

**TINTINA RESOURCES, INC.  
BLACK BUTTE COPPER  
PROJECT AMBIENT AIR  
MONITORING PROGRAM  
Quarterly Data Report  
First Quarter 2015**

*Prepared for:*

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## CERTIFICATION OF DATA INTEGRITY

Bison Engineering, Inc., certifies the data in this report is an accurate summary of the air quality conditions measured at the Black Butte Copper Project air monitoring site. Every effort was made to obtain accurate and representative data and to comply with the procedures set forth in the project-specific *Quality Assurance Project Plan*, the *State of Montana Ambient Air Monitoring Program Quality Assurance Project Plan (April 2013)*, and the Environmental Protection Agency's *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume I, A Field Guide to Environmental Quality Assurance (April 1994)*, *Volume II, Ambient Air Quality Program (May 2013)*, and *Volume IV, Meteorological Measurements (March 2008)*.

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Date: 4/29/15

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## **APPENDICES**

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- Appendix A: Meteorological Data
- Appendix B: Performance Audit Reports

## 1.0 INTRODUCTION

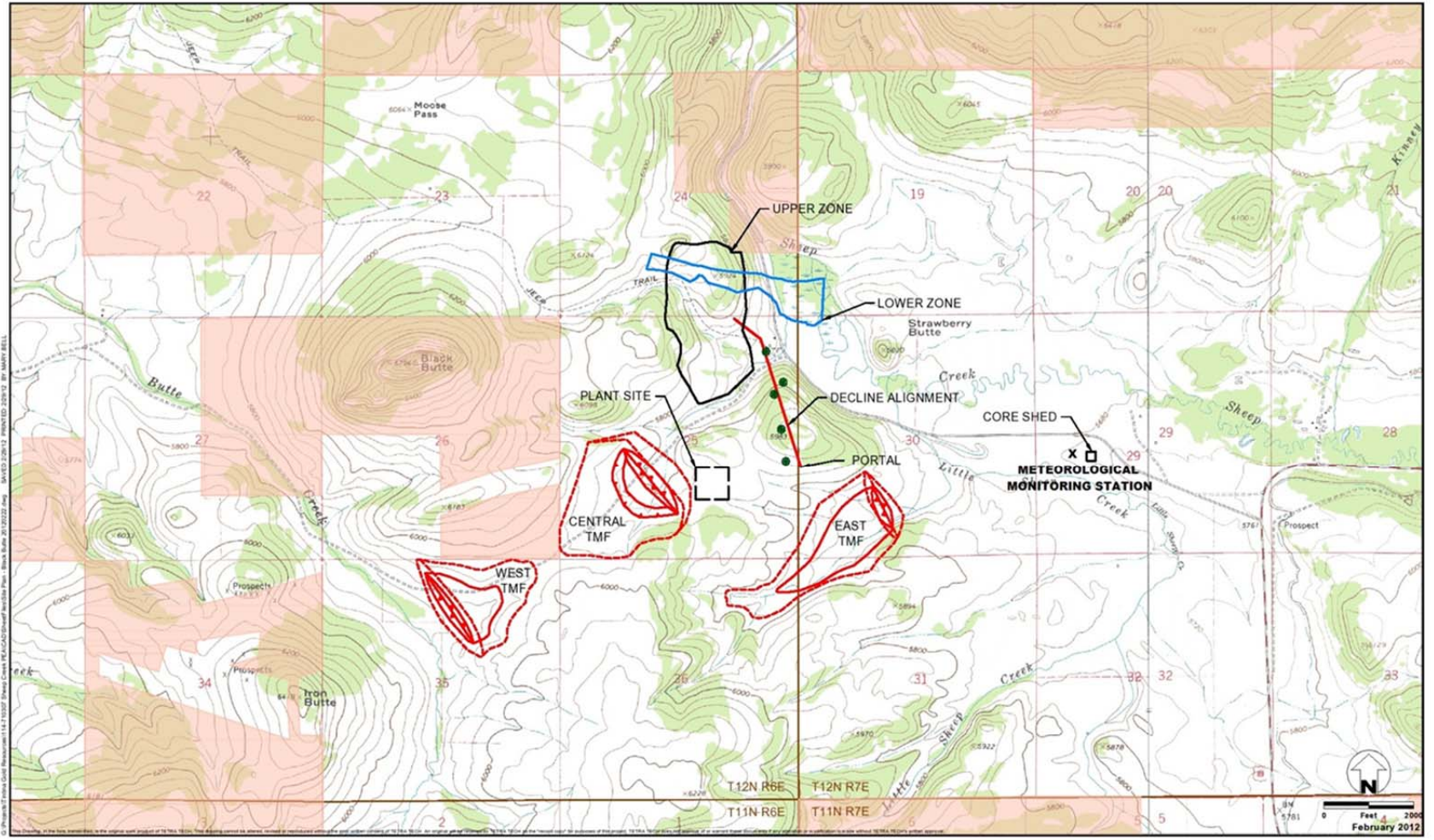
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Tintina Resources, Inc. established an ambient air monitoring site to measure wind speed, wind direction, standard deviation of wind direction, temperature at 9 meters and 2 meters, delta temperature, solar radiation, barometric pressure, and precipitation. The station was established to accurately characterize the local meteorology and collect baseline data in support of an operating permit application and various environmental studies.

