

SUMMARY STUDIES

SETBACK
& SOUND

OF THE FIVE FOLLOWING TOWN WIND TURBINE ORDINANCES
with back-up DATA verbatim

preceded with a literal SUMMARY OF HIGHLIGHTS from Montville and a
helpful DEFINITIONS list from Montville

- TOWN OF BUCKFIELD WIND ENERGY FACILITY ORDINANCE (95 pages)
- TOWN OF DIXMONT WIND ENERGY FACILITY ORDINANCE (35 pages)
- TOWN OF JACKSON WIND TURBINE ORDINANCE (52 pages)
- TOWN OF MONTVILLE WIND TURBINE GENERATOR ORDINANCE (42 pages)
- TOWN OF PHILLIPS WIND ENERGY FACILITY ORDINANCE (17 pages)

Prepared for: **IWOC**

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June 25, 2011

SUMMARY OF HIGHLIGHTS: MONTVILLE INDUSTRIAL WIND TURBINE GENERATOR ORDINANCE

VERBATIM:

The ordinance is written to protect the health, safety and welfare of all the residents of Montville.

It provides for the responsible development of industrial wind turbine facilities. It balances the needs of the residents of Montville with those of industrial wind developers so as not to compromise the health, safety or welfare of any residents.

It provides fair and protective regulation that requires industrial wind developers to be good business partners, good corporate citizens and good neighbors to the residents of Montville.

It does not in any way limit personal home or farm windmills under 150 ft in height and with less than 100 kW generation capacity.

Provides protective setbacks that are based on science, and are drawn from the real-life experience of people who live near industrial wind turbines such as those in Mars Hill, Freedom, and Vinalhaven within Maine, and elsewhere.

Setbacks (the distance between the Project Boundary and non-participating landowners' property line) are the greater of one mile or 13 times the height of the turbine, to the property line of nonparticipating landowners so as to protect their right to enjoy the full use of their property in its entirety. This provision anticipates the larger wind turbines coming into our state. One mile is globally recognized as the absolute minimum setback for 400 ft turbines.

Sound levels in the ordinance are consistent with the actual background noise levels as they exist in rural, residential communities such as Montville.

Sound levels are measured in both dBAs (audible sound) and dBCs (low-frequency noise levels) to protect restorative sleep and health.

Allows abutting landowners the option to sign mitigation waivers for setback distance; sound and noise levels; shadow flicker and blade reflection. A mitigation waiver, which is a legally binding contract between the owner of the wind turbine generator and a non-participating landowner, allows a landowner to decide to waive the protections afforded him by the ordinance on these specific items. Signed mitigation waivers will be recorded with the deed to the affected property in the Registry of Deeds.

Inclusion of an Operational License to make sure that when an industrial wind turbine facility is sold, the new owner/operator will honor all the commitments made to the town by the previous owner/operator.

Requires a decommissioning bond to avoid abandonment of industrial wind turbines and to protect the town from expensive decommissioning costs.

A tax provision that informs the town of the potential impact an industrial wind turbine plant may have on taxes in Montville.

An application process that is transparent, protects the town financially, and a Code of Ethics to avoid conflicts of interest from being part of the process.

NOTE from Sheri Fowler: Montville's FINDINGS AND RATIONALE can be accessed electronically at: http://friendsofraggedmountain.org/form_links.html

I found this 18 pager to be well written and easily understood... please read.

GENERAL INFORMATIONAL DEFINITIONS from Montville

Ambient Sound – Ambient sound encompasses all sound present in a given environment, being usually a composite of sounds from many sources near and far. It includes intermittent noise events, such as, from aircraft flying over, dogs barking, wind gusts, mobile farm or construction machinery, and the occasional vehicle traveling along a nearby road. The ambient also includes insect and other nearby sounds from birds and animals or people. The nearby and transient events are part of the ambient sound environment but are not to be considered part of the long-term background sound.

A-Weighted Sound Level (dBA) – A measure of over-all sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. It is used to describe sound in a manner representative of the human ear's response. It reduces the effects of the low with respect to the frequencies centered around 1000 Hz. The resultant sound level is said to be "Aweighted" and the units are "dBA." Sound level meters have an A-weighting network for measuring Aweighted sound levels (dBA) meeting the characteristics and weighting specified in ANSI Specifications for Integrating Averaging Sound Level Meters, S1.43-1997 for Type 1 instruments, and be capable of accurate readings (corrections for internal noise and microphone response permitted) at 20 dBA or lower. In this document dBA means LAeq unless specified otherwise.

