CBRMarslandPEm Resource

From: John Schmuck [John_Schmuck@Cameco.com]
Sent: Thursday, May 22, 2014 5:30 PM
To: Lancaster, Thomas; Burrows, Ronald
Cc: Doug Pavlick; Sabrina Fox; Larry Teahon
Subject: Cameco December 2013 Response to RAI 8.C.1
Attachments: Appendix S - Response to RAI 8.C.1.pdf

Tom - Cameco's response to RAI 8.C.1 was provided in the first paragraph of redline text in the version of Appendix S submitted in December 2013. I am providing a copy to facilitate our PM to PM clarification discussion this coming Tuesday.

Thanks. .john

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Appendix S

Justification for Use of 15 Years
of Scottsbluff Meteorlogical
Data

Appendix S
Justification for Use of 15 Years of Scottsbluff's Meteorological Data

A regression analyses for wind parameters at the Scottsbluff meteorological station is presented below with p-values. The objective of the regression analysis is to show that the value of one variable "x" (short-term wind speed or direction frequency) reliably represents or predicts the value of another variable "y" (long-term wind speed or direction frequency). In order to demonstrate that short-term wind patterns reliably represent the longer term wind patterns, the short-term wind frequency values (x) constitute the independent variable and the long-term values (y) are the dependent variable. Each point on the graph represents a specific wind speed class, or a specific wind direction category, depending on the context. Hence, there are six points for the wind speed analysis and 16 points for the wind direction analysis. The "x" value of each point corresponds to the short-term frequency of occurrence of a particular wind speed class or wind direction category. The "y" value of that point corresponds to the long-term frequency of occurrence of that same wind speed class or wind direction category.

If "x" and "y" are similarly distributed, then graphing them as described above will produce a scatterplot of points approximating a straight line with a slope near 1. The equations below show that for Scottsbluff, the wind speed correlation produced a slope of 0.94 and the wind direction correlation produced a slope of 0.90. For Chadron, the wind speed correlation produced a slope of 1.04 and the wind direction correlation produced a slope of 0.96. Also, under these conditions the regression analysis will produce a coefficient of determination (R2) close to 1. The equations below also show that for Scottsbluff, the wind speed correlation produced an R2 of 0.94 and the wind direction correlation produced an R2 of 0.97. For Chadron, the wind speed correlation produced an R2 of 0.98 and the wind direction correlation produced an R2 of 0.96. Since the sum of all the "x" values and the sum of all the "y" values are both equal to 1 (inherent to probability distributions), an R2 close to 1 indicates the individual short-term frequencies closely match their long-term counterparts. Hence, the short and long-term wind speed and direction distributions are similarly distributed, and the demonstration has been made.

This is not to suggest causation, only relation, which is all that regression analysis can justify. "x" does not cause "y." In this analysis the independent and dependent variables are related to each other through a third variable "z", which represents the regional climatic system. "z" causes both "x" and "y," in this case by the same mechanism.

As seen in **Figure S-1**, the wind direction correlation produced a very high coefficient of determination, or R^2. In the wind direction regression analysis below, the p-value of 0.000 indicates virtually no chance that this R^2 value is accidental. In other words, the 1-year distribution of wind directions is strongly correlated with the 15-year distribution, to a high degree of confidence.

Scottsbluff Regression Analysis: 15-Year Directions versus 1-Year Directions

The regression equation is:

15-Year Directions = 0.006077 + 0.9028 1-Year Directions

S = 0.00689141 R-Sq = 97.5% R-Sq(adj) = 97.4%

Analysis of Variance

Source	DF	SS	MS	F	P

S = 0.00685647 R-Sq = 95.8% R-Sq(adj) = 95.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.0160024	0.0160024	340.39	0.000
Error	15	0.0007052	0.0000470		
Total	16	0.0167075			

In similar fashion, the wind speed correlation for Chadron produced a very high coefficient of determination (**Figure S-8**). The p-value of 0.000 shown in the regression analysis below indicates virtual certainty that this R^2 value is not accidental. In other words, the 1-year distribution of wind speeds is strongly correlated with the 12-year distribution, to a high degree of confidence.