The meteorological monitoring system was installed in April 2012. The site is operated by Bison Engineering, Inc., of Helena and Billings. Figure 1 shows the location of the monitoring site.

This report presents the data collected during the first quarter (January through March) of 2015. In addition, a description of the monitoring system operations is presented, together with summaries of quality assurance activities, including calibrations and performance audits. Tabular summaries of the data completeness achieved and the periods of missing data also are presented. Appendix A presents hourly meteorological data collected.

**Figure 1. Monitoring Site Location**



**Site Plan  
Black Butte Copper Project  
Meagher County, Montana  
FIGURE 1**



## **2.0 MONITORING SYSTEM OPERATIONS**

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The installation of the monitoring meteorological system equipment took place in April 2012, soon after the equipment was received from the manufacturers. The installation and calibration of the equipment required about two weeks to complete. All meteorological parameters were in full operation and producing valid data by April 30, 2012.

Steve Heck of Bison conducted performance audits of the meteorological system on March 11, 2015. All results were satisfactory. The Bison report of the audits is presented in Appendix B. The wind speed and wind direction sensors were replaced and calibrated after the audits were completed.

### **3.0 CALIBRATION DATA**

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As discussed in Section 4.0, the system's as-found condition was audited on March 11, 2015. Refurbished wind speed and wind direction sensors were installed and calibrated after the audits were completed, so that the existing units could be serviced (they were working properly when removed). No calibration adjustments were needed for any of the other meteorological instruments, based on the audit results.

## **4.0 PERFORMANCE AUDIT DATA**

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Steve Heck of Bison conducted performance audits of the meteorological system on March 11, 2015. All results were satisfactory. The Bison report of the audits is presented in Appendix B.



## 5.0 DATA COMPLETENESS

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The meteorological percentages of data recovery achieved during the first quarter of 2015 are given in Tables 1 and 2. In these tables, the number of possible data values during each month of the quarter is given, together with the number of valid readings and the number of hours spent on quality assurance activities (such as calibrations, performance audits, and maintenance on the sensors). The quality assurance hours are added to the number of hours of valid data to compute the net percentage data recovery.

During the first quarter the net percentage data recovery was 94.4 percent for precipitation (discussed below), 99.5 percent for wind speed and 100.0 percent for all other parameters at the site. The loss of wind speed data was due to the sensor's cups being frozen in place because of weather. Those periods of missing data are summarized in Table 3a.

The precipitation gauge opening at the Tintina site is located approximately 18 inches above ground level, and the early part of the winter of 2014 – 2015 experienced heavy snowfall. The Tintina site representative was diligent about keeping the precipitation gauge and the area within its wind screen clear of snow, but the general snow depth at the Tintina site was sufficient to cause drifting at times during the latter half of January. This resulted in drifting of snow into the gauge, and false positive precipitation readings as the accumulated snow melted. The snowpack melted rapidly during February and March due to unusually mild weather, so drifting did not affect the precipitation readings in those months.

Table 3b lists the periods when drifting effects were suspected based on Bison's review of the meteorological data file. Those periods were assigned hourly values of 0.000 inches in Appendix A, since it is **probable** that the actual precipitation amount during those hours was zero. Because that cannot be known with certainty, those periods have been counted as missing data in Tables 1 and 2. This resulted in a net data recovery for precipitation of 83.6 percent for January and 94.4 percent for the quarter.

In general, false positive precipitation periods were suspected when:

- 1) Non-zero precipitation readings were accompanied by low-to-moderate relative humidity readings (versus readings of 75-80% or higher that would typically occur during a precipitation event), **and**
- 2) Significant wind (indicating potential drifting) was present, generally 4-5 meters per second or higher.

