SOUND LEVEL MODELING REPORT

Shelby Wind Project
Orleans County, New York

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1.0 EXECUTIVE SUMMARY

The Shelby Wind Project (the Project) is a proposed wind power generation facility expected to consist of two (2) wind turbines in Orleans County, New York. The Project is being developed by Borrego Solar Systems, Inc (Borrego). Epsilon Associates Inc. (Epsilon) has been retained by Borrego to conduct a sound level modeling study for this Project. This report presents results of the sound level modeling from the proposed wind turbines in Orleans County.

This sound level assessment includes computer modeling to predict worst-case future L_{10} sound levels from the Project, and a comparison of operational sound levels to regulatory limits. The analysis was conducted for two different scenarios: two (2) Vestas V150-4.3 wind turbines; and two (2) GE 3.4-140 wind turbines. This Project is required to comply with the Zoning Local Law of the Town of Shelby, Orelans County, New York (ByLaws) which are presented in Section 4 of this report. The ByLaws limit sound produced by wind energy conversion systems (WECS) to 50 dBA at any residence.

The worst-case L_{10} sound levels produced by the Project were predicted through modeling. The highest predicted worst-case Project Only L_{10} sound level at a modeling receptor is 43 dBA with the Vestas V150-4.3 wind turbine, and 44 dBA with the GE 3.4-140 wind turbine. Therefore, with the Vestas or GE wind turbine option, the Project meets the Ordinance sound limit of 50 dBA.

2.0 INTRODUCTION

The proposed Project will consist of two (2) wind turbines. Borrego is considering two different wind turbines: Vestas V150-4.3 units with a hub height of 120 meters, or GE 3.4-140 units with a hub height of 120 meters. Figure 2-1 shows the locations of the wind turbines in Orleans County over aerial imagery.

A detailed discussion of sound from wind turbines is presented in a white paper prepared by the Renewable Energy Research Laboratory.[1] A few points are repeated herein. Wind turbine sound can originate from two different sources: mechanical sound from the interaction of turbine components, and aerodynamic sound produced by the flow of air over the rotor blades. Prior to the 1990's, both were significant contributors to wind turbine sound. However, recent advances in wind turbine design have greatly reduced the contribution of mechanical sound. Aerodynamic sound has also been reduced from modern wind turbines due to slower rotational speeds and changes in materials of construction. Aerodynamic sound, in general, is broadband (has contributions from a wide range of frequencies). It originates from encounters of the wind turbine blades with localized airflow inhomogeneities and wakes from other turbine blades and from airflow across the surface of the blades, particularly the front and trailing edges. Aerodynamic sound generally increases with increasing wind speed up to a certain point, then typically remains constant, even with higher wind speeds. However, sound levels in general also increase with increasing wind speed with or without the presence of wind turbines.

This report presents the findings of a sound level modeling analysis for the Project. The Project wind turbines were modeled in CadnaA using sound data from Vestas and GE technical reports. The results of this analysis are found within this report.

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[1] Renewable Energy Research Laboratory, Department of Mechanical and Industrial Engineering, University of Massachusetts at Amherst, Wind Turbine Acoustic Noise, June 2002, amended January 2006.

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

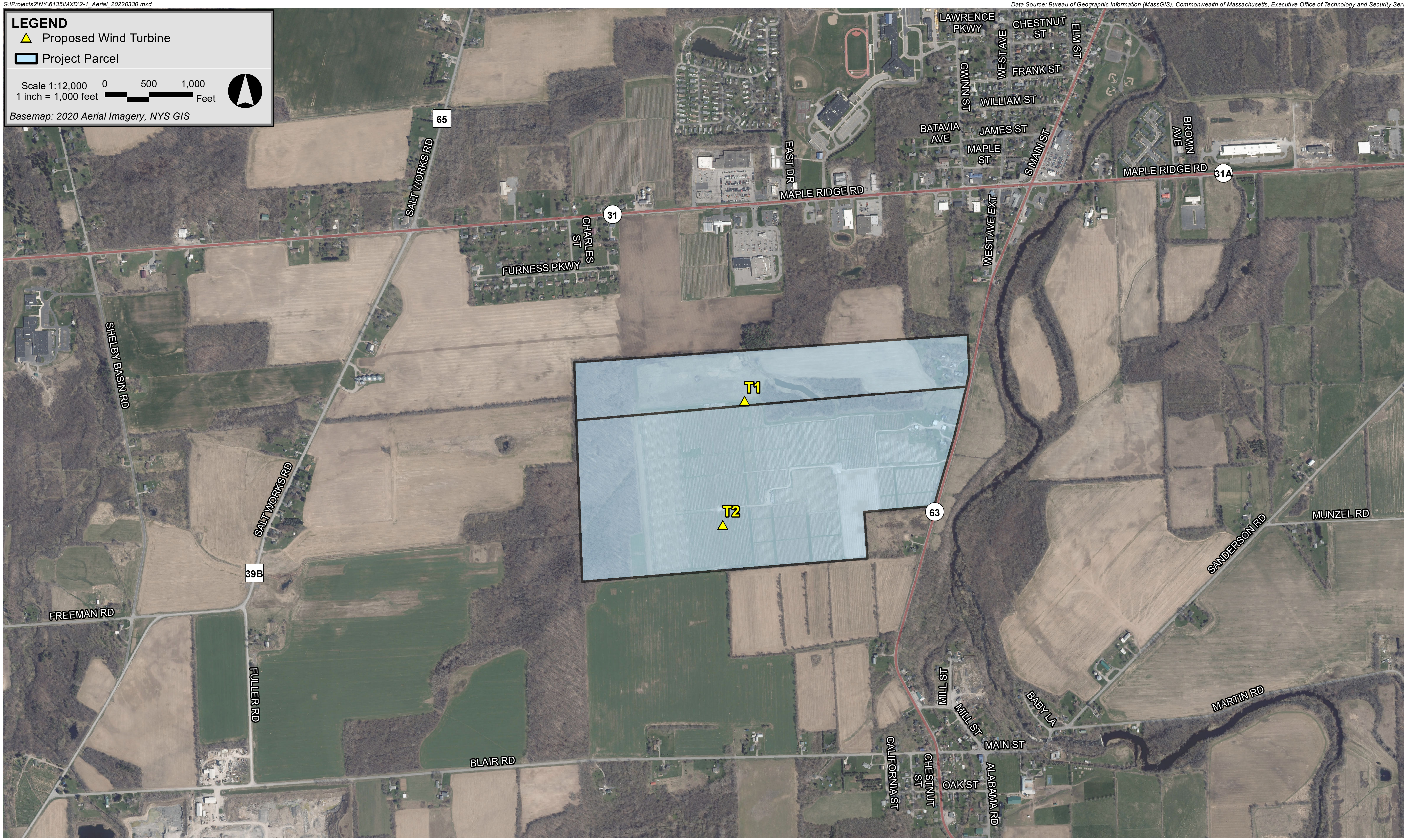

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Figure 2-1
Aerial Locus

3.0 SOUND TERMINOLOGY

There are several ways in which sound levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. The following information defines the sound level terminology used in this analysis.