Chadron Regression Analysis: 12-Year Speeds versus 1-Year Speeds

The regression equation is:

12-Year Speeds = - 0.00580 + 1.04 1-Year Speeds

S = 0.0146045 R-Sq = 98.2% R-Sq(adj) = 97.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.0590527	0.0590527	276.86	0.000
Error	5	0.0010665	0.0002133		
Total	6	0.0601191			

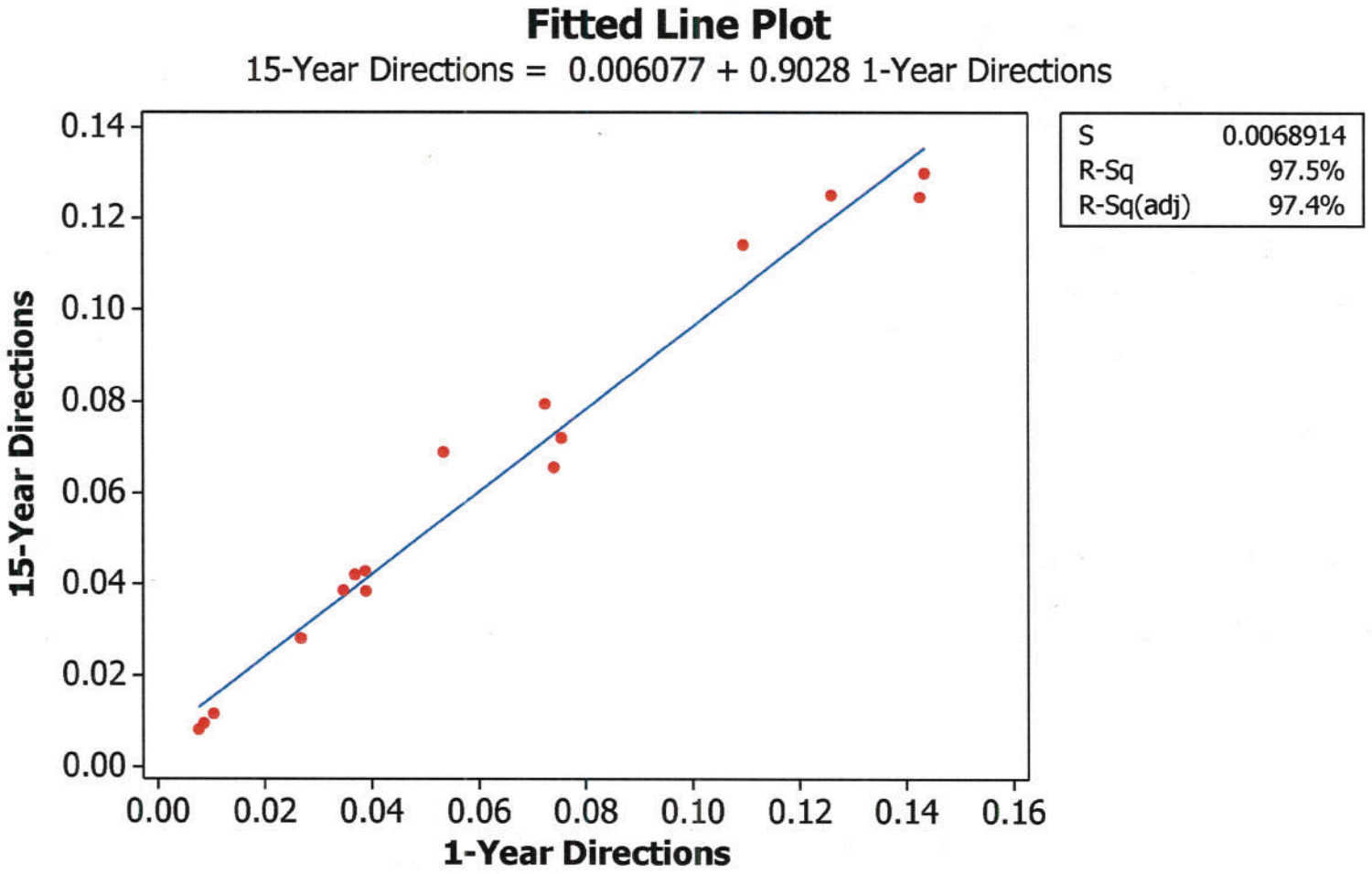

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FIGURE S-1
WIND DIRECTION CORRELATION
FOR SCOTTSBLUFF AIRPORT

K:\CBR_Projects\CO0001636_Marsland\3_IMAGES\Illustrator\Appendix S-1.ai @ 08/06/2013