**Table 1. Monthly Data Completeness**

<b>January 2015</b>					
Parameter	Readings Possible	Valid Readings	Percentage Recovery	Quality Assurance Hours	Net Percentage Recovery
<b>Black Butte Copper Project Met Tower</b>					
Wind Speed	744	744	100.0	0	100.0
Wind Direction	744	744	100.0	0	100.0
Standard Deviation	744	744	100.0	0	100.0
Temperature 9 Meters	744	744	100.0	0	100.0
Temperature 2 Meters	744	744	100.0	0	100.0
Temperature Delta T	744	744	100.0	0	100.0
Solar Radiation	744	744	100.0	0	100.0
Barometric Pressure	744	744	100.0	0	100.0
Relative Humidity	744	744	100.0	0	100.0
Precipitation	744	622	83.6	0	83.6
<b>Total</b>	<b>7,440</b>	<b>7,318</b>	<b>98.4</b>	<b>0</b>	<b>98.4</b>

**Table 1. Monthly Data Completeness (Continued)**

<b>February 2015</b>					
<b>Parameter</b>	<b>Readings Possible</b>	<b>Valid Readings</b>	<b>Percentage Recovery</b>	<b>Quality Assurance Hours</b>	<b>Net Percentage Recovery</b>
<b>Black Butte Copper Project Met Tower</b>					
Wind Speed	672	672	100.0	0	100.0
Wind Direction	672	672	100.0	0	100.0
Standard Deviation	672	672	100.0	0	100.0
Temperature 9 Meters	672	672	100.0	0	100.0
Temperature 2 Meters	672	672	100.0	0	100.0
Temperature Delta T	672	672	100.0	0	100.0
Solar Radiation	672	672	100.0	0	100.0
Barometric Pressure	672	672	100.0	0	100.0
Relative Humidity	672	672	100.0	0	100.0
Precipitation	672	672	100.0	0	100.0
<b>Total</b>	<b>6,720</b>	<b>6,720</b>	<b>100.0</b>	<b>0</b>	<b>100.0</b>

**Table 1. Monthly Data Completeness (Continued)**

<b>March 2015</b>					
<b>Parameter</b>	<b>Readings Possible</b>	<b>Valid Readings</b>	<b>Percentage Recovery</b>	<b>Quality Assurance Hours</b>	<b>Net Percentage Recovery</b>
<b>Black Butte Copper Project Met Tower</b>					
Wind Speed	744	727	97.7	6	98.5
Wind Direction	744	738	99.2	6	100.0
Standard Deviation	744	738	99.2	6	100.0
Temperature 9 Meters	744	738	99.2	6	100.0
Temperature 2 Meters	744	738	99.2	6	100.0
Temperature Delta T	744	738	99.2	6	100.0
Solar Radiation	744	738	99.2	6	100.0
Barometric Pressure	744	738	99.2	6	100.0
Relative Humidity	744	738	99.2	6	100.0
Precipitation	744	738	99.2	6	100.0
<b>Total</b>	<b>7,440</b>	<b>7,369</b>	<b>99.0</b>	<b>60</b>	<b>99.9</b>

**Table 2. Quarterly Data Completeness**

<b>First Quarter 2015</b>					
Parameter	Readings Possible	Valid Readings	Percentage Recovery	Quality Assurance Hours	Net Percentage Recovery
<b>Black Butte Copper Project Met Tower</b>					
Wind Speed	2,160	2,143	99.2	6	99.5
Wind Direction	2,160	2,154	99.7	6	100.0
Standard Deviation	2,160	2,154	99.7	6	100.0
Temperature 9 Meters	2,160	2,154	99.7	6	100.0
Temperature 2 Meters	2,160	2,154	99.7	6	100.0
Temperature Delta T	2,160	2,154	99.7	6	100.0
Solar Radiation	2,160	2,154	99.7	6	100.0
Barometric Pressure	2,160	2,154	99.7	6	100.0
Relative Humidity	2,160	2,154	99.7	6	100.0
Precipitation	2,160	2,032	94.1	6	94.4
<b>Total</b>	<b>21,600</b>	<b>21,407</b>	<b>99.1</b>	<b>60</b>	<b>99.4</b>

**Table 3a. Periods of Missing Data**

<b>First Quarter 2015</b>						
Starting Date/Hour	Ending Date/Hour	Site	Parameter	Total Hours	Percent of Month	Circumstance
Mar 23/21	Mar 24/7	Met Tower	Wind Speed	11	0.51	Missing data: Cups frozen in place.