Background Sound (L90) – refers to the sound level present at least 90% of the time. Background sounds are those heard during lulls in the ambient sound environment. That is, when transient sounds from flora, fauna, and wind are not present. Background sound levels vary during different times of the day and night. Because WTGs operate 24/7 the background sound levels of interest are those during the quieter periods which are often the evening and night. Sounds from the WTG of interest, near-by birds and animals or people must be excluded from the background sound test data. Nearby electrical noise from streetlights, transformers and cycling AC units and pumps etc., must also be excluded from the background sound test data.

Background sound level (dBA and dBC (as L90)) is the sound level present 90% of the time during a period of observation that is representative of the quiet time for the soundscape under evaluation and with duration of ten (10) continuous minutes. Several contiguous ten (10) minute tests may be performed in one hour to determine the statistical stability of the sound environment.

Measurement periods such as at dusk when bird and insect activity is high or the early morning hours when the 'dawn chorus' is present are not acceptable measurement times. Longer term sound level averaging tests, such as 24 hours or multiple days are not at all appropriate since the purpose is to define the quiet time background sound level. It is defined by the LA90 and LC90 descriptors. It may be considered as the quietest one (1) minute during a ten (10) minute test. LA90 results are valid only when LA10 results are no more than 10 dB above LA90 for the same period. LC10 less LC90 are not to exceed 10 dB to be valid.

The background noise environment consists of a multitude of distant sources of sound. When a new nearby source is introduced the new background noise level would be increased. The addition of a new source with a noise level 10 dB below the existing background would increase the new background 0.4 dB. If the new source has the same noise level as the existing background then the new background is increased 3.0 dB. Lastly, if the new source is 3.3 dB above the existing background then the new background would have increased 5 dB. For example, to meet the requirement of $L90A + 5 \text{ dB} = 31 \text{ dBA}$ if the existing quiet nighttime background sound level is 26 dBA, the maximum wind turbine noise immission contribution independent of the background cannot exceed 29.3 dBA Leq at a dwelling. When adding decibels, a 26 dBA background combined with 29.3 dBA from the turbines (without background) results in 31 dBA.

Further, background L90 sound levels documenting the pre-construction baseline conditions should be determined when the ten (10) minute maximum wind speed is less than 2 m/s (4.5 mph) near ground level/microphone location 1.5 m height.

GENERAL INFORMATIONAL DEFINITIONS from Montville

C-Weighted Sound Level (dBC) – Similar in concept to the A-Weighted sound Level (dBA) but C-weighting does not de-emphasize the frequencies below 1k Hz as A-weighting does. It is used for measurements that must include the contribution of low frequencies in a single number representing the entire frequency spectrum. Sound level meters have a C-weighting network for measuring C-weighted sound levels (dBC) meeting the characteristics and weighting specified in ANSI S1.43-1997 Specifications for Integrating Averaging Sound Level Meters for Type 1 instruments. In this document dBC means L_{Ceq} unless specified otherwise.

Decibel (dB) – A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level (L_p) in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 MicroPascals.

Hertz (Hz) – Frequency of sound expressed by cycles per second.

Infra-Sound – sound with energy in the frequency range of 0-20 Hz is considered to be infra-sound. It is normally considered to not be audible for most people unless in relatively high amplitude. However, there is a wide range between the most sensitive and least sensitive people to perception of sound and perception is not limited to stimulus of the auditory senses. The most significant exterior noise induced dwelling vibration occurs in the frequency range between 5 Hz and 50 Hz. Moreover, levels below the threshold of audibility can still cause measurable resonances inside dwelling interiors. Conditions that support or magnify resonance may also exist in human body cavities and organs under certain conditions. Although no specific test for infrasound is provided in this document, the test for immission spectra imbalance will limit low frequency sound and thus, indirectly limit infrasound. See low-frequency noise (LFN) for more information.

Low Frequency Noise (LFN) – refers to sounds with energy in the lower frequency range of 20 to 200 Hz. LFN is deemed to be excessive when the difference between a C-weighted sound level and an A-weighted sound level is greater than 20 decibels at any measurement point outside a residence or other occupied structure.

Mechanical Noise – sound produced as a byproduct of the operation of the mechanical components of a WTG(s) such as the gearbox, generator and transformers.

Noise – any unwanted sound. Not all noise needs to be excessively loud to represent an annoyance or interference.

