Exhibit H

Luverne Wind Farm (South Field)
Acoustic Assessment
Steele & Griggs Counties, North Dakota

June 2, 2009

Prepared for

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75 PU-08-34 Filed 06/08/2009 Pages: 24
Exhibit H from June 5, 2009 Hearing
Office of Administrative Hearings

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ACRONYMS AND ABBREVIATIONS

A	extraneous attenuation factors
Applicant	Ashtabula Wind II, LLC
CadnaA	Computer Aided Noise Abatement Program
D	directivity
DW	downwind
dB	decibel
dBA	A-weighted decibel
dBL	linear decibel
EPA	United States Environmental Protection Agency
ft	feet
GIS	Geographic Information System
Hz	Hertz
HPD	hearing protection devices
IEC	International Electrotechnical Commission
ISO	Organization for International Standardization
L_{dn}	day-night averaged sound level
L_{eq}	equivalent sound level
LFN	low frequency noise
L_{max}	maximum instantaneous sound level
L_p	sound pressure level
L_w	sound power level
m	meter
m/s	velocity in meters per second
MW	megawatt
NSA	noise sensitive area
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
Project	Luverne Wind Farm (South Field)
R	linear (slant) distance of Lp from source
Tetra Tech	Tetra Tech EC, Inc.
µPa	micropascal
USGS	United States Geological Survey
W	watt
WTG	wind turbine generator

EXECUTIVE SUMMARY

Tetra Tech EC, Inc. has completed an acoustic analysis for a proposed 80-turbine wind energy project, the Luverne Wind Farm located in Griggs and Steele Counties, North Dakota. This assessment was developed to address sound levels resulting from wind turbine operations of the proposed Project. The objectives of this study were to: (1) quantify Project sound sources and site-specific sound propagation characteristics; (2) computer simulate future wind turbine generator (WTG) sound levels over a range of future Project operational and meteorological conditions; and (3) determine the feasibility of the Project to operate in compliance with applicable noise standards and guidelines.

Wind turbine sound source data was obtained from General Electric, the manufacturer of the GE xle 1.5 MW wind turbine model that will be used in the proposed Project. Sound propagation modeling was conducted using the Computer Aided Noise Abatement (CadnaA) software program (version 3.7.123), a comprehensive 3-dimensional acoustic modeling tool specifically developed for the power generation industry in compliance with ISO 9613-2. The industry standard CadnaA acoustic modeling software is widely used by sound engineers due to its adaptability to describe complex acoustic scenarios. It has been shown to be a highly effective acoustic modeling tool for wind energy development projects sited in Europe, Canada and the United States. Further information on acoustic modeling methodologies are given in Section 3.0 of this report. The results of the acoustic modeling results were compared to EPA environmental noise guidelines and OSHA regulatory limits for worker exposure and public safety.

The overall conclusions of the acoustic assessment are as follows:

1. Acoustic modeling results even with a number of conservative assumptions demonstrate the Project will comply with EPA noise guidelines and OSHA safety standards at all existing inhabited structures considered to be noise sensitive areas (NSAs).
2. The proposed turbines will not result in a steady state pure tone or apparent tonal conditions at existing NSA locations under any WTG operating condition, as defined per International Electromechanical Commission (IEC) specifications.
3. Operation of the Project may result in periodically audible sound at NSAs under certain operational and meteorological conditions. Specifically, the Project will be audible at the closest NSAs relative to the Project WTGs, background sound levels are low, and wind speeds high enough for turbine operation. Residents outside their houses and with a direct line of sight to an operating wind turbine may hear a gentle swooshing sound characteristic of WTGs. At receptors located farther from the Project and during conditions favorable to sound propagation and very quiet background ambient sound conditions, WTGs may be periodically audible but are within the recommended limits to avoid adverse effects on public health and safety.

1.0 INTRODUCTION

Ashtabula Wind II, LLC (the Applicant) proposes to construct a 120 megawatt (MW) wind energy facility in Griggs and Steele Counties,, North Dakota, referred to as the Luverne Wind Farm, (South Field) (the Project). The Project consists of a total of 80 1.5 MW GE xle wind turbine generators (WTGs) with a rotor diameter of 270.0 ft (82.5 m) and an effective hub height of 262.5 ft (80 m) above grade. One alternate WTG was also included in the acoustic assessment. This alternate WTG brings the total number of WTGs to 81 1.5 MW GE xle WTGs included in the acoustic assessment.

In support of the environmental permitting efforts, Tetra Tech EC, Inc. was retained to perform the acoustic assessment for the Project. This document presents the findings of that assessment including the calculated future sound levels during Project operation and an evaluation the feasibility of the Project to operate in compliance with all applicable noise regulations.

1.1 Project Acoustic Study Area

The proposed Project is located on approximately 22,265 acres in southeast Griggs and southwest Steele Counties, North Dakota. The city of Valley City is located about 25 miles south of the Project area. The physical setting of the Project area is characterized by a flat to gently rolling landscape composed of glacial drift. The topography of the area slopes from northwest to southeast across the north half of the property and east to west across the remainder of the property, where it is drained by tributaries of the Sheyenne River. Elevation at the property in the general vicinity of the proposed WTG locations ranges from approximately 425 – 465 m above mean sea level.

The majority of the property is used as cropland and is interspersed with residences, farm buildings, and areas of woody vegetation. Drainages, overhead power lines, and underground crude oil pipeline, underground power lines, and primary and secondary roads pass through the Project area, which is also bounded to the south by a railroad right-of-way. The proposed WTG locations and Project substation are located entirely in cropland. Proposed access roads and underground collection lines are located primarily in cropland but occasionally run along public rights-of-way. There is little to no manufacturing, commercial, or industrial activities close to the Project area.

The Project provided a Farmstead Location Report, dated as of December 23, 2008. Per this supporting documentation and with guidance from the Applicant, a total of 38 potential Noise Sensitive Areas (NSAs) were identified in the Project area and were included in the acoustic assessment. Figure 1 presents the Luverne Wind Farm Project area and locations of the proposed WTGs in the south field in Griggs and Steel Counties.

1.2 Existing Acoustic Environment

Both Griggs and Steele Counties would generally be characterized as agricultural and rural and existing ambient sound levels are expected to be relatively low, although sound levels can be sporadically elevated in localized areas during periods of use. Background sound levels vary both spatially and temporally depending on proximity to area sound sources and activities. Principal contributors to the existing acoustic environment within both Counties likely include motor vehicle traffic, mobile farming equipment, farming activities such as plowing and irrigation, all-terrain vehicles, local roadways, rail movements, periodic aircraft flyovers, and natural sounds such as birds, insects, and leaf or vegetation rustle during elevated wind conditions in areas with established tree stands or established crops. Diurnal effects result in sound levels that are typically quieter during the night than during the daytime except during periods when evening and nighttime insect noise dominate.

