APPENDIX A

SOUND LEVEL TERMINOLOGY AND COMMON MEASURES
OF COMMUNITY NOISE
SOUND LEVEL TERMINOLOGY AND COMMON MEASURES OF COMMUNITY NOISE

The unit of sound pressure is the decibel (dB). The decibel scale is logarithmic to accommodate the wide range of sound intensities to which the human ear is subjected. A property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a sound of 70 dB is added to another sound of 70 dB, the total is only a 3-decibel increase (or 73 dB), not a doubling to 140 dB. Thus, every 3 dB increase represents a doubling of sound energy. For broadband sounds, a 3 dB change is the minimum change perceptible to the human ear. Table A-1 below gives the perceived change in loudness of different changes in sound pressure levels.¹

The acoustic energy level of a source is its sound power level (L_w), and L_w is also measured on a decibel scale, where the reference power is 10⁻¹² Watts. The sound power level (e.g., L_w of 110 dBA re 10⁻¹² W) is the same at any distance since it represents the energy intensity of a source. Thus, L_w values do not have reference distances. By contrast, a sound pressure level (e.g., L_p of 81 dBA re 20 µPa at 50 feet) must have a reference distance. Sound power levels are typically greater than 100 dBA in value and the large L_w numbers should not be confused with the sound pressure levels we hear.

TABLE A-1
SUBJECTIVE EFFECT OF CHANGES IN SOUND PRESSURE LEVELS

<table>
<thead>
<tr>
<th>CHANGE IN SOUND LEVEL</th>
<th>APPARENT CHANGE IN LOUDNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 dB</td>
<td>Just perceptible</td>
</tr>
<tr>
<td>5 dB</td>
<td>Noticeable</td>
</tr>
<tr>
<td>10 dB</td>
<td>Twice (or half) as loud</td>
</tr>
</tbody>
</table>

Non-steady noise exposure in a community is commonly expressed in terms of the A-weighted sound level (dBA); A-weighting approximates the frequency response of the human ear. Levels of many sounds change from moment to moment. Some are sharp impulses lasting 1 second or less, while others rise and fall over much longer periods of time. There are various measures of sound pressure designed for different purposes. To establish the background ambient sound level

in an area, the $L_{90}$ metric, which is the sound level exceeded 90 percent of the time, is typically used. The $L_{90}$ can also be thought of as the level representing the quietest 10 percent of any time period. This is a broadband sound pressure measure, i.e., it includes sounds at all frequencies. The $L_{eq}$, or equivalent sound level, is the steady-state sound level over a period of time that has the same acoustic energy as the fluctuating sounds that actually occurred during that same period. It is commonly referred to as the average sound level. The $L_{\text{max}}$, or maximum sound level, represents the one second peak level experienced during a given time period.

Sound level measurements typically include an analysis of the sound spectrum into its various frequency components to determine tonal characteristics. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves, and typically the frequency analysis examines eleven octave bands from 16 to 16,000 Hz. MassDEP Noise Policy states that a source creates a pure tone if acoustic energy is concentrated in a narrow frequency range and one octave band has a sound level 3 dB greater than both adjacent octave bands.

The acoustic environment in a suburban area such as Plymouth results from numerous sources and the major source is motor vehicle traffic on local roadways and cranberry bog operations around the site. Typical sound levels associated with various activities and environments are presented in Table A-2.
### TABLE A-2
COMMON SOUND LEVELS

<table>
<thead>
<tr>
<th>Sound Level (dBA)</th>
<th>Common Indoor Sounds</th>
<th>Common Outdoor Sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>Rock Band</td>
<td>Jet Takeoff at 1000’</td>
</tr>
<tr>
<td>100</td>
<td>Inside NYC Subway Train</td>
<td>Chain Saw at 3’</td>
</tr>
<tr>
<td>90</td>
<td>Food Blender at 3’</td>
<td>Impact Hammer (Hoe Ram) at 50’</td>
</tr>
<tr>
<td>80</td>
<td>Garbage Disposal at 3’</td>
<td>Diesel Truck at 100’</td>
</tr>
<tr>
<td>70</td>
<td>Vacuum Cleaner at 10’</td>
<td>Lawn Mower at 100’</td>
</tr>
<tr>
<td>60</td>
<td>Normal Speech at 3’</td>
<td>Auto (40 mph) at 100’</td>
</tr>
<tr>
<td>50</td>
<td>Dishwasher in Next Room</td>
<td>Busy Suburban Area at night</td>
</tr>
<tr>
<td>40</td>
<td>Empty Conference Room</td>
<td>Quiet Suburban Area at night</td>
</tr>
<tr>
<td>25</td>
<td>Empty Concert Hall</td>
<td>Rural Area at night</td>
</tr>
</tbody>
</table>
APPENDIX B

APPLICABLE STATE AND LOCAL NOISE STANDARDS
MASSDEP NOISE POLICY INTERPRETATION
Noise Pollution Policy Interpretation

Noise is a public health concern that falls within the scope of Massachusetts Department of Environmental Protection (MassDEP) authority as a form of regulated air pollution. See the related law, regulations, and policy: M.G.L. Chapter 111, Sections 142A-M, 310 CMR 7.00: Air Pollution Control, and MassDEP Noise Policy

Definitions (310 CMR 7.00)

- **Noise** is defined as "sound of sufficient intensity and/or duration as to cause a condition of air pollution."

