

**HIGH BRIDGE WIND PROJECT**

NY SITING BOARD CASE 18-F-0262

SOUND TESTING COMPLIANCE PROTOCOL

Date: July 19, 2019

## TABLE OF CONTENTS

---

1)	BACKGROUND	1
2)	SOUND INSTRUMENTATION	1
3)	NOISE DESCRIPTORS, WEIGHTING, RESPONSE, AND OTHER SETTINGS	2
4)	CALIBRATION REQUIREMENTS	3
5)	WEATHER AND TESTING CONDITIONS	4
6)	TESTING POSITIONS	4
7)	SEASONS AND TESTING TIMES	5
8)	MEASUREMENT PROCEDURES	6
9)	BACKGROUND CORRECTIONS AND ANALYSIS OF RESULTS	7
10)	ADDITIONAL TESTING	11
11)	SUBSTATION TESTING	11
12)	ADDITIONAL PROVISIONS	12
13)	WITNESSING AND NOTIFICATIONS	12
14)	REPORTING AND DOCUMENTATION	13
15)	TERMS AND DEFINITIONS	14
16)	REFERENCES	15

## 1) BACKGROUND

The proposed Project is being developed by High Bridge Wind, LLC (the “Applicant” or “High Bridge”) a wholly-owned subsidiary of Calpine Corporation. The proposed Facility consists of the construction and operation of a commercial-scale wind power project, including the installation and operation of up to 25 wind turbines, together with the associated collection/POI substation, battery storage, collection lines, access roads, meteorological towers, and one operation and maintenance (O&M) building. These turbines and related facilities will be sited within privately-owned leased land within an approximately 28,000-acre Facility Area.

To deliver electricity to the New York State power grid, High Bridge Wind proposes to construct a collection substation, which will include up to 5 MW of battery storage, and a point of interconnection (POI) substation. The collection substation will be located at the end of the Facility’s 34.5 kilovolt (kV) collection system and will connect to the POI substation via a short overhead 115 kV transmission line of approximately 200 feet. The POI substation will interconnect with NYSEG’s Jennison to East Norwich 115 kV transmission line in the Town of Guilford.

The Applicant anticipates that any Certificate issued by the Siting Board will include regulatory limits and design goals for this Facility as it relates to noise and vibration impacts. The purpose of this protocol is to outline how adherence to regulatory limits and certificate conditions will be demonstrated, both as a matter of routine post-construction testing and to address specific complaints made through the complaint resolution process outlined in the Applicant’s Noise Complaint Resolution Plan.”

## 2) SOUND INSTRUMENTATION

- a) Sound Level Meters (SLMs): All sound level measurements will be conducted using Type-1 integrating SLMs that meet the requirements of ANSI S1.43-1997(R 2007) “Specifications for Integrating-Averaging Sound Level Meters”. Where noted, Type-2 SLMs complying with ANSI/ASA S 1.4- 1983(R 2006) or ANSI S1.43-1997(R 2007) can be used. Alternatively, sound level measurements will be conducted using Type-1 integrating SLMs that meet the requirements of ANSI/ASA S1.4-2014 / Part 1 / IEC 61672-1-2013.
- b) One-Third Octave Band Analyzers: The instruments will have Class-1 one-third octave-band analyzers that meet ANSI S1.11-2004 (R2009) “Specification for Octave- Band and Fractional-Octave-Band Analog and Digital Filters”. Alternatively, the instruments will have Class-1, one-third octave-band analyzers that meet ANSI S1.11-2014/ Part 1 / IEC 61260-1: 2014.
- c) Acoustical/field calibrators: Any acoustical calibrator will be a Type-1 precision calibrator that meets the requirements of ANSI S1.40-2006 (R2011) “Specifications and Verification Procedures for Sound Calibrators”. Where noted, Type-2 precision calibrators can be used.

