Hoffman Falls Wind

Pre-Construction Sound Level Impact Assessement

OFFICE OF RENEWABLE ENERGY SITING

§900-2.8 EXHIBIT 7: NOISE AND VIBRATION - Revision 1

Prepared for:

Hoffman Falls Wind LLC
90 State Street
Albany, NY 12207

Prepared by:

Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

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PUBLIC VERSION

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EXHIBIT 7 NOISE AND VIBRATION - Revision 1

This Assessment will track the requirements of the Noise and Vibration regulations from the Office of Renewable Energy Siting (ORES) §900-2.8 which were issued final March 3, 2021. Hoffman Falls Wind filed their original Section 94-c Application with ORES on February 15, 2024. Hoffman Falls Wind has not yet received their Siting Permit from ORES on that Application.

This version of Exhibit 7 has been revised from February 15, 2024 to reflect additional language revolving around ground-borne vibration associated with wind turbine operations.

7(a) Name of Preparer

This Assessment includes a detailed analysis of the potential sound impacts associated with the construction and operation of the Project. Exhibit 7 was prepared by Mr. Christopher Hoyt of Epsilon Associates, Inc. (Epsilon). Mr. Hoyt has ten years of experience in the areas of community noise impacts, meteorological and sound level data collection and analyses. He is a full member of the Institute of Noise Control Engineering (INCE). The modeling performed by Epsilon for the Project is sufficiently conservative in predicting sound impacts, and includes all proposed wind turbines, the switchyard, collector substation plus ancillary equipment operating at their maximum capacities.

7(b) Noise Design Goals for the Facility

The design goals for this wind facility are described below.

i) A maximum noise limit of forty-five (45) dBA L_{eq} (8-hour), at the outside of any existing non-participating residence,[1] and fifty-five (55) dBA L_{eq} (8-hour) at the outside of any existing participating residence. The Project meets these limits as discussed in Section 7(l).

ii) Prominent tones are defined by using the constant level differences listed under ANSI/ASA S12.9-2005/Part 4 Annex C (sounds with tonal content) (see Section 900-15.1(a)(1)(iii) of this Part), at the outside of any existing non-participating residence. Should a prominent tone occur, the broadband overall (dBA) noise level at the evaluated non-participating position shall be increased by 5 dBA for evaluation of compliance with subparagraphs (i) and (v) of this paragraph. None of the wind turbines under consideration for this Project currently produce a tone, as discussed in Section 7(e).

[1] For the purposes of this report, "non-participating residences" is defined to include both non-participating and potentially participating landowners that have residences within the study area (for more information on potentially participating receptors, see Appendix 4-B). Although the Applicant is actively pursuing Good Neighbor Agreements with potentially participating landowners, the broader definition outlined above is being applied in this report to support the conservative approach to abatement outlined in Exhibit 7(o).

iii) A maximum noise limit of sixty-five (65) dB L_{eq} (1-hour) at the full octave frequency bands of sixteen (16), thirty-one and a half (31.5), and sixty-three (63) Hertz (Hz) outside of any existing non-participating residence in accordance with Annex D of ANSI/ASA standard S12.9-2005/Part 4 Section D.2.(1) (Analysis of sounds with strong low-frequency content) (see section 900-15.1(a)(1)(iii) of this Part). The Project meets these limits as discussed in Section 7(f).

iv) Not producing human perceptible vibrations inside any existing non-participating residence that exceed the limits for residential use recommended in ANSI/ASA Standard S2.71-1983 "Guide to evaluation of human exposure to vibration in buildings" (see section 900-15.1(a)(1)(i) of this Part). The Project meets this limit as discussed in Section 7(g) and 7(m).

v) A maximum noise limit of forty (40) dBA L_{eq} (1-hour) at the outside of any existing non-participating residence from the collector substation equipment. The Project meets these limits as discussed in Section 7(l).

vi) A maximum noise limit of fifty-five (55) dBA L_{eq} (8-hour), short-term equivalent continuous average nighttime sound level from the facility across any portion of a non-participating property except for portions delineated as NYS-regulated wetlands pursuant to section 900-1.3(e) of this Part and utility ROW. The applicant shall demonstrate compliance with this design goal through the filing of noise contour drawings and sound levels evaluated at the worst-case discrete locations. No penalties for prominent tones will be added in this assessment. The Project meets these limits as discussed in Sections 7(k) and 7(l).

With regards to local laws applicable to the proposed Project see below. These local laws are discussed further in Section 7(l).

In the Towns of Fenner and Nelson, individual wind turbine towers shall be located with relation to property lines so that the level of noise produced during wind turbine operation shall not exceed 50 dBA, measured at the boundaries of all of the closest parcels that are owned by non-site owners and that abut either the site parcel(s) or any other parcels adjacent to the site parcel held in common by the owner of the site parcel as those boundaries exist at the time of special use permit application.

In the Towns of Eaton and Smithfield, the statistical sound pressure level generated by a Wind Energy Conversion System (WECS) shall not exceed L10 – 50 dBA measured at the nearest residence located off the Site. Sites can include more than one parcel of property and the requirement shall apply to the combined properties. If the ambient sound pressure level exceeds 50 dBA, the standard shall be ambient dBA plus five dBA. Independent certification shall be provided before and after construction demonstrating compliance with this requirement. In the event audible noise due to WECS operations contains a steady pure tone, such as a whine, screech, or hum, the standards for audible noise set forth in § 14(B)(1) shall be reduced by five dBA. A Pure Tone is defined to exist of the 1/3 octave band sound pressure level in the band, including the tone, exceeds the arithmetic average of the sound pressure levels of the two contiguous 1/3 octave bands by five dBA for center frequencies of 500 Hz and above, by eight dBA for center frequencies between 160 Hz and 400 Hz, or by 15 dBA for center frequencies less than or equal to 125 Hz. In the event the ambient noise level (exclusive of the development in question), exceeds the applicable standard given above, the applicable standard shall be adjusted so as to equal the ambient noise level. The ambient noise level shall be expressed in terms of the highest whole number sound pressure level in dBA, which is exceeded for more than five minutes per hour. Ambient noise levels shall be measured at the exterior of potentially affected existing residences. Ambient noise level measurement techniques shall employ all practical means of reducing the effect of wind generated noise at the microphone. Ambient noise level measurements may be performed when wind velocities at the proposed project site are sufficient to allow wind turbine operation, provided that the wind velocity does not exceed 30 mph at the ambient noise measurement location. Any noise level falling between two whole decibels shall be the lower of the two.

7(c) Radius of Evaluation

All sensitive receptors within at least a one (1)-mile radius from any wind turbine or substation proposed for the facility, were included in the analysis. Each of these sensitive receptors are visible in Figure 7-1.

A cumulative analysis requires noise modeling to include any wind turbine and substation existing and proposed by the time of the filing the application, and any existing sensitive receptors within a two (2)-mile radius from any wind turbine or substation proposed for the facility. The Fenner Wind Farm is an existing wind facility within a two (2)-mile radius of a Hoffman Falls Wind turbine or substation. As a result, a cumulative noise analysis occurred for these facilities (Hoffman Falls Wind and Fenner Wind). Further details are found in Appendix 7-H.

7(d) Modeling Standards, Input Parameters, and Assumptions

An estimate of the noise level to be produced by the Project was made using the following assumptions.

(1) Future sound levels associated with the Project were predicted using the Cadna/A noise calculation software developed by DataKustik GmbH. This software implements the ISO 9613-2 international standard for sound propagation (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation) for full octave bands from 31.5 Hertz (Hz) to 8000 Hz. As per ISO 9613-2, all calculations assumed favorable conditions for sound propagation, corresponding to a moderate, well-developed ground-based temperature inversion, as might occur on a calm, clear night, or equivalently downwind propagation. In addition, the ISO 9613-2 standard assumes all receptors are downwind of every sound source simultaneously. No meteorological correction (Cmet) was added to the results, pursuant to 19 NYCRR § 900-2.8(d).

    Elevation contours for the modeling domain were directly imported into Cadna/A, which allowed for consideration of terrain shielding where appropriate. The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey.

In addition to modeling at discrete points, sound levels were also modeled throughout a large grid of receptor points, each spaced 20 meters apart to allow for the generation of sound level isolines. Tabular results and sound level isolines were calculated and generated for the entire Study Area (see Section 7(h)).

i) All sound sources were assumed to be operating simultaneously at maximum sound power levels. The collector substation was also modeled by itself operating at maximum sound power level.

The sound power levels for each source used in the modeling are discussed below.

Wind Turbines

The sound level analysis includes twenty-four (24) wind turbines as provided to Epsilon by the Applicant (Layout 20231018). The source location coordinates, ground elevations, and heights above ground are summarized in Appendix 7-A. There are three wind turbine models by three different manufacturers under consideration by the Applicant that were evaluated for this analysis. The list of wind turbine manufacturers, models, hub heights, and rotor diameters examined for this assessment are presented below in Table 7-1. Each of the turbines includes the low-noise blade option, sometimes referred to as serrated trailing edge, or low-noise trailing edge blades.