The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. A property of the decibel scale is that the sound pressure levels of two or more separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is only a 3-decibel increase (53 dB), which is equal to doubling in sound energy, but not equal to a doubling in decibel quantity (100 dB). Thus, every 3-dB change in sound level represents a doubling or halving of sound energy. The human ear does not perceive changes in the sound pressure level as equal changes in loudness. Scientific research demonstrates that the following general relationships hold between sound level and human perception for two sound levels with the same or very similar frequency characteristics[2]:

- 3 dBA increase or decrease results in a change in sound that is just perceptible to the average person,
- 5 dBA increase or decrease is described as a clearly noticeable change in sound level, and
- 10 dBA increase or decrease is described as twice or half as loud.

Another mathematical property of decibels is that if one source of sound is at least 10 dB louder than another source, then the total sound level is simply the sound level of the higher-level source. For example, a sound source at 60 dB plus another sound source at 47 dB is equal to 60 dB.

A sound level meter (SLM) that is used to measure sound is a standardized instrument.[3] It contains "weighting networks" (e.g., A-, C-, Z-weightings) to adjust the frequency response of the instrument. Frequencies, reported in Hertz (Hz), are detailed characterizations of sounds, often addressed in musical terms as "pitch" or "tone". The most commonly used weighting network is the A-weighting because it most closely approximates how the human ear responds to sound at various frequencies. The A-weighting network is the accepted scale used for community sound level measurements; therefore, sounds are frequently reported as detected with a sound level meter using this weighting. A-weighted sound levels emphasize middle frequency sounds (i.e., middle pitched – around 1,000 Hz), and de-emphasize low and high frequency sounds. These sound levels are reported in decibels designated as "dBA". The C-weighting network has a nearly flat response for frequencies between 63 Hz and 4,000 Hz and is noted as dBC. Z-weighted sound

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[2] Bies, David, and Colin Hansen. 2009. *Engineering Noise Control: Theory and Practice*, 4th Edition. New York: Taylor and Francis.

[3] *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983 (R2006), published by the Standards Secretariat of the Acoustical Society of America, Melville, NY.

levels are measured sound levels without any weighting curve and are otherwise referred to as "unweighted". Sound pressure levels for some common indoor and outdoor environments are shown in Figure 3-1.

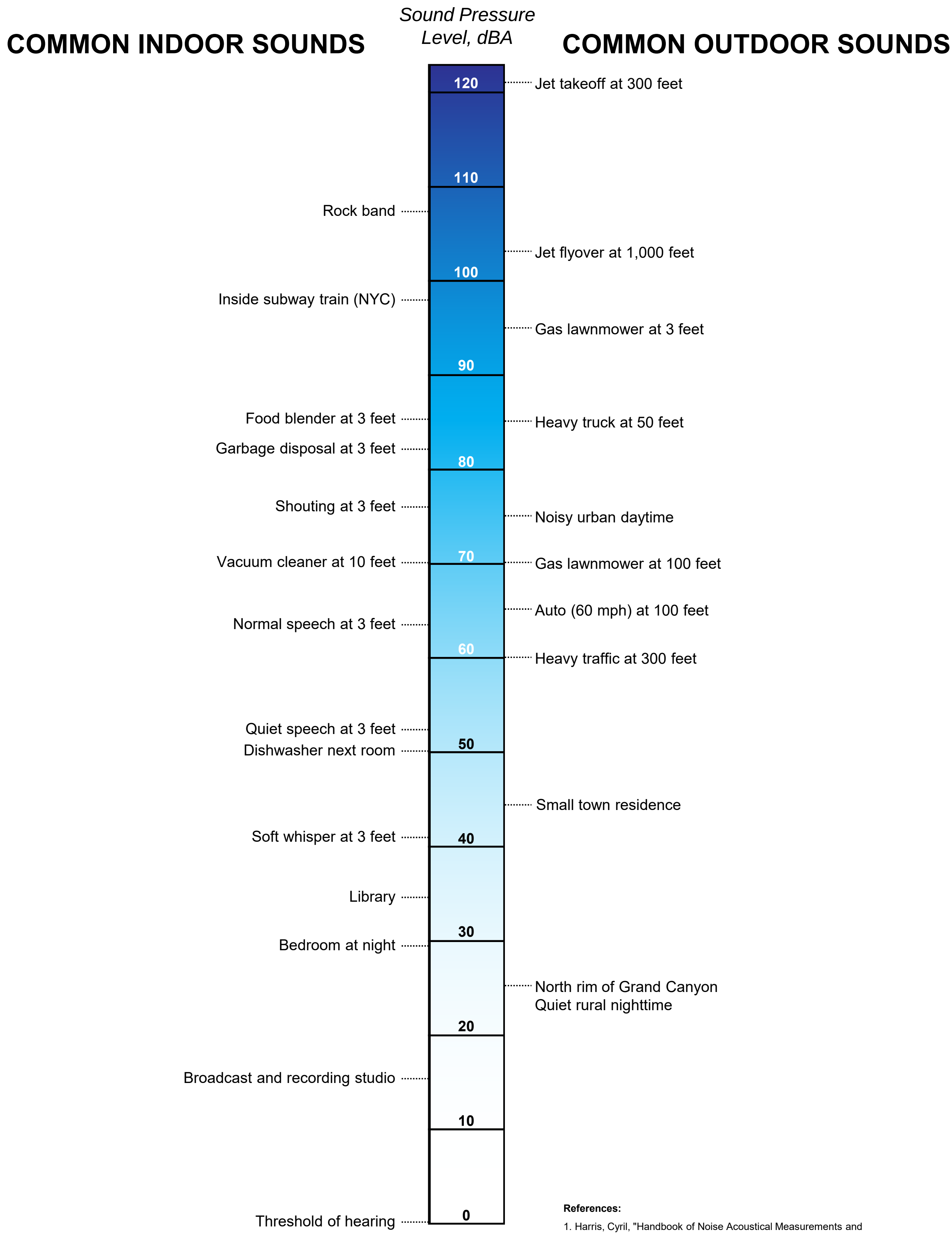
Because the sounds in our environment vary with time they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from some number of moment-to-moment A-weighted sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value between 0 and 100 in terms of percentage. Several sound level metrics that are commonly reported in community sound level monitoring are described below.