- d) Windscreens: The windscreens, when used, should be clean, dry, in good condition, and of a type recommended by the manufacturer of the meter. The manufacturer's instructions for installation of the windscreen around the microphone should be followed closely. The insertion loss caused by the windscreen as stated by the manufacturer shall not exceed 2 dB at any frequency of interest specified in section 3(c) of this protocol for sound incidence angles from 0° to ±180°. Alternatively, 7-inch diameter windscreens can be used. Measured sound levels will be automatically corrected by the SLMs or manually corrected as relevant for the insertion loss caused by the windscreen. Insertion losses for windscreens will be documented and included as an appendix to the report as specified in section 14(b) of this protocol. 7-inch diameter wind foam screens or equivalent are preferred.
- e) Sound Floor: SLMs will have a sound floor or self-generated noise (combined - electrical and thermal- microphone and preamplifier noise) at least 5 dB below the sound pressure levels that are intended to be measured at each one-third frequency band of interest as specified in section 3 (c) of this protocol. Alternatively, SLMs will have self-generated noise levels (Combined-electrical and thermal-microphone and preamplifier noise levels) lower than or equal to 22 decibels for broadband descriptors and lower than or equal to 10 decibels for all one-third frequency bands of interest. Sound floor characteristics should be documented with information from the manufacturer. When this is not available, sound floor characteristics may be documented with the most recent certificates of calibrations, provided the information was obtained and reported by an independent qualified laboratory. If this information is also unavailable, sound floor may be estimated by measuring sound levels with the SLM running in a very quiet condition such as inside an SLM hard case or inside the calibrator with the calibration tone "off," at an indoor quiet location such as inside a quiet room or a car turned off.
- f) Dynamic range: The dynamic range of SLMs will be properly selected (manually or automatically) to avoid any noise floor and overload issues.
- g) Temperature and Humidity: SLMs will have operating temperature and relative humidity ranges that comply with the standard listed in section 2(a) of this protocol and are expected to cover the estimated temperature and relative humidity conditions of the site during testing. When this is not possible, testing days and times with forecasted temperature and relative humidity values within the range of the SLMs may be selected. The temperature and humidity ranges from the SLM manufacturer will be reported.
- h) Tripods: SLMs will be mounted on tripods, stakes or poles. Operators, if present, will be at least 1.5 meters (5 feet) away from the sound microphone during testing.

### 3) NOISE DESCRIPTORS, WEIGHTING, RESPONSE, AND OTHER SETTINGS

- a) Broadband Descriptors: The sound levels of the Leq and L90 broadband descriptors at the residential positions shall be recorded and reported in 10 minute intervals. Additional broadband descriptors may be collected but are not required.

- b) One-Third Octave Band Descriptors: The Leq and L90 noise descriptors shall also be recorded at selected residential positions for the One-Third Octave Bands of interest (as specified in section 3(c) of this protocol) and included in the sound compliance test report in 10 minute intervals.
- c) Frequency Ranges of Interest: All one-third octave band measurements will include the frequencies from 12.5 Hz through 10,000 Hz. Any full octave band measurements will include the frequencies from 16 Hz through 8,000 Hz.
- d) Weighting: Broadband sound levels shall be reported by using the A- weighting scale in the frequency range of interest. Full Octave Bands and One-third Octave Band levels shall be reported by using the Z, Linear or un-weighted scale.
- e) Statistical Noise Descriptors Response: The response for determination of any statistical noise descriptors will be set to "Fast".
- f) Settings: All SLM settings will be reported.

#### 4) CALIBRATION REQUIREMENTS

- a) Laboratory Calibration: Each SLM and calibrator will have undergone laboratory calibration within two years prior to its use for any sound compliance test. Copies of the calibration certificates will be included as an appendix to the sound compliance test report.
- b) Field Calibration: If operators are present, the SLMs will be acoustically calibrated (sensitivity check) in the field at a minimum immediately before the operational sound testing period, and before and after any background sound testing period, according to the procedures given in the SLM instruction manual. Otherwise, SLM's will be calibrated every time operators visit the measurement locations, and at a minimum before and after any sound collection survey.
- c) Field calibration differences:
  - i) If the calibration level after a sound collection differs from the previous calibration level by  $\pm 0.5$  dB or less, all measurements made with that system shall be adjusted by one-half of the difference. Differences lower than or equal to 0.2 dB are exempt.
  - ii) Collected data with a difference between the initial and the final calibration exceeding  $\pm 0.5$  dB will not be used, and sound collections performed showing such difference will be repeated. In such cases, equipment shall be checked.
  - iii) Any difference between the acoustical calibrator reference sound level and the SLM calibration reading will be reduced to zero by adjusting the SLM sensitivity in the field, prior to any sound collection.
  - iv) The calibration sound level results will be documented and reported.