Table 7-1 Wind Turbine Analyzed for Sound Level Assessment

Manufacturer	Wind Turbine Model	Maximum Electrical Power (MW)	Hub Height (m)	Rotor Diameter (m)
Vestas	V150-4.5	4.5	120	150
Nordex	N149-4.X TS 108	4.X	108	149
General Electric	GE158-6.1	6.1	117	158

Technical reports from GE, Nordex, and Vestas were provided by the Applicant, which documented the expected sound power levels associated with each of the wind turbines. All technical documents provided are in Appendix 7-G. Of the three wind turbine options, the GE158-6.1 has the highest broadband A-weighted sound power level, and therefore modeling results of this turbine result in the highest broadband sound levels. Table 7-2 shows the broadband sound power levels as a function of wind speed from these technical reports. <BEGIN CONFIDENTIAL INFORMATION> [redacted] <END CONFIDENTIAL INFORMATION> The maximum octave band sound power levels for each wind turbine type are presented in Table 7-3 (A-weighted) and Table 7-4 (unweighted). For each one-third octave band, the highest sound power level published by the manufacturer has been used and then was converted into whole octave bands as input to the Cadna/A software, regardless of the wind speed at which they occur. The sound power levels presented in both tables do not include an uncertainty factor. <BEGIN CONFIDENTIAL INFORMATION>

Table 7-2 [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Table 7-3 [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted] [redacted]

Table 7-4 [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted] [redacted]

<END CONFIDENTIAL INFORMATION>

Collector Substation

In addition to the wind turbines, there will be a collector substation located within the Facility Site. One step-up transformer rated at 115 MVA (ONAF2) is proposed for the substation with a NEMA noise rating of 75 dBA. The 115 MVA transformer has not yet been manufactured and a test report with corresponding sound level data is not yet available. However, a design review plan of the expected transformer has been supplied by the Applicant and is provided in Appendix 7-F. Epsilon has conservatively estimated the sound emissions for a 115 MVA transformer using the techniques in the Electric Power Plant Environmental Noise Guide (Edison Electric Institute). In addition to the transformer, a total of six HVAC units have been incorporated into the acoustic model of the collector substation and the adjacent switchyard along Cody Road. One ground AC unit was incorporated into the acoustic model for the operation and maintenance (O&M) facility that will be located along South Road. Four of the HVAC units will be located at the switchyard control house and two of the HVAC units will be located at the substation control house. The manufacturer for the wall mounted HVAC units are expected to be Bard (W72AA) units or similar. The manufacturer for the ground AC unit is expected to be a LENNOX (MERIT Series ML14XC1) or similar. The modeling inputs of the transformer, HVAC units, and AC unit - coordinates, ground elevation, and height above ground - are summarized in Appendix 7-A. Table 7-5 summarizes the sound power level data used in the modeling.

Table 7-5 Collector Substation— Sound Power Levels

Sound Source	Broadband Sound Power Level [dBA]	Sound Power Levels per Octave-Band Center Frequency [Hz]								
		31.5	63	125	250	500	1k	2k	4k	8k
		dB	dB	dB	dB	dB	dB	dB	dB	dB
115 MVA Transformer	95[1,2]	91	97	99	94	94	88	83	78	71
Bard W72AA HVAC Unit[3]	78[4]	-	-	-	-	-	-	-	-	-
Air Conditioner Unit[5]	76	-	-	58	68	72	71	67	62	55

Notes:
[1] Sound levels estimated for a 115 MVA (ONAF2) transformer, NEMA Rating of 75 dBA, using the techniques in the EEI guide.
[2] Octave-band sound levels estimated, using the techniques in the EEI guide.
[3] Bard W72AA unit directly mounted with a standard supply air duct and a return air grille treatment. These will be located at the collector substation and switchyard.
[4] Octave-band sound levels not assumed, since the manufacturer did not provide octave band sound power levels.
[5] Lennox ML14XC1-036-230A01 single-phase ground unit. This will be located at the O&M Facility.

ii) For all modeling scenarios, the ground absorption factor (G) was set to 0.5 for the ground and 0 for water bodies.

iii) A temperature of 10 degrees Celsius and 70% relative humidity was used to calculate atmospheric absorption for the ISO 9613-2 model. These parameters were selected to minimize atmospheric attenuation in the 500 Hz and 1000 Hz octave bands where the human ear is most sensitive, and thus provide conservative results.

iv) The maximum A-weighted dBA L_{eq} (1-hour or 8-hour) sound pressure levels, and the maximum linear/unweighted/Z dB (L_{eq} 1-hour) sound pressure levels from the thirty-one and a half (31.5) Hz up to the eight thousand (8,000) Hz full-octave band, at all sensitive sound receptors (as defined in 19 NYCRR §900-2.8(h), sensitive receptors include any known residential structures [both participating and non-participating], outdoor public facilities and public areas, hospitals, schools, libraries, parks, camps, summer camps, places of worship, cemeteries, historic resources listed or eligible for listing on the State or National Register of Historic Places, any public lands, cabins and hunting camps identified by property tax codes, and any other seasonal residences with septic systems/running water) within the radius of evaluation are discussed and presented in Section 7(l).

v) The maximum A-weighted dBA L_{eq} sound pressure levels (L_{eq} (8-hour)) at the most critically impacted external property boundary lines of the facility site (e.g., non-participating boundary lines) are shown in Figure 7-4.1.

vi) Summaries of the number of receptors exposed to sound levels greater than thirty-five (35) dBA are shown in Section 7(l) grouped in one (1)-dBA bins.

vii) Sound level contours as specified in 19 NYCRR § 900-2.8(k) are shown in Figure 7-4.1.

(2) For this wind facility:

i) The maximum sound modeling L_{eq} (8-hour/1-hour) for the Facility was modeled using all three (3) of the wind turbine models in consideration with their highest broadband A-weighted apparent sound power level at any wind condition, if provided by the manufacturer. Summaries of the number of receptors exposed to sound levels greater than thirty-five (35) dBA are shown in Section 7(l) grouped in one (1)-dBA bins.

ii) The Cadna/A model used a one and half (1.5) meter assessment point above ground and the addition of an uncertainty factor of two (2) dBA.

(3) This subsection is applicable to solar projects and the Project is a wind facility.

7(e) Prominent Tones

ANSI/ASA S12.9-2013 Part 3, Annex B, section B.1 (informative) presents a procedure for testing for the presence of a prominent discrete tone. According to the standard, a prominent discrete tone is identified as present if the time-average sound pressure level in the one-third octave band of interest exceeds the arithmetic average of the time-average sound pressure level for the two adjacent one-third octave bands by any of the following constant level differences:

- 15 dB in low-frequency one-third-octave bands (from 25 up to 125 Hz);
- 8 dB in middle-frequency one-third-octave bands (from 160 up to 400 Hz); or,
- 5 dB in high-frequency one-third-octave bands (from 500 up to 10,000 Hz).

(1) Sound pressure level calculations using the Cadna/A modeling software which incorporates the ISO 9613-2:1996 propagation standard is limited to octave band sound levels; therefore, a quantitative evaluation of one-third octave band sound levels using the modeling software was not possible. Instead, one-third octave band sound pressure levels due to the closest wind turbines were calculated at the nearest ten (10) potentially impacted and representative receptor locations (both non-participants and participants) using equations accounting for hemispherical radiation and atmospheric absorption. The calculations at these locations were carried out for each of the individual wind turbine manufacturers being considered. No reference sound power level data below 6.3 Hz are available from any of the manufacturers. Therefore, sound power level data were extrapolated from each manufacturer's lowest published octave band down to 0.5 Hz. The extrapolation process assumed a 1 dB per octave increase in sound power levels from the lowest published value to 0.5 Hz. The results for all individual wind turbine manufacturers are presented in Tables 7-9.a to 7-9.c in Appendix 7-I. The results presented show that received sound pressure levels due to the closest wind turbines at each of these locations for all wind turbine manufacturers analyzed are not predicted to result in any prominent discrete tones as defined in the ANSI standards.

(2) One-third octave band sound power levels for the collector substation transformer were not supplied by the vendor for the substation equipment; therefore, a quantitative evaluation of one-third octave band sound using the spreadsheet modeling approach was not possible. For this reason, the substation transformer was assumed to be tonal and prominent by default.

7(f) Low Frequency Noise for Wind Facilities

Low frequency noise from the operation of the wind facility was evaluated. The evaluation occurred for all three wind turbines currently in consideration for the Facility. The evaluations were based on the following:

(1) Computer noise modeling that used the maximum sound power levels at the 31.5 and 63 Hz frequency bands at any wind speed among all turbines considered for each turbine location. All three wind turbine models are being considered for each turbine location.

(2) This alternative method was not explored, as all three individual wind turbine models were evaluated.