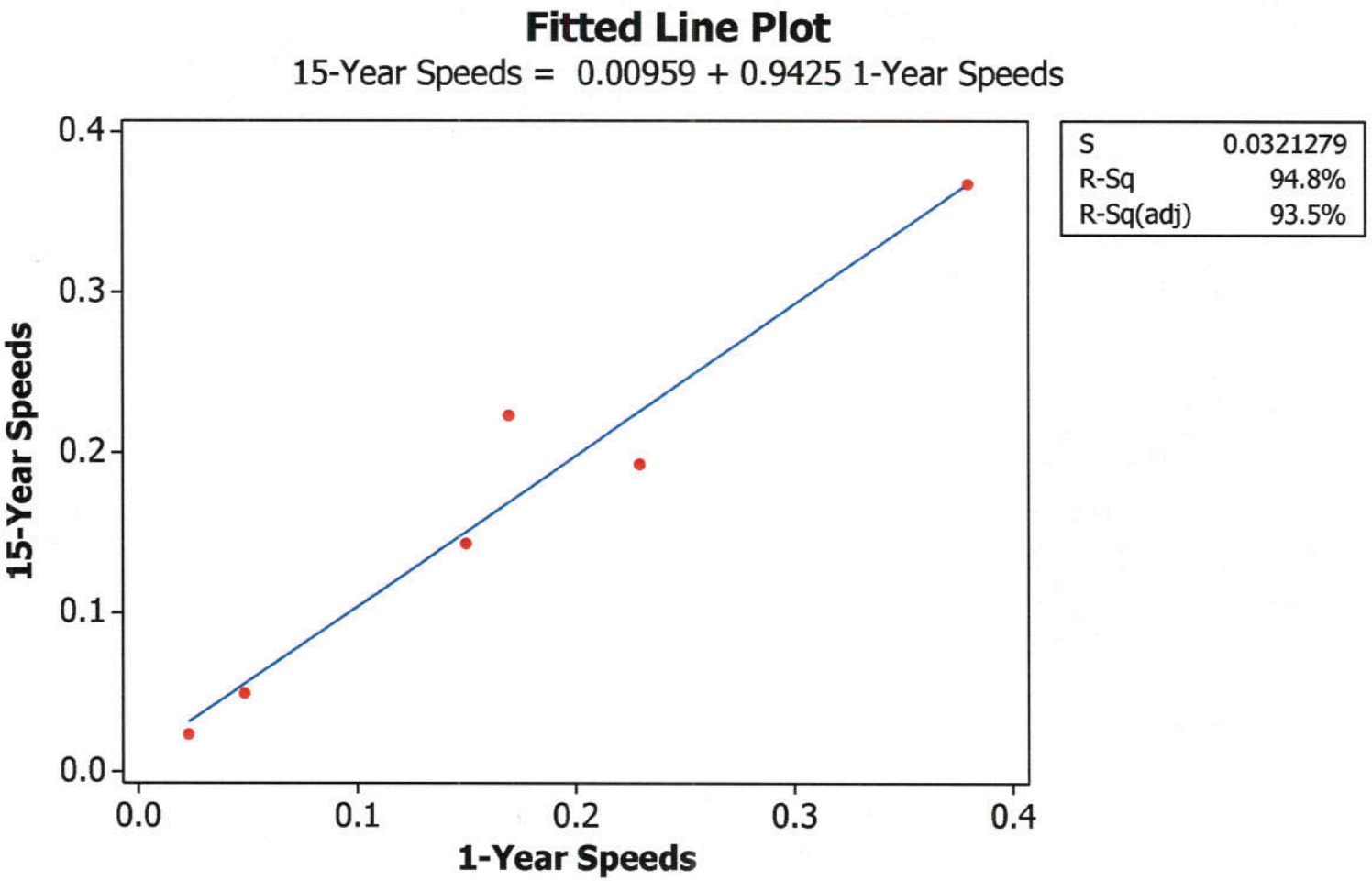

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FIGURE S-2
WIND SPEED CORRELATION
FOR SCOTTSBLUFF AIRPORT

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Chadron Airport
Chadron, NE
8/24/2010 Hr. 2 to 8/29/2011 Hr. 14