5) WEATHER AND TESTING CONDITIONS

- a) Wind conditions will be documented with information from the meteorological tower(s). Wind speed at hub heights will be documented.
- b) Sky cover and solar radiation or cloud height will be documented with weather information from the most representative (as related to those conditions at the Facility site) National Weather Station or airport's weather advisory service.
- c) All meteorological parameters of wind speed, wind direction, temperature, relative humidity, precipitation and atmospheric pressure (optional) will be evaluated at a minimum at one location on site (e.g. Meteorological tower or at a portable weather station). Wind speed will be measured at 2 meters +/- 0.20 meters above the ground at all locations to be tested.
- d) Portable weather stations will be located close to the sound microphones, as far as practical from any wind obstructions or vegetation that may affect the wind speed measurements.
- e) Reasonable efforts will be made to schedule sound tests during a period of time when representative wind conditions (as related to the noise descriptors that need to be evaluated) are forecasted but, in all cases, such tests shall be performed during the weather conditions described in this Protocol.
- f) Evaluation of maximum short-term noise limits will be conducted under the worst operational noise emissions (maximum sound power levels) and the most favorable propagation weather conditions including but not limited to downwind conditions and temperature inversions.
- g) Sound testing will not be conducted during adverse weather conditions such as rain, thunderstorms in the vicinity, snow fall, or under wet road conditions. Any data collected under these conditions will be discarded.

6) TESTING POSITIONS

- a) Sound testing will be conducted at a minimum at the six (6) most potentially impacted positions: four non-participating and two participating residential positions (on private or public space as applicable) considering anticipated sound impacts from computer noise modeling results, any preliminary measurements and complaints, if any.
- b) Three positions to be tested will be selected by the Applicant within 30 days after the start of commercial operations and approved by NYDPS Staff within 60 days after the start of commercial operations. Remaining positions will be selected by DPS Staff within 60 days after the start of commercial operations.
- c) Sound microphones will be located at a height of 1.5 meters above the ground.

- d) Final sound measurement positions will be selected to:
  - i) Minimize the influence of traffic noise from local roads. Measurement positions should be no closer than 15 meters (50 feet) from the center of any roadway, unless it is not possible to obtain permission from property owner(s) to collect sound information within the private property. In this case, measurement positions can be adjacent to the road, in the public right-of-way.
  - ii) Avoid or minimize the influence of any mechanical or electrical noise sources from any private or public spaces such as air conditioners, air condensers, heaters, boilers, fans, pumps, transformers, lighting, etc.
  - iii) Avoid or minimize the influence of sounds from water streams.
  - iv) Provide a clear sight view of the turbines where possible and minimize the effect of any sound obstruction.
  - v) Minimize the influence of reflections of any buildings and other small reflective surfaces as follows:
    - (1) Sound microphones shall not be located closer than 7.5 meters (25 feet) from any reflective surface.
    - (2) Sound microphones shall not be located closer than 1.5 meters (5 feet) from any reflecting object with small dimensions such as small trees, posts, bushes, etc.
- e) Positions proposed by the Certificate Holder will be identified with satellite pictures and coordinates and forwarded to DPS for review. Upon approval by NYDPS Staff of residential positions to be tested, the Certificate Holder will contact the landowner(s)/tenants(s) to request permission to collect outdoor sound readings close to their residences within the private properties. If permission is not granted or obtained, sound measurements can be taken on public space or an alternate proximal residential position, with the approval of NYDPS Staff.
- f) At its discretion, NYDPS Staff can conduct or request the Certificate Holder to conduct sound testing at any existing residential location, during the test subject to the Certificate Holder's ability to obtain landowner consent (if applicable), and subject to equipment and personnel availability. These locations must have a pre-construction sound modeled level of 40 dBA or higher (1-hour  $L_{eq}$ ), and no more than three additional complaint locations may be requested by DPS during each compliance testing program.

## 7) SEASONS AND TESTING TIMES

- a) Pursuant to Certificate Conditions of the Order, at least two sound compliance tests shall be performed by the Certificate Holder after the commercial operations date of the Facility: One during the "leaf-off" season and one during the "leaf-on" season.
- b) Within the first seven (7) months of the commercial operations date of the Facility, the Certificate Holder shall perform and complete the first Sound Compliance Test and the results shall be submitted to the Board, or the Commission after the Siting Board's jurisdiction has ceased, by filing with the Secretary a report from an independent

- c) acoustical or noise consultant, no later than eight (8) months after the commercial operations date, specifying whether or not the Facility is found in compliance with all Certificate Conditions on noise of this Certificate during the “leaf-on” or “leaf-off” season as applicable.
- d) The second Sound Compliance Test shall be performed, and results shall be submitted to the Siting Board, or the Commission after the Siting Board’s jurisdiction has ceased, by filing with the Secretary subject to the same conditions contained in the Order , but no later than thirteen (13) months after the commencement of operations of the Facility.

