Interested Party:	**SDFN/NDFN**	**Rec No.:**	**SDFN**
Re:	**Commitment 33**		

The following information is provided in response to Commitment 33 made by Agnico Eagle as part of the Meliadine Extension Project Proposal.

Commitment Made:

Agnico Eagle will provide a summary of the wind analysis for the windfarm from Agnico Eagle's 3rd Party Consultant.

Response by Agnico Eagle:

Agnico Eagle retained Hatch Ltd. (Hatch) for the purpose of developing a windfarm feasibility study for the Meliadine mine site to build a windfarm and integrate wind power into the existing diesel-powered generation and distribution system. Below is a summary of the wind analysis from the overall Wind Farm Feasibility Study (Hatch 2019) prepared for Agnico Eagle.

Wind Resource Assessment

To assess the potential of the Meliadine site for wind power development, a wind resource assessment was completed. The site was equipped with one Met mast (telecom tower) instrumented by Hatch in May 2016.

Site Description

The Met mast is located approximately 1.5 km south-southeast of the Meliadine camp. Hatch proceeded with the instrumentation of the mast (Table 4-1) and followed industry standards.

Table 4-1: Met Mast Characteristics (Coordinate System: NAD83)

ID	Type	Diameter of Last Section (m)	Height (m)	Latitude	Longitude	Elevation (m)
2704	Lattice	0.813	60	N 63° 01' 36.99"	W 92° 12' 51.07"	66

The Met mast was equipped with six anemometers, three wind vanes and two thermometers mounted on booms at several heights. The dimensions of the booms, their heights and orientations on the mast, were designed to comply with the best practices in wind resource assessment. All redundant anemometers (A2, A5, A6) and all wind vanes were heated to increase their reliability during icing periods. The period of data collection used in the analysis covers the period from June 1, 2016 to May 31, 2018 (i.e., 2 full years).

Wind Characteristics

The wind data were collected periodically from the Met mast and the quality of the data was analyzed. This is done by applying a variety of logical and statistical tests, observing the concurrent readings from different instruments and relating these observations to the physical conditions at the site (e.g., wind shading, freezing potential, etc.). There are many possible causes of erroneous data: faulty or damaged sensors, loose wire connections, broken wires, data logger malfunction, damaged mounting hardware, sensor calibration drift, icing events and different causes of shading (e.g., shading from the mast or from any obstacles at the site). Data points that are deemed erroneous or unreliable are replaced by redundant data when available or removed from the data set. Replacements were done by using a linear regression equation between anemometers at the same height. Direct replacement is applied to wind vanes as long as they are well correlated.

The data recovery rate for the analysis period is then calculated for each of the instruments using the following equation:

$$\text{Data recovery rate}(\%) = \frac{\text{Number of valid observations}}{\text{Number of potentialobservations}} * 100$$

The "Number of valid observations" is evaluated once erroneous or unreliable data are replaced with available redundant data. The "Number of potential observations" is the theoretical maximum number of measurements that could be recorded during the analysis period. A high data recovery rate ensures that the set of data available is representative of the wind resource over the measurement period.

Table 4-2 presents the height at which each instrument was installed, as well as the recovery rates calculated for each instrument after quality control and after replacements have been applied.

Table 4-2: Instruments Data Recovery Rates

Mast ID	Period	A1/A2* (62 m)	A3/A5* (47 m)	A4/A6* (32 m)	V1/V2/V3* (62/47/32 m)	T1/ T2* (61/5 m)
2704	June 1, 2016 to May 31, 2018	97.0%	96.5%	96.3%	97.2%	100.0%

* (A = Anemometer, V = Wind Vane, T = Thermometer)

Very good recovery rate was observed at all instruments which increases the confidence in the wind resource assessment.

The average wind speed measured at the top anemometer height (A1, 62m) was 8.53 m/s over the entire period considered in the current analysis.

The monthly wind speeds measured at each anemometer are shown in the following figure for mast 2704. As expected, the data confirms that wind speeds increase with height above ground level. Furthermore,

the graph shows the seasonal pattern of wind, which decreases towards summer months and increases towards winter months.