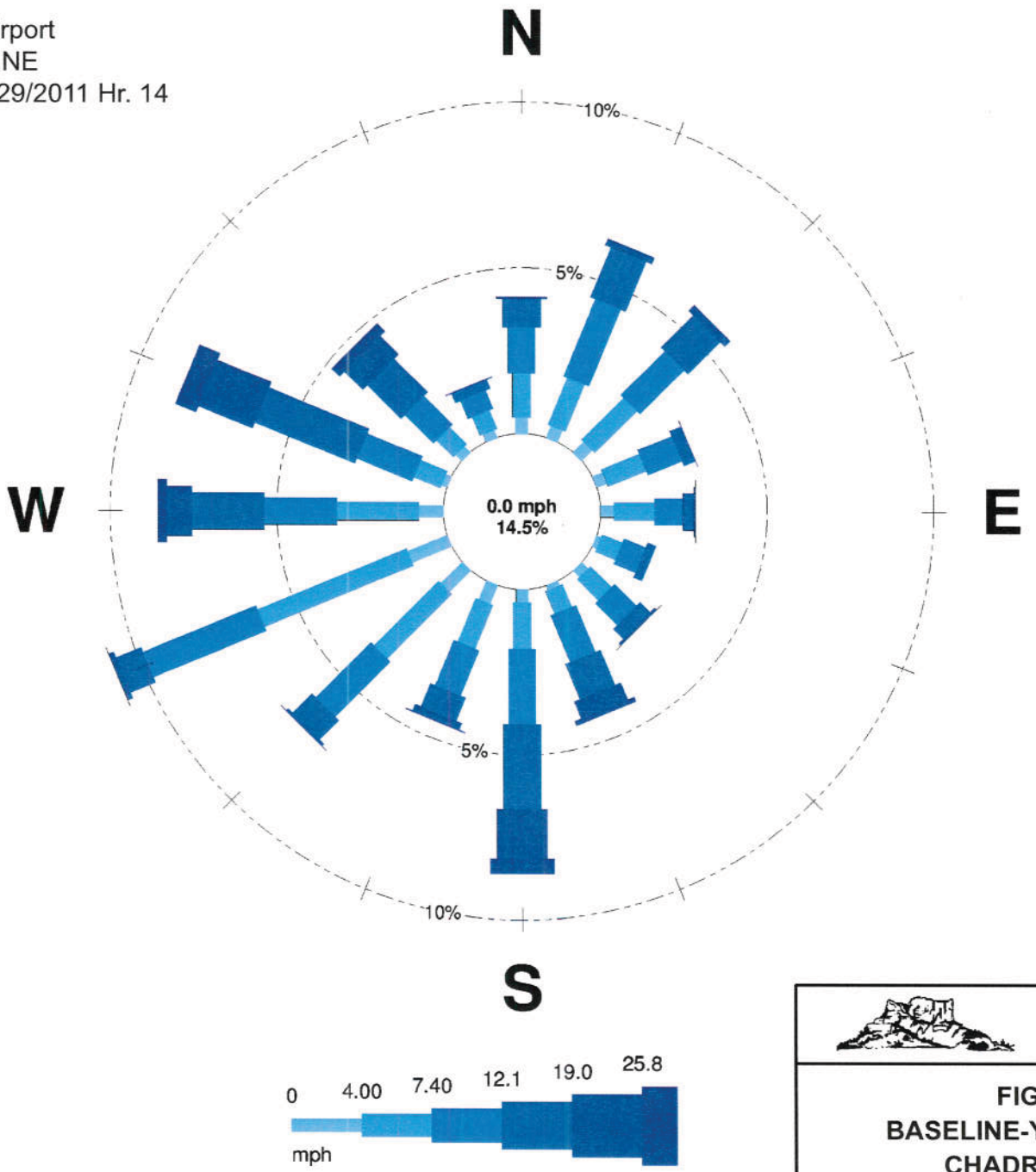

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FIGURE S-3
BASELINE-YEAR WIND ROSE
CHADRON AIRPORT

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Chadron Airport
Chadron, NE
1/1/2001 Hr. 1 to 12/31/2012 Hr. 23