8) MEASUREMENT PROCEDURES

Procedures will be as follows:

- a) Data Collection Procedure for Operational Sound Testing (All Noise Sources Turned ON plus background sounds)<sup>1</sup>:
  - i) Check SLMs calibration. Set any difference to zero at the beginning of the sound survey.
  - ii) Verify that all wind turbines from the Wind Generating Facility are in operation as described in this protocol.
  - iii) Report the time that the measurement is started. If operators are present external transient background sounds can be excluded by inhibiting data collection as stated in this section. Sound collections can be restarted or continued after the transient sound ceases.
  - iv) Complete one 10-minute cumulative collection. Record and report the time at which each measurement is concluded.
  - v) Continue with another 10-minute collection until six 10-minute samples are collected (1-hour).
  - vi) Proceed with testing the facility turned off.
- b) Data Collection procedures for background sound test (with Wind Generating Facility Noise Sources Turned OFF)<sup>2</sup>:
  - i) Check SLMs calibration. Set any difference to zero.
  - ii) Verify that all wind turbines from the Wind Generating Facility within a 1.5-mile radius of any position to be tested are turned OFF.
  - iii) Complete three 10-minute sound collections at each evaluated position within the hour following the end of the operational sound tests (Wind Generating Facility Noise Sources “ON” plus background sounds).
  - iv) Record and report the time at which each measurement collection is stopped.
  - v) If operators are present, check SLMs calibration at the end of the measurements. Record results and set any difference to zero.
  - vi) Additional Operational Testing may now be conducted using the procedures listed above in section 8(a).

---

<sup>1</sup> Operational sound testing will be conducted 1-hour before and after a shutdown event. The wind generating facility can continue operating as needed until the next shutdown occurs.

<sup>2</sup> Shutdown events can continue as needed but in all cases background sounds will be measured within the first and last 1-hour of a shutdown if it exceeds two-hours.

- c) Time of measurements:
  - i) the daytime will be collected between 7:00 a.m. and 10:00 p.m. EST; and
  - ii) the nighttime will be collected between 10:00 p.m. and 7:00 a.m.
  
- d) Duration of measurements per season:
 

Measurements for evaluation of short-time noise descriptors (Leq-8-hour, Leq-1-h at 16 Hz, 31.5 Hz, 63 Hz.) will be collected over a minimum period of 48 hours to increase the likelihood that all receptors are evaluated at maximum sound power levels from the turbines and under downwind conditions;
  
- e) Transient Sounds
  - i) Transient Sounds: Exclusion of transient sounds is limited to external sound sources other than wind and wind turbine's noise. Transient noises produced within the Wind Generating Facility site will not be inhibited at the time of testing.
  - ii) Transient sounds can be excluded by operators present or by post processing of the data.
  - iii) For the purposes of this testing, the following sounds will be considered transient:
    - (1) Sounds caused by cars, trucks, motorcycles, planes and any means of transportation.
    - (2) Any sounds caused by human activity (e.g. conversations, shouting, music, use of any sound or mechanical equipment).
    - (3) Any sounds caused by animals such as dogs, birds, peepers and insects. When animal sounds are unavoidable (such as insect sounds during the summer) instruments may not need to be paused, provided the sounds can be filtered by post-processing as specified in this protocol.
    - (4) Transient sounds inhibited during operational sound testing will also be inhibited during background sound testing should they occur. SLMs will have means to inhibit data collection whenever a transient background sound occurs. Operators will pause or hold the sound collection while transient sounds occur and reset or continue the measurement after the transient sound has ceased.
  - iv) If operators are present, trigger cables are preferred so that operator's sounds and reflections are minimized.
  - v) SLMs with "delete-back" capabilities are also preferred. If SLMs with "delete-back" capabilities are used, the SLMs can be set up to a maximum deletion of a 10- second sound reading interval.
  - vi) Sound collection can be restarted or continued after the transient sound ceases.
  - vii) If operators are present, the Certificate Holder will ensure that personnel are qualified and properly trained to exclude transient events as specified in this protocol so that the need for post-processing is avoided or minimized.

## 9) BACKGROUND CORRECTIONS AND ANALYSIS OF RESULTS

No corrections for background sounds (noise sources OFF) are necessary if operational sound test results (with the noise sources ON plus the background sounds) comply with certificate conditions in the Order.

a) SHORT-TERM NOISE LEVELS AT RESIDENTIAL POSITIONS.