- **Air pollution** means "the presence in the ambient air space of one or more air contaminants or combinations thereof in such concentrations and of such duration as to: (a) cause a nuisance; (b) be injurious, or be on the basis of current information, potentially injurious to human health or animal life, to vegetation, or to property; or (c) unreasonably interfere with the comfortable enjoyment of life and property or the conduct of business."

When Does MassDEP Evaluate Noise Impacts?

MassDEP evaluates how noise may affect people when 1) the agency reviews applications for approval under its air pollution regulations (310 CMR 7.02) for construction of facilities that will generate more than threshold amounts of pollutants such as nitrogen dioxide, sulfur dioxide, carbon monoxide, volatile organic compounds, particulate matter, and substances that are toxic in air; and 2) the agency responds to complaints from the public about noise generated by an existing source:

- When reviewing applications for pre-construction approval of new sources of air pollution, MassDEP examines the potential increase in sound levels over ambient conditions and the impacts of noise at both the source’s property line and at the nearest residence or other sensitive receptor (e.g., schools, hospitals) located in the area surrounding the facility and occupied at the time of the permit review. Please note: **MassDEP requires that an air approval be obtained when a proposed facility is expected to emit more than threshold amounts of specific pollutants. If noise is the only air pollutant expected to be emitted by a facility, a pre-construction air approval is not required.**

- When MassDEP responds to a complaint about an existing source of noise, it focuses on protecting affected people at their residences and in other buildings that are occupied by sensitive receptors from nuisances and the public health effects of the noise. Please note: **An existing source of sound may or may not have needed a MassDEP air approval before it was built.**
Where Are MassDEP's Noise Criteria Applied?

The MassDEP noise pollution policy describes criteria that MassDEP uses to evaluate noise impacts at both the property line and the nearest occupied residence or other sensitive receptor. When noise is found to be a nuisance or a threat to health, MassDEP requires the source to mitigate its noise.

Noise levels that exceed the criteria at the source's property line by themselves do not necessarily result in a violation or a condition of air pollution under MassDEP regulations (see 310 CMR 7.10 U). The agency also considers the effect of noise on the nearest occupied residence and/or building housing sensitive receptors:

- In responding to complaints, MassDEP measures noise levels at the complainant's location and at other nearby locations that may be affected (e.g., residences and/or buildings with other sensitive receptors). If the noise level at a sensitive receptor's location is more than 10 dB(A) above ambient, MassDEP requires the noise source to mitigate its impact.

- A new noise source will be required to mitigate its sound emissions if they are projected to cause the broadband sound level at a residence or building housing sensitive receptors to exceed ambient background by more than 10 dB(A).

- A new noise source that would be located in an area that is not likely to be developed for residential use in the future (e.g., due to abutting wetlands or similarly undevelopable areas), or in a commercial or industrial area with no sensitive receptors may not be required to mitigate its noise impact on those areas, even if projected to cause noise levels at the facility’s property line to exceed ambient background by more than 10 dB(A). However, a new noise source that would be located in an area in which housing or buildings containing other sensitive receptors could be developed in the future may be required to mitigate its noise impact in these areas.

This policy has been designed to protect affected residents and other sensitive occupants of nearby property, but not necessarily uninhabited areas in and around the source’s property. Sources of noise may need to implement mitigation if residences or buildings occupied by sensitive receptors are developed where they may be affected by the source’s noise.
PLYMOUTH ZONING BYLAW WIND ENERGY FACILITIES
L) Prohibited Uses

The following uses are prohibited in a TRVD:

a. Wholesale sales or bulk storage of petroleum based fuels, including but not limited to home heating oil, diesel fuel, kerosene or gasoline; sales, services, rentals, repairs, storage or salvage of motor vehicles, recreational vehicles, or other gasoline or diesel powered engines, motors, or generators; major automotive garages, body shops, any garage conducting repairs out of doors, tire recapping and retreading; automobile salvage yards; trucking and freight terminals;

b. Exterior storage of products or merchandise in substantial quantities; exterior storage of junk, scrap, salvage, any secondhand materials; exterior storage of bulk petroleum products; interior storage or transmission of refined petroleum products in such a way that rupture of the storage tank will result in direct leakage into the ground; disposal of liquid or leachable wastes, including landfilling of sludge and septage; use of septic cleaners containing toxic organic chemicals; open or leachable storage of road salt or deicing chemicals; use of sodium chloride for ice control; disposal or stockpiling of snow or ice from outside the property; storage, generation, treatment or disposal of hazardous wastes; production, manufacture, or warehousing of hazardous or toxic substances; landfills or open dumps; storage of commercial fertilizers except in an approved storage structure; storage of animal manure unless contained; storage of any products, materials, or vehicles in connection with manufacturing or commercial uses not on the property;

c. Drive-in movie theaters; massage parlors; casinos; betting establishments, gaming establishments (except for the sale of government sponsored lottery or gaming programs) and racetracks and firing ranges;

d. Adult uses, including adult book stores, adult motion picture theaters, adult dance clubs, adult paraphernalia stores, adult video stores and other such uses under G.L. c. 40A § 9A; adult dance clubs, including entertainment establishments allowing one or more individuals to perform the state of nudity, as defined under G.L. c. 272 §31

§ 205-73 Wind Energy Facilities [Added 10-24-05 FTM by Article 22; Amended 10-23-06 FTM by Art. 32]

A. Purpose. The purpose of this bylaw is to encourage by special permit the use of wind energy and to minimize the impacts of wind facilities on the character of neighborhoods, on property values, on the scenic, historic, and environmental resources of the Town; and to protect health and safety, while allowing wind energy technologies to be utilized.