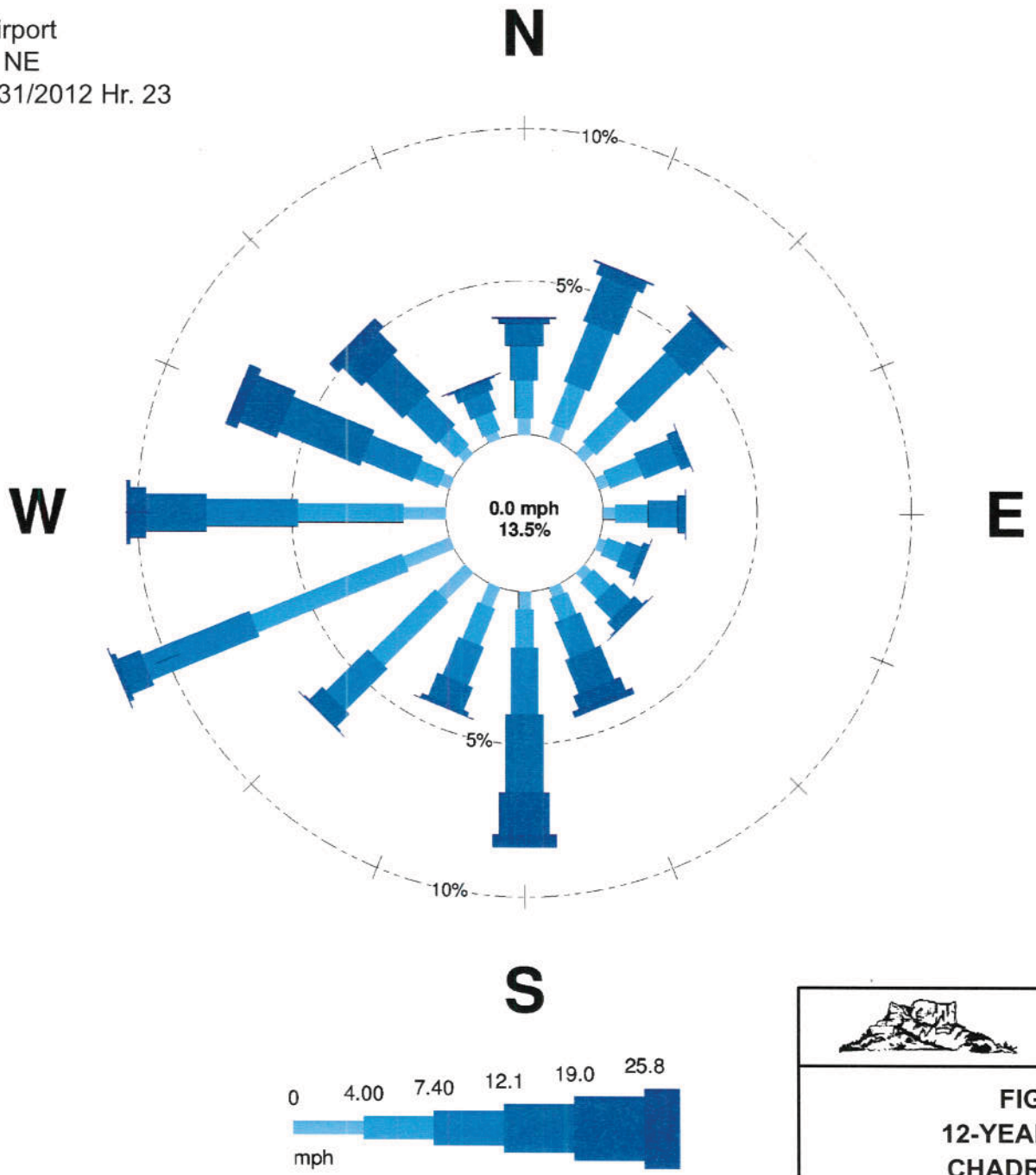

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FIGURE S-4
12-YEAR WIND ROSE
CHADRON AIRPORT

K:\CBR_Projects\CO001636_Marsland\3_IMAGES\Illustrator\Appendix S-4.ai @ 03/27/2013