- L_{10} is the sound level exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder sounds like those from passing motor vehicles.

- L_{50} is the sound level exceeded 50 percent of the time. It is the median level observed during the measurement period. The L_{50} is affected by occasional louder sounds like those from passing motor vehicles; however, it is often found comparable to the equivalent sound level under relatively steady sound level conditions.

- L_{90} is the sound level exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent sound sources.

- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is typically A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by loud sounds if there are fluctuating sound levels.



References:
1. Harris, Cyril, "Handbook of Noise Acoustical Measurements and Noise Control", p 1-10., 1998
2. "Controlling Noise", USAF, AFMC, AFDTC, Elgin AFB, Fact Sheet, August 1996
3. California Dept. of Trans., "Technical Noise Supplement", Oct, 1998

Figure 3-1

Common Indoor and Outdoor Sound Levels

4.0 NOISE REGULATIONS

4.1 Town of Shelby, NY ByLaws

The Project, located within the Town of Shelby, NY is required to comply with the Zoning Local Law of the Town of Shelby, Orleans County, New York which state:

Section 597.13 Setbacks for Wind Energy Conversion Systems

A. The statistical sound pressure level generated by a WECS shall not exceed L_{10} – 50 dBA measured at the closest exterior wall of any residence existing at the time of completing the SEQRA review of the application. If the ambient sound pressure level exceeds 50 dBA, the standard shall be ambient dBA plus 5 dBA. Independent certification shall be provided before and after construction demonstrating compliance with this requirement.

B. 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 subparagraph 1) of this subsection shall be reduced by five (5) dBA. A pure tone is defined to exist if the one-third (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 (2) contiguous one third (1/3) octave bands by five (5) dBA for center frequencies of five hundred (500) Hz and four hundred (400) Hz, or by fifteen (15) dBA for center frequencies less than or equal to one hundred and twenty-five (125) Hz.

C. 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 (5) 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 all wind turbine operation, provided that the wind velocity does not exceed thirty (30) mph at the ambient noise measurement location.

Therefore, receptors have been evaluated against the L_{10} sound level limit of 50 dBA in this analysis.

5.0 MODELED SOUND LEVELS

5.1 Sound Sources

5.1.1 Project Wind Turbines

The sound level analysis for the Project includes two (2) wind turbines. The Project will consist of either two Vestas V150-4.3 units with Serrated Trailing Edge (STE) blades, or two GE 3.4-140 units with Low Noise Trailing Edge (LNTE) blades.

The V150-4.3 wind turbines have a rotor diameter of 150 meters. Both wind turbines have a hub height of 120 meters. A technical report from Vestas[4] was provided to Epsilon which documented the expected sound power levels associated with the V150-4.3 under normal operation.

The GE 3.4-140 wind turbine has a rotor diameter of 140 meters. The wind turbines have a hub height of 120 meters. A technical report from GE[5] was provided to Epsilon which documented the expected sound power levels associated with the GE 3.4-140 under normal operation.

5.2 Modeling Methodology

The sound impacts associated with the proposed wind turbines were predicted using the CadnaA sound level calculation software developed by DataKustik GmbH. This software uses the ISO 9613-2 international standard for sound propagation.[6] The benefits of this software are a more refined set of computations due to the inclusion of topography, ground attenuation, multiple building reflections (if applicable), drop-off with distance, and atmospheric absorption. The CadnaA software allows for octave band calculation of sound from multiple sources as well as computation of diffraction.

Inputs and significant parameters employed in the model are described below.

- *Project Layout:* This analysis is for the wind turbine array provided to Epsilon on March 24, 2022. The proposed Project layout is identified in Figure 5-1 and location coordinates are provided in Appendix A.
- *Modeling Receptor Locations:* Epsilon generated a modeling receptor dataset consisting of 173 receptors via desktop analysis. The dataset is representative of residential, commercial, and industrial buildings within the vicinity of the project. All modeling

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4 Restricted V150-4.3 MW Third Octave Noise Emission, 11-11-2020.

5 General Electric Company, Technical Documentation Wind Turbine Generator Systems Sierra 140 – 60 Hz Product Acoustic Specifications, 2021.

6 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation,* International Standard ISO 9613-2:1996 (International Organization for Standardization, Geneva, Switzerland, 1996).

receptors were input as discrete points at a height of 1.5 meters above ground level to mimic the ears of a typical standing person.

- *Modeling Grid:* A modeling grid with 20-meter spacing was calculated for the entire Project Area and the surrounding region. The grid was modeled at a height of 1.5 meters above ground level for consistency with the discrete modeling points. This modeling grid allowed for the creation of sound level isolines.
- *Terrain Elevation:* Elevation contours for the modeling domain were directly imported into CadnaA 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.
- *Source Sound Levels:* Sound power levels used in the modeling were described in Section 5.1. Documentation from Vestas provided levels that represent "worst-case" operational sound level emissions for the Project's proposed wind turbines.
- *Meteorological Conditions:* A temperature of 10°C (50°F) and a relative humidity of 70% was assumed in the model.
- *Ground Attenuation:* Spectral ground absorption was calculated using a G-factor of 0 which corresponds to "hard ground" consisting of a hard ground surface. The model, consistent with the standard, allows inputs between 0 (hard ground) and 1 (porous ground). This is a conservative approach as the vast majority of the area is actually agricultural.