- i) The fractional-band Leq 10-minute background sound levels will be logarithmically subtracted from the fractional-band Leq 10-minute operational sound levels (Wind Generating Facility sound sources ON plus background) for each measurement position in order to determine the Wind Generating Facility contribution to the total A-weighted sound levels. The “exact equation” (Equation 8), as contained in Note 2 of section 6.9 of ANSI/ASA S12.9-2013/Part 3, will be used and applied to the (A) 10-minute operational sound levels. If insect, bird, animal and/or leaf rustle sounds were present, they can be excluded from the measurements by correcting the applicable one-third frequency band sound levels at the frequencies where they occurred as appropriate. Overall corrected Leq (A) 10-minute background and operational sound levels will then be recalculated to obtain both background and operational overall Leq (A) 10-minute corrected sound levels. Both raw and corrected data will be reported with explanations.
- ii) If the arithmetic difference between the operational sound levels (Wind Generating Facility noise sources turned ON plus background sounds) and the background sound levels (after turning the Wind Generating Facility noise sources OFF) is less than 3 dB, the calculated result will be reported and a “n/a” note will be added.
- iii) Leq-1-h levels will be calculated as the energy-based average of a minimum of three Leq-10-minute samples in one-hour period.
- iv) Leq-8-h levels will be calculated as the energy-based average of all valid Leq-1-h samples in an eight-hour period.
- v) Operational noise levels from the Wind Generating Facility only (Leq 8-h), at the selected residential positions (after background corrections are applied), will then be evaluated for compliance with Certificate Conditions of the Order.

b) PROMINENT TONES:

- i) Prominent tones will be defined as follows: A prominent discrete tone is identified as present if:
  - (1) The time-average sound pressure level (Leq) in the one-third-octave band of interest exceeds the time-average sound pressure level (Leq) in both adjacent one-third-octave bands and the threshold of hearing (as indicated in Table 1 of this protocol); and,
  - (2) The time-average sound pressure level (Leq) in the one-third-octave band of interest exceeds the arithmetic average of the time-average sound pressure level (Leq) for the two adjacent one-third-octave bands by any of the following constant level differences:
    - (a) 15 dB in low-frequency one-third-octave bands (from 25 up to 125 Hz); or
    - (b) 8 dB in middle-frequency one-third-octave bands (from 160 up to 400 Hz); or
    - (c) 5 dB in high-frequency one-third-octave bands (from 500 up to 10,000 Hz).
- ii) Prominent tones will be evaluated by using the Leq-1-min sound level results (linear, Z or un-weighted). All collected data will be reported.

- (3) The one-third octave band operational sound levels measured at each residential position will be evaluated, to determine if any prominent tones as defined herein were present during testing and caused by operation of the Wind Generating Facility.
- (a) Initially, no correction for background sounds will be applied to the operational sound results for this evaluation.
  - (b) If any prominent tones are found, the operational sound pressure levels of the 1/3-octave bands containing the tones will be evaluated to determine if they exceed the values listed as hearing thresholds in Table 1 of this protocol for the respective frequencies. If they exceed the values, the prominent tones will be denoted as audible and the opposite will be denoted as inaudible. Operational prominent tones that are found being inaudible will be reported as such and may not require further analysis.
  - (c) If any prominent tones are found to be audible:
    - (i) The background sound levels  $L_{eq}$  (With all Wind Generating Facility sound sources OFF) will be evaluated to determine if the prominent tone was caused by other sound sources in the background rather than noise sources from the Wind Generating Facility. The results of this evaluation will be reported.
    - (ii) The operational sound levels will then be corrected by using the exact equation listed in note 2 of section 6.9 (equation 8) of ANSI/ASA S12.9-2013/Part 3 to determine operational sound levels from the Wind Generating Facility sources only (Operational sound levels minus background sound levels). If the difference between an uncorrected operational sound level (Wind Generating Facility sound sources ON plus background sounds) and a background sound level is lower than 3 dB the operational sound level from the Wind Generating Facility sources only (background corrected) will be set equal to -99 dB for subsequent calculations (as recommended by section 6.9 d. 1 of ANSI/ASA S12.9-2013/Part 3) and reported with an "n/a" note. Operational noise levels from the Wind Generating Facility noise sources only (background corrected) will then be evaluated for prominent tones. Results will be reported.
    - (iii) If any prominent tones are found, the operational sound levels from the Wind Generating Facility sources only (background corrected), will then be re-evaluated to determine whether or not the prominent tones are caused by the application of background corrections. In this case, the operational sound level from the Wind Generating Facility noise sources only (Background corrected) at each one-third frequency band of interest will be evaluated for audibility (as specified in section 11.b.3.ii of this protocol) and if found audible, it will be compared to the arithmetic average of the uncorrected operational noise levels (sources ON plus background sounds) of the two adjacent one third octave bands.

