2	0.3	0.4	0.3	0.3	0.3	0.3	5.6	5.0- 5.4 E
L 12.1-13.0	0.7	0.6	0.1	0.0	0.0	0.1	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0.4	0.2	0.3	4.4	5.5- 5.8 R
E 13.1-14.0	0.9	0.5	0.0	0.0	0.0	0.0	0.5	0.4	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.5	5.0	5.9- 6.3 S
S 14.1-15.0	0.6	0.3	0.0	0.0	0.0	0.1	0.5	0.3	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.5	3.6	6.4- 6.7 /
/ 15.1-16.0	0.5	0.3	0.0	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.2	0.3	3.3	6.8- 7.2 S
H 16.1-17.0	0.6	0.2	0.0	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.2	0.4	0.4	0.3	0.3	0.4	3.6	7.3- 7.6 E
O 17.1-18.0	0.3	0.2	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.1	0.1	0.4	0.3	0.4	0.2	0.2	2.6	7.7- 8.0 C
U 18.1-19.0	0.5	0.2	0.0	0.0	0.0	0.0	0.6	0.1	0.1	0.0	0.1	0.4	0.5	0.4	0.2	0.4	3.5	8.1- 8.5 O
R 19.1-20.0	0.4	0.2	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.0	0.1	0.4	0.4	0.2	0.2	2.5	8.6- 8.9 N
20.1-25.0	0.9	0.4	0.0	0.0	0.0	0.2	1.2	0.3	0.1	0.1	0.2	1.3	2.0	1.6	0.6	0.8	9.8	9.0-11.2 D
25.1-30.0	0.5	0.2	0.0	0.0	0.0	0.1	0.6	0.1	0.0	0.1	0.0	0.9	1.4	1.0	0.3	0.4	5.5	11.3-13.4
30.1-35.0	0.3	0.2	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.4	0.8	0.5	0.1	0.2	2.9	13.5-15.6
35.1-40.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.3	0.1	0.1	1.2	15.7-17.9
>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.5	>17.9
CALM																	0.3	CALM
TOTAL	13.7	9.3	2.8	1.9	1.1	2.0	9.3	8.7	6.4	3.8	4.2	7.4	9.7	8.0	4.7	6.7	100.0	TOTAL
AV SPEED (MPH)	13.0	11.4	7.5	6.4	5.6	10.8	14.4	9.6	9.1	9.4	10.5	18.1	20.4	19.4	15.1	14.9	13.6	AV SPEED (MPH)
AV SPEED (M/SEC)	5.8	5.1	3.3	2.9	2.5	4.8	6.4	4.3	4.1	4.2	4.7	8.1	9.1	8.7	6.8	6.7	6.1	AV SPEED (M/SEC)

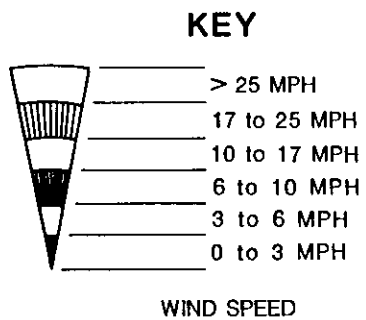
SOURCE: GEORESEARCH, INC.