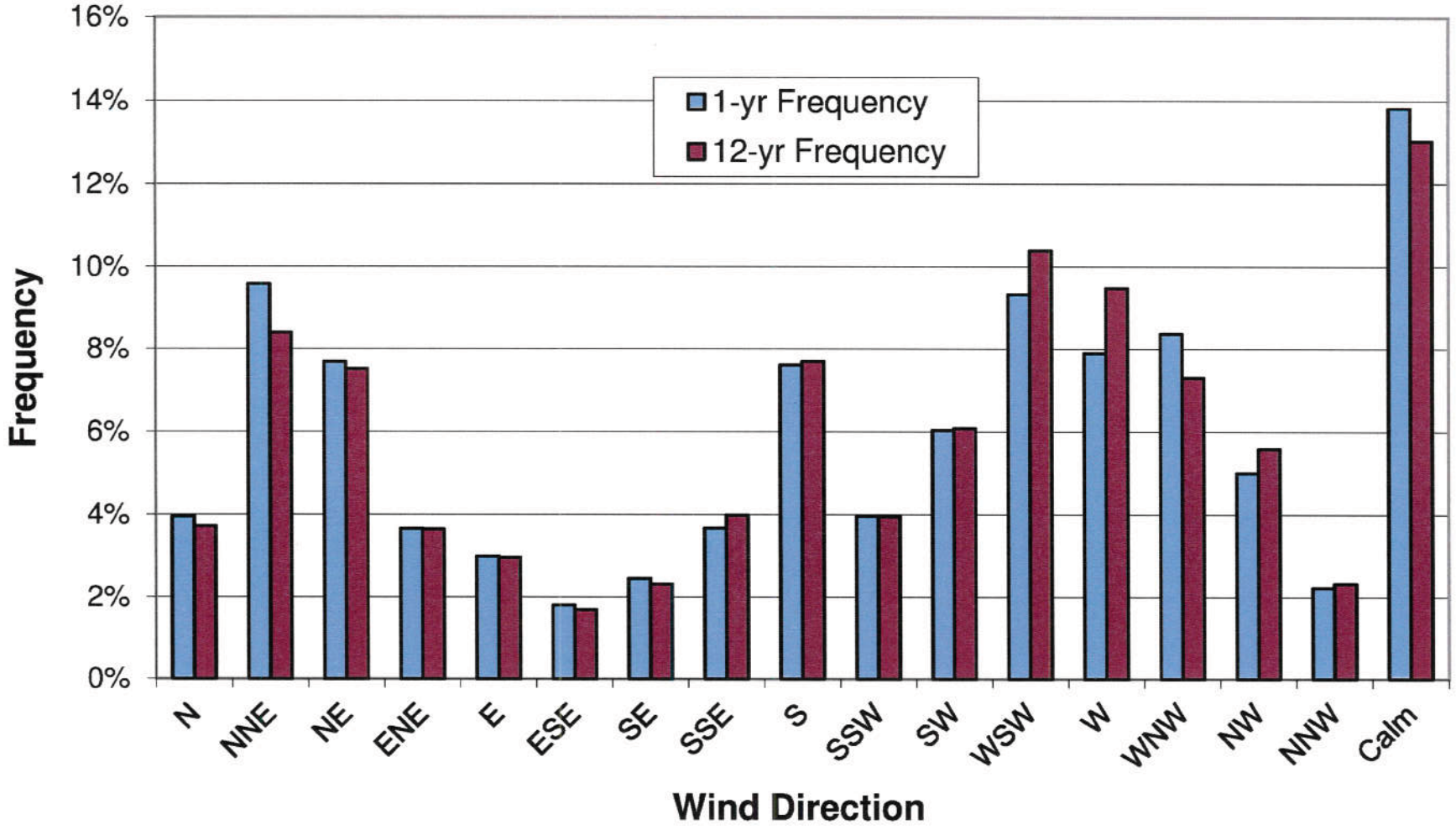

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FIGURE S-5
CHADRON AIRPORT
WIND DIRECTION DISTRIBUTION

K:\CBR_Projects\CO0001636_Marsland\3_IMAGES\Illustrator\Appendix S-5.ai @ 03/27/2013

