Oliver III Wind Energy Center
Acoustic Assessment
Morton County, North Dakota

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Prepared for

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TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AGL	above ground level
Applicant	NextEra Energy Resources, LLC
BIL	basic impulse level
BLM	Bureau of Land Management
CadnaA	Computer-Aided Noise Abatement Program
dB	decibel
dBA	A-weighted decibel
dBL	unweighted decibel
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
GE	General Electric
Hz	Hertz
HPD	hearing protection devices
IEC	International Electrotechnical Commission
ISO	Organization for International Standardization
kHz	kilohertz
kV	kilovolt
L_{dn}	day-night averaged sound level
L_{eq}	equivalent sound level
LFN	low frequency noise
L_{max}	maximum sound level
L_p	sound pressure level
L_w	sound power level
m/s	meters per second
mph	miles per hour
MISO	Midwest ISO
MVA	megavolt ampere
MW	megawatt
NEMA	National Electrical Manufacturers Association
OSHA	Occupational Safety and Health Administration
PEIS	Programmatic Environmental Impact Statement
Project	Oliver III Wind Energy Center
pW	picowatt
Tetra Tech	Tetra Tech EC, Inc.
µPa	microPascal
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
W	watt
WTG	wind turbine generator

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) has completed an acoustic assessment for the proposed Oliver III Wind Energy Center (Project) located in Morton County, North Dakota. A screening-level analysis was completed to evaluate expected sound levels resulting from wind turbine generator (WTG) operations as well sound from the electrical substation. The overall objectives of this study were to: (1) determine Project sound sources and site-specific sound propagation characteristics incorporating terrain effects; (2) Simulate sound levels using internationally accepted calculation standards; and (3) determine the feasibility of the Project to operate in compliance with applicable noise guidelines. The study also included assessment of noise generated during Project construction and maintenance activities and reviewed the potential for cumulative sound impacts with other existing or reasonably foreseeable future development.

Wind turbine sound source data was obtained from General Electric (GE), the manufacturer of the GE 1.6-megawatt (MW)-100 wind turbine model and as documented in the 2011 GE Specification. It is expected that the GE WTGs installed will have similar sound profiles to what was used in the acoustic modeling analysis; however, it is possible that the final warranty sound power levels may vary slightly. Sound propagation modeling was conducted using the Computer-Aided Noise Abatement (CadnaA) program (version 4.2.140), a comprehensive 3-dimensional acoustic modeling computer simulation software specifically developed for the power generation industry, with calculations made in accordance with the Organization for International Standardization (ISO) 9613-2 “Attenuation of Sound during Propagation Outdoors”. The industry standard CadnaA acoustic modeling software is widely used by sound engineers due to its adaptability to describe complex acoustic scenarios. The results of the acoustic modeling were compared to relevant standards including the U.S. Environmental Protection Agency (EPA) environmental noise guidelines and Occupational Safety and Health Administration (OSHA) regulatory limits for worker exposure and public safety.

Acoustic modeling results demonstrate that the Project has been adequately designed to operate in compliance with levels recommended by the EPA guidelines at all existing inhabited structures considered to be noise sensitive receptors with the exception of a potential exceedance at receptor ID 6003, which occurred under anomalous meteorological conditions. Receptor ID 6003 has been identified as a Project participant and as an unoccupied structure. The acoustic modeling incorporated a number of conservative model input assumptions to ensure that the project impacts were not underestimated. The Project will also be constructed and operated in adherence with all applicable OSHA Regulation noise safety standards. Operation of the Project may result in periodically audible sound at noise sensitive receptors under certain operational and meteorological conditions. Specifically, the Project will be audible at the closest receivers relative to the Project, when background sound levels are low, and wind speeds high enough for WTG operation. Residents outside their houses with a direct line of sight to an operating WTG may hear a gentle swooshing sound characteristic of wind energy projects. During meteorological conditions favorable to sound propagation and very quiet background ambient sound conditions, WTGs may be periodically audible at more distant locations. Conversely, at times the Project may be partially or fully masked by elevated ambient sound levels generated by the increased wind speed.

Individual response to low level WTG sound is largely subjective and therefore not easily predictable and may depend on several technical and non-technical factors, including predetermined perceptions of the proposed Project and wind energy in general, individual and community economic incentives, existing background sound levels, and/or the proximity of the listener to a single or grouping of WTGs. However, sound from the Project when audible will likely not be deemed excessive or unusually loud at the proposed setback distances and will be consistent with sound generated at similar wind energy projects successfully sited throughout the state of North Dakota employing similar noise criteria and WTG setback distances.

