Bowers Wind Project

Sound Level Assessment - Peer Review

CARROLL PLANTATION AND KOSSUTH TOWNSHIP, MAINE

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Executive Summary

Champlain Wind, LLC proposes to construct, operate and maintain a 27 turbine utility scale wind energy facility in Carroll Plantation and Kossuth Township. Turbines will be located on Bowers Mountain, an unnamed ridge to the south in Carroll Plantation and Dill Hill in Kossuth Township.

Multiple turbine models are being evaluated for this project. The applicant submits a combination of greatest impact turbine selections to aid in an impact evaluation at receiver points with the greatest potential to exceed MDEP 375.10 regulations.

Review Basis

At the request of the Land Use Regulation Commission (LURC) a peer review is undertaken to determine if the applicant's noise impact assessment is reasonable and technically correct according to standard engineering practices and the Commission Regulations on Control of Noise (12 MRSA §685-B(4-B)(A)).

This review includes the Sound Level Assessment dated January 2011, correspondence from the applicant or their consultant and associated telephone calls.

1.0 Introduction

Stantec Consulting Ltd. submits a sound level assessment for the proposed Bowers Wind Project (up to 27 turbines) identifying pertinent noise control regulations, land uses in the project vicinity and sound estimates for the project operation. Greatest impact potential sound estimates are based on a combination of Siemens 2.3 and 3.0 wind turbine generators. Three receiver points are selected to demonstrate greatest potential to exceed the Maine DEP sound level limits.

2.0 Sound Terminology

Informational

3.0 Project Overview

3.1 Study Area

A description of the project and site including characteristics of ground cover are detailed.

3.2 Construction

A standard discussion of construction sounds is presented with the stated intention of complying with 06-096 CMR 375.10 nighttime noise limits and federal requirements.

3.3 Operation

Mechanisms of wind turbine noise production are discussed. The definition of routine operation sound is appropriate.

4.0 Sound Level Criteria

This project will be subject to the sound level standards described in the Department of Environmental Protection's noise control regulations, 06-096 C.M.R. 375.10. (55 dBA daytime and 45 dBA nighttime).

4.1 Existing Sound Levels

The project is located in a "quiet" area making it subject to the 55 dBA daytime and 45 dBA nighttime limits at protected locations, which may include distances up to 500 feet from the living or sleeping quarters.

5.0 Sound from Wind Turbines

5.1 Meteorology

A general discussion of atmospheric stability and turbulence, as related to wind turbine sound analysis methodology IEC 61 400-11 is briefly outlined.

5.2 Masking

Stantec notes that masking noise from surface winds may often be a factor. However, for modeling purposes masking was not considered since stable atmospheric conditions make wind turbine sounds more noticeable.

5.3 Tonal Sound

Applicant explains tonal sound definition and states "Based on a review of octave band data for these turbines, no tonal sounds are expected.

5.4 Short Duration Repetitive Sound

Stantec expects that no SDRS events (defined by 06-096 C.M.R. 375.10.G.19) will occur. It is the reviewer's opinion that SDRS events will occur, but the frequency of events and associated penalties are unlikely to be a significant factor.

6.0 Predicted Sound Levels

6.1 Model Description

Computer modeling for the project was done with Cadna software employing ISO 9613-2 algorithms. Protected location predicted sound levels were evaluated at a height of 4m.

6.1.1 Meteorological Factors

The meteorological conditions assumed in the model are:

Downwind conditions for all receivers from each wind turbine
Temperature = 10° C (50° F)
Relative Humidity = 70 %
Wind Conditions = variable

6.1.2 Terrain and Vegetation

The modeling assumed no intervening vegetation and a ground absorption factor of G = 0.0 was used. At the reviewer's request the ground absorption factor was adjusted to G = 0.0 (formerly G = 0.8) with an adjustment factor of manufacturer's turbine sound power level uncertainty only for evaluation of "worst-case" results.

6.1.3 Summary of Model Assumptions

The following input variables conclude the assumptions used in the project modeling:

- Receiver height of 4 meters
- Source height equal to hub height of turbine
- Additional uncertainty factor added for each turbine using manufacturers specifications.

The modeling uncertainty factor of 3 dBA was removed in deference to the reviewer's recommendation of using a ground absorption factor of G = 0.0.

6.2 Construction

Standard discussion of construction noise. Construction noise must meet 45 dBA nighttime standards at protected locations.

6.3 Operation

Operating sound levels were evaluated for 10 Siemens 3.0 MW turbines at locations 1-6 and 11- 14 and the remaining 17 locations turbines 7-10 and 15-27 to be Siemens 2.3 MW. Stantec evaluated and modeled three receptor points that are most likely to exceed Maine DEP sound level limits.

The reviewer requested the applicant remodel the project assuming an adjusted ground absorption factor (see Section 6.1.2).

7.0 Sound Compliance Assessment Plan

The applicant states that a detailed plan will be in place prior to operation. This plan will be submitted to LURC for approval. The plan will include compliance testing methods including methods for the collection of one-third octave data, fast-response measurement data and audio recordings. Sample calculations of each type of compliance analysis will be provided.

The reviewer will provide sound compliance assessment plan details in the conclusion to this review.

8.0 Summary and Conclusions

Sound levels were predicted for three receptor locations. These receptors represented protected areas of the project most likely to exceed nighttime noise limits for quiet areas. The modeling demonstrated compliance at these locations.