Scenic or Special Resource – a scenic resource of state or national significance, as defined in Title 35-A M.R.S.A. §3451(9), any site registered in the National Registry of Historic Places, or a scenic or special resource of local significance identified as such.

Sound – A fluctuation of air pressure which is propagated as a wave through air

Sound Power – The total sound energy radiated by a source per unit time. The unit of measurement is the watt. Abbreviated as L_w. This information is determined for the WTG manufacturer under laboratory conditions specified by IEC 61400-11 and provided to the local developer for use in computer model construction. There is known measurement error in this test procedure that must be disclosed and accounted for in the computer models. Even with the measurement error correction it cannot be assumed that the reported L_w values represent the highest sound output for all operating conditions. They reflect the operating conditions required to meet the IEC 61400-11 requirements. The lowest frequency is 50 Hz for acoustic power (L_w) requirement (at present) in IEC 61400-11. This Ordinance requires wind turbine certified acoustic power (L_w) levels at rated load for the total frequency range from 6.3 Hz to 10k Hz in

GENERAL INFORMATIONAL DEFINITIONS from Montville

one-third octave frequency bands tabulated to the nearest 1 dB. The frequency range of 6.3 Hz to 10k Hz shall be used throughout this Ordinance for all sound level modeling, measuring and reporting.

Sound Pressure – The instantaneous difference between the actual pressure produced by a sound wave and the average or barometric pressure at a given point in space.

Statistical Noise Levels – Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_NA, where L_NA is the A-weighted sound level exceeded for N% of a given measurement period. For example, L₁₀ is the noise level exceeded for 10% of the time. Of particular relevance, are: LA₁₀ and LC₁₀ the noise level exceeded for 10% of the ten (10) minute interval. This is commonly referred to as the average maximum noise level. LA₉₀ and LC₉₀ are the A-weighted and C-weighted sound levels exceeded for 90% of the ten (10) minute sample period. The L₉₀ noise level is defined by ANSI as the long-term background sound level (i.e. the sounds one hears in the absence of the noise source under consideration and without short term or near-by sounds from other sources), or simply the “background level.” Leq is the A or C-weighted equivalent noise level (the “average” noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

Tonal sound or tonality – Tonal audibility. A sound for which the sound pressure is a simple sinusoidal function of the time, and characterized by its singleness of pitch. Tonal sound can be simple or complex.

Wind Turbine Generators (WTG) – equipment that converts and then transfers energy from the wind into usable forms of electrical energy, and includes all related and supporting items including but not limited to all buildings, structures, electrical equipment, substations, transmission lines, access roads, parking lots, areas to be stripped or graded, and areas to be landscaped or screened.

(note: for more definitions see pages 4 - 10 of the Town of Montville Wind Turbine Generator Ordinance)

**Town of BUCKFIELD
Wind Turbine Generator Ordinance**

23 June 2011 SUMMARY Study of Set-Back and Sound:

Set-Back Distance

-The larger of one mile or 13 times the Turbine height, measured horizontally from the Project Boundary to the nearest property line

Noise Standards

- Not to exceed preconstruction/operation background sound levels by more than 3 dBA or dBC at night
- Low frequency noise levels (dBC) due to wind turbine operation as measured inside or at any property line not to exceed 20 dBC above pre-development ambient noise level (measured as dBA)
- Maximum not to exceed 50 dBC

DATA EXTRACTED FROM BUCKFIELD WIND ENERGY FACILITY ORDINANCE (95 pages):

Setbacks to property lines are a minimum buffer of one mile from the Project Boundary. This is assuming a 1.5 MW industrial wind turbine, which has a Turbine Height of approximately 400 feet. However, larger wind turbines are louder, so a varying setback basis is required. A one mile setback is approximately equal to 13 times the turbine height for a 400 foot turbine. Therefore, the Setback Distance is defined as the larger of one mile or 13 times the Turbine Height, measured horizontally from the Project Boundary to the nearest property line.

Setbacks for public roads are based on an approximation of an 1800-foot debris field for ice throw. Four times the turbine height for a 440 foot Wind Turbine is equal to 1760 feet.

12.1 Setback Standards

12.1.1 Setback to Non-participating Landowner Property Lines — Given the abundant evidence that wind turbines sited too close to humans has deleterious effects on them, and given that the most effective means of preventing negative health effects is proper setbacks, WEFs must be located no closer than the Setback Distance from non-participating property lines. Property owners may waive this setback with a written Mitigation Waiver. (See Section 12.4).