1.0 INTRODUCTION

Oliver Wind III, LLC, a subsidiary of NextEra Resources, LLC (NextEra) proposes to construct and operate the Oliver III Wind Energy Center located in Morton County, North Dakota. According to the turbine layout dated September 13, 2012, the Project consists of 30 GE 1.6-100wind turbine generators (WTGs), individually rated at 1.6 megawatt (MW), plus 3 alternatives (for a total of 33 WTGs). Each WTG will have a rotor diameter of 328 feet (100 meters) and an effective hub height of 262.5 feet (80 meters) above grade. The total potential power output capacity of the Project is approximately 48 MW. The Project will interconnect and deliver power into the Midwest ISO (MISO) system. The Project infrastructure also includes a collection electric substation, which has one 60 megavolt-ampere (MVA) transformer onsite, enabling the interconnection to the Oliver III transmission line. The transmission line was permitted as a separate action with a decision rendered on April 20, 2011 (PU-09-724).

Tetra Tech, Inc. (Tetra Tech) was retained to perform the acoustic assessment including analysis of expected future sound levels resulting from operation of all Project components at existing potential noise sensitive receptors (i.e., structures). The operational acoustic analysis was used to determine the feasibility of the Project to operate in compliance with the applicable noise standards and guidelines. This document presents the findings of the Oliver III Wind Energy Center acoustic assessment.

1.1 Project Area

The proposed Project Area is located in Morton County, North Dakota, a primarily rural agricultural area located north of Interstate 94 and east of State Highway 31, approximately 15 miles northwest of Bismarck, North Dakota. There are a few small communities near the Project Area. The city of New Salem is located approximately 10 miles to the southwest; the city of Center is located approximately nine miles north of the Project. The land within the Project Area boundary is privately owned and primarily agricultural with scattered farmstead structures. Current land use is predominantly dryland farming of spring and winter wheat, barley, sunflowers and corn, interspersed with cattle grazing.

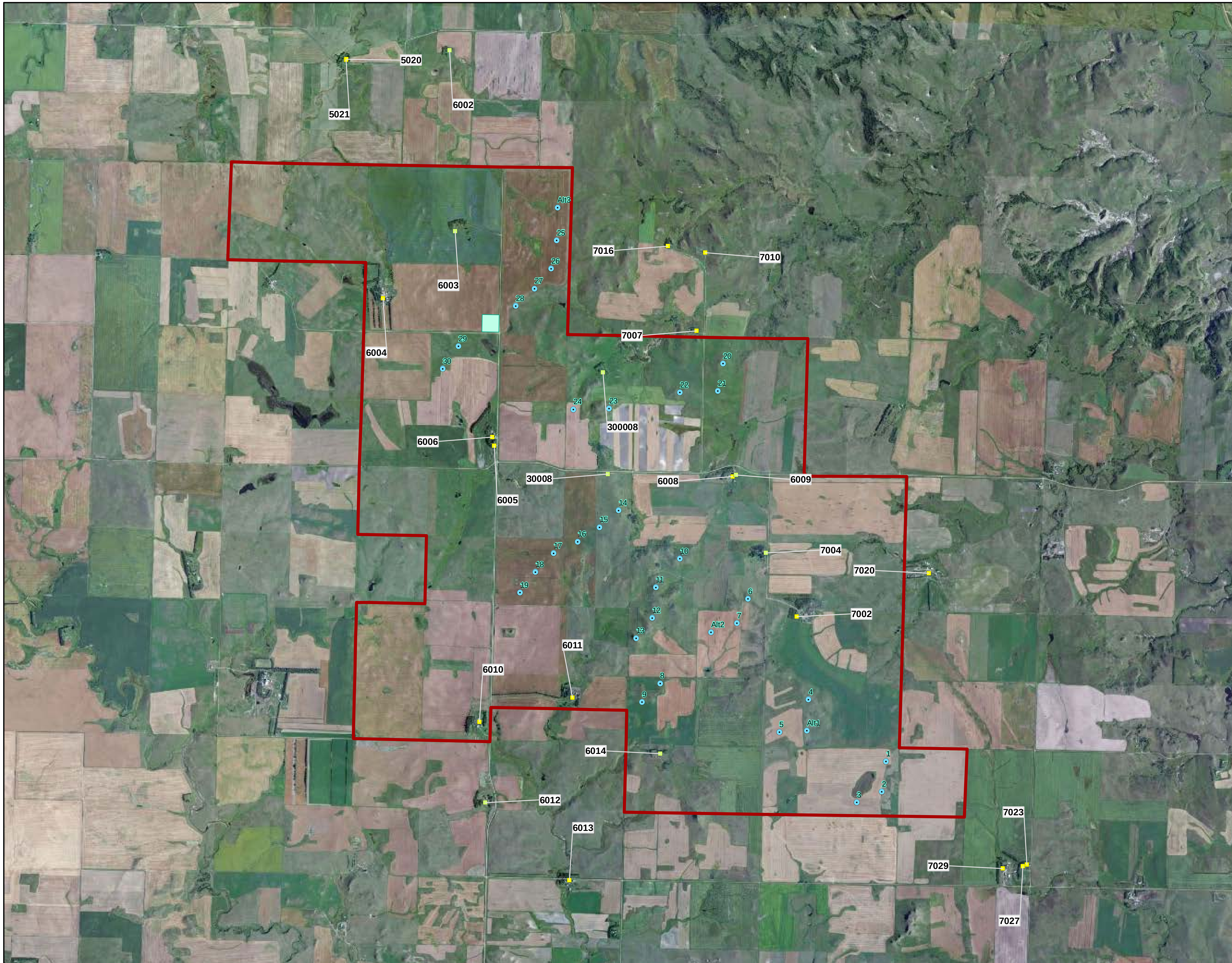
The Project Area is located within the Northwestern Great Plains ecoregion. Landscape components within this ecoregion include western mixed-grass/short-grass prairie, planted or tame grassland, upland deciduous forest, and associated wetlands. This semiarid, unglaciated region of North Dakota has a topography characterized by level to rolling plains with isolated sandstone buttes or badlands formations. Native grasslands persist in areas of steep or broken topography, but they have been largely replaced by spring wheat and alfalfa over most of the ecoregion. The Project Area is characteristic of the upland portion of the Missouri Slope and River Breaks regions, with the majority of the land surface currently covered by rangelands with some areas identified as native prairie. Patches of trees and shrubs exist throughout the Project Area, located primarily between agricultural fields, in drainages, and as shelter belts around homesteads and between agricultural fields.