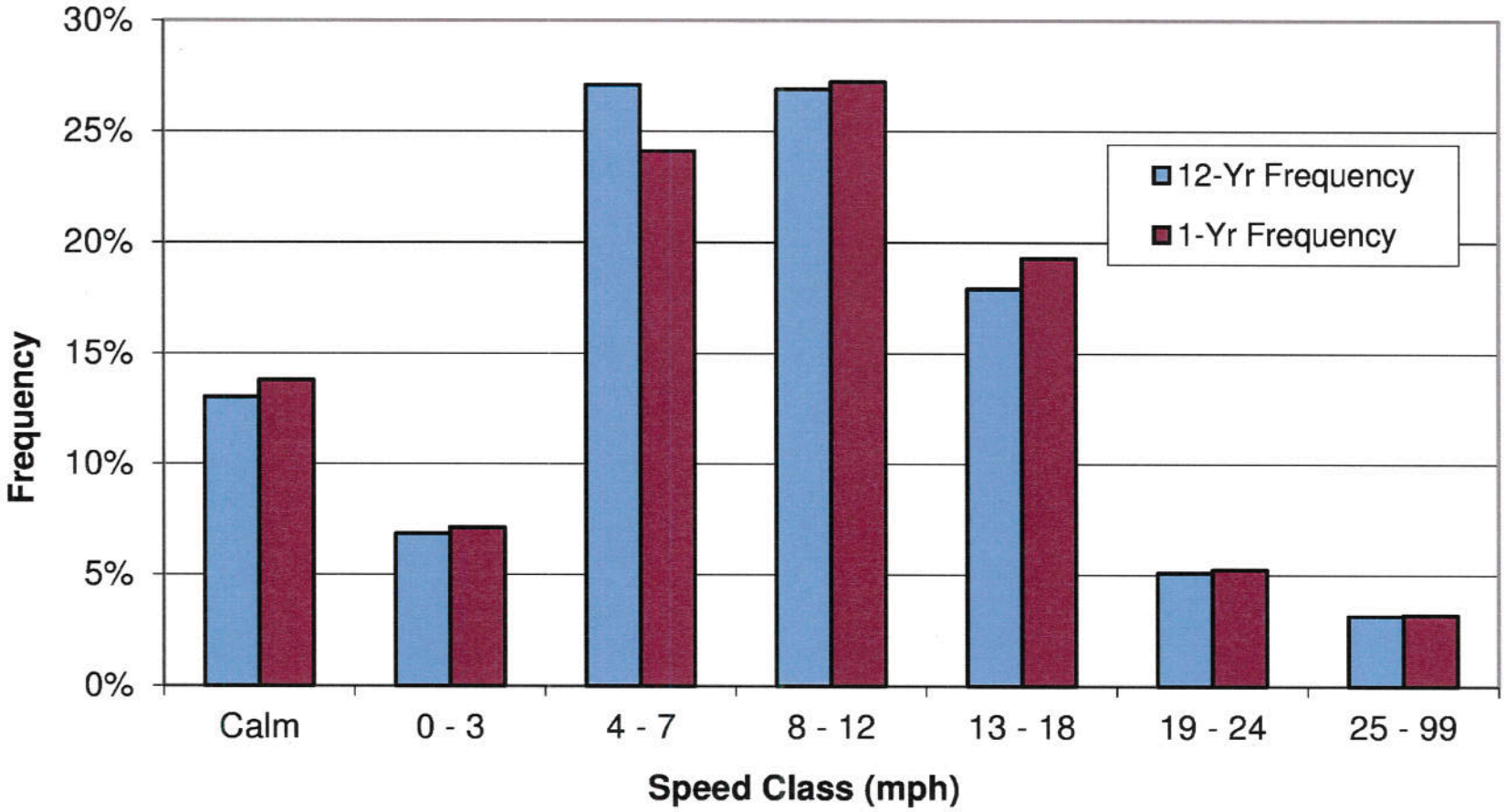

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FIGURE S-6
CHADRON AIRPORT
WIND SPEED DISTRIBUTION

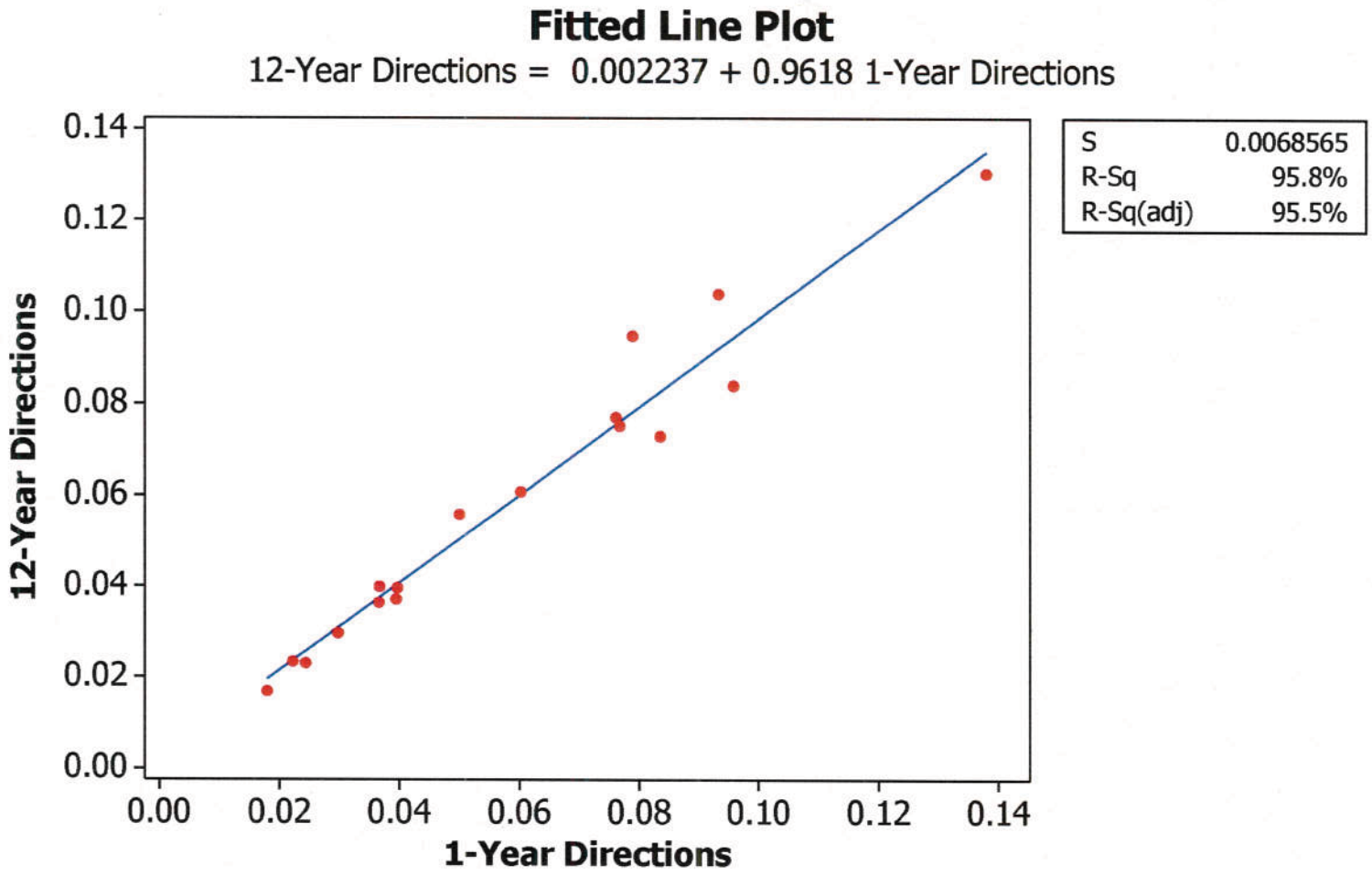

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FIGURE S-7
WIND DIRECTION CORRELATION
FOR CHADRON AIRPORT

K:\CBR_Projects\CO0001636_Marsland\3_IMAGES\Illustrator\Appendix S-7.ai @ 08/06/2013