Octave band sound power levels corresponding to the highest available wind turbine broadband sound power level for the wind turbine were input into CadnaA to model wind turbine generated broadband sound pressure levels during conditions when worst-case sound power levels are expected. Sound pressure levels were modeled at 173 receptors within the vicinity of the Project. In addition to modeling at discrete points, sound levels were also modeled throughout a large grid of points, each spaced 20 meters apart to allow for the generation of sound level isolines.

Several modeling assumptions inherent in the ISO 9613-2 calculation methodology, or selected as conditional inputs by Epsilon, were implemented in the CadnaA model to ensure conservative results (i.e., higher sound levels), and are described below:

- All modeled sources were assumed to be operating simultaneously and at the design wind speed corresponding to the greatest sound level impacts.
- As per ISO 9613-2, the model 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.
- Meteorological conditions assumed in the model (T=10℃/RH=70%) were selected to minimize atmospheric attenuation in the 500 Hz and 1 kHz octave bands where the human ear is most sensitive.

- No additional attenuation due to tree shielding, air turbulence, or wind shadow effects was considered in the model.

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Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

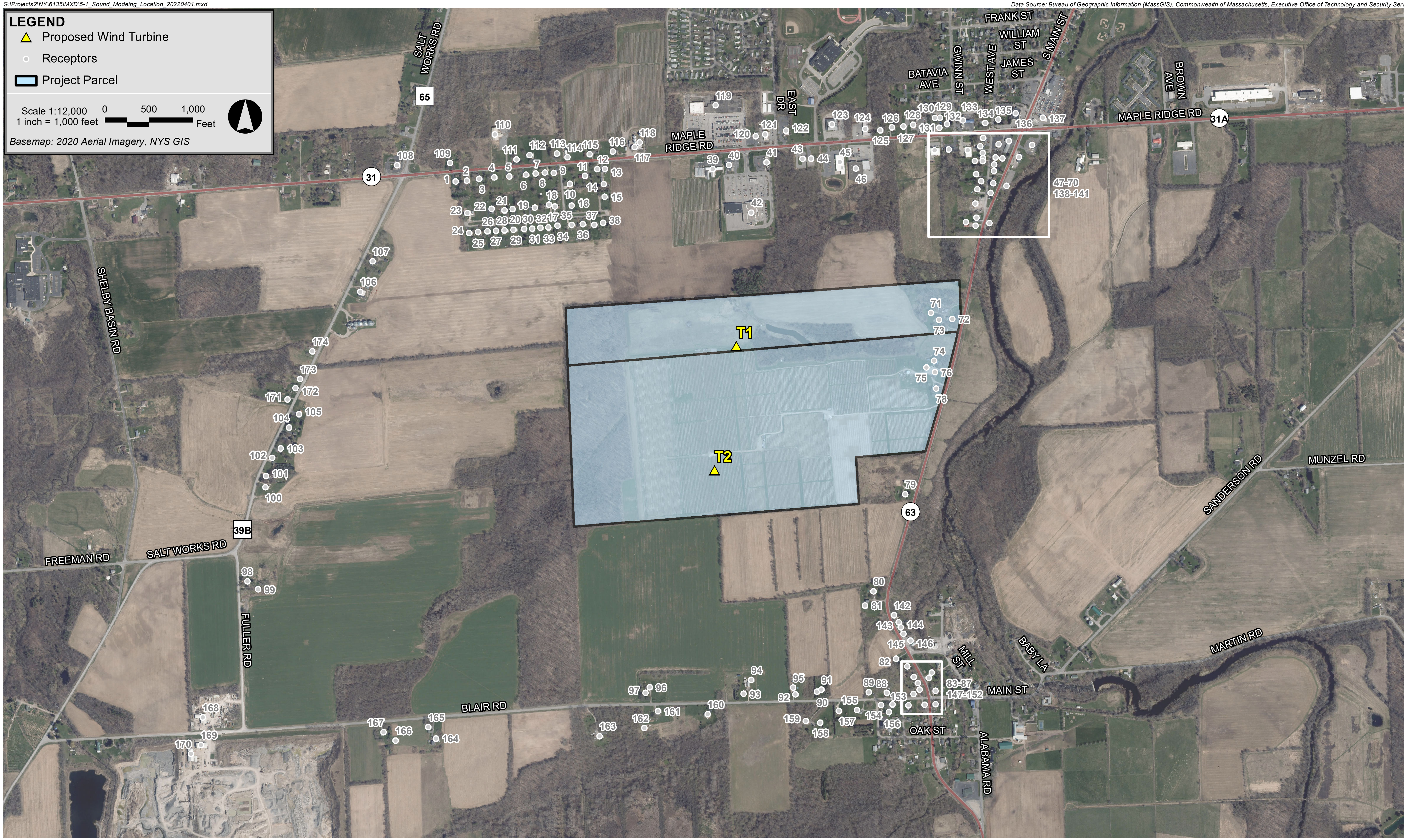

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Figure 5-1

Sound Modeling Locations

5.3 Sound Level Modeling Results

All modeled sound levels, as output from CadnaA are A-weighted equivalent sound levels (L_{eq}, dBA). Based on Epsilon's experience in conducting post-construction sound level measurement programs for wind energy facilities, the L_{10} sound level is approximately 1 dBA higher than the equivalent sound level (L_{eq}, dBA) when the wind turbine sound is prevalent and steady under ideal wind and operational conditions. Therefore, 1 dBA has been added to all modeled sound levels before comparison to the Town of Shelby's Bylaw L_{10} limit. Calculations were conducted at the 173 receptors modeled within the vicinity of the Project. In addition to the discrete modeling points, sound level isolines were generated from the modeling grid.

5.3.1 Project Only Results – V150-4.3

Table B-1 in Appendix B shows the predicted "Project Only" broadband (L_{10}, dBA) sound levels at the 173 receptors modeled in the vicinity of the Project. These broadband sound levels range from 28 to 43 dBA and represent the worst-case sound levels produced solely by the Project wind turbines. The highest predicted sound level of 43 dBA occurs at receptor #42. In addition to the discrete modeling points, sound level isolines generated from the modeling grid are presented in Figure 5-2.