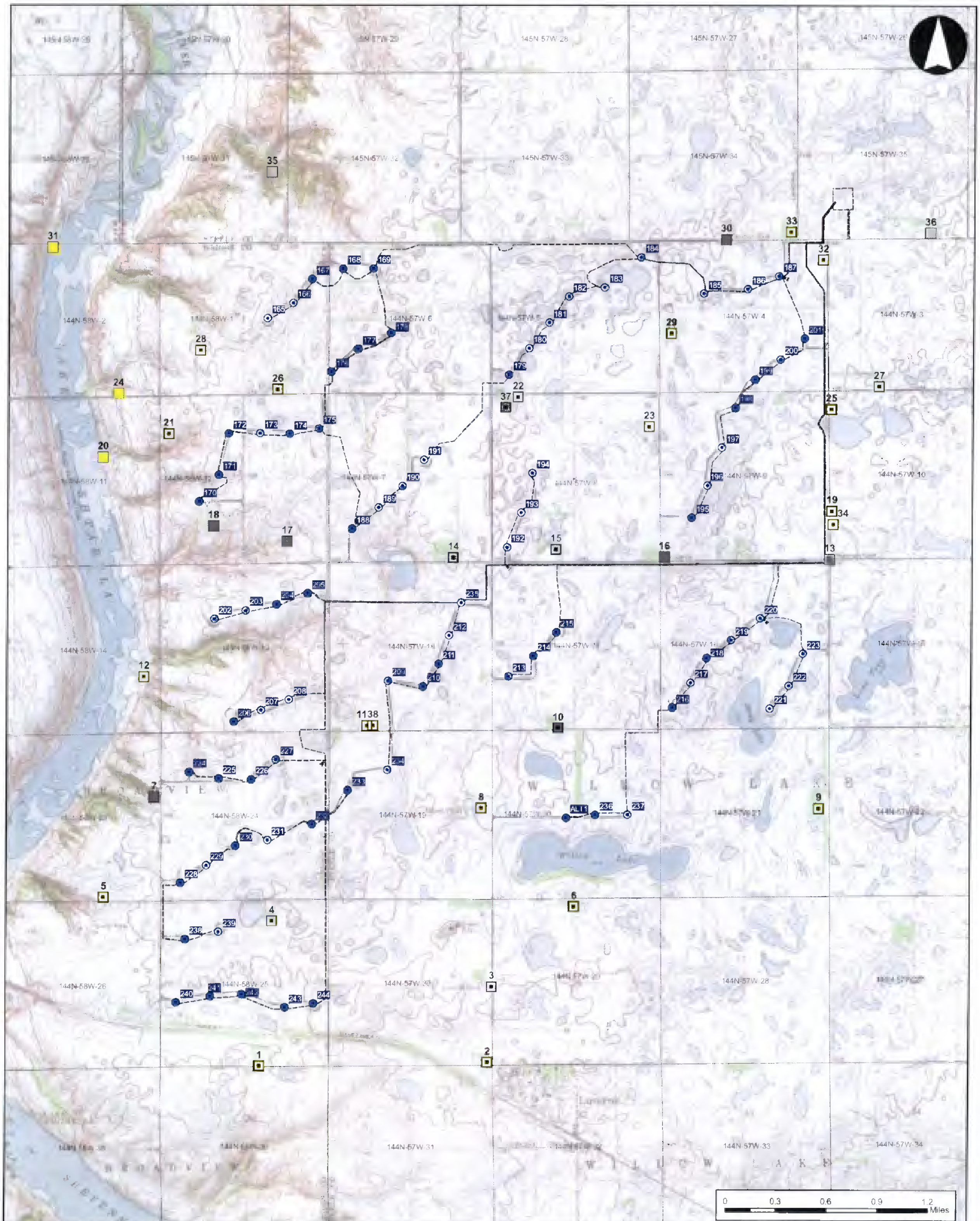
In areas with elevated background sound levels, sound from an individual source may be obscured through a mechanism referred to as acoustic masking. Seasonal effects like cricket chirping which occurs in the evening and overnight periods during warmer months, as well as wind-generated ambient noise may contribute to this masking effect. The latter is most prevalent in rural and suburban areas with established tree stands. Wintertime defoliate conditions typically have lower background sound levels due to lower wind masking effects and reduced outdoor activities in colder climates. This also results in people exhibiting lower sensitivities to outdoor sound levels, particularly in this geographical region of the U.S., as windows are closed and limited time is spent outdoors.

1.3 Acoustic Terminology

All sounds originate with a source whether it is a human voice, motor vehicles on a roadway, or crickets chirping in a field. Sound energy propagates through a medium where it is sensed and then interpreted by a receiver. A sound source is defined by a sound power level (L_w), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts (W). Sound energy travels in the form of a wave, as a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. A sound pressure level, (L_P), is a measure of this fluctuation at a given location and can be obtained through the use of a microphone or derived from information about the source and its surroundings. Sound power, however, cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure taken near the source.

Sound levels are presented on a logarithmic scale to account for the large range of pressure which the human ear can perceive, and is expressed in units called decibels (dB). A decibel is actually defined as a ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing (20 μPa for sound pressure and 1 pW for sound power in air). An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sources are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the result is a 3-decibel increase (or 53 dB), not an arithmetic doubling of 100 dB. The human ear does not sense changes in the sound pressure level as equal changes in perceived loudness. Scientific research demonstrates that the following general relationships hold between sound level and human perception for two broadband sound levels with the same or similar frequency characteristics:

- 1 dBA is the practically achievable limit of the accuracy of sound measurement systems and corresponds to an approximate 10% variation in sound pressure. A 1 dBA increase or decrease is a non-perceptible change in sound.
- 3 dBA increase or decrease is a doubling (or halving) of acoustic energy and it corresponds to the threshold of perceptibility of change in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors.
- 5 dBA increase or decrease is described as a perceptible change in sound level and is a discernable change in an outdoor environment.
- 10 dBA increase or decrease is a tenfold increase or decrease in acoustic energy but is perceived as a doubling or halving in sound (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).



TETRA TECH

ASHTABULA WIND II, LLC
LUVERNE WIND FARM
ACOUSTIC ASSESSMENT
STEELE AND GRIGGS COUNTIES, NORTH DAKOTA

FIGURE 1. PROJECT LAYOUT

JUNE 2009

Legend

- Wind Turbine Generator (siteplan layout dated 5/22/09)
- Receptor Identified in FSR
- Occupied Receptor
- Unoccupied Receptor
- Unknown Occupancy Status
- Collection Line (5/22/09)
- Access Road (5/22/09)
- Township-Range-Section

REFERENCE MAP

Since the human ear does not perceive every frequency with equal loudness, measurements of complex sounds are often adjusted with what is known as a weighting filter. In community sound assessments, an A-weighted filter is generally applied to sound pressure measurements to mimic the response of the human auditory system. Weighted measurements of this kind are given in units of dBA.