**Table 3b. Suspected False Non-Zero Precipitation Readings**

<b>First Quarter 2015</b>				
Start Date	Start Hour	End Date	End Hour	Number of Hours
<b>January 2015</b>				
Jan 16	13	Jan 18	6	42
Jan 18	12	Jan 19	20	33
Jan 24	11	Jan 26	3	41
Jan 26	11	Jan 26	16	6

## 6.0 MONITORING DATA

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The hourly data values collected at the monitoring sites are given in the data tables in Appendix A. Each of these tables presents one month's data for all parameters in the monitoring system. In addition, the average, maximum, and minimum values for each parameter for each day are listed (for wind direction, the prevailing wind direction for the day is given). For those hours with missing data, a code is given that explains the reason the data were missing. These codes are given in Table 4.

Monthly and quarterly wind rose distributions from the monitoring site are presented in Tables 5 through 8. These tables give the percentage frequency of occurrence of winds from 16 cardinal directions and from 22 wind speed ranges. These same data are presented graphically in Figures 2 through 5. In the wind rose figures, the length of each "petal" of the rose is proportional to the percentage of time the wind blew from that direction. On the bottom of each figure is a histogram showing the average wind speed from each of the cardinal wind directions.

**Table 4. Missing Data Codes**

<b>Mnemonic Code</b>	<b>Description</b>	<b>Equivalent EPA Null Value Reason Code</b>
Sc	Scheduled but not collected	9972
Ti	Sample time out of limits	9973
Fi	Filter damage	9976
Op	Voided by operator	9978
ND	Machine malfunction	9980
Wx	Bad weather	9981
Co	Collection error	9983
Lb	Lab error	9984
QA	Poor quality assurance results	9985
Pwr	Power failure	9988
Wi	Wildlife damage	9989
AZ	Automatic zero/span check	9991
ZS	Manual zero/span check	9986
Au	Performance audit	9992
Ma	Routine maintenance/repairs	9993
Ca	Multipoint calibration	9995
PZ	Precision/zero/span	9998

**Table 5. Monthly Wind Rose Summary, Black Butte Copper Project Met Tower**

January 2015																		
Direction>>>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total	
Wind Speed (meters per second)	0.1 - 1.0	3.2	2.3	2.0	2.0	4.4	5.5	4.6	2.8	1.5	0.3	0.7	0.5	0.5	1.2	1.5	1.6	34.7
	1.1 - 2.0	0.7	1.7	2.8	2.6	4.0	4.2	3.0	1.5	0.8	0.4	0.4	0.4	0.8	1.6	1.6	0.5	27.0
	2.1 - 3.0	0.1	0.1	0.8	2.0	2.3	0.4	0.3	0.4	0.4	0.1	0.0	0.5	1.1	0.8	1.5	0.5	11.4
	3.1 - 4.0	0.1	0.1	0.0	0.1	0.8	0.3	0.0	0.1	0.4	0.0	0.0	0.3	0.9	2.4	1.3	0.0	7.0
	4.1 - 5.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.7	1.3	1.5	0.9	0.1	5.1
	5.1 - 6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0	1.9	1.5	0.0	0.0	4.2
	6.1 - 7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.1	2.0	1.6	0.5	0.1	4.8
	7.1 - 8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.5	0.1	0.5	0.1	2.7
	8.1 - 9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.4	0.3	0.0	1.2
	9.1 - 10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.3	0.0	0.0	1.1
	10.1 - 11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4
	11.1 - 12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3
	12.1 - 13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	13.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	14.1 - 15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
	15.1 - 16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16.1 - 17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	17.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	18.1 - 19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	19.1 - 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Calm																		0.0
Total	4.2	4.4	5.6	6.7	11.6	10.3	7.8	5.8	3.4	0.9	1.3	3.1	12.0	11.6	8.2	3.1	100.0	
Average Speed	0.9	1.2	1.4	1.6	1.5	1.1	1.0	1.9	1.8	2.1	1.6	3.7	5.6	4.2	3.2	1.9	2.4	