5.3.2 Project Only Results – GE 3.4-140

Table B-2 in Appendix B shows the predicted "Project Only" broadband (L_{10}, dBA) sound levels at the 173 receptors modeled in the vicinity of the Project. These broadband sound levels range from 29 to 44 dBA and represent the worst-case sound levels produced solely by the Project wind turbines. The highest predicted sound level of 44 dBA occurs at receptor #42. In addition to the discrete modeling points, sound level isolines generated from the modeling grid are presented in Figure 5-3.

Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services

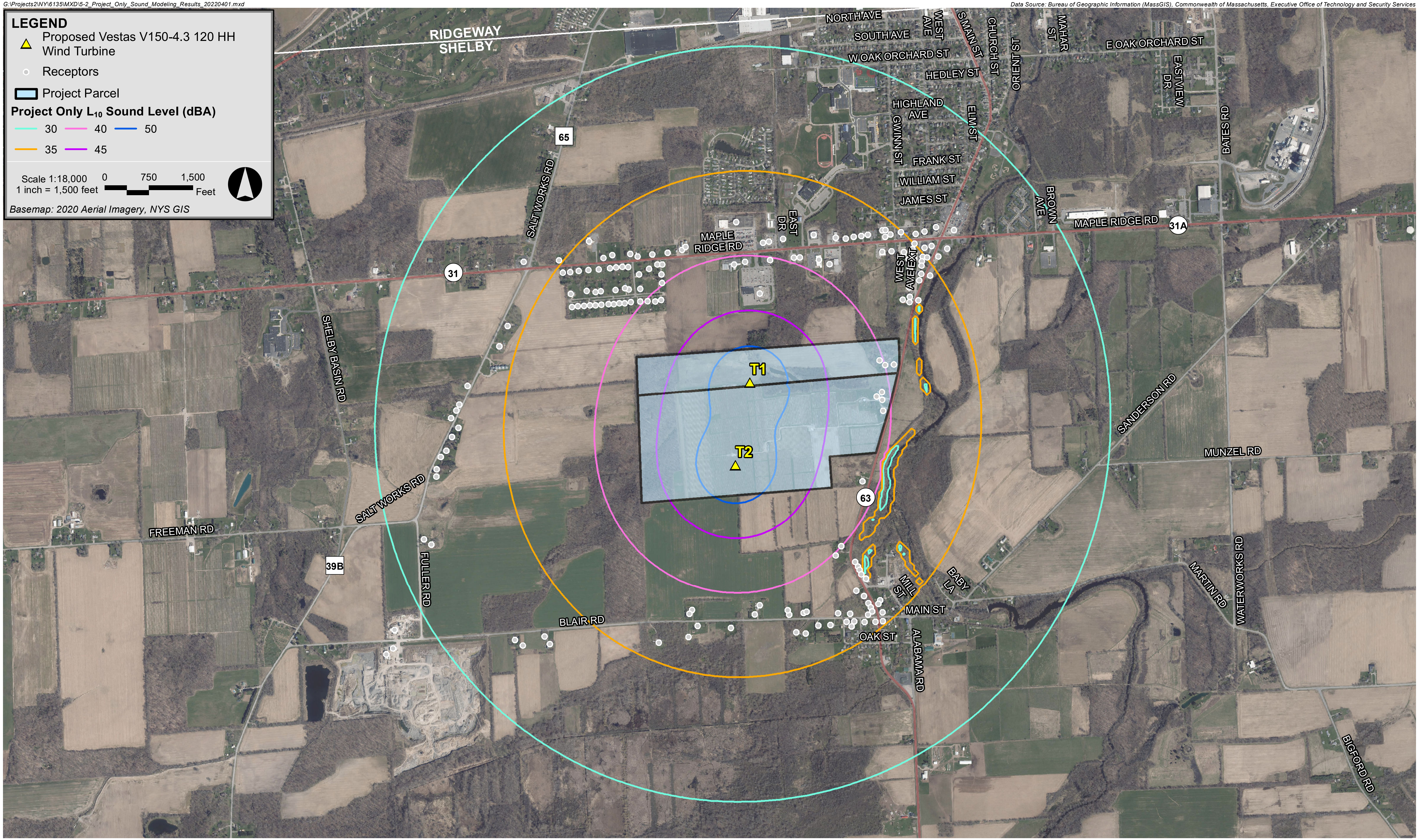

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Figure 5-2

Project Only Sound Level Modeling Results – Vestas V150-4.3

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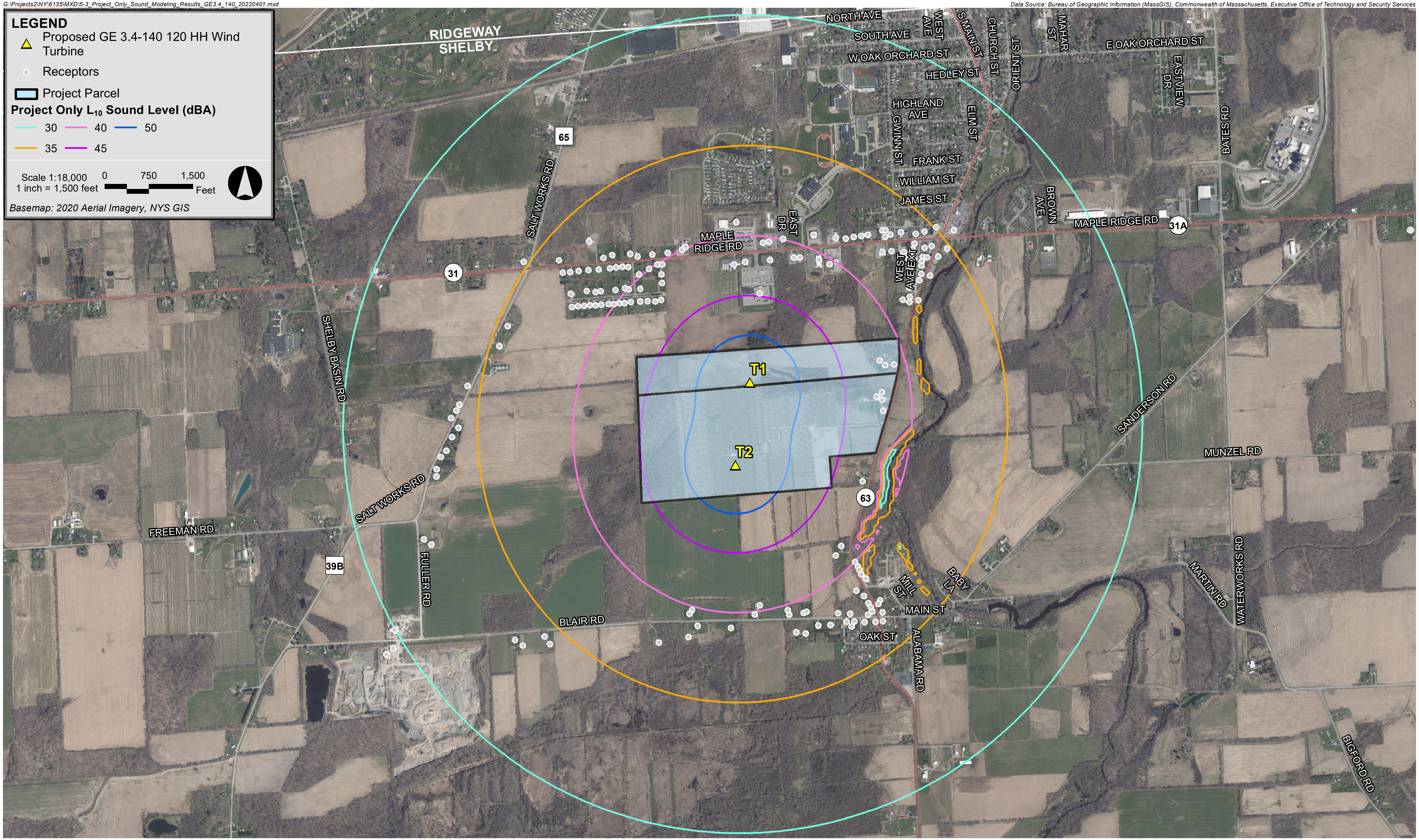
Data Source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services