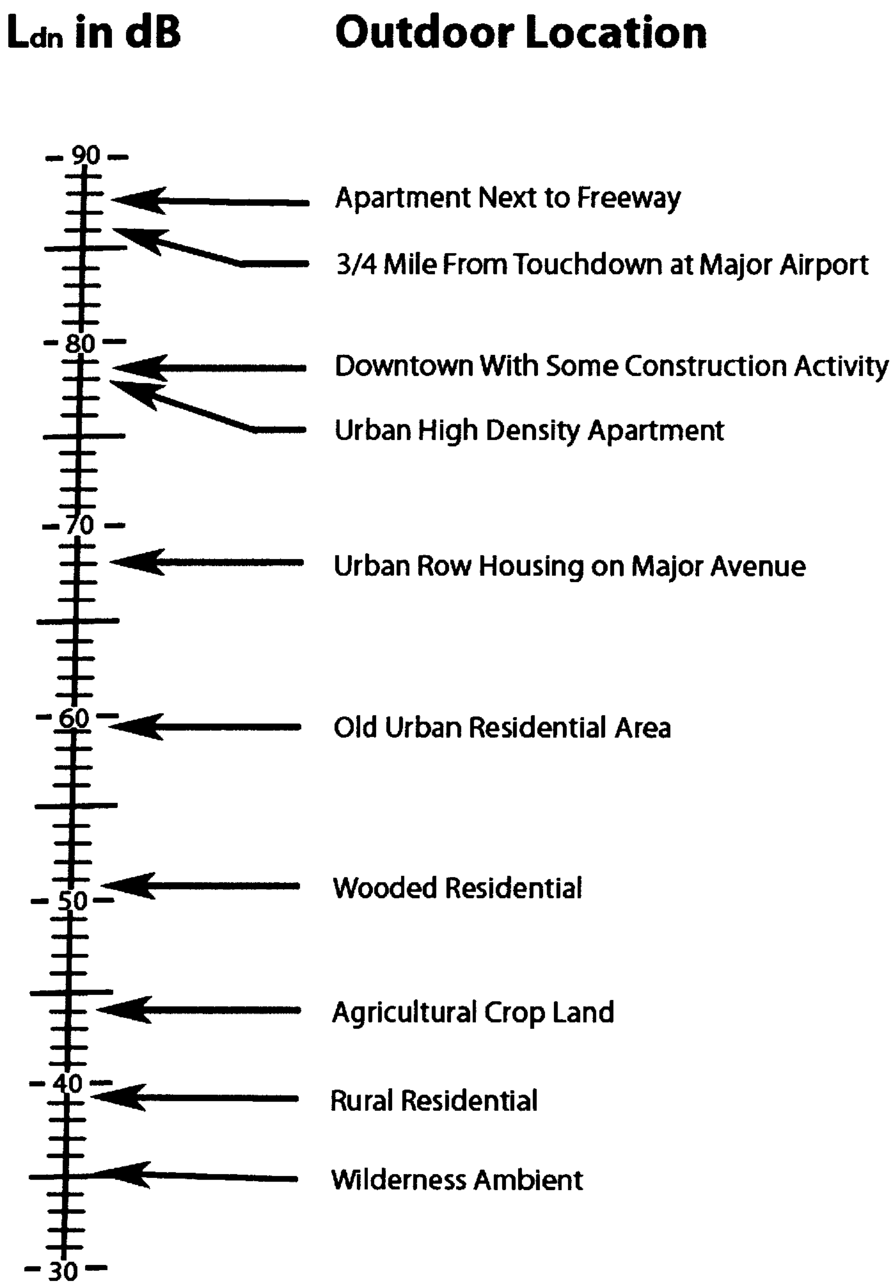
While the concept of sound is strictly defined by the laws of physics, the term 'noise,' has further qualities of being excessive or loud. The perception of sound as noise is often influenced by such factors as intensity, sound quality, duration, and existing background levels. The effects of noise on people can be classified into three general categories: (1) subjective effects of annoyance, nuisance, and dissatisfaction; (2) activity interference, i.e. speech, sleep, and learning; and (3) physiological effects such as anxiety or hearing loss. The sound levels associated with environmental noise generally produce effects only in the first two categories.

Sound can be measured, modeled and presented in various formats, with the most common metric being the equivalent sound level, (L_{eq}). The equivalent sound level has been shown to provide both an effective and uniform method for comparing time varying sound levels and is widely used in acoustic assessments of wind energy projects. Community sound levels are also often described in terms of the day-night averaged sound level (L_{dn}) which accounts for the increased potential for annoyance that comes with elevated sound levels at night. In addition, the maximum sound level, (L_{max}), can be used to quantify the maximum instantaneous sound pressure level generated by a source and is often used in establishing regulatory noise limits.

Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, data may also include the analysis of the various frequency components of the sound spectrum 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 (or 1/3 octave) bands from 16 Hz (low) to 16,000 Hz (high).

EPA estimates of various outdoor sound pressure levels and acoustic environments are presented in the day-night averaged sound level (L_{dn}) in Table 1. Table 2 presents additional reference information on terminology used in the Luverne Wind Farm acoustic assessment.

Table 1 Various Outdoor Sound Pressure (L_P) Levels



Notes:

µPa - Micropascals describe sound pressure levels (force/area).
dBA - A-weighted decibels describe sound pressure on a logarithmic scale referenced to 20 µPa.
Reference: USEPA, Protective Noise Levels. Condensed Version of EPA Levels Document. Publication EPA-550/9-79-100, November, 1978.

Table 2 Acoustic Terms and Definitions

Term	Definition
Noise	Unwanted sound based on level, character, frequency or pitch, time of day, and sensitivity and perception of the listener.
Sound Pressure Level (L_P)	Pressure fluctuations in a medium (air in this case). Sound pressure is measured in decibels referenced to 20 micronewtons per square meter, the approximate threshold of human perception to sound at 1000 Hz.
Sound Power Level (L_W)	The total acoustic power of a noise source measured in decibels referenced to 10^{-12} watts. Sound power is independent of the environment. The wind turbine noise specification is provided by the manufacturer in these terms since sound power is independent of environment.
A-Weighted Decibels (dBA)	Environmental sound is typically composed of acoustic energy across many different frequencies. Noise exposure in a community is commonly expressed in terms of the A-weighted sound level; are referred to as dBA in this report. A-weighting approximates the frequency response of the human ear.
Unweighted Decibels (dBL)	Unweighted sound levels are referred to as linear, or dBL. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise.
Propagation/Attenuation	The decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Other factors that can effect attenuation include air absorption, terrain effects, ground absorption, diffraction around objects and topographical features, trees, and meteorological conditions including wind velocity, temperature, humidity and non-homogenous atmospheric conditions.
Aerodynamic noise	Aerodynamic noise is produced by the movement of an object through the air. For wind turbines, it is the noise caused by the rotor blades passing through the air. In general, the higher the rotational speed, the louder the sound. Recent improvements in the mechanical design of large WTGs have resulted in significantly reduced mechanical noise. As a result, aerodynamic noise is the dominant source from modern WTGs.
Acoustic Modulation	Technical term describing the variation of sound pressure levels (blade swish) caused by aerodynamic noise as the WTG blade passes through the air and the interaction with the WTG tower structure , i.e. shielding effect or blade/tower aerodynamic interaction.
Broadband	Containing sound energy at all frequencies across the entire audible spectra.
Octave Bands	The audible range of humans spans from 20 to 20,000 Hertz and is typically divided into center frequencies (Hz) ranging from 31 to 8,000 Hz.
Low Frequency Noise (LFN)	The frequency range of 10 Hz to 200 Hz is typically defined as low frequency noise. At sufficiently high levels, LFN can cause vibrations in structures and physiological effects in humans. LFN is generally associated with older wind turbines with downwind rotors. The lowest note on a full range piano is approximately 32 Hz and middle C is approximately 261 Hz.
Directivity	Directivity accounts for the variation in sound intensity with orientation relative to the noise source. The Directivity correction is given as DI.
Wavelength	The distance between peaks of a propagating wave with a well defined frequency. It is related to the frequency through the following equation $\lambda=c/f$ where c is the sound speed and f is the frequency in Hz. It has the dimension of length.

Notes: Compiled by TtEC Boston from multiple technical and engineering resources

2.0 NOISE REGULATIONS AND GUIDELINES

This section presents information on the criteria used to evaluate the effects of noise from the Project. With the exception of the EPA environmental noise guidelines and the United States Occupational Health and Safety Administration's (OSHA) regulations that describe health and safety limits for noise exposure, there are no overarching state, county, or federal noise requirements specific to this Project or wind energy facilities in the State of North Dakota.

2.1 Environmental Protection Agency Environmental Noise Guidelines

While the EPA has no regulation governing environmental noise, the agency has conducted several extensive studies to identify the effects of sound level on public health and welfare. In 1974, the EPA published a landmark noise document entitled, "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety". This publication remains the authoritative study based on a large sampling of community reaction to noise. The EPA sound level guidelines do not provide an absolute measure of noise impact, but rather a consensus on potential activity interference and annoyance. For outdoor residential areas, the recommended EPA guideline is an L_{dn} of 55 dBA (equivalent to a L_{eq} (1-hour) of 48.6 dBA assuming continuous 24-hour operation). The EPA sound level guidelines also suggest an L_{eq} of 70 dBA (24-hour) limit to avoid adverse effects on health and safety at publicly accessible property lines or work areas. Since the protective levels were derived without concern for technical or economic feasibility, and contain a margin of safety to insure their protective value, they must not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there are no reason to suspect that the general population will be at risk from any of the identified effects of noise. The EPA criteria limits are summarized in Table 3.