Results will be reported.

(4) If any audible prominent tones are found at any evaluated residential positions and if they are found to be produced by the operation of the Wind Generating Facility, broadband Wind Generating Facility operational noise level results for that/those position(s) (Leq (A)-10 minute) will be evaluated for compliance with Certificate Conditions of the Order.

(5) Comments about whether or not the Wind Generating Facility is found in compliance with the audible prominent tone condition of the Order will be included in the report.

c) LOW FREQUENCY NOISE

i) Operational and background low frequency sound level measurements will be conducted at the selected residential testing positions as specified in this protocol. Sound levels at these positions will either be reported as extracted from the SLMs for the 31.5 and 63 Hz full octave bands or calculated based on the sound levels from the 25 to 80 Hz one-third octave bands as appropriate and applicable.

ii) The Leq-10-min operational sound levels at the 31.5 Hz and 63 Hz full- octave bands measured at the selected residential positions will be evaluated to determine if the low frequency noise levels from operation of the Wind Generating Facility (under testing operational conditions) in combination with natural environmental background sounds exceed 65 dB. Initially, no background sound corrections will be made. If operational sound levels (without any background corrections) comply with Certificate Conditions of the Order further analysis may not be needed.

iii) If other sound sources, not related to Wind Generating Facility operation, created or exacerbated low frequency sound levels during the test, measured background Leq-10-min sound levels (Wind Generating Facility noise sources OFF) can be subtracted from the measured operational sound levels (All Wind Generating Facility noise sources ON plus background sounds) at the same specific one-third octave bands where they occurred in order to determine the Wind Generating Facility contribution to low frequency sounds at those bands. Background noise sources will be identified and described as feasible. The full octave band sound levels will then be recalculated as the energy based average of Leq-10-min samples for each one-hour period. The full octave-band results will be reported. Both raw and corrected data will be reported.

iv) Compliance with, or exceedance of, the 65-dB requirement at 31.5 and 63 Hz full octave bands of Certificate Conditions of the Order at selected residential positions and under tested operational conditions, will be evaluated and reported for all Leq-1-h results.

d) AMPLITUDE MODULATION

Evaluation of amplitude modulation will follow the procedures and methods specified by the Institute of Acoustics document: IOA Noise Working Group (Wind Turbine Noise), Amplitude Modulation Working Group, Final Report a method for Rating Amplitude Modulation in Wind Turbine Noise 09 August 2016, Version 1.

10) ADDITIONAL TESTING

This protocol reflects the minimum requirements contemplated for the leaf-on and leaf-off compliance sound tests required by the Order. If additional testing is required, those tests will be performed by following all the provisions of this protocol except as follows:

- a) If a violation or non-compliance situation is found at any residences not previously evaluated, those positions will be added to the tests.
- b) Seasons and testing times: If a violation or non-compliance situation is found in a specific time frame any retest may need to be conducted to cover approximately the times that the violation or non-compliance situation was found.
- c) Scenarios to be tested: The Wind Generating Facility will be retested at approximately the same operational and weather conditions where the non-compliance situation or violation was found.

11) SUBSTATION TESTING

Testing from substation noise will be performed by following this protocol with the following modifications:

- a) Sound testing will be conducted at a minimum at the two (2) most potentially impacted non-participating residences (seasonal or full-year, on private or public space as applicable) considering anticipated sound impacts from computer noise modeling results, any preliminary measurements and complaints, if any.
- b) Turbines should be operating at low-noise/low-energy production, such as at wind speeds lower than or equal to 5 meters per second at hub height to avoid interference and masking from wind turbine noise. If a violation or non-compliance situation is found at other hub-height wind conditions, testing (or retesting) will need to be conducted to cover approximately the operating and weather conditions at which the violation or non-compliance situation was found.
- c) Testing will be conducted during minimal nighttime background sound conditions, between 10:00 p.m. and 7:00 a.m. If a violation or non-compliance situation is found in another time frame, any test or retest may need to be conducted to cover approximately the times of the day when the violation or non-compliance situation was found.
- d) Since substation noise sources cannot be turned-off to measure background sounds, a proxy location will be selected. Select proxy location(s), far from the influence of the noise from the substation, at a location with similar soundscape than the location(s) that are intended to be tested. A location in the vicinity where noise sources from the substation are blocked by natural barriers (topography) or man made structures (buildings) can also be selected.