(3) The maximum linear/unweighted/Z L_{eq} (1-hour) sound pressure levels (dB) in a year at the 16, 31.5 and 63 Hz full octave bands for all receptors within the radius of evaluation are reported in tabular and spreadsheet compatible format in Appendix 7-D. A list of all sound receptors with sound pressure levels (SPLs) equal to or greater than 65 dB at 16, 31.5, or 63 Hz, are discussed further and provided in Section 7(l). The number of receptors exceeding 65 dB at 16, 31.5 or 63 Hz are reported and grouped below in 1-dB bins with Table 7-6 through Table 7-10. This encompasses all three wind turbine models, and each of their respective unmitigated and mitigated model runs.

Table 7-6 Receptors Modeled at 65 dB or Greater for Low Frequency Criteria– Total Sound L_{eq} (1-hour)- Unmitigated V150-4.5

Modeled Leq Sound Level [dB][1]	# of Receptors					
	16 Hz		31.5 Hz		63 Hz	
	Participating	Non-Participating	Participating	Non-Participating	Participating	Non-Participating
75	0	0	0	0	0	0
74	0	0	0	0	0	0
73	0	0	0	0	0	0
72	0	0	0	0	0	0
71	0	0	0	0	0	0
70	0	0	0	0	0	0
69	0	0	0	0	0	0
68	0	0	0	0	0	0
67	0	0	0	0	0	0
66	0	0	0	0	0	0
65	0	0	0	0	0	0
64	0	0	0	0	0	0
63	0	0	0	0	0	0
62	1	0	0	0	0	0
61	2	7	0	0	0	0
60	8	8	0	0	0	0

Notes: 1. Rounded to the nearest whole decibel. All receptors are either residences or unknown.

Table 7-7 Receptors Modeled at 65 dB or Greater for Low Frequency Criteria– Total Sound L_{eq} (1-hour)- Unmitigated N149-4.X TS 108

Modeled Leq Sound Level [dB][1]	# of Receptors					
	16 Hz		31.5 Hz		63 Hz	
	Participating	Non-Participating	Participating	Non-Participating	Participating	Non-Participating
75	0	0	0	0	0	0
74	0	0	0	0	0	0
73	0	0	0	0	0	0
72	0	0	0	0	0	0
71	0	0	0	0	0	0
70	0	0	0	0	0	0
69	0	0	0	0	0	0
68	0	0	0	0	0	0
67	0	0	0	0	0	0
66	1	2	0	0	0	0
65	5	6	0	0	0	0
64	6	12	0	0	0	0
63	8	61	0	0	0	0
62	2	46	1	2	0	0
61	2	52	5	6	0	0
60	1	63	6	12	0	0

Notes: 1. Rounded to the nearest whole decibel. All receptors are either residences or unknown.

Table 7-8 Receptors Modeled at 65 dB or Greater for Low Frequency Criteria– Total Sound L_{eq} (1-hour)- Mitigated N149-4.X TS 108

Modeled Leq Sound Level [dB][1]	# of Receptors					
	16 Hz		31.5 Hz		63 Hz	
	Participating	Non-Participating	Participating	Non-Participating	Participating	Non-Participating
75	0	0	0	0	0	0
74	0	0	0	0	0	0
73	0	0	0	0	0	0
72	0	0	0	0	0	0
71	0	0	0	0	0	0
70	0	0	0	0	0	0
69	0	0	0	0	0	0
68	0	0	0	0	0	0
67	0	0	0	0	0	0
66	0	0	0	0	0	0
65	5	6	0	0	0	0
64	7	9	0	0	0	0
63	6	48	0	0	0	0
62	3	46	0	0	0	0
61	2	53	5	6	0	0
60	2	53	7	9	0	0

Notes: 1. Rounded to the nearest whole decibel. All receptors are either residences or unknown.

Table 7-9 Receptors Modeled at 65 dB or Greater for Low Frequency Criteria– Total Sound L_{eq} (1-hour)- Unmitigated GE158-6.1

Modeled Leq Sound Level [dB][1]	# of Receptors					
	16 Hz		31.5 Hz		63 Hz	
	Participating	Non-Participating	Participating	Non-Participating	Participating	Non-Participating
75	0	0	0	0	0	0
74	0	0	0	0	0	0
73	0	0	0	0	0	0
72	0	0	0	0	0	0
71	0	0	0	0	0	0
70	0	0	0	0	0	0
69	0	0	0	0	0	0
68	0	0	0	0	0	0
67	1	2	0	0	0	0
66	5	6	0	0	0	0
65	6	13	0	0	0	0
64	8	63	0	0	0	0
63	2	42	1	5	0	0
62	2	53	9	7	0	0
61	1	65	5	18	0	0
60	0	69	6	68	0	0

Notes: 1. Rounded to the nearest whole decibel. All receptors are either residences or unknown.

Table 7-10 Receptors Modeled at 65 dB or Greater for Low Frequency Criteria– Total Sound L_{eq} (1-hour)- Mitigated GE158-6.1

Modeled Leq Sound Level [dB][1]	# of Receptors					
	16 Hz		31.5 Hz		63 Hz	
	Participating	Non-Participating	Participating	Non-Participating	Participating	Non-Participating
75	0	0	0	0	0	0
74	0	0	0	0	0	0
73	0	0	0	0	0	0
72	0	0	0	0	0	0
71	0	0	0	0	0	0
70	0	0	0	0	0	0
69	0	0	0	0	0	0
68	0	0	0	0	0	0
67	0	0	0	0	0	0
66	3	0	0	0	0	0
65	8	11	0	0	0	0
64	5	38	0	0	0	0
63	5	53	0	0	0	0
62	2	51	8	2	0	0
61	3	48	6	12	0	0
60	0	62	5	64	0	0

Notes: 1. Rounded to the nearest whole decibel. All receptors are either residences or unknown.

7(g) Infrasound for Wind Facilities

Infrasound for the wind facility with levels at the 16 Hz full-octave band were based on extrapolated SPL data down to 16 Hz. The extrapolation estimates were examined for all three wind turbine models and were based on corrections applied to the sound pressure results at 31.5 Hz to obtain the sound pressure results at 16 Hz for each receptor as follows:

(1) If no information from the manufacturer is available for the 16 Hz full-octave frequency band for any turbine models considered for the Facility, at a minimum 4 dB shall be added to the SPLs at 31.5 Hz, to obtain SPLs at 16 Hz.

(2) This alternative method was not explored, as all three individual wind turbine models were evaluated on an individual basis and a single highest manufacturer’s sound power level at 16 Hz and 31.5 Hz were not used for extrapolation purposes across all wind turbine models.

(3) If computer noise modeling uses only one wind turbine model across the Site, noise reduction operations are not used in the design, and the sound power level information at 16 Hz is available for some but not all turbines considered for the Facility, at a minimum 4 dB, or the difference between the maximum sound power level at 16 Hz at any wind speed known for any turbines considered for the Facility and the sound power level for the 31.5 Hz full-octave frequency band used for computer modeling, whichever is greater, shall be applied to the sound pressure results at 31.5 Hz to obtain the sound pressure results at 16 Hz. This difference between 16 and 31.5 Hz was used for all three individual wind turbine models that were analyzed.

(4) No additional corrections were applied by the Applicant to create more conservative (i.e., higher) SPLs at the receptors than obtained as indicated above.

7(h) Sound Study Area

Figure 7-1 is a map of the Sound Study Area showing the location of sensitive sound receptors within a two (2)-mile radius in relation to the Facility (including the collector substation and the point of interconnect).

(1) In total, 2333 discrete receptors were analyzed for the Project. These include 1548 residential receptors, 87 public receptors, 229 commercial receptors, 464 other receptors, and 5 unknown receptors. Of the 2333 receptors, 59 were defined as participating and 2274 were defined as non-participating, as defined in Section 7(h)(3) below. A detailed listing of all receptors including receptor ID, tax ID #, latitude/longitude, elevation, participation status, and receptor category are included as Appendix 7-B.

(2) All residences were included as sensitive sound receptors regardless of participation in the Facility (e.g., participating and non-participating residences) or occupancy (e.g., year-round, seasonal use)

(3) Only properties that have a signed contract with the Applicant prior to the date of filing the application were identified as "participating." Other properties were designated "non-participating." [2]

7(i) Evaluation of Ambient Pre-Construction Baseline Noise Conditions

An evaluation of ambient pre-construction baseline noise conditions was conducted for approximately 15 days in 2023 by using the L_{90} statistical and the L_{eq} energy based noise descriptors, and by following the recommendations included in ANSI/ASA S3/SC 1.100 -2014-ANSI/ASA S12.100-2014 American National Standard entitled Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas. The full details of the ambient pre-construction sound level measurement program are found in Appendix 7-C.

7(j) Evaluation of Future Noise Levels during Construction

(1) Future construction noise modeling was performed for the main phases of construction and from activities at the proposed wind turbines, proposed temporary concrete batch plant/laydown area and proposed horizontal directional drilling (HDD) locations using the ISO 9613-2:1996 3-D sound propagation standard as implemented in the Cadna/A software package. Reference sound source information was obtained from either Epsilon's consulting files or the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM).