Table 3 Summary of EPA Cause and Effect Noise Levels

Location	Level	Effect
All public accessible areas with prolonged exposure	70 dBA $L_{eq(24)}$	Safety / hearing loss concerns
Outdoor at residential structure and other NSAs where a large amount of time is spent	55 dBA L_{dn}	
Outdoor areas where limited amounts of time are spent, i.e., park areas, school yards, golf courses, etc.	55 dBA $L_{eq(24)}$	Protection against annoyance and activity interference
Indoor residential	45 dBA L_{dn}	
Indoor non-residential	55 dBA $L_{eq(24)}$	

The EPA sound level guidelines states that the levels identified are low enough to be protective with an adequate margin of safety. The EPA sound level guidelines do not impose arbitrary federal decisions about the appropriateness of noise environments upon any level of government, nor is it a source of instructions for solving local noise problems, it is best viewed as a technical aid for local decision makers who seek to balance scientific information about effects of noise on people with other considerations, and to reconcile local economic and political realities with scientific information such as cost and technical feasibility. It should also be noted that in any environment, a portion of the general population may be annoyed (and complain) due to the presence of any level of recurring audible sound regardless of the actual or perceived loudness.

2.2 Occupational Safety and Health Administration Noise Safety Standards

The Federal Government has long recognized the potential hazards caused by noise on industrial and construction projects. OSHA's current noise standard for the construction industry stems from the occupational noise standard originally published in 1969 by the Bureau of Labor Standards under the authority of the Construction Safety Act (40 U.S.C. 333). OSHA adopted the construction noise standard in 1971 (36 FR 7340, 4/27/ 71) and later recodified it as 29 CFR 1926.52. Another section of the construction standard (29 CFR 1926.101) contains a provision requiring employers to provide hearing protection devices when needed. Both sections 1926.52 and 1926.101 apply to employers engaged in construction where high noise levels are possible.

Paragraph (a) of section 1926.52 requires protection against the effects of noise exposure when 8-hour time-weighted average sound levels exceed a permissible exposure limit (PEL) of 90 dBA, measured on the A-scale of a sound level meter set at slow response. The exposure level is raised 5 dB for every halving of exposure duration as shown in Table 4. Furthermore, exposure to impulsive or impact noise should not exceed a 140 dB peak sound pressure level.

Table 4 OSHA Permissible Daily Noise Exposure Limits

Duration of Exposure Per Day (Hours)	Sound Level (dBA)
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

Paragraph 29 CFR 1926.52(b) states that when employees are subjected to noise doses exceeding those shown in Table 4, feasible administrative or engineering controls will be identified and implemented to lower employee noise exposure. If controls fail to reduce sound to the PEL, personal protective equipment must be provided and used to reduce noise exposure. In compliance with OSHA, Project contractors will be required to readily provide construction workers with OSHA approved hearing protection devices (HPD) and to identify high noise areas and activities where hearing protection will be required. Operational sound generated from the Project will not approach OSHA noise exposure limits even in very close proximity to individual WTG locations.

2.3 Summary of Acoustic Criteria

A summary of the pertinent acoustic criteria used to assess sound levels at existing sensitive areas during Project operation is provided below:

- EPA 70 dBA $L_{eq\ (24)}$ at publicly accessible Project property lines or extents of work areas where extended public exposure is possible;
- EPA 55 dBA $L_{eq\ (24)}$ in outdoor areas where limited time is spent;
- 55 dBA $L_{dn\ (24)}$ outdoors at all residential receptor locations where extended periods of time are spent outdoors, residential structures and areas in close proximity to the residential structure, i.e. yards. Wind turbines operate intermittently depending on wind conditions at hub height. Assuming the wind turbine is operating as a continuous steady state sound source and is the dominant contributor of environmental sound level at the receiver location, the L_{dn} is approximately 6.4 dB above the measured L_{eq}. Consequently, an L_{dn} of 55 dBA corresponds to a maximum instantaneous L_{eq} of 48.6 dBA; and
- OSHA regulatory limits for worker exposure and public safety

The application of the EPA noise guidelines are one important aspect of affording adequate protection of human health and quality of life. The noise criteria cannot be used to infer audibility thresholds; however, compliance with EPA guidelines would likely result in reduced probability of annoyance and noise complaints. Inaudibility under all operating conditions is an unrealistic expectation, and one that is not required under any other industrial, commercial, or agricultural activity in the State of North Dakota. OSHA noise safety standards are mandatory requirements at all times. Regulations presented are absolute and are assessed for Project generated sound only. They are independent of existing acoustic environment; therefore, no baseline sound survey is required to assess conformity.

3.0 ACOUSTIC MODELING METHODOLOGY

This section discusses the sound source characteristics, modeling procedures, and input parameters used in the acoustic assessment. Tetra Tech's procedures have been developed based on review of relevant databases and technical reports, Geographic Information System (GIS) data, manufacturers' sound emission data specifications., and extensive experience in the modeling and compliance measurements of operational wind energy facilities. Regulatory and GIS data sets were compiled through in-house libraries and verifiable federal, State, and local agency sources.

3.1 Wind Turbine Sound Characteristics

There are two principal sound sources from an operating WTG: mechanical and aerodynamic sound. Mechanical sound is generated at the gearbox, generator, and cooling fan and is radiated from the surfaces of the nacelle and machinery enclosure and by openings in the nacelle casing. Aside from upset conditions that may result in abnormal mechanical noise emissions, the dominant noise generating components of utility scale WTGs is aerodynamic.

Aerodynamic sound is related to air flow and the interaction with the tower structure and rotor blades when in motion. Air flow entering the rotor swept area is not completely smooth, consisting of turbulent eddies of air that results in noise due to inflow turbulence. Air flow occurring across the blade produces turbulence at the surface boundary layer, resulting in trailing edge boundary sound. Trailing edge sound is considered the principal aerodynamic noise source component from WTGs. In addition, tip sound is created by vortex shedding as the blade tips pass through the air. Vortices that are shed from the tips of the WTG blades are blown back behind the rotating blades by the wind When these eddies cut across the wind support structure this results in the characteristic amplitude modulated (time-varying) swooshing sound at the rate at which the blade passes the tower. Acoustic modulation is most perceptible in close proximity to the base of the WTG tower.

Wind turbine manufacturers have instituted sound reduction measures to both reduce aerodynamic sound and increase power generation efficiency by reducing trailing edge and tip sound generation. Efforts to reduce aerodynamic sounds have included the use of lower tip speed ratios, lower blade angles of attack, upwind rotor designs, variable speed operation and the use of specially modified blade trailing edges to reduce turbulence. Early WTG designs had the blades located downwind of the support structure. As the blades passed through the vortex shed behind the support tower, the blade would become excited when it was momentarily deflected, resulting in a pressure pulse. This becomes the mechanism for the generation of excessive acoustic modulation and low frequency sound. The downwind rotor design is rarely used in modern utility-scale WTGs which employ the now-standard upwind rotor design, with blades upstream of the tower structure. This change in rotor location has eliminated the issues associated with the downwind design and resulted in a decrease of 10 dB or greater, which corresponds to a perceived decrease in loudness by a factor of two.