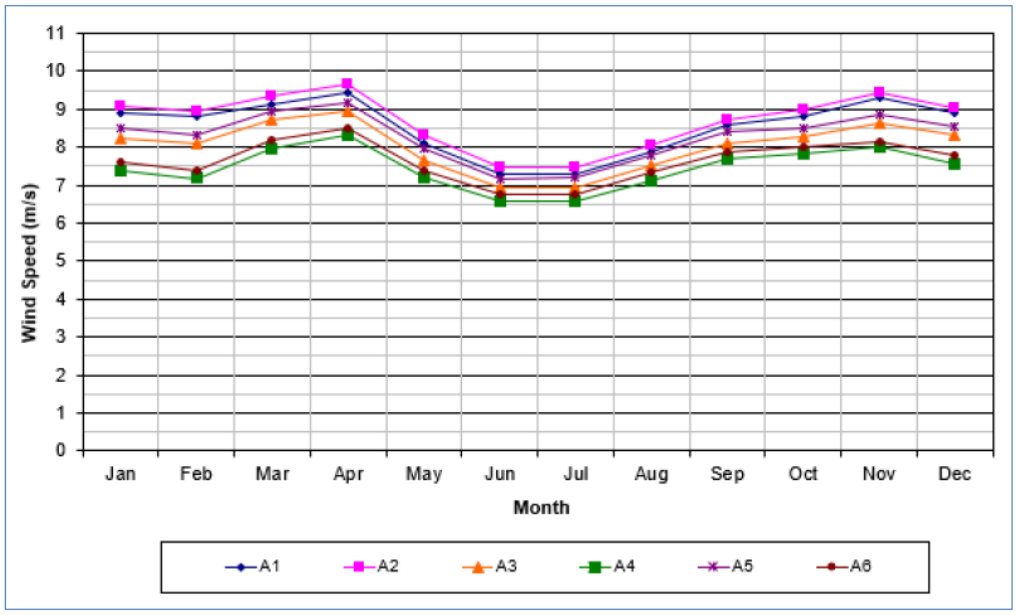

Figure 4-1: Averaged Monthly Wind Speeds for Each Anemometer from June 1, 2016 to May 31, 2018

The wind speed and direction distributions are shown in Figure 4-2. A significant proportion of the wind blows from the north-northwestern area of the project.

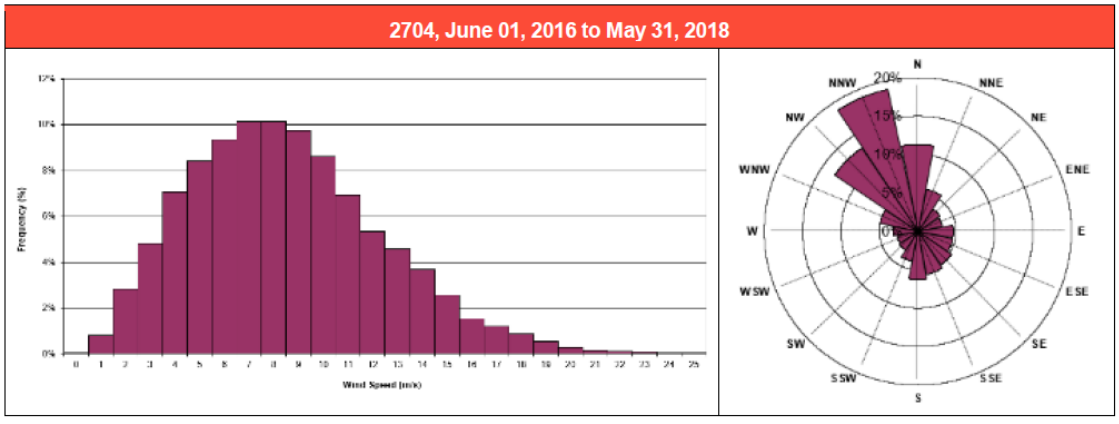

Figure 4-2: Wind Speed and Direction Frequency Distributions

Table 4-3 presents other climatic data calculated at the met mast location and used in the models to evaluate the energy production output of the turbines.

Table 4-3: Average Turbulence Intensity, Temperature and Air Density

Mast ID	Period	Average Turbulence Intensity at 62 m (%)	Annual Average Temperature at 61 m (°C)	Annual Average Air Density at 61 m (Kg/m³)
2704	June 1, 2016 to May 31, 2018	6.5%	-8.6	1.329

Long-term Wind Speed at Hub Height

To estimate the long-term wind regime at the site, several potential reference stations with historical data were selected. These were checked in terms of data quality, data availability, climatic similarity with the site, correlation fitness with the Met mast, and other information required to make the best selection among stations.

Based on the above criteria, a synthetic reference station was selected and considered suitable for the long-term projection of the data at the Met mast. A 14-year (2005-2018) of reanalysis wind data was purchased from Vortex and used to adjust the short-term data to long-term.

The use of Vortex data for a long-term adjustment is a bankable and suitable technique for the Meliadine, based on:

- the experience and renown of the agencies involved in the development of such data;
- the use of such methods by the major players in the wind industry;
- the good correlation obtained with onsite meteorological mast; and
- internal validation of the Vortex data.

The reference data point information is provided in Table 4-4.

Table 4-4: Identification of the Long-Term Reference Data

Name	ID	Instruments Height (m)	Latitude	Longitude	Elevation (m)
Vortex CFSR	63997	80.0	N 63° 01' 36.80"	W 92° 12' 51.01"	47.0

The wind speed data of the Met mast was correlated to the concurrent wind speed data at the long-term reference Vortex dataset. Good correlation results were obtained with hourly average values (R2 = 0.73) over the entire analysis period.

The regression equation was then used to estimate the long-term average wind speed at the mast as a function of the long-term wind speed at the reference dataset. The long-term average wind speed at the reference dataset was 7.00 m/s. It was estimated by averaging all annual averages over the period 2005 to 2018. The results are presented in the following table.

Table 4-5: Climatological Adjustment Factor at the Met Mast

Met Mast	Wind Speed over Correlation Period (m/s)	Adjustment Factor (%)	Long Term Annual Wind Speed (m/s)
2704	8.53	-0.77	8.45

Finally, the 10-minute measured data recorded at the Met mast were scaled down by the adjustment factor to reflect the long-term value. In terms of the wind direction data, the 2-year dataset for the Met mast remained untouched. As a result, the mast has a set of wind speeds and wind directions that are the best estimate of the long-term wind regime.

The long-term estimate was then extrapolated from measurement height to hub height using the observed wind shear at the Met mast. The long-term wind speed extrapolated to the hub height of 86 m was 9.03 m/s at the mast location.