Shelby Wind Orleans County, New York

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Figure 5-3

Project Only Sound Level Modeling Results – GE 3.4-140

6.0 EVALUATION OF SOUND LEVELS

The proposed Shelby Wind Project within Orleans County, New York is required to comply with the sound level requirements in the Zoning Local Law of the Town of Shelby, Orleans County, New York. The Local Law limit sound levels from wind turbines to 50 dBA at residences. Therefore, receptors within the Town of Shelby have been evaluated against the sound level limit of 50 dBA in this analysis.

All modeled sound levels, as output from CadnaA, are A-weighted equivalent sound levels (L_{eq}, dBA). Based on Epsilon's experience in conducting post-construction sound level measurement programs for wind energy facilities, the L_{10} sound level is approximately 1 dBA higher than the equivalent sound level (L_{eq}, dBA) when the wind turbine sound is prevalent and steady under ideal wind and operational conditions. Therefore, 1 dBA has been added to all modeled sound levels before comparison to the Town of Shelby's Bylaw L_{10} limit. These levels may be used in evaluating measured sound pressure levels over typical averaging durations, (i.e., 10 minutes or 1 hour). The highest predicted worst-case Project Only L_{10} sound level at a modeling receptor is 43 dBA with the Vestas V150-4.3 wind turbines, and 44 dBA with the GE 3.4-140 wind turbines. This occurs at receptor ID #42 for both modeling scenarios. All predicted worst-case Project Only L_{10} sound levels are below 50 dBA; therefore, the Project meets the requirements with respect to sound in the Local Law.

7.0 CONCLUSIONS

A comprehensive sound level modeling assessment was conducted for the proposed Shelby Wind Project. A total of two (2) wind turbines are included for this Project with two different scenarios. Sound levels resulting from the operation of these two scenarios were calculated at 173 discrete modeling points, and isolines were generated from a grid encompassing the area surrounding the wind turbines using the provided layout. The predicted sound levels at receptors in the Town of Shelby ranged from 28 to 43 dBA assuming Vestas V150-4.3 wind turbines, and 29 to 44 dBA assuming GE 3.4-140 wind turbines. Therefore, the Project meets the requirements with respect to sound in the Town of Shelby Local Law.

Appendix A

Wind Turbine Coordinates

Table A-1: Wind Turbine Coordinates

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD83 UTM Zone 17N (meters)	
			X (Easting)	Y (Northing)
1	Vestas V150 4.3 or GE 3.4-140	120	711203.89	4786388.16
2	Vestas V150 4.3 or GE 3.4-140	120	711128.92	4785959.76

Appendix B

Project Only Sound Level Modeling Results at Discrete Points

Table B-1: Sound Level Modeling Results Sorted by Receptor ID (V150-4.3)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
1	710235.63	4786955.88	35
2	710274.79	4786958.77	35
3	710317.50	4786965.68	35
4	710369.26	4786970.64	36
5	710421.51	4786973.37	36
6	710479.38	4786979.08	37
7	710512.36	4786983.45	37
8	710543.74	4786986.66	37
9	710574.83	4786985.95	37
10	710630.34	4786947.71	38
11	710681.72	4786975.49	38
12	710724.65	4786998.75	38
13	710750.99	4786999.82	38
14	710746.91	4786947.01	39
15	710750.29	4786903.51	39
16	710636.71	4786873.31	39
17	710578.05	4786869.51	38
18	710558.23	4786875.51	38
19	710509.02	4786866.21	38
20	710431.81	4786860.31	37
21	710404.91	4786856.37	37
22	710359.78	4786861.97	36
23	710276.88	4786847.35	36
24	710282.43	4786778.30	36
25	710313.33	4786781.97	36
26	710345.41	4786784.13	37
27	710375.49	4786786.62	37
28	710404.76	4786787.53	37
29	710435.13	4786790.02	38
30	710472.59	4786793.13	38
31	710499.87	4786793.97	38
32	710528.51	4786797.19	38
33	710555.82	4786797.26	39
34	710587.78	4786803.31	39
35	710636.62	4786806.38	39
36	710674.94	4786809.12	40
37	710714.27	4786806.84	40
38	710744.77	4786814.40	40
39	711122.65	4786998.64	40
40	711178.59	4787013.34	40
41	711308.64	4787022.57	40
42	711255.75	4786848.57	43