A somewhat unique acoustic characteristic of wind energy projects is that the sound generated by each individual wind turbine will increase as the wind speed across the site increases, up to a certain maximum sound level under elevated wind conditions (i.e., greater than approximately 8 m/s). The GE 1.5 MW xle is a variable speed type wind turbine with sound predominantly determined by the aerodynamic broadband noise of the rotor blades, which is directly related to the circumferential or blade tip speed. The trailing edge noise generation increases with increasing wind speed until rated power and rotor speed is reached. Noise emission measurements completed on the GE 1.5 MW xle by an independent qualified measuring institute show that once nominal power is reached, the sound power does not increase any longer with increasing wind speed. Background ambient sound levels will likely continue to increase, resulting in acoustic masking effects.

3.2 Acoustic Modeling Software and Calculation Methods

The operational acoustic assessment was performed using the Project design layout as of May 22, 2009 and employing the most recent version of DataKustic GmbH's CadnaA, the computer aided noise abatement program (v 3.7.123). CadnaA is a comprehensive 3-dimensional acoustic software model that conforms to the Organization for International Standardization (ISO) standard ISO 9613-2 "Attenuation of Sound During Propagation Outdoors".

The engineering methods specified in this standard consist of 1/1 octave band algorithms that incorporate the following:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption;
- Screening by topography and obstacles;
- Terrain complexity and ground effects;
- Source directivity factors;
- Height of both sources and receptors;
- Seasonal foliage effects; and
- Meteorological conditions including the effects of wind and atmospheric inversions.

The CadnaA acoustic modeling software has been shown to be a highly accurate and effective acoustic modeling tool for wind energy projects when appropriate WTG acoustic modeling techniques and site-specific terrain and topographical features are considered. Calculation correction factors have been applied to account for inherent limitations in the ISO 9613-2 standard to account for specialized application of a large dimension-elevated sound source such as a WTG.

The ISO9613-2 standard calculates received sound pressure levels for meteorological conditions favorable to propagation, i.e. downwind sound propagation or what might occur typically during a moderate atmospheric ground level inversion. Though a physical impracticality, the ISO 9613-2 standard simulates omnidirectional downwind propagation and worst case WTG source directivity factors. For receptors located between discrete WTG locations or WTG groupings, the acoustic model will result in over-predicted received sound level results. In addition, the acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix but flow at different velocities. This conservative assumption does not take into consideration turbulent eddies that form when winds change speed or direction, which can be destructive thereby increasing attenuation effects. Conversely, there may be anomalous meteorological conditions from time to time that will aid in the long range propagation of sound, potentially causing Project sound levels to increase, specifically at points of reception located further away from Project WTGs.

Topographical information was imported into the acoustic model using the official United States Geological Survey (USGS) digital elevation dataset to accurately represent terrain in three dimensions. Terrain conditions, types of vegetation, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613-2 standard accounts for ground absorption rates by assigning a numerical coefficient of 0 for acoustically hard, reflective surfaces and 1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, or for sound traveling over bodies of water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation. In contrast, ground covered in snow (common in this particular area during the winter season), vegetation, including suburban lawns, livestock and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation, i.e. G=1.0. A conservative ground absorption rate was selected, accounting for semi-reflective ground surfaces across the entire acoustic study area. This ground absorption coefficient was further reduced for receptor locations in close proximity to WTGs to account for decreased ground attenuation effects for an elevated sound source relative to receiver height. Additional sound attenuation through foliage and diffraction around and over existing anthropogenic structures were disregarded for all modeling scenarios. The results are therefore representative of a worst case defoliate winter time conditions.

For this model, each WTG is modeled as an elevated point source at the position of the hub, an approach which is valid when the distance from the source is large compared to the dimensions of the source. The equivalent continuous downwind octave band sound pressure level at a receiver location is calculated for each individual turbine source and its image sources on both a broadband and frequency dependent basis from 63 Hz to 8 kHz. Geometrical divergence accounts for spherical spreading in the free field from a point sound source according to the equation below:

$$L_P = L_W + DI_\theta - 10\log\left(\frac{1}{2}\pi R^2\right) - A \quad \text{in dBA or dBL}$$

Where:

L_P = calculated sound pressure level at receiver location

L_W = reference sound power level by octave band center frequency

DI_θ = directivity index correction to account for the variation in sound intensity with orientation relative to the noise source.

R = linear (slant) distance of Lp from source in meters (or feet multiplied by 3.28) to calculate geometrical divergence with distance

A = extraneous attenuation factors that may occur during propagation from the point sound source to the receiver.

For idealized point sources, sound levels will attenuate with increased distance from the source in accordance with the "inverse square law" due to geometric divergence which occurs as the sound energy is spread across a sphere of greater dimensions. The classical theory of spherical wave propagation may not be valid at large distances from a sound source when the influences of wind or temperature gradients are present (i.e., anomalous meteorological conditions). The waves are curved downward towards the ground and then reflected up and the process is repeated leading to a trapped sound wave. The wave refraction effects due to wind and temperature gradients during downwind conditions result into the convergence of modified cylindrical wave spreading. Though infrequent, Project operational sound levels resulting from anomalous meteorological conditions were also considered in the modeling analysis to ensure a complete and conservative assessment.

In addition to geometrical divergence, attenuation factors (A) include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. Meteorological factors that can influence sound propagation include (in approximate order of increasing importance): humidity, precipitation, temperature, atmospheric stability, turbulence, wind speed and direction.

The acoustic model assumes that all WTGs are operating continuously and concurrently at the maximum manufacturer-rated sound level at the given operational condition and sound energy is summed using the following equation, in accordance with ISO 9613-2:

$$L_{P_A}(DW) = 10\log\left\{\sum_{i=1}^{\#}\left[\sum_{j=1}^{9} 10^{0,1[L_{fT}(ij)+f(A-wtd)(j)]}\right]\right\}$$

Where:

n = # is the number of contributions i (sources and paths);

j = is an index indicating the nine standard octave band center frequencies spanning from 31 Hz to 8 kHz;

Calculations were completed using an 82 ft (25 m) by 82 ft grid with a receiver height of 5 ft (1.5 m) above grade (the approximate height of ears of a standing person). Calculations at discrete residential receptor locations were also completed at the same receiver height.

3.3 Acoustic Modeling Input Parameters

In order to assist Project developers and acoustical engineers, commercial wind turbine manufacturers report wind turbine sound power data at each integer wind speed referenced to a height of 32.8 ft (10 m) above grade, ranging from cut-in to full rated power. This internationally accepted International Electrotechnical Commission (IEC) standard was developed to ensure consistent and comparable sound emission data of utility-scale wind turbines between WTG manufacturers. These data are inclusive of mechanical and aerodynamic source components. Wind turbines can be somewhat directional, radiating more sound in some directions than others. The IEC test measurement protocol requires that sound measurements are made for the maximum downwind directional location when reporting apparent sound power levels. Thus, worst case directivity and sound generating efficiencies of the WTG are reported in the sound source data and used in the acoustic model calibration.

A summary of sound power data for the selected GE 1.5 MW xle WTG correlated by wind speed at a height of 10 m (32.8 ft) above grade are presented in Table 5. Source data were modeled at the rotor hub height of 80 m (262.4 ft). The GE 1.5 xle specification reports a confidence interval of K=2 dB to account for the manufacturer's warranty clause which was incorporated into the acoustic model to ensure a conservative acoustic modeling assessment.

Table 5 Broadband Sound Power Levels (dBA) Correlated with Wind Speed

	WTG L_{max} Sound Power Level (L_W) at Reference Wind Speed							
10-meter Wind Speed	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
GE 1.5 MW xle	<96	<96	<96	98.8	102.3	<104.0	<104.0	<104.0

A summary of sound power data for the GE 1.5 xle by octave band center frequency is presented in Table 6.