B. Definitions.

WIND FACILITY - All equipment, machinery and structures utilized in connection with wind-generated energy production and generation, including accessory transmission, distribution, collection, storage or supply systems whether underground, on the surface, or overhead and other equipment or byproducts in connection therewith
and the sale of the energy produced thereby, including but not limited to, wind turbine (rotor, electrical generator and tower) and accessory anemometers (wind measuring equipment), transformers, substation, power lines, control and maintenance facilities, site access and service roads.

WIND FACILITY, MUNICIPAL - A wind facility located on town owned property which is designed to provide its electrical output, or of the value thereof, for the use or benefit of the town and without regard to the ownership of the structure or equipment. A third party may own and operate with an agreed upon financial percentage of revenues benefiting the town.

CAPACITY FACTOR - The wind turbine’s actual energy output for the year divided by the energy output if the machine operated at its rated power output for the entire year.

C. Location and area requirements.

A wind facility may be erected by special permit subject to Environmental Design Conditions on land that contains a minimum of five (5) acres. The SPGA (Special Permit Granting Authority) may allow more than one wind turbine if it determines that the location is favorable to the clustering of wind turbines.

D. Planning Principles and design requirements.

Unless otherwise expressly provided by this section of the bylaw all requirements of the underlying zoning district shall apply and in addition the following design standards shall apply:

(1) All equipment necessary to monitor and operate the wind facility should be contained within the turbine tower unless technically infeasible. In which case, ancillary equipment may be located outside the tower, provided it is contained either within an underground vault, or enclosed within a separate structure or behind a year-round landscape or vegetated buffer.

(2) All utility connections from the wind facility site shall be underground except to the extent that underground utilities are not feasible in the determination of the SPGA. Electrical transformer for utility interconnections may be above ground if required by the utility provider.

(3) Clearing of natural vegetation shall be limited to that which is necessary for the construction, operation and maintenance of the wind facility.

(4) Wind turbines shall be lighted only if required by the Federal Aviation Administration (FAA). The proponent shall provide a copy of the FAA’s determination to establish the required markings and/or lights for the structure. Lighting of equipment structures and any other facilities on site (except lighting required by the FAA) shall be shielded from abutting properties.

(5) The wind facility shall be set back no less than a distance equal to the overall height of the wind turbine from the nearest lot line and shall be a minimum of 100 feet from any lot line. For purposes of calculating setbacks, the overall height of a wind turbine, the total height shall be measured from the average natural grade within the footprint of the supporting structure, to the uppermost extension of any blade or other part of the wind turbine.

(6) Wind facilities shall have a maximum height of 350-feet, as measured from the natural grade to the top of the hub were the rotor attaches.
(7) Wind facilities shall be a neutral, non-reflective color designed to blend with the surrounding environment.

(8) Noise. Except during short-term events such as high windstorms or utility outages, noise from the proposed wind turbine shall not exceed 60 dBA as measured from the nearest property line. This standard may be met through a 600-foot setback from the nearest property line. Reductions may be granted by the SPGA if the applicant can demonstrate through scientific analysis that the noise levels will not exceed 60 dBA at the property line.

(9) Shadowing/Flicker. The wind facility shall be sited in a manner that does not result in significant shadowing or flicker impacts. The proponent has the burden of proving that this effect does not have significant adverse impact on neighboring or adjacent uses either through siting or mitigation.

(10) Removal. The owner or his successors in interest shall remove any wind facility the use of which has been discontinued. At the time of removal, the wind facility site shall be restored to its natural state or to any other legally authorized use. All wind turbines and appurtenant structures shall also be removed. The SPGA shall require that escrow account or other suitable surety be established to ensure adequate funds are available for removal. Municipal wind facilities shall be exempt from the surety requirement. The amount of such surety shall be equal to 150 percent of the cost of compliance with this section. The applicant shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The amount shall include a mechanism for a Cost of Living Adjustment after 10 and 15 years.

(11) The wind facility shall be designed to prevent unauthorized site access.

E. Administration.

For this Section of the Zoning Bylaw, the Zoning Board of Appeals shall be the special permit granting authority (SPGA). In reviewing a Wind Facility, the SPGA shall be governed by the special permit and environmental design conditions and procedures as specified in § 205-9.

A special permit may be granted under this section if the SPGA finds that each of the design standards set forth have been met and that

1. There is no feasible alternative to the proposed height,

2. It is the minimum necessary

3. There is a clear and specific public benefit which may be realized only by exceeding 35 feet in height, and

4. The proposed structure will not in any way detract from the visual character or quality of the adjacent buildings, the neighborhood, or the Town as a whole.

The SPGA may impose, in addition to any applicable conditions specified in this section, such conditions as it finds reasonably appropriate to safeguard the neighborhood or otherwise serve the purposes of this section, including, but not limited to: screening, lighting, fences, modification of the exterior appearance of the structures, limitation upon size, method of access or traffic features, parking, removal upon cessation of use or other requirements.
The applicant must demonstrate that the wind facility operates at a capacity factor in excess of 25 percent.

The SPGA may require the proponent to provide or pay for professional consultants to evaluate the proposal to determine the acceptability of geographic location, to analyze the loading capacities of the proposed structures, and to review camouflage and screening techniques.