- e) Each location will be tested at a minimum for two hours, so that two 1-hour samples are obtained. Complete twelve 10-minute sound collections at each evaluated position at the same times that background sounds are measured at the proxy location(s).
- f) Testing of compliance with Certificate Conditions of the Order for substation components will also be conducted by following these provisions.

12) ADDITIONAL PROVISIONS

- a) A test plan will be developed as recommended by section 9.1.4 of ANSI S1.13-2005, prior to the test.
- b) A final testing schedule will be provided to NYDPS Staff prior to deployment. NYDPS Staff will be notified of any changes to test procedures prior to or during the test, if they occur.
- c) To avoid sound interruptions during testing, if communication equipment is used, it will not be operated on speaker/loudspeaker settings and will preferably be set with freehand earphones/microphones. All staff members and personnel will take proper actions to ensure that conversations and communications will not affect the sound collections.
- d) All clocks, including any SLMs and weather station meter clocks will be synchronized with the Wind Generating Facility operational time. Any difference between the Wind Generating Facility operational time and the official Eastern Standard Time will be noted and reported.
- e) Sound testing will be conducted at each selected residential position over consecutive 10-minute periods for the operational sound tests and the background sound tests.

13) WITNESSING AND NOTIFICATIONS

- a) At the discretion of NYDPS, NYDPS Staff representatives may be assigned to witness any sound test.
- b) At the discretion of the NYDPS, sound collections can be performed by NYDPS Staff with NYDPS instrumentation at any time, location and operational condition. NYDPS testing must adhere to the same testing protocol as the Certificate Holder. NYDPS at its discretion can collect any information related to sounds from the facility and the environment, and weather conditions, including but not limited to any sound levels by using any metric or sound descriptor.
- c) If the facility is required to conduct testing of the Wind Generating Facility at a specific operational condition that would require the Certificate Holders to modify the operation of any Wind Generating Facility equipment or setting any Wind Generating Facility equipment online or offline, NYDPS Staff shall coordinate with the Certificate Holders at least five (5) business days in advance of such testing. This advanced notice and coordination is required so the Certificate Holders can, among other things, ensure: Wind Generating Facility and operational conditions are in-order for testing; that any impact to its customers will be minimal; and that the Certificate Holders, and its customers, can properly notify

staff to accommodate the service interruption, and subsequent restoration, if any. If NYDPS Staff desire to conduct sound or vibration testing from the Wind Generating Facility and no modification to operational conditions of Wind Generating Facility equipment are required, no prior coordination is required.

- d) The Certificate Holders will coordinate with NYDPS Staff at least five (5) business days in advance of a tentative date for any sound tests.
- e) The Certificate Holders will coordinate with NYDPS Staff on a final date at least two (2) business days prior to any sound tests.
- f) The Certificate Holders will notify Towns officials and applicable residents about the final dates and times of the compliance tests.

#### 14) REPORTING AND DOCUMENTATION

A report will be prepared that includes at least the following analyses and documentation:

- a) A listing of make and model for each SLM, acoustical calibrator, weather station, weather hand held meter and anemometers (with corresponding serial numbers), and identifying which positions each instrument was used at, along with copies of laboratory calibration certificates for SLMs and calibrators, and any field calibration results (Sensitivity checks). SLM specifications including type, sound floors, humidity and temperature ranges, and settings will be included in the report along with a statement about whether the SLMs and calibrators had undergone laboratory calibration within two years prior to its use in the test. Accuracy for portable weather stations, hand held meters and/or anemometers will be documented along with a statement about whether the portable weather station and the hand-held meters or anemometers used for the tests comply with the accuracy requirements specified in this protocol;
- b) The insertion loss of the windscreen as stated by the manufacturer or accredited independent laboratory, for the fractional bands of interest specified in section 2 (b) of this protocol, and whether or not the insertion loss values in dB have been automatically or manually applied to the reported data;
- c) The names and qualifications of all personnel who conducted and/or provided direct oversight during the testing. Operators shall be knowledgeable with respect to the operation, performance capabilities and limitations of sound and weather instrumentation, and the specifics of this protocol;
- d) All logged A-Weighted (dBA) broadband Leq and L90 data measurements and results by electronic or digital means. If results are corrected, filtered or post-processed, both raw and corrected data will be reported;
- e) All logged one-third octave band data and full octave band results for the Leq.