Table 6 GE 1.5 xle Sound Power Level by Octave Band Center Frequency

Frequency (Hz)	Octave Band Sound Power Level (dBA)								Broadband (dBA)
	63	125	250	500	1000	2000	4000	8000	
GE 1.5 xle	83.4	92.2	97.8	99.4	97.7	93.4	86.6	84.8	104.0

4.0 MODELING RESULTS AND COMPLIANCE DETERMINATION

Operational broadband (dBA) sound pressure levels were calculated throughout the Project area. Acoustic modeling results and the overall analysis conclusions are given in the following sections.

4.1 Acoustic Modeling Results

Acoustic modeling for the final Project layout was completed for WTG cut-in and full rotational operating conditions thereby describing sound pressure levels over the entire range of future Project operational conditions. The acoustic modeling analysis consisted of calculating received sound levels at receptors in Griggs and Steele Counties. A list of receptors, unique number identifier, UTM coordinates and received sound levels are provided in Table 7.

Sound contour plots displaying Project operational sound levels in color-coded isopleths are provided in Figures 2-4. Figure 2 shows broadband (dBA) operational sound levels under low level wind speeds sufficient for WTGs to operate at initial WTG cut-in rotational speeds. Figures 3 and 4 show broadband (dBA) operational sound levels at wind speeds to sustain WTGs to operate at maximum rotational speeds for both moderate downwind propagation and worst case anomalous meteorological conditions, which can result in increased sound propagation over long distances, respectively. The acoustic modeling was completed for all WTGs are operating concurrently. The resultant sound contour plots are independent of the existing acoustic environment, i.e., the plots represent Project-generated sound levels only.

Table 7 Summary of WTG Acoustic Model Output at Receptors (dBA)

ID	UTM Coordinates (m) Easting	Northing	Residential Status	Cut-in	Maximum Rotational	Maximum with Anomalous Meteorological
1	577943	5234042	Occupied	35.3	43.3	43.8
2	580136	5234084	Occupied	27.7	35.6	37.8
3	*580172*	*5234823*	*Abandoned**	*29.5*	*37.4*	*39.5*
4	578058	5235452	Occupied	38.3	46.2	46.7
5	576452	5235674	Occupied	33.9	41.9	42.7
6	580955	5235593	Occupied	32.6	40.5	41.7
7	*576929*	*5236628*	*Abandoned**	*37.9*	*45.9*	*46.3*
8	580066	5236532	Occupied	34.7	42.7	44.0
9	583290	5236534	Occupied	30.9	38.8	40.4
10	*580797*	*5237298*	*Abandoned**	*36.6*	*44.6*	*45.5*
11	578959	5237317	Occupied	39.6	47.5	48.1
12	576824	5237783	Occupied	33.2	41.2	42.2
13	*583377*	*5238914*	*Abandoned**	*33.5*	*41.5*	*42.7*
14	*579780*	*5238925*	*Abandoned**	*39.3*	*47.3*	*47.9*
15	*580765*	*5239004*	*Abandoned**	*38.5*	*46.5*	*47.1*
16	*581799*	*5238934*	*Abandoned**	*37.2*	*45.2*	*46.0*
17	*578187*	*5239076*	*Abandoned**	*38.7*	*46.7*	*47.3*
18	*577480*	*5239221*	*Abandoned**	*41.3*	*49.2*	*49.6*
19	583396	5239372	Occupied	32.8	40.7	42.3
20	576426	5239877	Occupied	31.1	39.0	40.4
21	577050	5240101	Occupied	36.4	44.3	44.9
22	*580393*	*5240459*	*Non-Residential Farm Buildings**	*42.2*	*50.2*	*50.5*
23	581646	5240174	Occupied	36.2	44.2	45.2
24	576564	5240486	Occupied	30.0	38.0	39.5
25	583384	5240343	Occupied	35.3	43.3	44.0
26	578086	5240529	Occupied	40.3	48.3	48.6
27	583832	5240565	Occupied	32.6	40.6	41.8
28	577347	5240903	Occupied	35.3	43.2	44.1
29	581852	5241069	Occupied	37.6	45.6	46.2
30	*582369*	*5241959*	*Abandoned**	*37.2*	*45.1*	*45.6*
31	575932	5241880	Occupied	25.8	33.7	35.9
32	583294	5241769	Occupied	36.2	44.2	44.6
33	582990	5242031	Occupied	36.3	44.2	44.7
34	583409	5239245	Occupied	32.6	40.6	42.1
35	578022	5242598	Occupied (Not Confirmed)	28.3	36.2	37.6
36	584309	5242025	Occupied (Not Confirmed)	28.1	36.0	37.9
37	*580275*	*5240357*	*Non-Residential Farm Buildings**	*40.2*	*48.2*	*48.7*
38	579019	5237320	Occupied	39.7	47.7	48.2
Number of Potential Exceedances EPA Noise Guideline at NSAs				**None**	**None**	**None**

Notes: Abandoned homesteads and non-residential farm buildings (*) were not considered noise sensitive receivers for the determination of compliance status.

The manufacturers' guaranteed maximum sound power level of 106 dBA and worst case directivity effects were incorporated into the modeling analysis to ensure conservative results. Reported sound pressure levels are representative of receptors located downwind of the WTGs; lower sound levels are expected in other directions dependant on wind velocities, speed, direction, and gustiness. The acoustic modeling results were compared the broadband (dBA) guideline criteria as described in Section 2.0 of this report, specifically the EPA broadband guideline of 55 dBA L_{dn} (equivalent to a $L_{eq\ (1\text{-hour})}$ of 48.6 dBA assuming continuous 24-hour operation) which was used as a internal Project design goal.

The EPA criteria presented in Section 3.2 are based on a yearly L_{dn}. To compute this, knowledge of future atmospheric conditions across the site over a long period of time would need to be known. The approach used in this screening level analysis uses the L_{max}, or maximum received sound pressure levels representing the highest cumulative noise from the wind farm within the acoustic study area. Results are representative of the worst case in terms of potential received sound levels under the assumption of a sustained wind in a single direction over a continuous 24-hour period. Actual wind speeds and directions will vary. The worst case yearly L_{dn} was then calculated using the following equation, consistent with the EPA guidance:

$$\text{Yearly } L_{dn} \text{ (exterior)} = 10 \cdot \log_{10}[(15 \cdot 10^{(Leq(1\text{-hour})/10)} + 9 \cdot 10^{((Leq(1\text{-hour})+10)/10)} / 24] \text{ dBA}$$

In this equation for calculating environmental noise, the $L_{eq\ (1\text{-hour})}$ was assigned the value of the Project-generated instantaneous for the operating condition under analysis (cut-in or at full rotational speed). Under real world meteorological conditions, received sound pressure levels will fluctuate somewhere between cut-in and up to maximum rotational over the course of one year. During periods below the cut-in wind speeds when WTGs do not operate, the Project will generate minimal sound. For time-varying sources including wind energy conversion projects, assessing compliance under this continuous worst case operational condition (L_{max}) will ensure compliance during all other possible future operational conditions. Though this operating scenario is not realistic, its use will result in a highly conservative compliance assessment approach.

4.2 Compliance Determination

WTGs have been located to maintain a setback distance of 1,400 feet or greater from existing occupied residences. Project operational noise has been calculated and compared to relevant environmental noise criteria as established by the EPA and OSHA. Table 8 summarizes sound modeling results for Project cut-in and maximum rotational speeds as may occur during moderate wind velocities and under certain anomalous meteorological conditions.