F. Application for Special Permit. The following information must be submitted for an application to be considered complete:

(1) A locus plan at a scale of 1" = 200' which shall show all property lines, the exact location of the proposed structure(s), street landscape features, dwellings and other structures within one-hundred (100) feet of the property line.

(2) A one-inch-equals-40 feet vicinity plan, signed and sealed by a Registered Professional Engineer or Licensed Surveyor showing the following:

a) Property lines for the subject property and all properties adjacent to the subject property within 300 feet.

b) Outline of all existing buildings, including purpose (e.g., residential buildings, garages, accessory structures, etc.) on subject property and all adjacent properties within 300 feet. Distances, at grade, from the proposed wind facility to each building on the vicinity plan shall be shown.

c) Proposed location of the wind facility, including all turbines, fencing, associated ground equipment, transmission infrastructure and access roads.

(3) Location of all roads, public and private, on the subject property and on all adjacent properties within 300 feet including driveways proposed to serve the wind facility.

(4) All proposed changes to the existing property, including grading, vegetation removal and temporary or permanent roads and driveways,

(5) Representations, dimensioned and to scale, of the proposed facility, including cable locations, parking areas and any other construction or development attendant to the wind facility.

(6) Tree cover and average height of trees on the subject property and adjacent properties within 300 feet.

(7) Contours at each two feet Above Mean Sea Level (AMSL) for the subject property and adjacent properties within 300 feet.

(8) Representation of location of viewpoint for the sight-line diagram referenced below.

(9) Sight lines and photographs.

a) Sight-line representation. A sight-line representation shall be drawn from representative locations that show the lowest point of the turbine tower visible from each location. Each sight line shall be depicted in profile, drawn at one inch equals 40 feet. The profiles shall show all intervening trees and buildings. There shall be at least two sight line representations illustrating the visibility of the facility from surrounding areas such as the closest habitable structures or nearby public roads or areas.
b) Existing (pre-development) photographs. A color photograph of the current view shall be submitted from at least two locations to show the existing situation.

c) Proposed (post development). Each of the existing-condition photographs shall have the proposed wind facility superimposed on it to accurately simulate the proposed wind facility when built and illustrate its total height, width and breadth.

(10) Elevations. Siting elevations, or views at-grade from the north, south, east and west for a 50-foot radius around the proposed wind facility.

(11) Materials.

a) Manufacturer’s specifications for the proposed wind facility shall be provided for all equipment and attendant facilities.

b) Component materials of the proposed wind facility specified by type and specific treatment.

c) Colors of the proposed wind facility represented by a color board showing actual colors proposed.

(12) Landscape plan. A Landscape plan including existing trees and shrubs and those proposed to be added or removed, identified by size of specimen at installation and species.

(13) Other requirements.

a) Confirmation that the wind facility complies with all applicable Federal and State standards.

b) If applicable, a written statement that the proposed wind facility complies with, or is exempt from applicable regulations administered by the Federal Aviation Administration (FAA), Massachusetts Aeronautics Commission and the Massachusetts Department of Public Health.

c) Within 30 days of the pre-application conference, or within 21 days of filing an application for a Special Permit, the applicant shall arrange for a balloon or crane test at the proposed site to illustrate the height of proposed facility. The date, time and location of such test shall be advertised in a newspaper of general circulation in the town at least 14 days, but not more than 21 days prior to the test.

§ 205-74. Cordage Park Smart Growth District (CPSGD) [Added 5-20-06 SPTM by Article 13].

A. Purposes. The purposes of the Cordage Park Smart Growth District are:

(1) To provide an opportunity for residential and mixed-use development within a distinctive, attractive and livable environment that supports the commercial revitalization of Cordage Park and the North Plymouth Village Service Area.

(2) To promote continuing development and redevelopment in Cordage Park that is pedestrian friendly and consistent with Plymouth history and architecture.
APPENDIX C

GAMESA G-97 POWER CURVE
### TABLE A

**G97 2.0 MW WIND TURBINE SOUND POWER CURVE**  
(100 METER HUB HEIGHT)

<table>
<thead>
<tr>
<th>$W_{10}^1$ (m/s)</th>
<th>$W_s^2$ (m/s)</th>
<th>SPL (dB(A))</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4.3</td>
<td>95.3</td>
</tr>
<tr>
<td>4</td>
<td>5.8</td>
<td>96.2</td>
</tr>
<tr>
<td>5</td>
<td>7.2</td>
<td>100.3</td>
</tr>
<tr>
<td>6</td>
<td>8.7</td>
<td>103.7</td>
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<tr>
<td>7</td>
<td>10.1</td>
<td>105.8</td>
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<td>8</td>
<td>11.6</td>
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<td>9</td>
<td>13.0</td>
<td>105.8</td>
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<tr>
<td>10</td>
<td>14.5</td>
<td>105.8</td>
</tr>
</tbody>
</table>

1. Wind Speeds at 10 meters above ground level.  
2. Wind Speeds at 100 meters above ground level.
G97 2.0 MW Wind Turbine Power Curve and Noise Emission Levels (100 Meter Turbine Height)