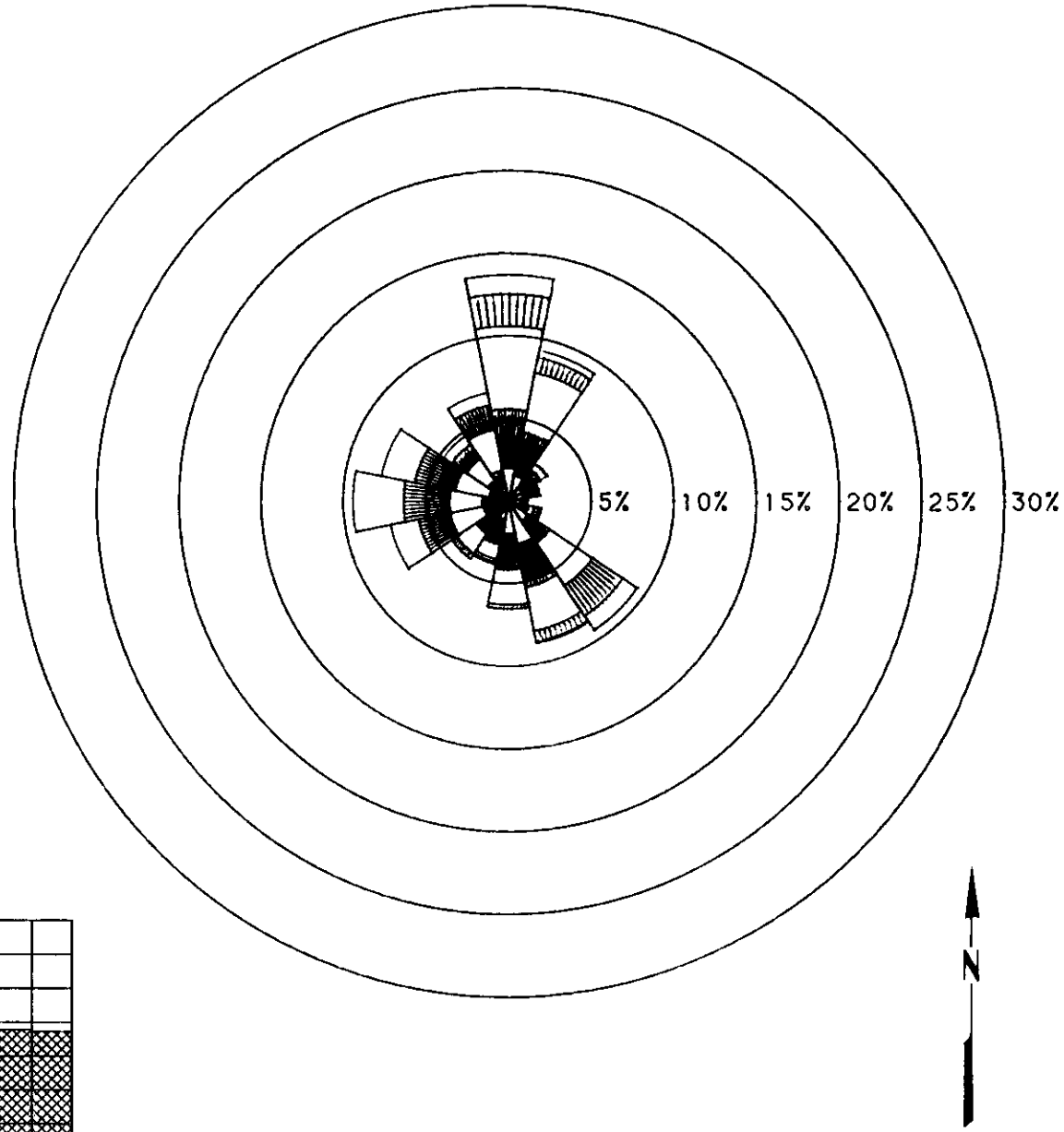
Figure IV - 11

Annual Wind Rose

LIBERTY COUNTY - WHITLASH

(1983 - 1985)





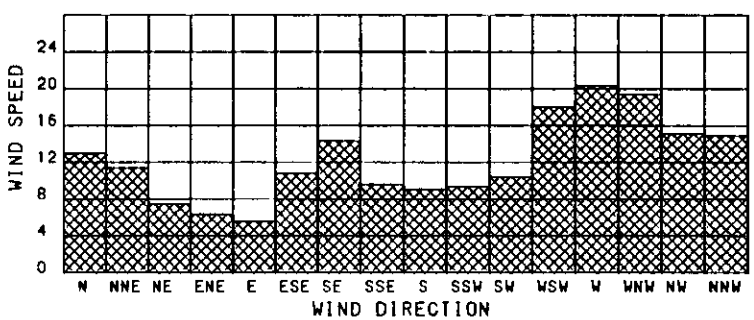


Table IV - 104

Coefficients of Weibull Distribution

LIBERTY COUNTY - WHITLASH

11/18/83 - 07/24/85

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	7.3683	1.4608
FEBRUARY	6.4123	1.7495
MARCH	5.7340	1.6656
APRIL	7.8202	1.7764
MAY	6.9605	1.8373
JUNE	6.6646	1.8168
JULY	5.8372	2.0553
AUGUST	5.9769	1.9078
SEPTEMBER	7.5464	1.5741
OCTOBER	NO DATA	NO DATA
NOVEMBER	5.1320	1.8202
DECEMBER	6.2746	1.7270
YEAR	6.4634	1.7458

SOURCE: GEORESEARCH, INC.