**Table 6. Monthly Wind Rose Summary, Black Butte Copper Project Met Tower**

February 2015																		
Direction>>>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total	
Wind Speed (meters per second)	0.1 - 1.0	1.2	1.5	2.1	1.5	1.5	1.9	1.8	1.0	0.4	0.3	0.1	0.4	0.7	0.4	0.4	1.0	16.5
	1.1 - 2.0	0.4	1.8	2.8	3.1	3.7	3.1	2.4	0.9	0.1	0.0	0.3	0.6	1.9	1.8	2.4	0.4	25.9
	2.1 - 3.0	0.1	0.4	0.3	0.9	2.8	0.4	0.7	0.4	0.4	0.1	0.1	0.4	1.6	2.8	2.2	0.9	15.0
	3.1 - 4.0	0.6	0.0	0.0	0.1	0.9	0.3	0.0	0.4	0.3	0.0	0.0	0.6	2.4	3.0	1.9	0.4	11.0
	4.1 - 5.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	1.3	0.0	0.3	0.1	0.3	4.2	1.0	1.9	0.3	10.0
	5.1 - 6.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.7	0.4	1.0	2.2	2.5	0.9	0.3	8.9
	6.1 - 7.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.3	0.3	2.7	1.5	0.4	0.4	6.5
	7.1 - 8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.6	0.1	1.8	0.3	0.0	0.3	3.4
	8.1 - 9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.0	0.3	0.0	0.0	0.4	1.5
	9.1 - 10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.6
	10.1 - 11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	0.6
	11.1 - 12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12.1 - 13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	13.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	14.1 - 15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	15.1 - 16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16.1 - 17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	17.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	18.1 - 19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	19.1 - 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Calm																		0.0
Total	3.0	3.7	5.2	5.7	9.1	6.0	4.9	5.2	1.8	2.1	3.3	3.9	18.0	13.4	10.3	4.6	100.0	
Average Speed	2.4	1.4	1.2	1.5	1.9	1.5	1.3	3.3	3.4	5.2	6.8	3.7	4.6	3.9	3.2	3.6	3.1	

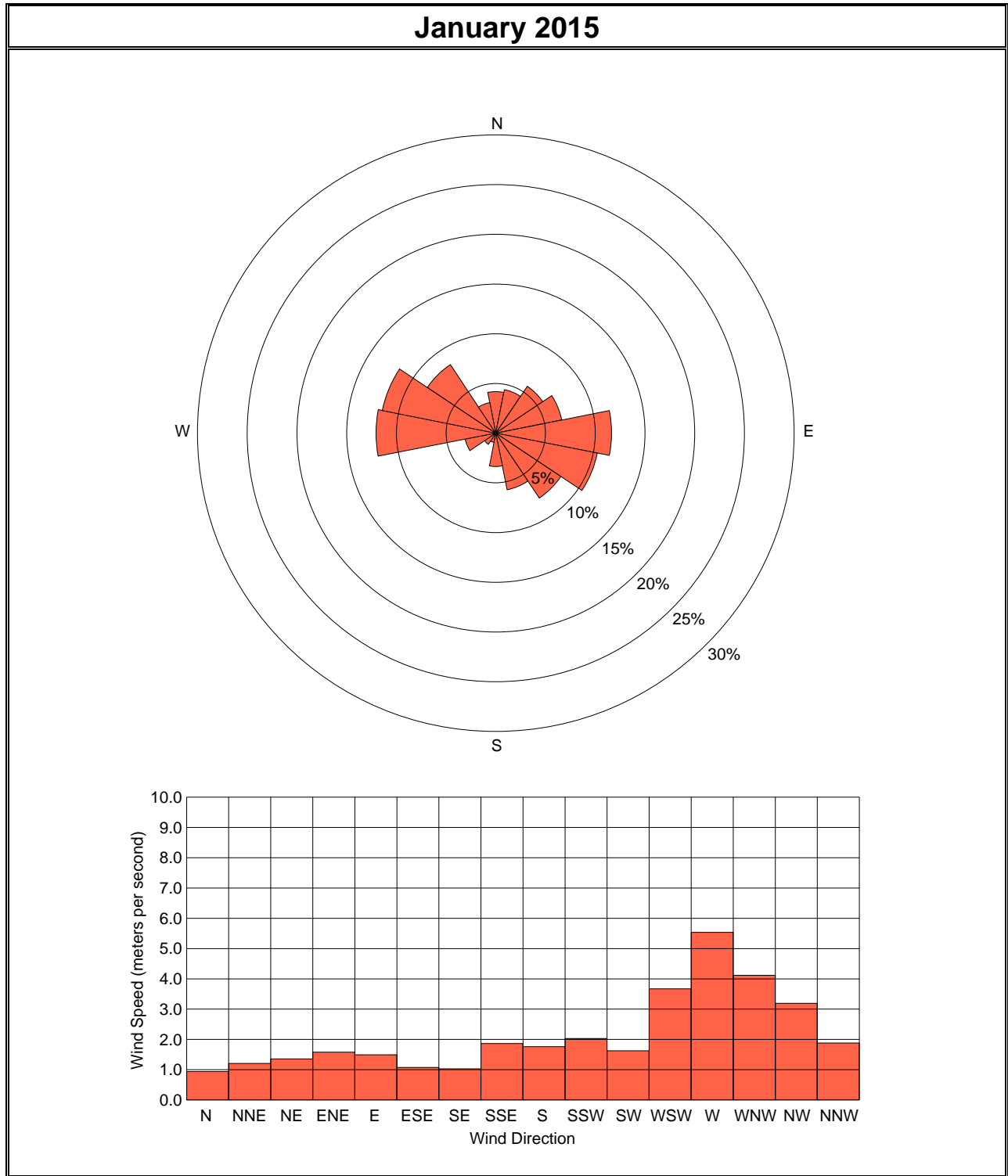
**Table 7. Monthly Wind Rose Summary, Black Butte Copper Project Met Tower**