Table 8 Summary of Modeling Results and Comparison to EPA Guidelines

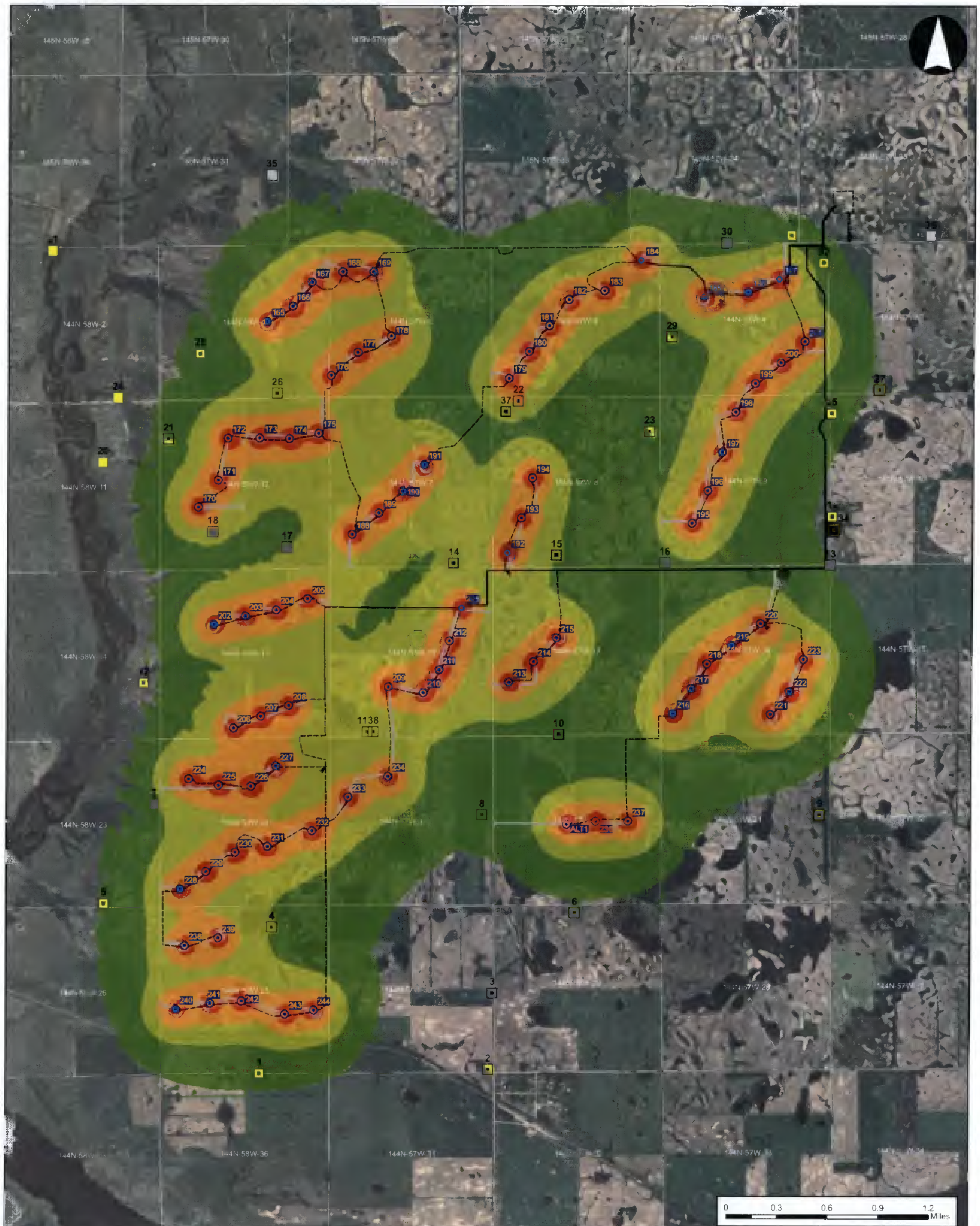
Operating Scenario	Receptor IDs of Potential Exceedances of EPA Guideline (NSAs)
Cut-in Operation	None
Maximum Rotational – Moderate Downwind Meteorological Conditions	None*
Maximum Rotational – Anomalous Downwind Meteorological Conditions	None*

Notes: Abandoned homesteads (*) were not considered noise sensitive receivers for the determination of compliance status.

The acoustic model contour plots and tabulated modeling results at discrete receptor locations clearly demonstrate the feasibility of the Project to operate in full compliance with the EPA noise guideline at all existing NSAs, defined as residential structures. Potential exceedances of the EPA noise guideline criteria were identified at two abandoned homesteads under moderate downwind meteorological conditions and at three abandoned homesteads under certain anomalous meteorological conditions. As unoccupied residences no further mitigation or WTG layout modifications are warranted at this time as these receptors are not considered noise sensitive.

The EPA guideline limits identified by the Applicant for use on this Project are not a legally enforceable, but serve as useful guidelines to determine the likelihood of adverse community noise impacts. The EPA guidelines do not require inaudibility of a sound source. In fact, even if received sound levels are below ambient conditions, the spectral and temporal characteristics of a sound may result in perceptible sound. The results of the acoustic modeling indicate that operation of the Project may result in periodically audible sound within the adjacent areas under certain operational and meteorological conditions. Individual response to low-level WTG noise is largely subjective and therefore not easily predictable and may depend on several technical and non-technical factors including predetermined perceptions of the Project, individual and community economic incentives, existing background sound levels which fluctuate, the proximity of listener to the Project, among several others. Project participants have been found to be less likely to be annoyed by low level WTG noise than non-participants. Non-participants that consider the development of renewable energy sources, and wind farms specifically, as beneficial will also be more likely to deem the low level environmental noise as generally acceptable.

In conclusion, acoustic modeling results even with a number of conservative assumptions demonstrate compliance with the EPA guideline limits as calculated at existing residential receptors. Sound from the Project when audible, will likely not be deemed excessive or unusually loud at the proposed setback distance and will be consistent with sound generated at similar wind energy projects successfully sited throughout the state of North Dakota employing similar noise criteria limits.