- **Sound Power Level**
- **Power Production**
APPENDIX D

EXAMPLE FIELD LOG SHEET
AND
MONITORING LOCATIONS PHOTOS
EXAMPLE FIELD LOG SHEET
<table>
<thead>
<tr>
<th>Time Period</th>
<th>Accepted</th>
<th>Car</th>
<th>Wind</th>
<th>Other</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00 - 0:05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0:05 - 0:10</td>
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<td>0:10 - 0:15</td>
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<td>5:25 - 5:30</td>
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</table>
MONITORING LOCATIONS PHOTOS
Monitoring Location 1 (ML-1) – 122 Bournehurst Drive (North of Turbine 5 (T5))
Monitoring Location 2 (ML-2) – 9 Shady Pine Lane (West of Turbine 3 (T3) and Turbine 4 (T4))

Monitoring Location 3 (ML-3) – Morning Mist Lane (West of Turbine 1 (T1))
Monitoring Location 4 (ML-4) – 14 Morning Mist Lane (Southwest of Turbine 1 (T1))
Monitoring Location (ML-5) – 680 Head of the Bay Road (Southeast of Turbine 1 (T1))
APPENDIX E

TURBINE-ON $L_{\text{max}}-L_{90}$ SUMMARY GRAPHS
1-Second Sound Levels at ML-1 With Turbines Operating
12:05 AM - 12:20 AM (August 23, 2017)

48.8 - 46.9 = 1.9 dBA increase over ambient applying DEP method

Wind Gusts

1-Second Measurements

Ambient L90

DEP Limit (Ambient +10 dBA)

Sound Level (dBA)

Time
1-Second Sound Levels at ML-1 With Turbines Operating
1:30 AM - 1:45 AM (August 23, 2017)

46.6 - 44.4 = 2.2 dBA increase over ambient applying DEP method

Sound Level (dBA)

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)

Wind Gusts
Airplane

46.6 - 44.4 = 2.2 dBA increase over ambient applying DEP method

46.7
Max 1-Sec

46.5
Max 1-Sec

46.6
Average Max 1-Sec

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-5 With Turbines Operating
11:00 PM - 11:15 PM (August 31, 2017)

41.0 - 36.0 = 5.0 dBA increase over ambient applying DEP method

40.8
41.0 Max 1-Sec
41.1
41.0 Average Max 1-Sec
41.0 Max 1-Sec
46.0
36.0
1-Second Sound Levels at ML-5 With Turbines Operating
11:15 PM - 11:30 PM (August 31, 2017)

1-Second Measurements

Ambient L90: 40.6 dB
Max 1-Sec: 46.0 dB
Average Max 1-Sec: 40.2 dB
Max 1-Sec: 36.0 dB

40.2 - 36.0 = 4.2 dB increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
12:50 AM - 1:05 AM (September 1, 2017)

39.4 - 35.2 = 4.2 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
1:05 AM - 1:20 AM (September 1, 2017)

40.6 - 35.2 = 5.4 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-2 With Turbines Operating
11:00 PM - 11:15 PM (September 18, 2017)

47.9 - 48.0 = 0.6 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-2 With Turbines Operating
11:15 PM - 11:30 PM (September 18, 2017)

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)

48.4 - 47.4 = 1.0 dBA increase over ambient applying DEP method

- Max 1-Sec
- Average Max 1-Sec
1-Second Sound Levels at ML-3 With Turbines Operating
2:30 AM - 2:45 AM (September 19, 2017)

44.4 - 42.8 = 1.6 dBA increase over ambient applying DEP method

44.5 Max 1-Sec

44.7 Max 1-Sec

44.4 Average Max 1-Sec

42.8

52.8
1-Second Sound Levels at ML-3 With Turbines Operating
2:45 AM - 3:00 AM (September 19, 2017)

43.9 - 42.8 = 1.1 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-4 With Turbines Operating
12:45 AM - 1:00 AM (September 19, 2017)

41.8 - 39.8 = 2.0 dBA increase over ambient applying DEP method

41.4 Max 1-Sec

41.9 Max 1-Sec

41.8 Average Max 1-Sec

42.0 Max 1-Sec

49.8

39.8

Wind

People

Trucks
1-Second Sound Levels at ML-4 With Turbines Operating
1:00 AM - 1:15 AM (September 19, 2017)

41.2 - 39.8 = 1.4 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-2 With Turbines Operating
1:15 AM - 1:30 AM (September 20, 2017)

50.3 - 49.7 = 0.6 dBA increase over ambient applying DEP method

50.2 Max 1-Sec

50.5 Max 1-Sec

50.3 Max 1-Sec

50.3 Average Max 1-Sec

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-2 With Turbines Operating
1:30 AM - 1:45 AM (September 20, 2017)

49.5 - 48.9 = 0.6 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-2 With Turbines Operating
3:00 AM - 3:15 AM (September 20, 2017)

50.3 - 48.9 = 1.4 dBA increase over ambient applying DEP method

Wind

Car

Wind

58.9

48.9

50.6

Max 1-Sec

Max 1-Sec

49.9

Max 1-Sec

50.4

Average Max 1-Sec

50.3

Ambient L90

DEP Limit (Ambient +10 dBA)

1-Second Measurements

Time

3:00 AM 3:05 AM 3:10 AM 3:15 AM
1-Second Sound Levels at ML-3 With Turbines Operating
1:15 AM - 1:30 AM (September 20, 2017)

44.2 - 41.6 = 2.6 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-3 With Turbines Operating
1:30 AM - 1:45 AM (September 20, 2017)

45.1 - 41.2 = 3.9 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-3 With Turbines Operating
3:00 AM - 3:15 AM (September 20, 2017)