(2) The majority of the construction activity will occur across the Project area around each of the proposed wind turbine locations and at the temporary concrete batch plant. By its very nature, construction activity moves around the Project Site. Full construction activity will generally occur at one location at a time, although there will be some overlap at adjacent construction locations for maximum efficiency. For modeling conservatism, it was assumed that full activity was occurring at the closest locations to their surrounding receptors. There are generally three phases of construction for a wind energy project – excavation, foundation work, and turbine erection. Table 7-5 presents the equipment sound levels for the louder pieces of construction equipment expected to be used at this site along with their phase of construction.

[2] For the purposes of this report, "non-participating residences" is defined to include both non-participating and potentially participating landowners that have residences within the study area (for more information on potentially participating receptors, see Appendix 4-B). Although the Applicant is actively pursuing Good Neighbor Agreements with potentially participating landowners, the broader definition outlined above is being applied in this report to support the conservative approach to abatement outlined in Exhibit 7(o).

Table 7-11 Sound Levels for Noise Sources Included in Construction Modeling

Phase	Equipment	Sound Level at 50 feet [dBA]
Excavation	Roller	80
Excavation	Grader	85
Excavation	Bulldozer	82
Excavation	Front End Loader	79
Excavation	Backhoe	78
Excavation	Dump Truck	76
Excavation	Excavator	81
Foundation	Concrete Mix Truck	79
Foundation	Concrete Pump Truck	81
Turbine Erection	Large Crane #1	81
Turbine Erection	Component Delivery Truck	84
Turbine Erection	Air Compressor	78
HDD Entry	Excavator (168 hp)	85
HDD Entry	Auger Drill Rig	85
HDD Entry	Pickup Truck/ATV	55
Commissioning	(2) Pickup Truck/ATV	55

(3) The operational modeling requirements included Sections 7(d)(1)(i) through 7(d)(1)(iii), and 7(d)(2)(ii) of this Exhibit were also used for modeling of construction noise.

(4) Worst-case sound levels from construction activity are shown using sound level contours in Figure 7-j.1, Figure 7-j.2, and Figure 7-j.3 and sound levels at the most critically impacted receptors are shown in Table 7-11, Table 7-12, and Table 7-13.

Three areas within the Project Area were chosen to calculate worst case construction sound levels. The areas and assumed locations of simultaneous construction are:

- Area 1 – This area includes the closest receptor to a wind turbine site (ID# 451). Modeling assumed simultaneous construction activity at this wind turbine (T-16), along with an additional nine select wind turbines (T-2, T-7, T-9, T-11, T-13, T-15, T-18, T-21, and T-22) across the Project Site. Foundation work, excavation work, and erection work were modeled at T-16 and all additional nine locations.

- Area 2 – This area includes all receptors in the vicinity of the temporary concrete batch plant/laydown area. Modeling for this area assumed simultaneous construction activity at the concrete batch plant/laydown area, and at the three closest turbine sites (T-16, T-18, and T-21) to the concrete batch plant/laydown area. Foundation work was modeled at the batch plant and all three additional locations.

- Area 3 – This area includes all receptors in the vicinity of the closest HDD entry point to a receptor. Modeling assumed simultaneous construction activity at this HDD entry point. HDD work and commissioning work was modeled at this HDD entry point.

For each of the areas, construction sound levels at the ten closest receptors have been calculated. These receptors included non-participating receptors and participating receptors. The results are shown as maximum 1-second L_{eq} sound levels with all pieces of equipment for each phase operating at the locations. These results overstate expected real-world results, because under actual construction conditions, not all pieces of equipment will be operating at the exact same time, and the highest sound levels from every piece of equipment will not tend to occur at the same time as was assumed in the modeling. Tabular results at receptors for each phase of construction activity are presented in Appendix 7-J.

Area 1 Modeling Results

The cumulative impacts from each of the three main phases of construction (excavation work, foundation work, and turbine erection work) were calculated with the Cadna/A model for the ten closest receptors to construction activity within Area 1. The loudest phase of construction within this area will be excavation work. A sound contour figure of excavation work occurring at T-16, the closest wind turbine to a receptor, and the additional nine selected wind turbines (T-2, T-7, T-9, T-11, T-13, T-15, T-18, T-21, and T-22) across the Project Site, are presented in Figure 7-j.1.

The highest sound level at a non-participating receptor within this area, near T-16 is 46 dBA during foundation (Receptor #449), 53 dBA during excavation (Receptor #449), and 50 dBA during turbine erection (Receptor #449). Modeling results of construction sound levels within this area are summarized in Table 7-12.

Table 7-12 Construction Noise Modeling Results – Area 1 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	Foundation	Excavation	Erection	Worst-Case Total (All Phases)
451	342.3	Participating	49	56	52	58
1017	459.7	Participating	47	53	50	55
452	468.0	Non-Participating	41	47	44	49
449	474.1	Non-Participating	46	53	50	55
453	485.4	Non-Participating	39	44	42	47
454	529.8	Non-Participating	40	46	43	49
713	616.3	Non-Participating	44	51	47	53
455	663.7	Non-Participating	39	45	42	47
448	719.2	Non-Participating	43	49	46	52
2188	770.8	Non-Participating	38	44	41	46

Area 2 Modeling Results

The cumulative impacts from foundation work were calculated with the Cadna/A model for the ten closest receptors to construction activity within Area 2. A sound contour figure of foundation work occurring simultaneously at the temporary concrete batch plant/laydown area and at the three closest turbine sites (T-16, T-18, and & T-21) to the concrete batch plant/laydown area are presented in Figure 7-j.2.

The highest sound level at a non-participating receptor within this area, near the temporary concrete batch plant, is 52 dBA during foundation work (Receptor #700). Modeling results of construction sound levels within this area are summarized in Table 7-13.

Table 7-13 Construction Noise Modeling Results – Area 2 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	Foundation
700	185.7	Non-Participating	52
710	310.8	Non-Participating	47
701	322.0	Non-Participating	48
702	382.8	Participating	47
699	766.3	Non-Participating	44
394	1035.0	Non-Participating	41
708	1048.3	Non-Participating	44
266	1095.7	Non-Participating	39
709	1111.1	Non-Participating	44
443	1125.2	Non-Participating	41

Area 3 Modeling Results

The cumulative impacts from HDD work and commissioning work were calculated with the Cadna model for the ten closest receptors to construction activity within Area 3. The loudest phase of construction within this area will be HDD work. A sound contour figure of HDD work occurring at the HDD entry point is presented in Figure 7-j.3.

The highest sound level at a non-participating receptor within this area is 75 dBA during HDD (Receptor #1873) and 47 dBA during commissioning (Receptor #1873). Modeling results of construction sound levels within this area are summarized in Table 7-14, and a sound contour figure of results is shown in Figure 7-j.3.

Table 7-14 Construction Noise Modeling Results – Area 3 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	HDD	Commissioning	Worst-Case Total (All Phases)
1873	30.2	Participating	75	47	75
1872	58.1	Non-Participating	69	39	69
1874	102.6	Non-Participating	63	34	63
1876	136.0	Non-Participating	60	32	60
1828	146.8	Non-Participating	59	31	59
1827	169.6	Non-Participating	58	30	58
1829	177.1	Non-Participating	58	29	58
1878	192.8	Non-Participating	57	29	57
1830	195.1	Non-Participating	57	29	57
1826	216.8	Non-Participating	56	28	56

Construction Noise Conclusions

Noise due to construction is an unavoidable outcome of construction. The major construction phases are excavation, foundation, turbine erection, and HDD. As stated in the ORES regulations §900-6.4; construction and routine maintenance activities on the facility shall be limited to 7 AM to 8 PM Monday through Saturday and 8 AM to 8PM on Sunday and national holidays, with the exception of construction and delivery activities, which may occur during extended hours beyond this schedule on an as-needed basis. In some instances, concrete foundation work and turbine erection work could extend into the overnight hours depending on the weather and timing of a concrete pour, which must be continuous. Most of the construction will occur at significant distances to sensitive receptors; therefore, noise from most phases of construction is not expected to result in impacts to sensitive receptors. There are a few instances where construction will be close to residences (#1872 #1873, & #1874) and coordination with these neighbors may be warranted. Construction noise will be minimized with best management practices (BMP).

7(k) Sound Levels in Graphical Format

(1) Figure 7-4.1 presents future L_{eq} (8-hour) sound contour lines showing expected sound levels during worst-case operation of the Project's wind turbines plus the collector substation using the methodology described above. Of the wind turbine models analyzed, the GE158-6.1 wind turbine contained the highest broadband sound power level. As a result, the (Mitigated) future L_{eq} (8-hour) sound contour lines with the GE158-6.1 are included with Figure 7-4.1. Figure 7-5.1 presents future L_{eq} (1-hour) sound contour lines showing expected sound levels during worst-case operation of the Project's collector substation-only using the methodology described above. No mitigation is expected at the collector substation; therefore, these sound contour lines are unmitigated for Figure 7-5.1. Figure 7-j.1 presents worst-case sound levels from construction activity L_{eq} (1-sec) sound contour drawings for Area 1, Area 2, and Area 3 using the methodology described in Section 7(j). Figure 7-8.1 presents cumulative L_{eq} (8-hour) sound contour lines showing expected future sound levels during worst-case operation of the Project's wind turbines plus the collector substation, in addition to the

existing Fenner Wind Farm. The methodology is described in detail in Appendix 7-H. Once again, with respect to this Facility (Hoffman Falls Wind), the GE158-6.1 wind turbine contained the highest broadband sound power level. As a result, the (Mitigated) future L_{eq} (8-hour) sound contour lines with the GE158-6.1 were used for the purposes of Figure 7-8.1.