Reviewer required changes to the ground absorption factor and subsequent adjustment factors applied to the predictive model resulted in no significant changes to predicted sound levels or proposed project design.

Conclusion – (Peer Review)

In my opinion the Bowers Wind Project noise assessment is reasonable and technically correct according to standard engineering practices required by LURC under 12 MRSA §685-B(4-B)(A) Regulations on Control of Noise (06-096 CMR 375.10).

Stantec estimated the operational sounds of the project using Cadna A software. Cadna utilizing ISO 9613-2 (1996) is widely used in the international community. Estimated accuracies for greater than 30 m mean source height and 1000 m source to receiver distances are not provided in ISO 9613-2, but numerous authors have presented simple corrections for wind turbine predictive modeling. It is this reviewer's experience and opinion that appropriately corrected ISO 9613-2 algorithms provide reasonable estimates of "worst-case" wind turbine noise that comply with MDEP Chapter 375.10 noise regulations.

The wind project prediction model based on CADNA/A software, based on the following prediction assumptions:

- individual wind turbine spherical wave fronts,
- moderately soft ground cover modeled as G = 0.0,
- atmospheric attenuation based on 10°C, 70% RH,
- no attenuation due to foliage or barriers,

- all wind turbines operating at maximum sound power output,
- incorporation of the manufacturer specified uncertainty levels,
- all turbines operating under moderate downwind conditions simultaneously and
- a receiver height of 4 m.

Incorporation of the manufacturer uncertainty factor and reflective ground modeling result in a reasonable prediction model for "worst-case" stable atmospheric conditions.

I recommend required routine operation noise compliance measurements at a minimum of three protected locations designated in the application noise assessment as "Receptor Locations" R1, R2 and R3 . R1 and R2 are not 500 feet from the residence, but rather in the immediate vicinity of the residences where there are sufficient openings to allow sound level measurements without overwhelming extraneous sounds from tree leaves, etc. S5 would be an adequate proxy for R2, if the open area is less than 50-75 feet in radius.

In the event that R3, adjacent Route 6 has insufficient (50-75' radius) open area to provide a suitable site for compliance measurements, a potential proxy location would exist on the Dill Hill Road, should it be improved for project access.

Receptor locations R1-R3 will serve as model confirmation measurement locations rather than actual compliance confirmation (45 dBA nighttime). R1-R2 locations represent the 2.3 and 3.0 Siemens turbines from a southwesterly direction. R3 location represents the 2.3 Siemens turbine from the North East direction. Please note - measurement location recommendations are subject to landowner agreement. Other perimeter protected locations are at greater distances and lower predicted project sound levels.

S-1 would be well-suited for meteorological measurements representing the R1-R2 locations..

Compliance should be demonstrated, based on following outlined conditions for 12, 10-minute measurement intervals per monitoring location meeting 06-096 CMR 375.10 requirements. All data submittals must be accompanied by concurrent time stamped audio recordings.

a. Compliance will be demonstrated when the required operating/test conditions have been met for twelve 10-minute measurement intervals at each monitoring location.

b. Measurements will be obtained during weather conditions when wind turbine sound is most clearly noticeable, i.e. when the measurement location is downwind of the development and maximum surface wind speeds ≤6 mph with concurrent turbine hub-elevation wind speeds sufficient to generate the maximum continuous rated sound power from the five nearest wind turbines to the measurement location. Measurement intervals affected by increased biological activities, leaf rustling, traffic, high water flow or other extraneous ambient noise sources that affect the ability to demonstrate compliance will be excluded from reported data. A downwind location is defined as within 45° of the direction between a specific measurement location and the acoustic center of the five nearest wind turbines.

c. Sensitive receiver sound monitoring locations should be positioned to most closely reflect the representative protected locations for purposes of demonstrating compliance with applicable sound level limits, subject to permission from the respective property owner(s). Selection of monitoring locations should require concurrence from MDEP.

d. Meteorological measurements of wind speed and direction should be collected using anemometers at a 10-meter height above ground at the center of large unobstructed areas and generally correlated with sound level measurement locations. Results should be reported, based on 1-second integration intervals, and be reported synchronously with hub level and sound level measurements at 10 minute intervals. The wind speed average and maximum should be reported from surface stations. MDEP concurrence on meteorological site selection is required.

e. Sound level parameters reported for each 10-minute measurement period, should include A-weighted equivalent sound level, 10/90% exceedance levels and ten 1-minute 1/3 octave band linear equivalent sound levels (dB). Short duration repetitive events should be characterized by event duration and amplitude. Amplitude is defined as the peak event amplitude minus the average minima sound levels immediately before and after the event, as measured at an interval of 50 ms or less, A-weighted and fast time response, i.e. 125 ms. For each 10-minute measurement period short duration repetitive sound events should be reported by percentage of 50 ms or less intervals for each observed amplitude integer above 4 dBA. Reported measurement results should be confirmed to be free of extraneous noise in the respective measurement intervals to the extent possible and in accordance with (b).

f. Compliance data collected in accordance with the assessment methods outlined above for representative locations selected in accordance with this protocol will be submitted to the Department for review and approval prior to the end of the first year of facility operation. Compliance data for each location will be gathered and submitted to the Department at the earliest possible opportunity after the commencement of operation, with consideration for the required weather, operations, and seasonal constraints.

g. All acoustic, meteorological and audio raw data files should be available for Department review upon request.