44.8 - 41.2 = 3.6 dBA increase over ambient applying DEP method

45.3

Max 1-Sec

44.5

Max 1-Sec

44.8

Average Max 1-Sec

41.2

51.2
1-Second Sound Levels at ML-3 With Turbines Operating
3:15 AM - 3:30 AM (September 20, 2017)

- Ambient L90
- DEP Limit (Ambient +10 dBA)

44.2 Max 1-Sec
44.5 Average Max 1-Sec
45.0 Max 1-Sec

Wind

44.5 - 41.2 = 3.3 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-3 With Turbines Operating
3:30 AM - 3:45 AM (September 20, 2017)

44.7 - 41.2 = 3.5 dBA increase over ambient applying DEP method

Wind

44.1
Max 1-Sec

45.1
Max 1-Sec

44.7
Average Max 1-Sec

41.2

51.2

3:30 AM 3:35 AM 3:40 AM 3:45 AM

Time

Sound Level (dBA)
### 1-Second Sound Levels at ML-4 With Turbines Operating

**1:15 AM - 1:30 AM (September 20, 2017)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Ambient L90</th>
<th>DEP Limit (Ambient +10 dBA)</th>
<th>Max 1-Sec</th>
<th>Average Max 1-Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:15 AM</td>
<td>43.2</td>
<td>53.6</td>
<td>45.7</td>
<td>44.8</td>
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<td>1:20 AM</td>
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<td>1:30 AM</td>
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- **44.8 - 43.6 = 1.2 dBA increase over ambient applying DEP method**

The chart shows 1-second sound levels with annotations for ambient, DEP limits, and max 1-sec measurements. The graph also highlights specific readings for car and wind conditions, with max 1-sec values noted at various times.
1-Second Sound Levels at ML-4 With Turbines Operating
1:30 AM - 1:45 AM (September 20, 2017)

1-Second Measurements

Ambient L90

DEP Limit (Ambient +10 dBA)

46.3 - 43.6 = 2.8 dBA increase over ambient applying DEP method

46.4 - 43.6 = 2.8 dBA increase over ambient applying DEP method

46.1 Max 1-Sec

46.3 Max 1-Sec

46.9 Max 1-Sec

46.4 Average Max 1-Sec

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-4 With Turbines Operating
3:00 AM - 3:15 AM (September 20, 2017)

47.4 - 43.6 = 3.8 dBA increase over ambient applying DEP method

Wind

47.4
Max 1-Sec

46.3
Max 1-Sec

48.5
Max 1-Sec

47.4
Average Max 1-Sec

3:00 AM 3:05 AM 3:10 AM 3:15 AM

Sound Level (dBA)
1-Second Sound Levels at ML-4 With Turbines Operating
3:15 AM - 3:30 AM (September 20, 2017)

47.3 - 43.6 = 3.7 dBA increase over ambient applying DEP method

Wind

53.6

47.6
Max 1-Sec

48.5
Max 1-Sec

47.3
Average Max 1-Sec

45.8
Max 1-Sec

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-1 With Turbines Operating
12:25 AM - 12:40 AM (October 4, 2017)

33.4 - 27.9 = 5.5 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-1 With Turbines Operating
12:40 AM - 12:55 AM (October 4, 2017)

33.5 - 27.9 = 5.6 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-1 With Turbines Operating
2:00 AM - 2:15 AM (October 4, 2017)

34.0 - 28.1 = 5.9 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-1 With Turbines Operating
2:20 AM - 2:35 AM (October 4, 2017)

33.1 - 28.1 = 5.0 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
11:00 PM - 11:15 PM (October 16, 2017)

41.3 - 31.5 = 9.8 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
11:15 PM - 11:30 PM (October 16, 2017)

41.7 - 31.5 = 10.2 dBA increase over ambient applying DEP method

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<tr>
<th>Time</th>
<th>Max 1-Sec</th>
<th>Average Max 1-Sec</th>
<th>Max 1-Sec</th>
<th>Wind</th>
<th>Car</th>
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<tr>
<td>11:15</td>
<td>41.5</td>
<td>31.5</td>
<td>42.2</td>
<td>Wind</td>
<td>Car</td>
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<td>11:20</td>
<td>41.3</td>
<td>31.5</td>
<td>41.7</td>
<td>Wind</td>
<td>Car</td>
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<td>31.5</td>
<td>Wind</td>
<td>Car</td>
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<td>11:30</td>
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<td>41.5</td>
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1-Second Sound Levels at ML-5 With Turbines Operating
12:40 AM - 12:55 AM (October 17, 2017)

40.8 - 31.5 = 9.3 dBA increase over ambient applying DEP method

Wind
Car
Wind
Car
Wind
Car
Car

40.8 - 31.5 = 9.3 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
11:35 PM - 11:50 PM (November 3, 2017)

43.8 - 34.6 = 9.2 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
1:10 AM - 1:25 AM (November 4, 2017)

- Ambient L90: 35.5 dB
- DEP Limit (Ambient +10 dBA): 38.5 dB

Cars:
- Max 1-Sec: 35.6 dB
- Average Max 1-Sec: 35.5 dB
- Difference: 7.0 dB increase over ambient applying DEP method

Birds:
- Max 1-Sec: 35.6 dB

35.5 - 28.5 = 7.0 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
1:25 AM - 1:40 AM (November 4, 2017)