(2) The sound contour maps include all sensitive sound receptors, boundary lines (differentiating participating and non-participating), and all Project noise sources.

(3) Sound contours are rendered until the thirty (30) dBA noise contour is reached, in one (1)-dBA steps, with sound contour multiples of five (5) dBA differentiated.

(4) Full-size hard copy maps (22" x 34") of these figures in 1:12,000 scale or better will be submitted to the Office.

7(l) Sound Levels in Tabular Format

A tabular comparison between the maximum sound impacts and any design goals, noise limits, and local requirements for the facility, and the degree of compliance at all sensitive sound receptors and at the most impacted non-participating boundary lines within the Study Area are presented below.

All Sources Running—Wind Turbines plus the Collector Substation

Future L_{eq} (8-hour) sound levels during worst-case operation of the Project's wind turbines plus the collector substation have been calculated using the methodology described in Section 7(d). Appendix 7-D provides the predicted A-weighted (dBA) and unweighted L_{eq} (1-hour) full octave band frequency (16 Hz to 8,000 Hz) sound pressure levels at all sensitive receptors. The methodology for the extrapolation of the 16 Hz frequency octave band was elaborated upon in Section 7(g). The results are sorted by receptor ID and sorted by the broadband A-weighted sound level high to low, and then are broken down by wind turbine model (V150-4.5, N149-4.X TS 108, and GE158-6.1), mitigation mode (Unmitigated or Mitigated), receptor type (Residential, Unknown, Public, Commercial, and Other) and participation (Non-Participating or Participating). In total, there are 16 tables for the V150-4.5 wind turbine model and 32 tables for the N149-4.X TS 108 or GE158-6.1 wind turbine models in Appendix 7-D.

1) V150-4.5, HH-120m

The first wind turbine analyzed is the Vestas V150-4.5 model. For the Unmitigated Total Project model run, the broadband sound levels range from 20 to 47 dBA across all discrete receptors.

Zero non-participating residential receptors would be over the maximum noise limit of 45 dBA L_{eq} (8-hour) if no noise mitigation is applied.

Zero participating residential receptors are over the maximum noise limit of 55 dBA L_{eq} (8-hour) if no noise mitigation is applied.

Zero non-participating residential receptors are over the maximum noise limit of 65 dB L_{eq} (1-hour) at 16 Hz, 31.5 Hz or 63 Hz if no noise mitigation is applied.

Table 7-15 presents the number of sensitive noise receptors that have been modeled to experience a worst-case sound level of 35 dBA or greater. Modeled sound levels have been rounded to the nearest integer and are presented in 1 dBA increments by receptor participation status.

The highest sound levels at residential receptors, under this Unmitigated scenario are:

- Non-Participating Receptor ID# 1835 - 45 dBA
- Participating Receptor ID# 1839 - 45 dBA

These sound levels are at or below the design goals of 45 dBA for a non-participating residence and 55 dBA for a participating residence. In addition, a maximum noise limit of fifty-five (55) dBA L_{eq} (8-hour), short-term equivalent continuous average nighttime sound level from the facility across any portion of a non-participating property was evaluated and is satisfied. Thus, the Project complies with all design goals with respect to the V150-4.5.

Table 7-15 Receptors Modeled at 35 dBA or Greater – Total Sound L_{eq} (8-hour)- Unmitigated V150-4.5

Modeled Leq Sound Level [dBA][1]	# of Receptors							
	Residential		Public[2]	Other		Unknown[2]	Commercial	
	Participating	Non-Participating	Non-Participating	Participating	Non-Participating	Non-Participating	Participating	Non-Participating
55	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	1	0
46	0	0	0	2	0	0	1	0
45	1	2	0	0	0	0	1	1
44	5	5	0	5	1	0	4	1
43	5	7	0	3	1	0	0	1
42	5	27	0	4	3	0	2	1
41	4	43	0	0	12	0	0	3
40	3	41	1	1	15	0	1	5
39	1	44	1	4	16	0	1	2
38	1	32	2	0	9	0	4	9
37	0	66	2	0	18	0	0	4
36	0	43	4	0	6	0	0	3
35	0	63	0	0	11	0	0	0

Notes: 1. Rounded to the nearest whole decibel.
2. Dataset contains no public or unknown participating discrete receptors

2) N149-4.X TS 108, HH-108m

The second wind turbine analyzed is the Nordex N149-4.X TS 108 model. For the Unmitigated Total Project model run, the broadband sound levels range from 19 to 48 dBA across all discrete receptors.

Two non-participating residential receptors would be over the maximum noise limit of 45 dBA L_{eq} (8-hour) if no noise mitigation is applied.

- Receptor ID# 1835 & 1838 - 46 dBA.

Zero participating residential receptors are over the maximum noise limit of 55 dBA L_{eq} (8-hour) if no noise mitigation is applied.

Two non-participating residential receptors would be over the maximum noise limit of 65 dB L_{eq} (1-hour) at 16 Hz, 31.5 Hz or 63 Hz, if no noise mitigation is applied.

- Receptor ID# 1835 & 1838 - 66 dB @ 16Hz.

In order to meet all design goals, the N149-4.X TS 108 wind turbine model would require noise mitigation to be placed on six wind turbines. At this time, the turbine manufacturer (Nordex) has provided technical noise mitigation mode documents for this specific model. While land negotiations are ongoing and the Applicant will continue to seek agreements with current non-participating landowners, one possible mitigation mode strategy is as follows: <BEGIN CONFIDENTIAL INFORMATION>

[redacted]

<END CONFIDENTIAL INFORMATION> Specific mitigation measures will be decided upon selection of a final wind turbine manufacturer and a finalized Project layout. The specific mitigation measures include, but are not limited to, having individual wind turbines programmed to operate at different sound optimized modes or noise-reduced operating modes based on any set of rules, such as wind direction and/or wind speed. Therefore, if exceedances with regards to any noise limits, are only anticipated to occur under very specific conditions then the necessary sound optimized modes will be applied for these conditions and not all other conditions. Outside of the specified conditions, the individual wind turbines identified will be expected to operate under their respective normal operation mode and will remain in compliance with respect to all noise limits. The expected mitigation measures will be presented in a final compliance filing and will be based on technical documentation from the final wind turbine manufacturer.

With this noise mitigation in place, an additional Mitigated Total Project run occurred.

For the Mitigated Total Project model run, the broadband sound levels range from 19 to 48 dBA across all discrete receptors.

Zero non-participating residential receptors would be over the maximum noise limit of 45 dBA L_{eq} (8-hour), with the noise mitigation above applied.

Zero participating residential receptors are over the maximum noise limit of 55 dBA L_{eq} (8-hour), with the noise mitigation above applied.

Zero non-participating residential receptors are over the maximum noise limit of 65 dB L_{eq} (1-hour) at 16 Hz, 31.5 Hz or 63 Hz, with the noise mitigation above applied.

Table 7-16 (Unmitigated) and Table 7-17 (Mitigated) below, present the number of sensitive noise receptors that have been modeled to experience a worst-case sound level of 35 dBA or greater.

Modeled sound levels have been rounded to the nearest integer and are presented in 1 dBA increments by receptor participation status.

The highest sound levels at residential receptors, under this Mitigated scenario are:

- Non-Participating Receptor ID# 1835 - 45 dBA
- Participating Receptor ID# 1839 - 46 dBA

These sound levels are at or below the design goals of 45 dBA for a non-participating residence and 55 dBA for a participating residence. In addition, a maximum noise limit of fifty-five (55) dBA L_{eq} (8-hour), short-term equivalent continuous average nighttime sound level from the facility across any portion of a non-participating property was evaluated and is satisfied. Thus, the Project complies with all design goals with respect to the N149-4.X TS 108.