March 2015																		
Direction>>>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total	
Wind Speed (meters per second)	0.1 - 1.0	0.7	1.1	1.4	0.7	1.8	1.0	1.0	0.6	0.6	0.0	0.1	0.1	0.3	0.4	0.6	0.7	10.9
	1.1 - 2.0	0.7	1.7	2.5	2.8	4.4	3.6	2.9	2.3	1.0	0.4	0.3	0.6	0.6	0.7	1.1	1.1	26.4
	2.1 - 3.0	0.0	0.0	0.4	1.2	1.7	2.8	0.6	1.2	0.0	0.3	0.3	0.6	2.5	0.8	1.0	0.6	13.8
	3.1 - 4.0	0.1	0.1	0.1	0.6	1.0	0.6	0.1	0.8	0.1	0.1	0.1	0.4	3.0	1.4	0.8	0.1	9.6
	4.1 - 5.0	0.3	0.0	0.0	0.1	0.4	0.1	0.0	0.3	0.0	0.4	0.3	1.2	2.9	1.5	0.7	0.7	8.9
	5.1 - 6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.1	0.6	1.5	5.0	1.1	0.6	0.8	10.3
	6.1 - 7.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.1	0.1	0.6	1.1	3.6	0.8	0.0	0.0	8.1
	7.1 - 8.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.3	0.8	2.3	1.0	0.1	0.0	5.4
	8.1 - 9.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.7	1.5	0.4	0.3	0.0	3.6
	9.1 - 10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.8	0.0	0.0	0.0	1.5
	10.1 - 11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.6
	11.1 - 12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.3
	12.1 - 13.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	13.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6
	14.1 - 15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	15.1 - 16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16.1 - 17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	17.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	18.1 - 19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	19.1 - 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Calm																		0.0
Total	2.1	3.2	4.4	5.4	9.2	8.0	4.5	7.7	2.2	1.9	3.0	7.6	23.5	8.3	5.1	4.0	100.0	
Average Speed	2.6	2.1	1.3	1.9	1.9	2.0	1.5	3.6	2.5	4.3	5.5	5.6	5.7	4.8	3.4	2.9	3.7	