- Ambient L90: 37.0 dB
- Max 1-Sec: 37.2 dB
- Average Max 1-Sec: 36.8 dB

Cars: 37.0 - 28.5 = 8.5 dBA increase over ambient applying DEP method

Birds: 38.5 dB
1-Second Sound Levels at ML-2 With Turbines Operating
11:40 PM - 11:55 PM (November 4, 2017)

44.4 - 38.3 = 6.1 dBA increase over ambient applying DEP method

44.5 Max 1-Sec

43.0 Max 1-Sec

45.8 Max 1-Sec

44.4 Average Max 1-Sec

Highway

Ambient L90

DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-2 With Turbines Operating
11:55 PM - 12:10 AM (November 4-5, 2017)

45.3 - 38.3 = 7.0 dBA increase over ambient applying DEP method

Highway

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-2 With Turbines Operating
12:10 AM - 12:25 AM (November 5, 2017)

45.3 - 38.3 = 7.0 dBA increase over ambient applying DEP method

45.3
45.2
45.5

Max 1-Sec
Max 1-Sec
Max 1-Sec

Average Max 1-Sec

48.3
38.3

Highway
Highway

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-2 With Turbines Operating
2:15 AM - 2:30 AM (November 5, 2017)

33.9 - 23.9 = 10.0 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-3 With Turbines Operating
2:00 AM - 2:15 AM (November 5, 2017)

31.1 - 26.1 = 5.0 dBA increase over ambient applying DEP method

1-Second Measurements
- Ambient L90
- DEP Limit (Ambient + 10 dBA)
30.5 - 26.1 = 4.4 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-4 With Turbines Operating
11:55 PM - 12:10 AM (November 4-5, 2017)

39.3 - 29.9 = 9.4 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-4 With Turbines Operating
12:10 AM - 12:25 AM (November 5, 2017)

39.7 - 29.9 = 9.8 dBA increase over ambient applying DEP method

1-Second Measurements

- Ambient L90
- DEP Limit (Ambient +10 dBA)

Sound Level (dBA)

Time

12:10 AM
12:15 AM
12:20 AM
12:25 AM

Car
Wind
Airplane
Car
Truck
Airplane

39.7 - 29.9 = 9.8 dBA increase over ambient applying DEP method

40.9 Max 1-Sec
38.4 Max 1-Sec
39.9 Max 1-Sec
39.7 Average Max 1-Sec

29.9
39.9
1-Second Sound Levels at ML-5 With Turbines Operating
12:55 AM - 1:10 AM (November 11, 2017)

32.9 - 26.8 = 6.1 dBA increase over ambient applying DEP method

- Airplane
  - Ambient L90: 32.6 dBA
  - Max 1-Sec: 34.6 dBA
  - Average Max 1-Sec: 32.9 dBA

- Car
  - Ambient L90: 31.5 dBA
  - Max 1-Sec: 32.8 dBA
  - Average Max 1-Sec: 31.5 dBA

- Highway
  - Ambient L90: 36.8 dBA
  - Max 1-Sec: 36.8 dBA

- DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-5 With Turbines Operating
1:10 AM - 1:25 AM (November 11, 2017)

35.0 - 26.8 = 8.2 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating  
1:25 AM - 1:40 AM (November 11, 2017)

34.6 - 26.8 = 7.8 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-4 With Turbines Operating
11:00 PM - 11:15 PM (March 5, 2018)

44.2 - 34.7 = 9.5 dBA increase over ambient applying DEP method
A chart showing 1-Second Sound Levels at ML-4 with Turbines Operating from 11:30 PM to 11:45 PM (March 5, 2018).

- **Ambient L90**: 44.7 dBA
- **Max 1-Sec**: 45.2 dBA
- **DEP Limit (Ambient +10 dBA)**: 54.7 dBA
- **Increase over Ambient**: 9.8 dBA

The chart indicates a 9.8 dBA increase over ambient applying the DEP method.
1-Second Sound Levels at ML-4 With Turbines Operating
11:50 PM - 12:05 PM (March 5-6, 2018)

44.6 - 34.7 = 9.9 dBA increase over ambient applying DEP method

Wind

People

Wind

Wind

People

Wind

44.7

34.7

45.4
Max 1-Sec

44.7
Max 1-Sec

43.7
Max 1-Sec

44.6
Average Max 1-Sec

1-Second Measurements
Ambient L90
DEP Limit (Ambient +10 dBA)
1-Second Sound Levels at ML-5 With Turbines Operating
11:30 PM - 11:45 PM (March 5, 2018)

44.3 - 35.4 = 8.9 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
11:50 PM - 12:05 PM (March 5-6, 2018)

1-Second Measurements
- Ambient L90
- DEP Limit (Ambient +10 dBA)

43.8 - 35.4 = 8.4 dBA increase over ambient applying DEP method
1-Second Sound Levels at ML-5 With Turbines Operating
1:10 AM - 1:25 AM (March 6, 2018)

43.7 - 35.4 = 8.3 dBA increase over ambient applying DEP method
APPENDIX F

TURBINE POWER PRODUCTION AND HUB HEIGHT WIND SPEED GRAPHS
Future Generation Wind Turbine Power Production During Acoustic Sampling
August 23, 2017 @ ML-1

Wind Speed (m/s)

Power Production kW/hr

Time
Future Generation Wind Turbine Power Production During Acoustic Sampling
August 23, 2017 @ ML-1
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 18- September 19, 2017 @ ML-2

Turbine Power Production
Hub Height Wind Speed
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 19, 2017 @ ML-3