Table 7-16 Receptors Modeled at 35 dBA or Greater – Total Sound L_{eq} (8-hour)- Unmitigated N149-4.X TS 108

Modeled Leq Sound Level [dBA][1]	# of Receptors							
	Residential		Public[2]	Other		Unknown[2]	Commercial	
	Participating	Non-Participating	Non-Participating	Participating	Non-Participating	Non-Participating	Participating	Non-Participating
55	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	1	0
47	0	0	0	2	0	0	1	0
46	1	2	0	0	0	0	1	1
45	3	5	0	2	1	0	3	1
44	7	4	0	5	1	0	1	1
43	5	18	0	5	3	0	2	1
42	2	35	0	0	5	0	0	2
41	3	50	1	0	19	0	0	4
40	3	38	1	3	15	0	2	4
39	0	33	1	2	9	0	4	5
38	1	38	1	0	12	0	0	6
37	0	65	2	0	10	0	0	3
36	0	42	4	0	10	0	0	2
35	0	49	0	0	8	0	0	0

Notes: 1. Rounded to the nearest whole decibel.
2. Dataset contains no unknown participating discrete receptors

Table 7-17 Receptors Modeled at 35 dBA or Greater – Total Sound L_{eq} (8-hour)- Mitigated N149-4.X TS 108

Modeled Leq Sound Level [dBA][1]	# of Receptors							
	Residential		Public[2]	Other		Unknown[2]	Commercial	
	Participating	Non-Participating	Non-Participating	Participating	Non-Participating	Non-Participating	Participating	Non-Participating
55	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	1	0
47	0	0	0	1	0	0	0	0
46	1	0	0	1	0	0	2	1
45	2	5	0	2	1	0	3	1
44	8	5	0	5	1	0	1	1
43	5	17	0	4	3	0	2	1
42	1	31	0	1	5	0	0	2
41	4	48	0	0	13	0	0	4
40	2	30	2	0	15	0	1	2
39	1	42	1	4	13	0	3	5
38	1	28	1	1	8	0	2	5
37	0	56	2	0	13	0	0	4
36	0	57	4	0	11	0	0	4
35	0	54	0	0	8	0	0	0

Notes: 1. Rounded to the nearest whole decibel.
2. Dataset contains no unknown participating discrete receptors

3) GE158-6.1, HH-117m

The third wind turbine analyzed is the General Electric GE158-6.1 model. For the Unmitigated Total Project model run, the broadband sound levels range from 19 to 48 dBA across all discrete receptors.

Six non-participating residential receptors would be over the maximum noise limit of 45 dBA L_{eq} (8-hour) if no noise mitigation is applied.

- Receptor ID# 1835 - 47 dBA.
- Receptor ID# 1838, 708, 1847, 1836, and 1837 – 46 dBA.

Zero participating residential receptors are over the maximum noise limit of 55 dBA L_{eq} (8-hour) if no noise mitigation is applied.

Eight non-participating residential receptors would be over the maximum noise limit of 65 dB L_{eq} (1-hour) at 16 Hz, 31.5 Hz or 63 Hz if no noise mitigation is applied.

- Receptor ID# 1835 & 1838 - 67 dB @ 16Hz.
- Receptor ID# 708, 1847, 1836, 1837, 1845, and 709 - 66 dB @ 16Hz.

In order to meet all design goals, the GE158-6.1 wind turbine model would require noise mitigation to be placed on six wind turbines. At this time, the turbine manufacturer (GE) has provided technical noise mitigation mode documents for this specific model. While land negotiations are ongoing and the Applicant will continue to seek agreements with current non-participating landowners, one possible mitigation mode strategy is as follows: <BEGIN CONFIDENTIAL INFORMATION>

[redacted]

<END CONFIDENTIAL INFORMATION> Specific mitigation measures will be decided upon selection of a final wind turbine manufacturer and a finalized Project layout. The specific mitigation measures include, but are not limited to, having individual wind turbines programmed to operate at different sound optimized modes or noise-reduced operating modes based on any set of rules, such as wind direction and/or wind speed. Therefore, if exceedances with regards to any noise limits, are only anticipated to occur under very specific conditions then the necessary sound optimized modes will be applied for these conditions and not all other conditions. Outside of the specified conditions, the individual wind turbines identified will be expected to operate under their respective normal operation mode and will remain in compliance with respect to all noise limits. The expected mitigation measures will be presented in a final compliance filing and will be based on technical documentation from the final wind turbine manufacturer.

With this noise mitigation in place, an additional Mitigated Total Project run occurred.

For the Mitigated Total Project model run, the broadband sound levels range from 19 to 48 dBA across all discrete receptors.

Zero non-participating residential receptors would be over the maximum noise limit of 45 dBA L_{eq} (8-hour), with the noise mitigation above applied.

Zero participating residential receptors are over the maximum noise limit of 55 dBA L_{eq} (8-hour), with the noise mitigation above applied.

Zero non-participating residential receptors are over the maximum noise limit of 65 dB L_{eq} (1-hour) at 16 Hz, 31.5 Hz or 63 Hz, with the noise mitigation above applied.

Table 7-18 (Unmitigated) and Table 7-19 (Mitigated) below, present the number of sensitive noise receptors that have been modeled to experience a worst-case sound level of 35 dBA or greater.

Modeled sound levels have been rounded to the nearest integer and are presented in 1 dBA increments by receptor participation status.

The highest sound levels at residential receptors, under this Mitigated scenario are:

- Non-Participating Receptor ID# 1835 - 45 dBA
- Participating Receptor ID# 451 - 46 dBA

These sound levels are at or below the design goals of 45 dBA for a non-participating residence and 55 dBA for a participating residence. In addition, a maximum noise limit of fifty-five (55) dBA L_{eq} (8-hour), short-term equivalent continuous average nighttime sound level from the facility across any portion of a non-participating property is satisfied, as evident with the sound contours shown in Figure 7-4.1. Figure 7-4.1 shows the sound contours produced by the total Project with regards to the mitigated GE158-6.1 model run, as it produces the highest broadband sound power level of all the wind turbine models in consideration. Thus, the Project complies with all design goals with respect to the GE158-6.1.

Table 7-18 Receptors Modeled at 35 dBA or Greater – Total Sound L_{eq} (8-hour)- Unmitigated GE158-6.1

Modeled Leq Sound Level [dBA][1]	# of Receptors							
	Residential		Public[2]	Other		Unknown[2]	Commercial	
	Participating	Non-Participating	Non-Participating	Participating	Non-Participating	Non-Participating	Participating	Non-Participating
55	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	2	0	0	2	0
47	1	1	0	0	0	0	1	0
46	1	5	0	0	1	0	1	1
45	8	5	0	6	1	0	3	2
44	4	9	0	5	2	0	2	0
43	2	36	0	1	3	0	0	3
42	5	42	0	0	13	0	0	4
41	2	34	1	1	16	0	2	2
40	1	39	1	4	14	0	0	2
39	1	34	2	0	7	0	4	8
38	0	55	2	0	16	0	0	5
37	0	47	4	0	6	0	0	3
36	0	52	0	0	9	0	0	0
35	0	42	1	0	5	0	0	1

Notes: 1. Rounded to the nearest whole decibel.
2. Dataset contains no unknown participating discrete receptors.

Table 7-19 Receptors Modeled at 35 dBA or Greater – Total Sound L_{eq} (8-hour)- Mitigated GE158-6.1

Modeled Leq Sound Level [dBA][1]	# of Receptors							
	Residential		Public[2]	Other		Unknown[2]	Commercial	
	Participating	Non-Participating	Non-Participating	Participating	Non-Participating	Non-Participating	Participating	Non-Participating
55	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	1	0	0	1	0
47	0	0	0	0	0	0	0	0
46	1	0	0	0	0	0	1	1
45	7	4	0	6	0	0	5	2
44	4	7	0	6	3	0	1	0
43	4	27	0	1	2	0	1	2
42	2	33	0	0	9	0	0	4
41	3	46	0	0	13	0	0	2
40	3	35	2	3	15	0	2	1
39	1	38	2	2	13	0	4	8
38	0	30	2	0	13	0	0	3
37	0	50	3	0	9	0	0	2
36	0	68	1	0	8	0	0	5
35	0	48	1	0	7	0	0	0

Notes: 1. Rounded to the nearest whole decibel.
2. Dataset contains no unknown participating discrete receptors

<u>Collector substation only</u>

Future L_{eq} (1-hour) sound levels during worst-case operation of the Project's collector substation only have been calculated using the methodology described above. Appendix 7-E provides the predicted A-weighted (dBA) and full octave band frequency (31.5 Hz to 8,000 Hz) sound pressure levels at all discrete receptors. The results are sorted by receptor ID and sorted by A-weighted sound level from high to low for all receptor types (Residential, Unknown, Public, Commercial, and Other) and participation (Non-Participating or Participating). In total, there are sixteen tables from Table 7-5.1a to 7-5.1p found in Appendix 7-E. Sound level contours from the collector substation generated from the modeling grid are presented in Figure 7-5.1.

The highest sound level under this scenario is 32 dBA at a non-participating residence (Receptor ID #1880). This sound level meets the design goal of 35 dBA, assuming the 5 dBA tonal penalty, which is likely for the substation transformer.

Local Requirements

In the Towns of Fenner and Nelson each require that "individual wind turbine towers shall be located with relation to property lines so that the level of noise produced during wind turbine operation shall not exceed 50 dBA, measured at the boundaries of all the closest parcels that are owned by non-site owners and that abut either the site parcel(s) or any other parcels adjacent to the site parcel held in common by the owner of the site parcel as those boundaries exist at the time of special use permit application." See Town of Fenner Land Use Regulations Section VII. 606-31 (E) and Town of Nelson Land Use Development, Section 512.2.D.