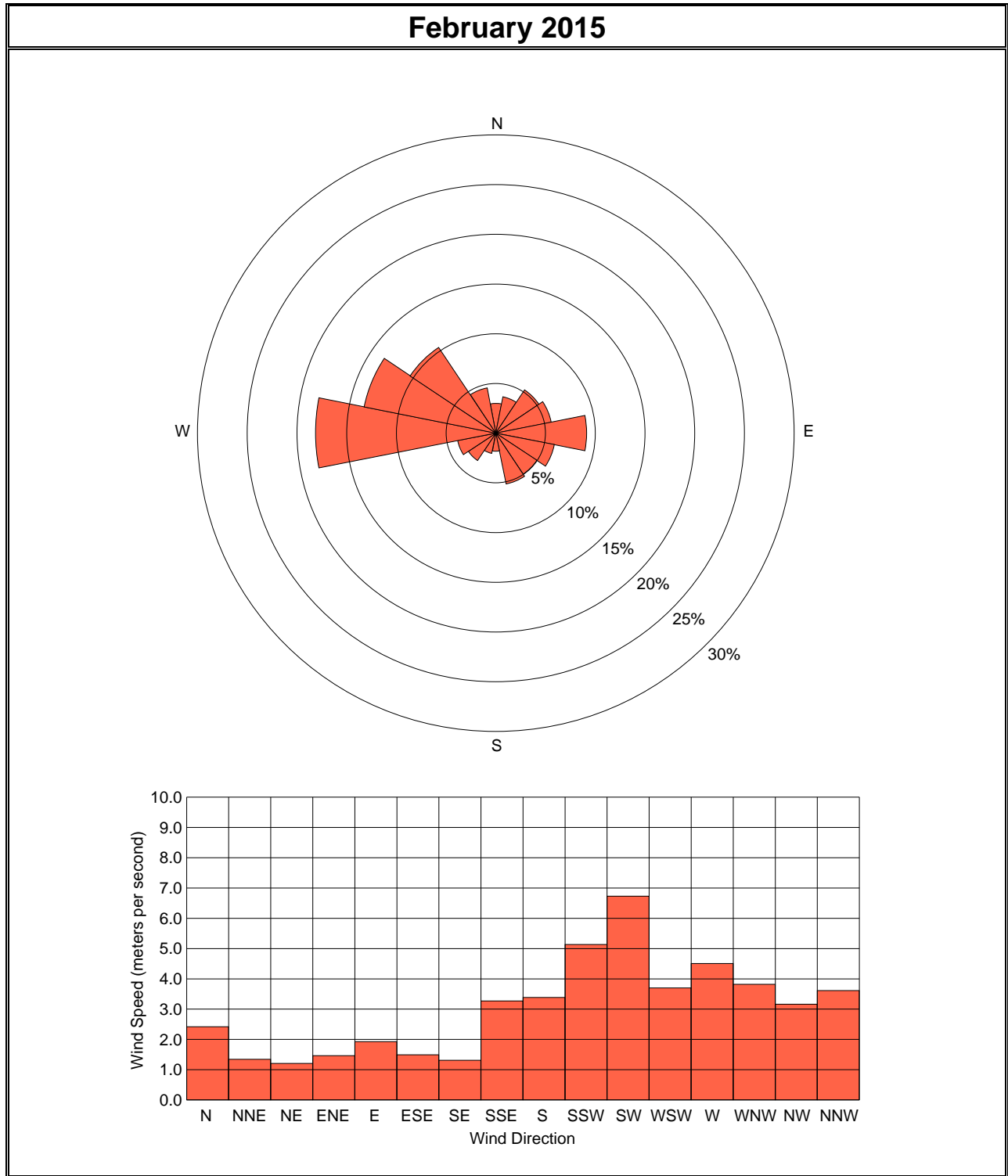
**Table 8. Quarterly Wind Rose Summary, Black Butte Copper Project Met Tower**

First Quarter 2015																		
Direction>>>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total	
Wind Speed (meters per second)	0.1 - 1.0	1.7	1.6	1.8	1.4	2.6	2.8	2.5	1.5	0.8	0.2	0.3	0.4	0.5	0.7	0.8	1.1	20.9
	1.1 - 2.0	0.6	1.7	2.7	2.8	4.1	3.6	2.8	1.6	0.7	0.3	0.3	0.5	1.1	1.4	1.7	0.7	26.5
	2.1 - 3.0	0.1	0.2	0.5	1.4	2.2	1.2	0.5	0.7	0.3	0.2	0.1	0.5	1.7	1.4	1.5	0.7	13.3
	3.1 - 4.0	0.3	0.1	0.0	0.3	0.9	0.4	0.0	0.5	0.3	0.0	0.0	0.4	2.1	2.2	1.4	0.2	9.1
	4.1 - 5.0	0.1	0.0	0.0	0.0	0.2	0.1	0.0	0.6	0.0	0.2	0.2	0.7	2.8	1.4	1.2	0.4	7.9
	5.1 - 6.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.8	3.0	1.7	0.5	0.4	7.7
	6.1 - 7.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.1	0.3	0.5	2.8	1.3	0.3	0.2	6.5
	7.1 - 8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.3	0.5	1.9	0.5	0.2	0.1	3.8
	8.1 - 9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.8	0.3	0.2	0.1	2.1
	9.1 - 10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.1	0.0	0.0	1.1
	10.1 - 11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.5
	11.1 - 12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2
	12.1 - 13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	13.1 - 14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
	14.1 - 15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	15.1 - 16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	16.1 - 17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	17.1 - 18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	18.1 - 19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	19.1 - 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Calm																		0.0
Total	3.1	3.8	5.1	5.9	10.0	8.2	5.8	6.3	2.5	1.6	2.5	4.9	17.8	11.0	7.8	3.9	100.0	
Average Speed	1.8	1.5	1.3	1.7	1.8	1.5	1.2	3.0	2.4	4.2	5.3	4.7	5.3	4.2	3.3	2.9	3.1	