12.1.2 Setback to Public Roads - Wind Turbines will be set back from any public road a distance no less than 4 times the turbine height, measured horizontally.

12.2.2 Noise Limits at Non-participating Property Lines

No WEF turbine shall be located so as to cause an exceedance of the preconstruction/operation background sound levels by more than 5 dBA or dBC for day and evening (as defined in section 27.17.1 & 27.17.2) . No WEF turbine shall be located so as to exceed the preconstruction/operation background sound levels by more than 3 dBA or dBC at night (as defined in section 27.17.3) The background sound levels shall be the L90 dB sound levels sound descriptor (both A and C weighting) measured during a pre-construction noise study during the quietest times. Measurements shall be for ten (10) minutes or more. L90 results are valid when L10 results are no more than 15 dB above L90 for the same time period. Noise sensitive sites are to be selected based on the WEF's predicted sound emissions (in dBA, dBC and 1/3 octaves to blade passage frequency), which are to be provided by the Applicant and verified by the Independent Acoustical Engineer.

12.2.2.1 Audible noise levels (dBA) due to wind turbine operation will not exceed the pre-construction ambient noise as defined in 12.2.2 as measured at any property line. Property owners may waive this noise restriction with a written Mitigation Waiver. (See Section 12.4 .)

12.2.2.2 Low frequency noise levels (dBC) due to wind turbine operation as measured inside or at any Property Line will not exceed:

20 decibels (measured as dBC) above the pre-development ambient noise level (measured as dBA). There is a maximum not-to-exceed level of 50 dBC. Property owners may waive this noise restriction with a written Mitigation Waiver. (See Section 12.4 .)

**Town of DIXMONT
Wind Energy Facility Ordinance**

23 June 2011 SUMMARY Study of Set-Back and Sound:

Set-Back requirements

- To comply with requirements in Zoning Ordinance
- 'turbines' to be set back at least 2,500 ft from property line
- 'turbines' to be set back at least 1,500 ft from Public Way
- 'turbines' to be set back at least 1,200 ft above ground electric or phone line
- 'turbines' to be set back not less than 5,280 ft from any residence, business, school, daycare, church, hospital or other occupied structure
- 'turbines' to be set back not less than 1,500 ft from a participating parcel or project parcel
- 'turbines' to be set back a minimum of 2,500 ft from scenic or special resource

Sound Requirements

- A. Sound limits 0 - 5,280 ft
 - No audible turbine sound levels to exceed
 - 40 dBA night
 - 50 dBA daytime
 - and 5dB penalty for tones
 - Low frequency sound limits:
 - LeqC minus L90A must be less than 20 dB outside any occupied structure
 - L90C may not exceed 50 dBC properties 1 mile or more from State highways or major roads and may not exceed 55 dBC for closer properties
- B. Sound limits 5,280 - 7,920 ft (1 - 1.5 mi)
 - audible sound not to exceed pre-construction sound levels by 10dBA
 - not to exceed (LeqC minus L90A) by 20 dB
 - L90C not to exceed 50 dBC for properties 1 mile away from State highways or major roads and may not exceed 55 dBC for closer properties

DATA EXTRACTED FROM DIXMONT WIND ENERGY FACILITY ORDINANCE (35 pages):

(b) Set-Back Requirements

- (1) A WEF shall comply with the following set-back requirements, which shall apply in addition to the siting requirements found elsewhere in this Ordinance. If more than one set-back requirement applies, the greater set-back distance shall be met.
 - A. All parts of a WEF shall comply with all applicable set-back requirements in the Town's zoning Ordinance.
 - B. Each WT shall be set back at least 2,500 feet from the property line of any Non-Participating Parcel. Property owners may waive this setback with a written Mitigation Waiver agreement.
 - C. Each WT shall be set back at least 1,500 feet from any public way.
 - D. Each WT shall be set back at least 1,200 feet from any above-ground electric power line or telephone line except that a lesser setback shall be permitted if the utility agrees, in writing, and this agreement is approved by the Planning Board.

- E. Each WT shall be set back not less than 5,280 feet from any residence, business, school, daycare facility, church, hospital, or other Occupied Structure on any Non-Participating Parcel. Property owners may waive this setback with a written Mitigation Waiver agreement.
- F. Each WT shall be set back not less than 1,500 feet from any residence, business, school, daycare facility, church, hospital, or other Occupied Structure, including those located on any Participating Parcel or Project Parcel.
- G. All WTs must be set back a minimum of 2,500 feet from any Scenic or Special Resource as defined in Section (III).
- H. All set-back distance measurements shall be based on horizontal distances.