These local laws by the Towns of Fenner and Nelson fail to specify a metric or averaging time for the sound level limit and instead set a "not to exceed" limitation. Moreover, monitoring and measuring sound at all parcel boundaries is difficult and impractical. Sound monitoring equipment needs to be placed at discrete locations to measure sound and cannot be placed across all portions of a property line. Due to terrain and vegetation, it would be extremely difficult to access all portions of a property line. It would take several dozen monitors to adequately monitor across all non-participating property boundaries in the Facility Site. In addition, sound monitoring equipment needs to be calibrated and maintained regularly to ensure accurate measurements, and placing dozens of monitors across the site would result in costly and frequent site visits to ensure the equipment was working properly, assuming the Applicant could even find enough sound monitors to comply with this onerous requirement. A monitoring program of this scale would be extremely difficult to implement, and results of the monitoring would likely be inconclusive if the L_{max} metric was utilized as further described below.

94-c only requires that property line limits be demonstrated through the filing of noise contour drawings and sound levels at the worst-case discrete locations (See 900-2.8(b)(1)(vi)). As a result, the Applicant is requesting a waiver for each of these local sound limits in the Towns of Fenner and Nelson. Compliance with these local laws is unreasonably burdensome given the technical difficulties with measuring such a requirement, along with the ambiguous and restrictive nature of the local laws. Moreover, setting monitoring limits at property lines where it is unlikely that people will actually reside does not protect against potential health impacts associated with sound impacts. See Exhibit 24 for more details on the Applicant's waiver request.

If the Applicant were forced to comply with a not to exceed 50 dBA limit at non-participating property lines then the Applicant would need to use the strictest interpretation of the language. The term "not to exceed" is not a sound level metric and it only indicates that any metric applied, shall not exceed that value. If the not to exceed language is interpreted to mean the L_{max} sound level metric, then most or all of the proposed wind turbines would not be able to be constructed in these towns. The L_{max} is the maximum instantaneous sound level. L_{max} is not typically used for evaluating sound regulations for several reasons including:

- Wind turbine manufacturers do not present sound level data using the L_{max} metric. Wind turbine sound level data is presented in terms of L_{eq}.

- The L_{max} is a highly variable sound level metric that results in poor repeatability, even when measured with laboratory calibrated instruments.
- The L_{max} is a statistical anomaly that is not representative of long-term sound exposure.
- Background sound levels (produced by non-wind turbine sources) cannot be subtracted out of L_{max} measured values because L_{max} is not an equivalent average sound level.

In some instances, moving turbines based solely on a property line limit would increase sound levels at inhabited residences.

The sound from the Facility will meet the 94-c requirements and will adequately minimize noise on adjacent properties and at specific locations where people reside within the Towns of Fenner and Nelson. Refer to Exhibit 24: Local Laws and Ordinances of the 94-c Application for more information regarding the Town's requirements and the Applicant's waiver request.

In the Towns of Eaton and Smithfield, the statistical sound pressure level generated by a Wind Energy Conversion System (WECS) shall not exceed L_{10} – 50 dBA measured at the nearest residence located off the Site. Sites can include more than one parcel of property and the requirement shall apply to the combined properties. If the ambient sound pressure level exceeds 50 dBA, the standard shall be ambient dBA plus five dBA. Independent certification shall be provided before and after construction demonstrating compliance with this requirement. In the event audible noise due to WECS operations contains a steady pure tone, such as a whine, screech, or hum, the standards for audible noise set forth in § 14(B)(1) shall be reduced by five dBA. A Pure Tone is defined to exist of the 1/3 octave band sound pressure level in the band, including the tone, exceeds the arithmetic average of the sound pressure levels of the two contiguous 1/3 octave bands by five dBA for center frequencies of 500 Hz and above, by eight dBA for center frequencies between 160 Hz and 400 Hz, or by 15 dBA for center frequencies less than or equal to 125 Hz. In the event the ambient noise level (exclusive of the development in question), exceeds the applicable standard given above, the applicable standard shall be adjusted so as to equal the ambient noise level. The ambient noise level shall be expressed in terms of the highest whole number sound pressure level in dBA, which is exceeded for more than five minutes per hour. Ambient noise levels shall be measured at the exterior of potentially affected existing residences. Ambient noise level measurement techniques shall employ all practical means of reducing the effect of wind generated noise at the microphone. Ambient noise level measurements may be performed when wind velocities at the proposed Project Site are sufficient to allow wind turbine operation, provided that the wind velocity does not exceed 30 mph at the ambient noise measurement location. Any noise level falling between two whole decibels shall be the lower of the two.

As these standards align or are exceeded by the 94-c regulations, the Facility will comply with this local law provision in the Towns of Eaton and Smithfield. The Facility will meet or has been shown to comply with 19 NYCRR §900-2.8 (b)(1)(i) for all three wind turbine models being considered by the Applicant. This regulation addresses residences off the Project Site (non-participating).

This is a maximum noise limit of forty-five (45) dBA L_{eq} (8-hour), outside of any existing non-participating residence, which is more restrictive than the fifty (50) dBA L_{10} stated in the local law. The Facility will meet or has been shown to comply with §900-2.8 (e)(1) for all three wind turbine models being considered by the Applicant. This regulation addresses prominent discrete tones, which aligns with the local law discussing pure tones. The Facility will meet or has been shown to comply with §900-2.8 (i), which addresses an ambient pre-construction noise study. This study is detailed further in Section 7(e), as ambient sound pressure levels were captured throughout the Project Study Area.

7(m) Community Noise Impacts

(1) Hearing Loss for the Public

The Project's potential to result in hearing loss to the public was evaluated against the 1999 "Guidelines for Community Noise" published by the World Health Organization (WHO). According to the WHO Guidelines, the threshold for hearing impairment is 70 dBA L_{eq} (24-hour), 110 dBA (L_{max}, fast) or 120/140 dBA (peak at the ear) for children/adults. Operational noise will always be less than 55 dBA L_{eq} (8-hour) at any residence. This is well below the 70 dBA limit. The only construction noise source for this Project capable of exceeding the WHO hearing impairment threshold is blasting. To avoid any exceedances of the WHO standard, the contractor responsible for blasting will follow the requirements in the Blasting Plan (Appendix 10-A of the Section 94-c Application). All other construction activities will produce noise below the WHO hearing impairment threshold. Therefore, no Project activities have the potential to cause hearing loss to the public.

(2) Potential for Structural Damage

The potential for structural damage is low, due to the lack of structures near major Project components. If any blasting is required, the contractor responsible for blasting will follow the requirements in the Blasting Plan (Appendix 10-A of the Section 94-c Application.). The Blasting Plan will follow U.S. Bureau of Mines standards that limit vibration magnitudes to prevent damage to above and below-ground structures.

(3) Potential for Human Perceptible Vibrations

While not studied nearly as extensively as airborne vibration, the potential for wind turbines to create adverse ground-borne vibration has been investigated. Measurement of ground-borne vibration associated with wind turbine operations can be detectable with instruments, but is below the threshold of perception, even within a wind farm.

Gastmeier & Howe measured vibration at a residence 325 meters (1,066 feet) from several 1.8 MW wind turbines and found vibration levels were well below the perception limits found in ISO 2631-2 ("*Evaluation of human exposure to whole-body vibration*", Part 2). [3]

The Massachusetts Department of Environmental Protection (MA DEP) and the Massachusetts Department of Public Health commissioned an expert panel who found that seismic motion from wind turbines is so small that it is difficult to induce any physical or structural response. [4] Two reports cited in the MA DEP review (*Styles 2005* [5]*; Schofield 2010* [6]*)* indicate that at 100 meters from a wind turbine the maximum motion that is induced is 120 nanometers (at about 1 Hz). A nanometer is 10^{-9} meter, which is equivalent to 1.2×10^{-7} meter of ground displacement. To put the motion in perspective, the diameter of a human hair is on the order of 10^{-6} meter. Extremely sensitive measuring devices were required to detect this slight motion. The Schofield measurements were conducted on a Vestas V-47 with a maximum rotational rate of 29 rpm (blade pass frequency of 1.47 Hz).

Ground-borne vibration measurements were made by Epsilon from Siemens 2.3 and GE 1.5sle wind turbines in Texas.[7] The maximum ground-borne vibration root-mean square (RMS) particle velocities were 0.071 mm/second (0.71×10^{-4} meters/second) in the 8 Hz one-third octave band. This was measured 1,000 feet downwind from a GE 1.5sle WTG under maximum power output and high wind at the ground. The background ground-borne vibration RMS particle velocity at the same location was 0.085 mm/sec. Both of these measurements meet ANSI S2.71-1983[8] recommendations for perceptible vibration in residences during night time hours of 1.0×10^{-4} meters/second at 8 Hz. Soil conditions were soft earth representative of an active agricultural use. No perceptible vibration was felt from the operation of the wind turbines. The GE 1.5sle has a maximum rotation rate of 20 rpm (blade pass frequency of 1 Hz), and the Siemens 2.3 has a maximum rotation rate of 15.4 rpm (blade pass frequency of 0.77 Hz).