Turbine Power Production
Hub Height Wind Speed
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 19, 2017 @ ML-4

![Graph showing Turbine Power Production and Hub Height Wind Speed](image-url)
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 20, 2017 @ ML-2

Problems with ISO New England Dispatch cause on-off cycling of turbines.
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 20, 2017 @ ML-3

Problems with ISO New England Dispatch cause on-off cycling of turbines
Future Generation Wind Turbine Power Production During Acoustic Sampling
September 20, 2017 @ ML-4

Problems with ISO New England Dispatch cause on-off cycling of turbines
Future Generation Wind Turbine Power Production During Acoustic Sampling
October 16- October 17, 2017 @ ML-5 & ML-6

Wind Speed (m/s)
Power Production kW/hr

Turbine Power Production
Hub Height Wind Speed
Future Generation Wind Turbine Power Production During Acoustic Sampling
November 3- November 4, 2017 @ ML-5
Future Generation Wind Turbine Power Production During Acoustic Sampling
November 4- November 5, 2017 @ ML-2 & ML-3
Future Generation Wind Turbine Power Production During Acoustic Sampling
November 4- November 5, 2017 @ ML-4
Future Generation Wind Turbine Power Production During Acoustic Sampling
November 11, 2017 @ ML-5

![Graph showing Turbine Power Production and Hub Height Wind Speed over time.](image-url)
Future Generation Wind Turbine Power Production During Acoustic Sampling
March 5- March 6, 2018 @ ML-4 & ML-5

Turbine Power Production
Hub Height Wind Speed
APPENDIX G

TOWN OF PLYMOUTH SPECIAL PERMIT (Case No. 3608)
PLYMOUTH ZONING BOARD OF APPEALS

DECISION

CASE NO: 3608

PETITIONER: FUTURE GENERATION WIND, LLC

PROPERTY OWNERS: GARLAND NYE REALTY TRUST

SUBJECT PROPERTY: OFF OF HEAD OF THE BAY ROAD,
PLYMOUTH, MASSACHUSETTS (PID NO. 129-000-002B-001)

TITLE REFERENCES: PLYMOUTH COUNTY REGISTRY OF DEEDS,
BOOK 21658, PAGE 322

DATE OF PUBLIC HEARING: DECEMBER 15, 2010, CONTINUED TO
FEBRUARY 16, 2011, CONTINUED TO APRIL 6, 2011, CONTINUED TO MAY 4, 2011 AND
CONCLUDED THEREON

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In exercise of its discretionary powers, the Plymouth Zoning Board of Appeals (Members: Peter Conner, William Keohan, David Peck, Michael Main and Edward Conroy) voted four (4) to one (1) (Mr. Conroy in the negative) to grant the Petition of Future Generation Wind, LLC ("Petitioner" or "Applicant") for (1) a Special Permit subject to Environmental Design Conditions pursuant to Section 205-73, Paragraphs A through F of the Plymouth Zoning Bylaw (the "Bylaw"), and (2) waiver of setback and/or other dimensional or similar requirements pursuant to Section 205-3 (Special Permit definition), Section 205-9, Paragraph C(6), and/or other applicable provisions of the Bylaw in order to establish Wind
cost of compliance with Section 205-73D(10) of the Bylaw, which net cost has been determined to be $23,000. The amount shall include a mechanism for a Cost of Living Adjustment after ten (10) years and fifteen (15) years which adjusted net costs have been determined to be $27,487 after ten (10) years and $30,348 after fifteen (15) years.

5. The Town is entitled to pursue the remedies set forth in Section 205-15 of the Bylaw in the event that the terms of this Special Permit approval are violated.

6. Prior to the certificate of completion, said improvements are to be installed under the supervision of a registered professional engineer. The engineer must certify that the physical improvements noted in the site plan have been installed in accordance with the conditions noted here and accepted installation practices.

7. If the Nordex N100 Wind Turbine system is not the final selection of turbine for this project, the Petitioner shall return to the Board of Appeals for final approval of the manufacturer, color and specifications of the turbine. The Board of Appeals shall determine if the alternative system is comparable to the one described in this decision. The intent of this Condition is not to authorize selection of a turbine that is inconsistent with this decision.

8. The Director of Inspectional Services is authorized to allow internal site field changes to the plans that do not amount to a substantial modification of the plans. Such changes may include substituting or moving particular plant material, number of shrubs or trees; moving a structure in a manner that does not materially change the project; reconfiguring drainage areas; or similar changes where it is impractical to install or construct as originally designed. The intent of this Condition is not to authorize internal site field changes that are inconsistent with this decision. Further, the Board of Appeals reserves the right, on its own motion or by the request of the Director of Inspectional Services or the Applicant, to determine whether any such proposed change is inconsistent with this decision.

9. The Petitioner has agreed (a) to comply with the requirements of the document entitled “Future Generation Wind Noise Complaint Protocol” attached hereto as Addendum A and incorporated herein by reference; (b) after completion of construction and initiation of operation of the wind turbine, to conduct an acoustic analysis study to verify compliance with current DEP noise criteria and Section 205-73D(8) of the Town of Plymouth’s Zoning Bylaw regarding noise and to provide the Director of Inspectional Services of the Town of Plymouth with a copy of the study; and (c) to program the noise reduction mode on the turbine that will enable the Petitioner, if necessary, to implement operational measures to bring the turbine into compliance with the criteria set forth in subsections (a) and (b) of this Condition.