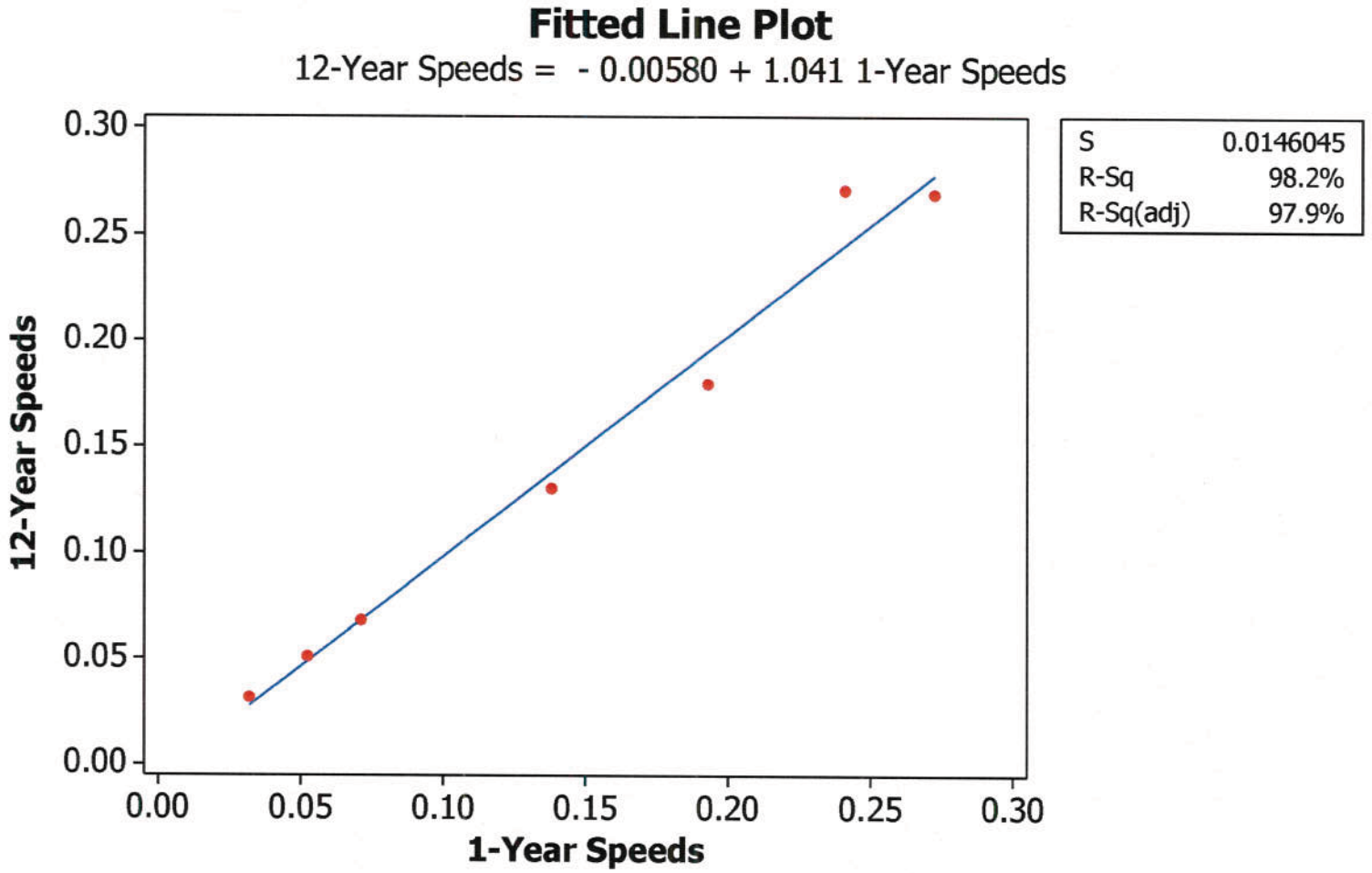

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FIGURE S-8
WIND SPEED CORRELATION
FOR CHADRON AIRPORT

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