ANSI S2.71-1983 presents recommendations for magnitudes of ground-borne vibration which humans will perceive and possibly react to within buildings. A basic rating is given in Table 1 of the standard for the most stringent conditions, which correspond to the approximate threshold of perception of the most sensitive humans. From the base rating, multiplication factors should be applied according to the location of the receiver; for continuous sources of vibration in

[3] *Recent Studies of Infrasound from Industrial Sources,* W. Gastmeier & B. Howe, Canadian Acoustics, 36(3), 2008.

[4] *Wind Turbine Health Impact Study: Review of Independent Expert Panel,* Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, January 2012.

[5] *Microseismic and Infrasound Monitoring of Low Frequency Noise and Vibration from Windfarms,* P. Styles et al, Keele University, 18 July 2005.

[6] *Seismic Measurements at the Stateline Wind Project,* R. Schofield, University of Oregon, 2010.

[7] *A Study of Low Frequency Noise and Infrasound from Wind Turbines,* Epsilon Associates, Inc., prepared for NextEra Energy Resources, LLC, July 2009.

[8] *Guide to the Evaluation of Human Exposure to Vibration in Buildings,* ANSI/ASA S2.71-1983 (R June 19, 2020).

residences at nighttime, the multiplication factor is 1.0 – 1.4. For spaces in which the occupants may be sitting, standing, or lying at various times, the standard recommends using a combined axis rating which is obtained from the most stringent rating for each axis. Measurements in each of the 3 axes should be compared to the combined axis rating. Table 1 of the standard presents the base response RMS velocity ratings for the combined axis.

The Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wuerttemberg, Germany published a detailed study on infrasound and vibration from wind turbines.[9] The results found that vibration velocity levels from a 2.4 MW Nordex N117 wind turbine at distances of less than 300 meters (~1,000 feet) were less than $0.1x10^{-4}$ meters/sec.

In summary, studies on ground-borne vibration have found that vibration produced by wind turbines can be detected by extremely sensitive instruments, but is not perceptible by humans and is not fundamentally different than background vibration that is ever-present in the natural environment. These studies have found that this ground-borne vibration potentially associated with the operation of wind turbines is not a concern.

The nearest operating wind turbine for the Hoffman Falls Wind project to a non-participating residence (#1835) is approximately 1,237 feet (377 meters). <BEGIN CONFIDENTIAL INFORMATION> [redacted] <END CONFIDENTIAL INFORMATION> Based on the literature findings presented above, where ground-borne vibration was below perceptible thresholds at comparable distances and frequency of rotation, ground-borne vibrations from the operation of the Facility will be below the thresholds as recommended in ANSI S2.71-1983 at non-participating residences.

7(n) Noise Abatement Measures for Construction Activities

(1) Noise Abatement Measures

Noise due to construction is an unavoidable outcome of construction. The Applicant will communicate with the public to notify them of the beginning of construction of the Facility. Most of the construction will occur at significant distances to sensitive receptors, and therefore noise from most phases of construction is not expected to result in impacts to sensitive receptors. Nonetheless construction noise will be minimized using BMP such as those listed below.

[9] Low-frequency sound noise incl. infrasound from wind turbines and other sources, LUBW Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wuerttemberg, Germany, November 2016.

- Blasting may be necessary at specific turbine sites. As needed, blasting will be limited to daytime hours and conducted in accordance with the Hoffman Falls Wind Preliminary Blasting Plan.

- Pile driving is not anticipated at this site.

- Pursuant to 19 NYCRR § 6.2(k)(1), utilizing construction equipment fitted with exhaust systems and mufflers that have the lowest associated noise whenever those features are available and maintaining functioning mufflers on all transportation and construction machinery.

- Maintaining equipment and surface irregularities on construction sites to prevent unnecessary noise.

- Configuring, to the extent feasible, the construction in a manner that keeps loud equipment and activities as far as possible from noise-sensitive locations.

- Using back-up alarms with a minimum increment above the background noise level to satisfy the performance requirements of the current revisions of Standard Automotive Engineering (SAE) J994 and OSHA requirements.

- Developing a staging plan that establishes equipment and material staging areas away from sensitive receptors when feasible.

- Contractors shall use approved haul routes to minimize noise at residential and other sensitive noise receptors.

(2) Complaint Management Plan

Complaints due to construction or operation of the Project have the potential to occur. If complaints do arise, the Complaint Management Plan will follow as described in 19 NYCRR § 10.2(e)(7) of the 94-c regulations. In accordance with 19 NYCRR § 6.2(a), (c) and (d), the Applicant will provide notice of commencement of construction and completion of construction. The notice will include the procedure and contact information for registering a complaint. To minimize noise impacts during construction, the Applicant will comply with 19 NYCRR § 6.2(k)(2), which includes responding to noise and vibration complaints according to the complaint resolution protocol approved by the Office.

(3) Compliance with Local Laws

Pursuant to 19 NYCRR § 6.2(k)(3), the Applicant will comply with the requirements set in place by the Towns of Eaton and Smithfield, as discussed in Section 7(l). For the Towns of Fenner and Nelson, the Applicant is seeking a waiver of this local law. Refer to Exhibit 24: Local Laws and Ordinances of the 94-c Application for more information regarding the Town’s requirements and the Applicant’s waiver request.

7(o) Noise Abatement Measures for Facility Design and Operation

(1) Wind Facilities

(i) Adverse noise impacts will be avoided or minimized through careful siting of Project components. Noise-reduced operations are expected to occur on various wind turbines to varying degrees, in order to demonstrate compliance. The amount of mitigation and the necessary NRO modes were discussed at greater length in prior sections 7(d) and 7(l). All tabular results for the modeled Project sound levels L_{eq} (8-hour) in Appendix 7-D have been reported as either "Unmitigated" or "Mitigated." No mitigation is required for the substation under the current design, therefore, all tabular results presented in Appendix 7-E are "Unmitigated."

(ii) Specific mitigation measures will be decided upon selection of a final wind turbine manufacturer and a finalized Project layout. The specific mitigation measures include, but are not limited to, having individual wind turbines programmed to operate at different sound optimized modes or noise-reduced operating modes based on any set of rules, such as wind direction and/or wind speed. Therefore, if exceedances with regards to any noise limits, are only anticipated to occur under very specific conditions then the necessary sound optimized modes will be applied for these conditions and not all other conditions. Outside of the specified conditions, the individual wind turbines identified will be expected to operate under their respective normal operation mode and will remain in compliance with respect to all noise limits. The expected mitigation measures will be presented in a final compliance filing and will be based on technical documentation from the final wind turbine manufacturer. The mitigation and wind turbine NRO's will be implemented at the start date of operations.

(2) Solar Facilities

This subsection is not applicable to the proposed Project.

7(p) Software Input Parameters, Assumptions, and Associated Data for Computer Noise Modeling

1) GIS files used for the computer noise modeling, including noise source and receptor locations and heights, topography, final grading, boundary lines, and participating status have been submitted to the Office by digital means.

2) The Cadna/A computer noise modeling files have been submitted to the Office by digital/electronic means.

3) Site plan and elevation details of the substation, as related to the location of all relevant noise sources are presented in Appendix 7-F.

4) (i) Sound power level from the turbines in consideration for the Facility have been documented with information from the manufacturers following the IEC 61400-11 standard and IEC TS 61400-14 to the extent possible in Appendix 7-G.

   (ii) To the extent possible based on manufacturer, in Appendix 7-G the sound power level information has been reported with associated wind speed magnitudes, angular speed of the rotor, and rated power.

   (iii) As provided by the individual manufacturers to the extent possible, all sound power level information in Appendix 7-G addresses normal operations, noise reduced operations, and low-noise or serrated trailing edge blade noise reduction measures.

5) This subsection is not applicable to the proposed Project.

7(q) Miscellaneous

(1) A glossary of terminology, definitions, and abbreviations used throughout this Exhibit are included as Appendix 7-K. The references mentioned in the application are found in Appendix 7-L.

(2) All information has been reported in tabular, spreadsheet compatible or graphical format as follows:

   (i) All data reported in tabular format has been clearly identified to include headers and summary footer rows. Headers include identification of the information contained in each column, such as noise descriptors; weighting; duration of evaluation; time of the day, whether the value is a maximum or average value and the corresponding time frame of evaluation.

   (ii) Table titles identify whether the tabular or graphical information corresponds to the "unmitigated" or "mitigated" results, if any mitigation measures are evaluated, and “cumulative” for cumulative noise assessments.

   (iii) Columns or rows with results related to a specific design goal, noise limit or local requirement, identify the requirement to which the information relates.

   (iv) Tables include rows at the bottom summarizing the results to report maximum and minimum values of the information contained in the columns. Sound receptors are separated into different tables according to their use (e.g., participating residences, potentially participating residences, non-participating residences, public, commercial, unknown, etc.).

   (v) This Exhibit reports estimates of the absolute number of sensitive sound receptors that will be exposed to noise levels that exceed any design goal or noise limit (in total as well as grouped in one (1)-dBA bins).