Table B-1: Sound Level Modeling Results Sorted by Receptor ID (V150-4.3)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
43	711432.47	4787034.83	39
44	711462.63	4787035.77	39
45	711561.71	4787022.98	39
46	711616.96	4787000.90	39
47	711889.56	4787064.15	36
48	711938.22	4787067.25	36
49	712002.77	4787063.71	35
50	712046.45	4787077.77	35
51	712056.57	4787106.66	35
52	712055.10	4787055.10	35
53	712055.83	4787036.79	35
54	712055.10	4787026.17	35
55	712026.91	4787026.91	35
56	712032.40	4786981.51	36
57	712049.24	4786957.35	36
58	712036.43	4786929.89	36
59	712029.11	4786880.47	36
60	712033.50	4786831.05	36
61	712030.57	4786803.59	37
62	711996.53	4786816.41	37
63	712109.28	4787085.48	34
64	712144.79	4787095.00	34
65	712099.40	4787039.35	35
66	712123.19	4787036.06	35
67	712094.64	4787015.56	35
68	712093.17	4786993.23	35
69	712091.71	4786950.39	35
70	712081.83	4786916.71	35
71	711875.46	4786502.73	40
72	711950.62	4786481.43	39
73	711904.18	4786478.32	40
74	711887.52	4786337.22	40
75	711860.28	4786314.44	40
76	711890.10	4786297.54	40
78	711894.09	4786241.43	40
79	711787.07	4785876.38	41
80	711678.31	4785540.99	40
81	711648.70	4785492.59	39
82	711755.68	4785308.60	37
83	711795.11	4785281.64	36
84	711817.14	4785245.41	36
85	711830.76	4785224.25	36

Table B-1: Sound Level Modeling Results Sorted by Receptor ID (V150-4.3)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
86	711837.14	4785201.64	35
87	711815.98	4785185.98	35
88	711723.51	4785190.04	36
89	711661.47	4785192.94	36
90	711482.53	4785194.01	37
91	711497.87	4785201.35	37
92	711408.14	4785185.67	38
93	711229.67	4785187.00	38
94	711256.03	4785235.04	39
95	711400.80	4785208.35	38
96	710905.44	4785209.45	38
97	710891.81	4785190.54	38
98	709517.31	4785575.19	31
99	709554.60	4785548.15	31
100	709579.99	4785900.09	32
101	709581.60	4785939.11	32
102	709602.98	4786002.18	32
103	709632.91	4786034.25	32
104	709661.24	4786106.41	32
105	709695.45	4786152.91	33
106	709907.20	4786575.68	34
107	709949.99	4786680.44	34
108	710033.60	4787012.42	33
109	710216.56	4787019.80	34
110	710370.99	4787119.15	35
111	710446.73	4787032.09	36
112	710491.49	4787047.83	36
113	710585.43	4787053.24	37
114	710622.31	4787040.95	37
115	710698.55	4787050.29	38
116	710778.72	4787059.63	38
117	710853.47	4787075.37	38
118	710871.18	4787091.11	38
119	711132.83	4787218.99	37
120	711271.53	4787112.26	39
121	711303.50	4787118.65	38
122	711375.79	4787131.93	38
123	711534.65	4787153.08	37
124	711649.25	4787138.33	37
125	711700.89	4787133.41	37
126	711742.21	4787142.75	36
127	711781.55	4787146.69	36

Table B-1: Sound Level Modeling Results Sorted by Receptor ID (V150-4.3)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
128	711815.00	4787152.59	36
129	711890.25	4787175.71	35
130	711906.97	4787176.69	35
131	711905.00	4787141.77	35
132	711932.05	4787154.07	35
133	711987.14	4787167.35	35
134	712063.86	4787158.00	34
135	712108.62	4787170.30	34
136	712168.13	4787192.43	33
137	712261.57	4787176.69	33
138	712225.67	4787081.77	34
139	712179.93	4787040.45	34
140	712137.14	4786940.61	35
141	712077.63	4786813.23	36
142	711749.09	4785458.25	38
143	711764.83	4785434.15	38
144	711772.21	4785417.42	38
145	711781.55	4785394.80	37
146	711805.65	4785371.19	33
147	711879.43	4785260.04	36
148	711869.10	4785242.33	36
149	711891.72	4785197.09	35
150	711892.28	4785151.59	35
151	711854.81	4785149.29	35
152	711798.60	4785147.64	35
153	711744.37	4785150.93	36
154	711704.60	4785148.96	36
155	711621.11	4785131.54	36
156	711730.24	4785123.98	35
157	711558.33	4785128.91	36
158	711493.57	4785088.15	36
159	711444.27	4785093.41	36
160	711105.71	4785116.75	37
161	710934.13	4785127.27	37
162	710887.13	4785069.41	36
163	710733.30	4785041.15	36
164	710168.27	4785033.26	33
165	710141.65	4785072.04	33
166	710028.90	4785026.03	32
167	709987.16	4785054.95	32
168	709363.57	4785105.89	29
169	709357.22	4785010.64	28

Table B-1: Sound Level Modeling Results Sorted by Receptor ID (V150-4.3)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
170	709322.29	4784979.95	28
171	709656.41	4786203.76	32
172	709683.55	4786243.22	32
173	709699.27	4786274.06	33
174	709741.82	4786369.95	33

Table B-2: Sound Level Modeling Results Sorted by Receptor ID (GE 3.4-140)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
1	710235.63	4786955.88	36
2	710274.79	4786958.77	36
3	710317.50	4786965.68	37
4	710369.26	4786970.64	37
5	710421.51	4786973.37	37
6	710479.38	4786979.08	38
7	710512.36	4786983.45	38
8	710543.74	4786986.66	38
9	710574.83	4786985.95	39
10	710630.34	4786947.71	39
11	710681.72	4786975.49	40
12	710724.65	4786998.75	40
13	710750.99	4786999.82	40
14	710746.91	4786947.01	40
15	710750.29	4786903.51	41
16	710636.71	4786873.31	40
17	710578.05	4786869.51	40
18	710558.23	4786875.51	39
19	710509.02	4786866.21	39
20	710431.81	4786860.31	38
21	710404.91	4786856.37	38
22	710359.78	4786861.97	38
23	710276.88	4786847.35	37
24	710282.43	4786778.30	38
25	710313.33	4786781.97	38
26	710345.41	4786784.13	38
27	710375.49	4786786.62	38
28	710404.76	4786787.53	39
29	710435.13	4786790.02	39
30	710472.59	4786793.13	39
31	710499.87	4786793.97	39
32	710528.51	4786797.19	40
33	710555.82	4786797.26	40
34	710587.78	4786803.31	40
35	710636.62	4786806.38	41
36	710674.94	4786809.12	41
37	710714.27	4786806.84	42
38	710744.77	4786814.40	42
39	711122.65	4786998.64	42
40	711178.59	4787013.34	41
41	711308.64	4787022.57	41
42	711255.75	4786848.57	44