Section V - Site Permit Requirements and Standards

(a) Sound Modeling, Sound Standards and Sound-Related Enforcement Procedures

- (1) *Independent Pre-licensing Sound Study.* An Application for a WEF Site Permit shall include a four season sound study as specified in the Appendix. This study shall be conducted by a Qualified Independent Acoustical Consultant, selected by the Planning Board. The consultant will review this study and assist the Planning Board in determining whether the proposed WEF will comply with the sound limits set forth in this Ordinance. The Applicant shall provide financial surety that the cost of the study, and its review, will be borne by the Applicant, in accordance with Section (VII) of this Ordinance.
- (2) *Sound Limits(0 to 5280 feet).* No Site Permit shall be issued if the pre-licensing information or sound study indicates that the proposed WEF will not comply with the following requirements, which are to apply everywhere within one mile (5280 feet) of any WT, except on Project Parcel(s) or on a Participating Parcel(s) which is subject to a Mitigation Waiver which specifies different sound limits than those below. If pre-construction estimates of the post-construction sound levels, exceed the limits below, then the WEF Application will be denied; if these limits are exceeded after the WEF has been built, then the WEF will be in violation of this Ordinance.

The sound limits below are stated in terms of $L_{90}A(\text{pre})$, $L_{eq}A(\text{post})$, $L_{eq}C(\text{post})$, $L_{90}C(\text{post})$ and $L_{eq}A(\text{post})$. Each of these quantities is defined in the Appendix, particularly in Parts c(3)A, c5 and d. Prior to construction of the WEF, the "pre" values are as measured and the "post" values are as calculated, following the guidelines of the Appendix. After the WEF has been constructed, the "pre" values are the WEF-Off values and the "post" values are the WEF-On values.

A. *Audible Sound Limit*

- i. No WT, WES or WEF shall be located so as to generate post-construction sound levels that exceed 40 dBA at night (7:00 p.m. to 7:00 a.m.) or 50 dBA during the day (7:00 a.m. to 7:00 p.m.). The appropriate value to use for the post-construction sound level is $L_{eq}A(\text{post})$.
- ii. A 5 dB penalty is applied for tones as defined in IEC 61400-11.

B. *Low Frequency Sound Limit*

- i. $L_{eq}C(\text{post})$ minus $L_{90}A(\text{pre})$ must be less than 20 dB outside of any occupied structure.
- ii. $L_{90}C(\text{post})$ may not exceed 50 dBC, without contribution from other ambient sounds, for properties located one mile or more away from state highways or other major roads, and it may not exceed 55 dBC for properties closer than one mile from a state highway or other major road.

C. *Mitigation Waiver*

Property owners may waive these sound restrictions with a written Mitigation Waiver agreement. A complete copy of any such agreement must be filed with the Planning Board and Recorded in the Penobscot County Registry of Deeds.

- (3) *Sound Limits (5280 feet to 7920 feet)*. No Site Permit shall be issued if the pre-licensing information or sound study indicates that the proposed WEF will not comply with the following requirements, which are to apply everywhere within a distance ranging from one mile (5280 feet) to one and one-half miles (7920 feet) of any WT, except on Project Parcel(s) or on a Participating Parcel(s) which is subject to a Mitigation Waiver which specifies different sound limits than those below. If pre-construction estimates of the post-construction sound levels, exceed the limits below, then the WEF Application will be denied; if these limits are exceeded after the WEF has been built, then the WEF will be in violation of this Ordinance.

The sound limits below are stated in terms of $L_{90}A(\text{pre})$, $L_{\text{eq}}A(\text{post})$, $L_{\text{eq}}C(\text{post})$, $L_{90}C(\text{post})$ and $L_{\text{eq}}A(\text{post})$. Each of these quantities is defined in the Appendix, particularly in Parts c(3)A, c5 and d. Prior to construction of the WEF, the "pre" values are as measured and the "post" values are as calculated, following the guidelines of the Appendix. After the WEF has been constructed, the "pre" values are the WEF-Off values and the "post" values are the WEF-On values.

- A. *Audible Sound Limit*. No WT, WES or WEF shall be located so as to generate post-construction sound levels that exceed pre-construction sound levels by more than 10 dBA. The appropriate value to use for the pre-construction sound level is $L_{90}A(\text{pre})$; the appropriate value to use for the post-construction sound level is $L_{\text{eq}}A(\text{post})$.