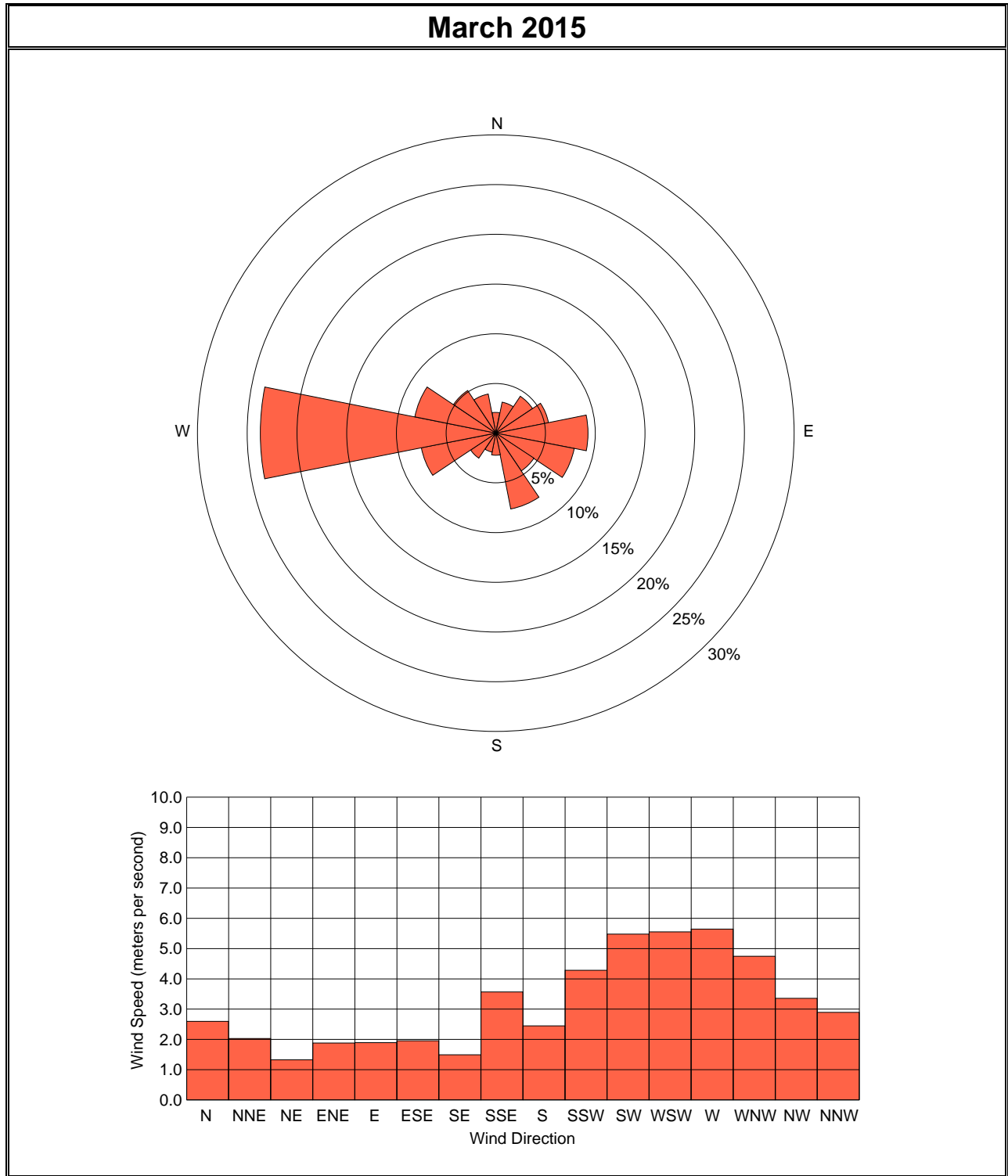
**Figure 2. Monthly Wind Rose, Black Butte Copper Project Met Tower**



**Figure 3. Monthly Wind Rose, Black Butte Copper Project Met Tower**



**Figure 4. Monthly Wind Rose, Black Butte Copper Project Met Tower**



**Figure 5. Quarterly Wind Rose, Black Butte Copper Project Met Tower**