Table B-2: Sound Level Modeling Results Sorted by Receptor ID (GE 3.4-140)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
43	711432.47	4787034.83	41
44	711462.63	4787035.77	40
45	711561.71	4787022.98	40
46	711616.96	4787000.90	40
47	711889.56	4787064.15	37
48	711938.22	4787067.25	37
49	712002.77	4787063.71	36
50	712046.45	4787077.77	36
51	712056.57	4787106.66	36
52	712055.10	4787055.10	36
53	712055.83	4787036.79	36
54	712055.10	4787026.17	36
55	712026.91	4787026.91	37
56	712032.40	4786981.51	37
57	712049.24	4786957.35	37
58	712036.43	4786929.89	37
59	712029.11	4786880.47	37
60	712033.50	4786831.05	38
61	712030.57	4786803.59	38
62	711996.53	4786816.41	38
63	712109.28	4787085.48	36
64	712144.79	4787095.00	35
65	712099.40	4787039.35	36
66	712123.19	4787036.06	36
67	712094.64	4787015.56	36
68	712093.17	4786993.23	36
69	712091.71	4786950.39	36
70	712081.83	4786916.71	37
71	711875.46	4786502.73	41
72	711950.62	4786481.43	40
73	711904.18	4786478.32	41
74	711887.52	4786337.22	42
75	711860.28	4786314.44	42
76	711890.10	4786297.54	42
78	711894.09	4786241.43	42
79	711787.07	4785876.38	42
80	711678.31	4785540.99	41
81	711648.70	4785492.59	41
82	711755.68	4785308.60	38
83	711795.11	4785281.64	38
84	711817.14	4785245.41	37
85	711830.76	4785224.25	37

Table B-2: Sound Level Modeling Results Sorted by Receptor ID (GE 3.4-140)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
86	711837.14	4785201.64	37
87	711815.98	4785185.98	37
88	711723.51	4785190.04	37
89	711661.47	4785192.94	38
90	711482.53	4785194.01	39
91	711497.87	4785201.35	39
92	711408.14	4785185.67	39
93	711229.67	4785187.00	39
94	711256.03	4785235.04	40
95	711400.80	4785208.35	39
96	710905.44	4785209.45	39
97	710891.81	4785190.54	39
98	709517.31	4785575.19	32
99	709554.60	4785548.15	32
100	709579.99	4785900.09	33
101	709581.60	4785939.11	33
102	709602.98	4786002.18	33
103	709632.91	4786034.25	33
104	709661.24	4786106.41	33
105	709695.45	4786152.91	34
106	709907.20	4786575.68	35
107	709949.99	4786680.44	35
108	710033.60	4787012.42	34
109	710216.56	4787019.80	36
110	710370.99	4787119.15	36
111	710446.73	4787032.09	37
112	710491.49	4787047.83	37
113	710585.43	4787053.24	38
114	710622.31	4787040.95	38
115	710698.55	4787050.29	39
116	710778.72	4787059.63	39
117	710853.47	4787075.37	40
118	710871.18	4787091.11	39
119	711132.83	4787218.99	39
120	711271.53	4787112.26	40
121	711303.50	4787118.65	40
122	711375.79	4787131.93	40
123	711534.65	4787153.08	39
124	711649.25	4787138.33	38
125	711700.89	4787133.41	38
126	711742.21	4787142.75	38
127	711781.55	4787146.69	37

Table B-2: Sound Level Modeling Results Sorted by Receptor ID (GE 3.4-140)

Receptor ID	Coordinates UTM NAD83 Zone 17N X (m)	Coordinates UTM NAD83 Zone 17N Y (m)	Source Only L_{10} Broadband Sound Level (dBA)
128	711815.00	4787152.59	37
129	711890.25	4787175.71	36
130	711906.97	4787176.69	36
131	711905.00	4787141.77	37
132	711932.05	4787154.07	36
133	711987.14	4787167.35	36
134	712063.86	4787158.00	35
135	712108.62	4787170.30	35
136	712168.13	4787192.43	34
137	712261.57	4787176.69	34
138	712225.67	4787081.77	35
139	712179.93	4787040.45	35
140	712137.14	4786940.61	36
141	712077.63	4786813.23	37
142	711749.09	4785458.25	40
143	711764.83	4785434.15	39
144	711772.21	4785417.42	39
145	711781.55	4785394.80	39
146	711805.65	4785371.19	35
147	711879.43	4785260.04	37
148	711869.10	4785242.33	37
149	711891.72	4785197.09	36
150	711892.28	4785151.59	36
151	711854.81	4785149.29	36
152	711798.60	4785147.64	36
153	711744.37	4785150.93	37
154	711704.60	4785148.96	37
155	711621.11	4785131.54	37
156	711730.24	4785123.98	37
157	711558.33	4785128.91	38
158	711493.57	4785088.15	37
159	711444.27	4785093.41	38
160	711105.71	4785116.75	39
161	710934.13	4785127.27	38
162	710887.13	4785069.41	38
163	710733.30	4785041.15	37
164	710168.27	4785033.26	34
165	710141.65	4785072.04	34
166	710028.90	4785026.03	33
167	709987.16	4785054.95	33
168	709363.57	4785105.89	30
169	709357.22	4785010.64	29

Table B-2: Sound Level Modeling Results Sorted by Receptor ID (GE 3.4-140)

Receptor ID	Coordinates UTM NAD83 Zone 17N		Source Only L_{10} Broadband Sound Level (dBA)
	X (m)	Y (m)	
170	709322.29	4784979.95	29
171	709656.41	4786203.76	33
172	709683.55	4786243.22	34
173	709699.27	4786274.06	34
174	709741.82	4786369.95	34