B. *Low Frequency Sound Limit*

- i. $L_{\text{eq}}C(\text{post})$ minus $L_{90}A(\text{pre})$ must be less than 20 dB outside of any occupied structure.
- ii. $L_{90}C(\text{post})$ may not exceed 50 dBC, without contribution from other ambient sounds, for properties located one mile or more away from state highways or other major roads, and it may not exceed 55 dBC for properties closer than one mile from a state highway or other major road.

C. *General Standard*

$L_{\text{eq}}A(\text{post})$ may never exceed 35 dBA within 100 feet of any occupied structure.

D. *Mitigation Waiver*

Property owners may waive these sound restrictions with a written Mitigation Waiver agreement. A complete copy of any such agreement must be filed with the Planning Board and Recorded in the Penobscot County Registry of Deeds.

- (4) *Post-construction Sound Measurements*. Starting within twelve months after the date when the WEF is operating, a post-construction sound study shall be performed, with all WTs operating, as described in Part d of the Appendix. Post-construction sound studies shall be conducted by a Qualified Independent Acoustical Consultant chosen by the Planning Board. The Permittee will provide financial surety that the costs of these studies shall be paid by the Permittee. The surety required by Section (VII) shall include these costs. A Consultant of the Permittee may observe the Town's consultant. The WEF Permittee shall provide all technical information required by the Planning Board or Independent Qualified Acoustical Consultant before, during, and/or after any acoustical studies required by this document and for local area acoustical measurements. The post-construction sound measurements, as described in Part d of the Appendix, shall be repeated at least every five years throughout the life of the facility.

**Town of MONTVILLE
Wind Turbine Generator Ordinance**

23 June 2011 SUMMARY Study of Set-Back and Sound:

Set-Back

- The minimal allowable horizontal distance as measured from the project boundary to a defined point (e.g. a property line or road)

Set-Back Distance

- The larger of one mile or 13 times the Turbine height, measured horizontally from the project boundary to the nearest property line

Sound Standards

- Not to exceed preconstruction/background sound by 5 dBA or dBC at property line
- Not to exceed 20 dBC above predevelopment ambient noise level (measured as dBA) inside or at any property line
- Not to exceed a maximum level of 50 dBC

**DATA EXTRACTED FROM MONTVILLE WIND TURBINE GENERATOR ORDINANCE
(42 pages):**

This section addresses the interrelated standards of setbacks, noise, shadow flicker and mitigation waivers and applies to all WTGs.

Setbacks provide a number of important Ordinance functions, including but not limited to: 1) working in conjunction with noise standards as a primary means of mitigating potential and unforeseen noise complaints; 2) providing for public safety in the event of a catastrophic turbine failure or ice throw; 3) mitigating the effects of shadow flicker from larger turbines

In general, the taller the turbine, and the greater the number of turbines in a WTG, the greater the setback needed to mitigate noise, debris hazards, and shadow flicker. However, setbacks for noise must also be implemented in conjunction with specific wind turbine noise limits (see Section 12.2). Although larger wind turbines appear to generate the highest proportion of published noise complaints, poorly designed smaller turbines can also cause serious noise.

Setbacks to property lines are a minimum buffer of one mile from the Project Boundary. This is assuming a 1.5 MW industrial wind turbine, which has a Turbine Height of approximately 400 feet. However, larger wind turbines are louder, so a varying setback basis is required. A one mile setback is approximately equal to 13 times the turbine height for a 400 foot turbine. Therefore, the Setback Distance is defined as the larger of one mile or 13 times the Turbine Height, measured horizontally from the Project Boundary to the nearest property line.

Setbacks for public roads are based on an approximation of an 1800-foot debris field for ice throw. Four times the turbine height for a 440 foot Wind Turbine is equal to 1760 feet.

12.1 Setback Standards

12.1.1 Setback to Non-participating Landowner Property Lines – Given the abundant evidence that wind turbines sited too close to humans has deleterious effects on them, and given that the most effective means of preventing negative health effects is proper setbacks, WTGs must be located no closer than the Setback Distance from non-participating property lines. Property owners may waive this setback with a written Mitigation Waiver. (See Section 12.4).

12.1.2 Setback to Public Roads - Wind Turbines will be set back from any public road a distance no less than 4 times the turbine height, measured horizontally.