TETRA TECH

ASHTABULA WIND II, LLC

LUVERNE WIND FARM

ACOUSTIC ASSESSMENT

STEELE AND GRIGGS COUNTIES, NORTH DAKOTA

FIGURE 2. RECEIVED SOUND LEVELS: WTGS AT CUT-IN

JUNE 2009

Legend

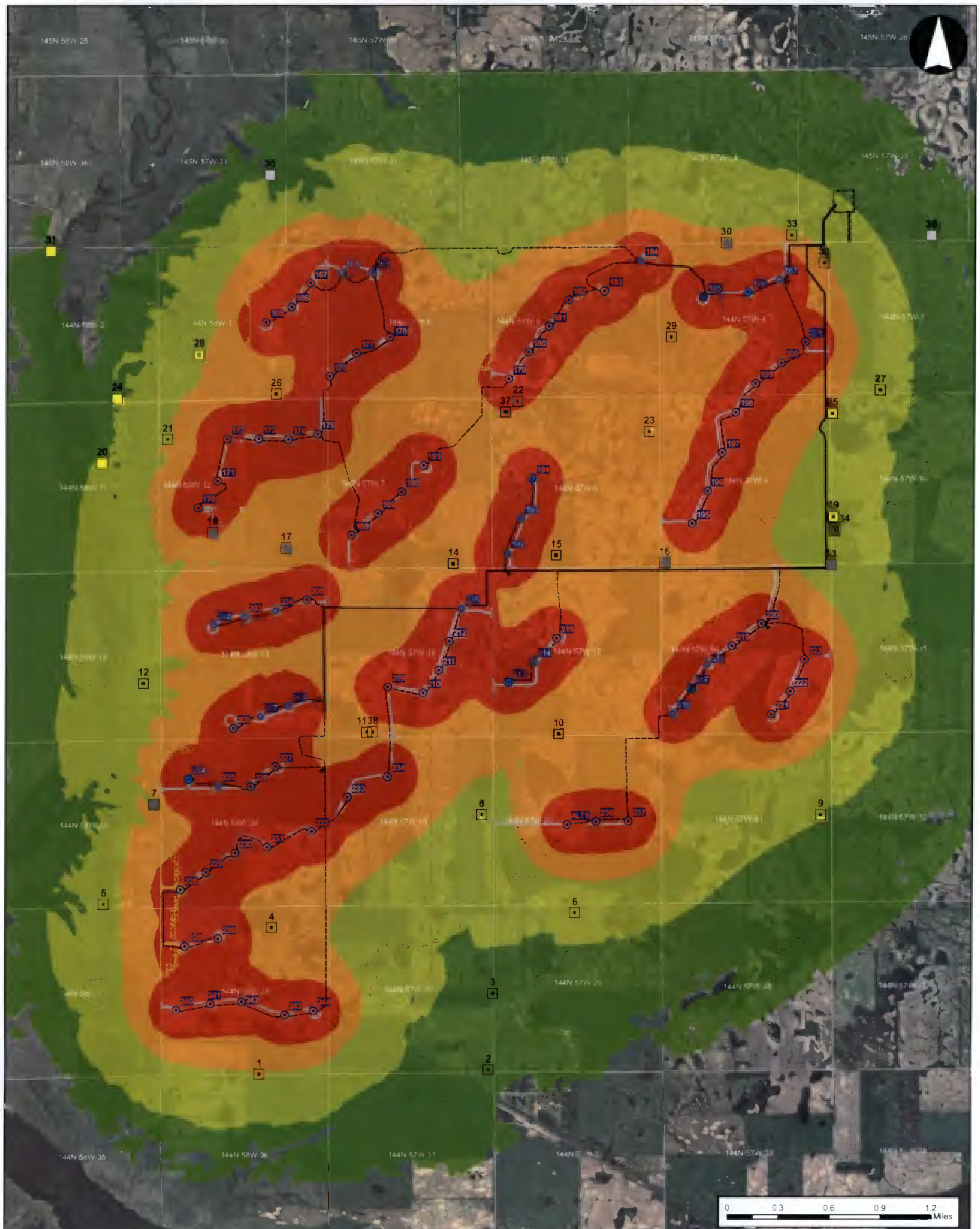
- Wind Turbine Generator (siteplan layout dated 5/22/09)
- Receptor Identified in FSR
- Occupied Receptor
- Unoccupied Receptor
- Unknown Occupancy Status
- Collection Line (5/22/09)
- Access Road (5/22/09)
- Township-Range-Section

Received Sound Levels

- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- >48.6 dBA*

*EPA Guideline = 48.6 dBA

REFERENCE MAP



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LUVERNE WIND FARM
ACOUSTIC ASSESSMENT
STEELE AND GRIGGS COUNTIES, NORTH DAKOTA

FIGURE 3. RECEIVED SOUND LEVELS: WTGS AT FULL ROTATION

JUNE 2009

Legend

- Wind Turbine Generator (siteplan layout dated 5/22/09)
- Receptor Identified in FSR
- Occupied Receptor
- Unoccupied Receptor
- Unknown Occupancy Status
- Collection Line (5/22/09)
- Access Road (5/22/09)
- Township-Range-Section

Received Sound Levels

- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- >48.6 dBA*

*EPA Guideline = 48.6 dBA

REFERENCE MAP

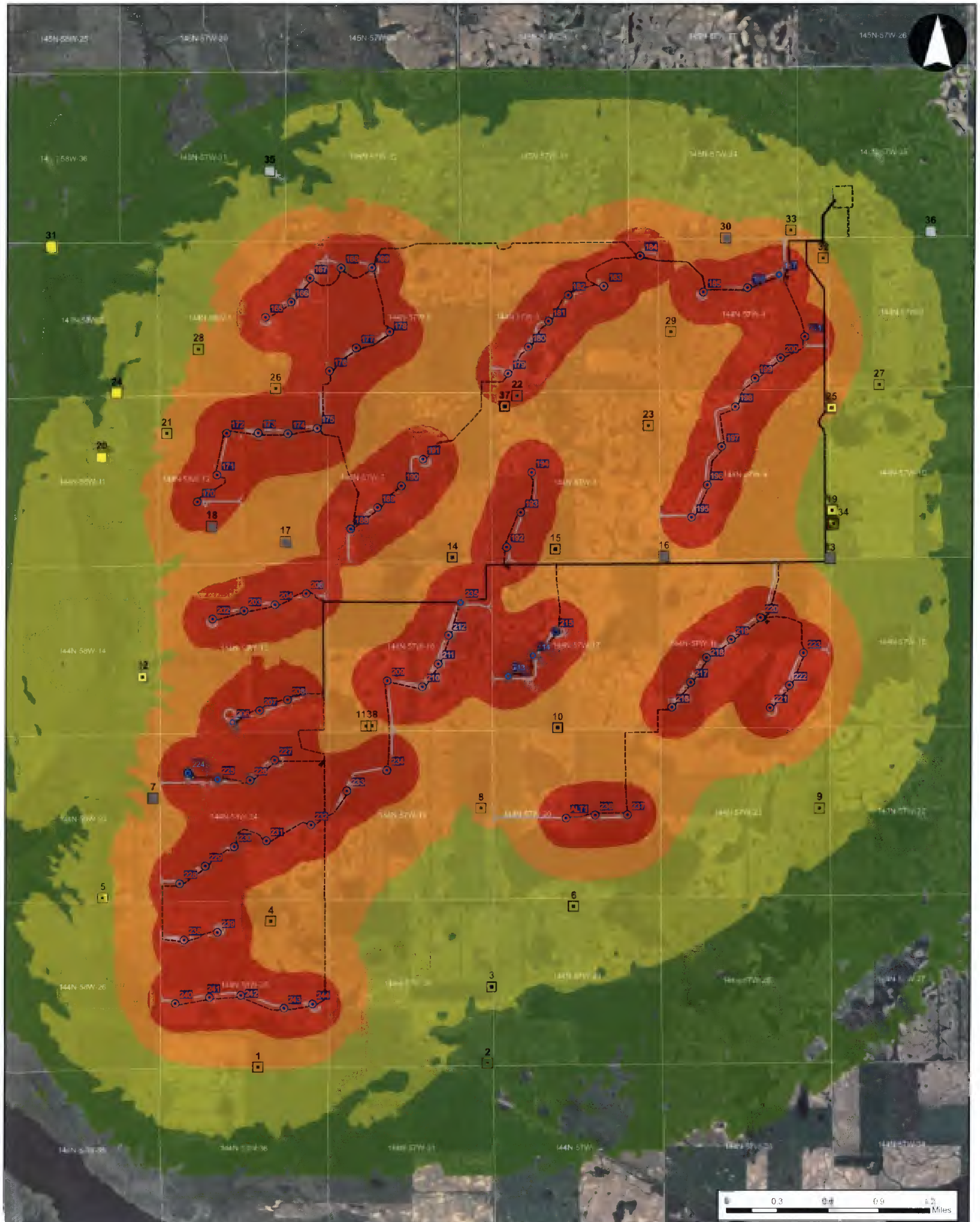

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FIGURE 4. RECEIVED SOUND LEVELS:
WTGS AT FULL ROTATION
ANOMALOUS METEOROLOGICAL CONDITIONS

JUNE 2009

Legend

- Wind Turbine Generator (siteplan layout dated 5/22/09)
- Receptor Identified in FSR
- Occupied Receptor
- Unoccupied Receptor
- Unknown Occupancy Status
- Collection Line (5/22/09)
- Access Road (5/22/09)
- Township-Range-Section

Received Sound Levels

- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- >48.6 dBA*

*EPA Guideline = 48.6 dBA

REFERENCE MAP

5.0 TECHNICAL REFERENCES

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