

**Stetson II Wind Project
Sound Testing Protocol
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This wind turbine sound testing protocol for compliance assessment was developed for Stetson II in recognition of recent assessment plans/protocols established by the Maine DEP for similar projects. These recent protocols evolved through years of sound level testing of wind turbine projects in Maine and comprehensive evaluation of those test programs by the Maine DEP and its acoustical consultant (W. Brown of EnRad Consulting). R. Scott Bodwell, P.E. of Bodwell EnviroAcoustics worked closely with Maine DEP staff and Mr. Brown to refine testing protocol criteria including instrumentation, site and weather conditions, meteorological observations, sound level measurement data and analysis methods.

These efforts culminated with development of a Sound Compliance Assessment Plan for the Rollins Wind Project on April 6, 2009. For Rollins, the focus of the sound level testing was re-oriented from extended quarterly sound level measurements over 24-hour periods to collecting test data under specific operating, site and weather conditions.

The specific test conditions required for Rollins were established based on the results of sound testing at wind projects in Maine under a wide range of site and weather conditions and are also supported internationally by technical literature from acoustical experts and scientists. Atmospheric stability is a key component of the Rollins protocol, which is designed to yield measurement results during the most critical operating conditions for sound propagation from wind turbines. Other components of the Rollins protocol establish measurement, reporting and analytical criteria for assessing tonal and short duration repetitive sound levels, which are types of sounds regulated by Maine DEP Chapter 375.10 and not regulated by LURC's noise standard (LURC Chapter 10.25). Similar protocols have been approved for other recent projects in Maine with some additional refinements based in part on compliance testing at Stetson I Wind. Further, the test protocol for Oakfield Wind was reviewed and approved by an independent acoustical consultant acting on behalf of the Town of Oakfield.

Stetson II Wind is the first utility scale wind energy project in LURC jurisdiction where the Maine DEP noise regulation (Chapter 375.10) is being applied. Bodwell EnviroAcoustics and First Wind propose a Sound Testing Protocol for Stetson II that is similar to that established for Rollins and other recent wind projects. In lieu of quarterly testing, the proposed testing protocol dictates reporting sound level measurement results for twelve 10-minute measurement periods meeting precise test conditions. The proposed Sound Testing Protocol for Stetson II Wind is as follows:

Operations sound testing for Stetson II Wind requires carefully specified measurement conditions, monitoring specifications and reporting requirements to characterize and consistently quantify wind

turbine sound levels. Compliance for Stetson II will be demonstrated when the specified test conditions have been met for 12, ten-minute measurement intervals for each monitoring location selected as set forth below and in accordance with Maine DEP Chapter 375.10 requirements.

Measurements will be obtained during weather conditions when wind turbine sound is most clearly noticeable. This occurs when the monitoring location is downwind from the wind turbines and the maximum surface wind is 6 mph or less with concurrent turbine hub-elevation wind speeds sufficient to generate the maximum continuous rated sound power from the five nearest wind turbines to the monitoring location. These conditions usually occur during nighttime inversion periods. A downwind location is defined as within 45 degrees of the direction between a specific monitoring location and the acoustic center of the five nearest wind turbines.

Measurement intervals influenced by increased biological activity, leaf rustling, traffic, high water flow or other extraneous ambient sounds that affect the ability to demonstrate compliance will be excluded from the reported data. The objective is to obtain 10-minute measurement intervals that fully meet the specified criteria. If Stetson II must adjust measurement results for such sounds, background ambient monitoring will be necessary. If background ambient monitoring is proposed, locations and times will be determined with concurrence from LURC.

Sound monitoring locations will be positioned to most closely reflect 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 will also consider the origin of community noise complaints that may be received by Stetson II Wind. Monitoring locations will require concurrence from LURC prior to testing.

Meteorological measurements of wind speed and direction will be collected using anemometers at a height of 10 meters above ground. To the maximum extent practicable, the anemometers will be positioned at the center of large unobstructed areas generally correlated with sound monitoring locations. Results will be reported based on 1-second measurement intervals and synchronously with wind turbine power output and sound level measurements at 10-minute intervals. The average and maximum surface (10 meter) wind speed will be reported from each meteorological station. Concurrence from LURC is required on selection of meteorological station locations.

Sound level parameters reported for each 10-minute measurement interval meeting the protocol criteria will include the following:

1. Ten-minute A-weighted and C-weighted equivalent sound levels (L_{Aeq} and L_{Ceq}).
2. Ten-minute 10% and 90% percentile exceedance levels (L_{A10} and L_{A90}).
3. Ten one-minute 1/3-octave band linear equivalent sound levels (dB) with analysis for the presence of tonal sounds.
4. Short duration repetitive events characterized by event duration and amplitude based on A-weighted sound levels measured at an interval of 50 milliseconds or less using the fast time response:

- a. Event duration is the time in seconds when the maximum sound level exceeds the average minima immediately before and after the event by a specified dBA level;
 - b. Amplitude is the difference between the maximum sound level and the average minima immediately before and after the event; and
 - c. Events will be reported by percentage of 50 ms or less intervals for each observed amplitude integer above 4 dBA.
5. Calculation of the required 5 dBA assessment for tonal and short duration repetitive sounds when they occur.
 6. Reported measurements will be confirmed to be free of extraneous sounds to the extent possible.
 7. Measurement data will be reported at each monitoring location for 12, 10-minute periods meeting the protocol criteria.

Note that reporting items for tonal and short duration repetitive sounds are not required when measured 10-minute equivalent sound levels (L_{Aeq}) are 5 dBA or more below the applicable sound level limits.

In some circumstances, it may not be feasible to meet the wind speed and operations criteria due to terrain features or limited elevation change between the wind turbines and monitoring locations. In these cases, measurement periods are acceptable if the following conditions are met:

- i. The difference between the L_{A90} and L_{A10} during any 10-minute period is less than 5 dBA, and
 - ii. The surface wind speed (10 meter height) is 6 mph or less for 80% of the measurement period and does not exceed 10 mph at any time; or the turbines are shut down during the monitoring period and the difference in the observed L_{A50} after shut down is equal to or greater than 6 dBA, and
 - iii. Observer logs or recorded sound files clearly indicate the dominance of wind turbine sounds;
- OR, if the following condition is met:
- iv. The overall 10-minute L_{Aeq} is 5 dBA or more below the applicable sound level limit.

Prior to initiating sound level compliance testing, Stetson II will provide detailed procedures and sample calculations to LURC to be used for assessment of the 5 dBA penalty for the presence of short duration repetitive and tonal sounds as set forth in Maine DEP Chapter 375.10. In addition, within 60 days of final commissioning, Stetson II will provide procedures to document, analyze and respond to sound complaints from the community. A summary of community sound complaints will be reported to LURC on a quarterly basis.

Compliance monitoring data in accordance with the assessment methods outlined above will be gathered and submitted to LURC at the earliest possible opportunity after commencement of facility operation with consideration for the required weather and operating conditions, and selection of sound monitoring locations and meteorological stations. Stetson II will report the status of compliance monitoring to LURC staff on a quarterly basis. A compliance assessment report providing sound level and meteorological data, and analysis of results shall be submitted to LURC for review and approval prior to the end of the first year of facility operation. Additional sound level testing beyond the first year of operations is not planned but could be initiated if deemed appropriate in response to a consistent pattern of community sound complaints.