- f) All measured and logged data will be reported to the nearest tenth of a decibel in digital and graphical format. Spreadsheet compatible files will be provided by electronic or digital means;
- g) Field data sheets and notes;
- h) Meteorological conditions during testing: The report shall include the continuous log of all measurements of meteorological conditions collected including average wind speed, average wind direction, ambient air temperature, relative humidity, barometric pressure (Optional) and rain fall (Precipitation). Sky cover and general weather conditions will be reported;
- i) Broadband and fractional band results by electronic or digital means;
- j) Evaluated residential and any sound monitor positions including GPS coordinates and approximate distances to the closest five turbines along with photos and a description of the state of vegetation and whether or not the closest wind turbines are visible from the sound microphone positions;
- k) Height of sound microphones as related to the ground along with photos of the residential locations being evaluated and an identification of the number of stories.
- l) Figures depicting the sound testing positions in relation to the Wind Generating Facility, property lines, roads and the existing residences as of the date of the Order that were evaluated with the test. Other existing non-residential buildings will be included for reference only.
- m) A complete log of the operational load and operational conditions of the Wind Generating Facility during testing periods. Statements about whether the operational conditions during testing comply with the requirements of this protocol will be included. Any difference between Wind Generating Facility's and Eastern standard time will be reported; and
- n) An analysis of results including overall sound levels, prominent tones and low frequency noise levels and whether they were found to comply or exceed the applicable certificate conditions of the Order at any selected residential position and whether or not additional mitigation measures are necessary to comply with Certificate Conditions of the Order.

15) TERMS AND DEFINITIONS

- a) Sound and Noise: "Noise" is usually defined as unwanted sound. If "Sound" comprises noises and other sounds, "sound" may be a broader designation. Sound sources within the Wind Generating Facility may be referred as both "noise" and/or "sound". Some animal sounds may be more properly referred to as "sounds" rather than "noise". For the purposes of this protocol the words "sound" or "noise" may be used interchangeably.
- b) Background sound: all-encompassing sound associated with a given environment without contributions from the source or sources of interest as specified in this protocol.

- c) Continuous background sound: background sound measured during a measurement period, after excluding the contribution of transient background sounds by inhibiting the collection or post-processing. For the purposes of this protocol the term “background sound(s)” is used for both “background sound(s)” and “continuous background sound(s)”, interchangeably.
- d) Operational sound: Sound that includes both Wind Generating Facility noise sources and background sound unless otherwise noted.
- e) Wind Generating Facility sound only: All sounds originating from the Wind Generating Facility without contributions of background sounds as specified in this protocol.
- f) Transient background sound: background sound associated with one or more sound events which occur infrequently during the basic measurement period, a measurement interval with or without the source operating, as specified in this protocol.
- g) Protocol: Refers to this document, unless otherwise noted.

## 16) REFERENCES

References listed in this section are for informational purposes only.

- a) ANSI S1.4-1983 (R 2006) American National Standard Specification for Sound Level Meters; and Amendment No. 1 in ANSI S1.4A-1985
- b) ANSI/ASA S1.11-2004 (R 2009) American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters
- c) ANSI/ASA S1.40-2006 (R 2011) American National Standard Specifications and Verification Procedures for Sound Calibrators
- d) ANSI/ASA S1.43-1997 (R 2012) American National Standard Specifications for Integrating-Averaging Sound Level Meters
- e) ANSI/ASA S12.9-2013/Part 3 (Quantities and Procedures for Description and Measurement of Environmental Sound. Part 3: Short-Term Measurements with an Observer Present)
- f) ANSI/ASA S12.9-2005/Part 4 (Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response).
- g) ANSI/ASA S12.18-1994 (R 2009) American National Standard Procedures for Outdoor Measurement of Sound Pressure Level.
- h) ISO 226: 2003, Acoustics – Normal equal-loudness contours.

Table 1: Thresholds of human hearing for evaluation of audibility of tones

<b>1/3 Octave Band Center Frequency [Hz]</b>	<b>Threshold of Hearing [dB]</b>
20	78.5
25	68.7
31.5	59.5
40	51.1
50	44.0
63	37.5
80	31.5
100	26.5
125	22.1
160	17.9
200	14.4
250	11.4
315	8.6
400	6.2
500	4.4
630	3.0
800	2.2
1,000	2.4
1,250	3.5
1,600	1.7
2,000	-1.3
2,500	-4.2
3,150	-6.0
4,000	-5.4
5,000	-1.5
6,300	6.0
8,000	12.6
10,000	13.9

The threshold levels are from ISO 226:2003 “Acoustics—Normal equal-loudness-level contours”.