A total of 31 potential receptor locations were identified within the designated acoustic study area, based on the Farmstead report dated February 11, 2010 provided by NextEra. Of these 31 receptors identified, 23 are existing occupied structures. Figure 1 presents the Project Layout, including the Morton County acoustic study area, the locations of the proposed WTGs, and receptor locations, that were incorporated in the Acoustic Assessment.

OLIVER WIND III, LLC
OLIVER III WIND ENERGY CENTER
Morton County, North Dakota

FIGURE 1
PROJECT LAYOUT

October, 2012



Legend
- Oliver III WTG (9/13/2012)
- Receptor - Occupied
- Receptor - Unoccupied
- Substation
- Project Boundary (6/5/2012)

N
W E
S

0 0.5 1
Miles

REFERENCE MAP

Path: P:\GIS\NextEra_OliverIII\GIS\Spatial\MXD\20121105_Noise\OliverIII_Noise_Fig1_ProjectLayout.mxd

1.2 Existing Acoustic Environment

Morton County is generally characterized as a rural agricultural land use area. Existing ambient sound levels are expected to be relatively low, although sound levels may be sporadically elevated in localized areas due to roadway noise or periods of human activity. Background sound levels vary both spatially and temporally depending on proximity to area sound sources, roadways and natural sounds. Principal contributors to the existing acoustic environment include motor vehicle traffic, mobile farming equipment, farming activities such as plowing and irrigation, all-terrain vehicles, local roadways, 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 may dominate the soundscape, predominantly in the warmer seasons.

Following review of the applicable noise limits, it was concluded that a baseline sound survey to further document the existing acoustic conditions was not requisite to provide a regulatory compliance determination, mainly due to the proposed setback distances to noise sensitive receptors (i.e. residential uses) and the largely rural surroundings.

1.3 Acoustic Terminology

Airborne sound is described as the rapid fluctuation or oscillation of air pressure above and below atmospheric pressure, creating a sound wave. Sound is characterized by properties of the sound waves, which are frequency, wavelength, period, amplitude, and velocity. Noise is further defined as unwanted sound and is measured in the same way. A sound source is defined by a sound power level (L_w), which is independent of any external factors. The acoustic 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, 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 and can be directly determined with a microphone or calculated from information about the source sound power level and the surrounding environment through predictive acoustic modeling. While the sound power of a source is strictly a function of the total amount of acoustic energy being radiated by the source, the sound pressure levels produced by a source are a function of the distance from the source and the effective radiating area or physical size of the source. In general, the magnitude of a source's sound power level is always considerably higher than the observed sound pressure level near a source due to the fact that the acoustic energy is being radiated in various directions.

Sound levels are presented on a logarithmic scale to account for the large pressure response range of the human ear, and are expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals (μPa). Conversely, sound power is commonly referenced to 1 picowatt (pW), which is one trillionth of a watt. Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), which corresponds to the rate in cycles per second that sound pressure waves are generated. Typically, a sound frequency analysis examines 11 octave (or 33 1/3 octave) bands ranging from 16 Hz (low) to 16,000 Hz (high). This range encompasses the entire human audible frequency range. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system. Sound exposure in acoustic assessments are commonly measured and calculated as A-weighted decibels (dBA). Unweighted sound levels are referred to as linear. 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. Sound levels that are linear are presented as dBL.

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 dBA is added to another sound of 50 dBA, the result is a 3-decibel increase (or 53 dBA), not an arithmetic doubling to 100 dBA. With respect to how the human ear perceives changes in sound pressure level relative to changes in "loudness", scientific research demonstrates that the following general relationships hold between sound level and human perception for two sound levels with the same or very similar frequency characteristics:

- 1 dBA is the practical limit of accuracy for sound measurement systems and corresponds to an approximate 10 percent variation in the sound pressure level. 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 pressure level and it corresponds to the threshold of change in loudness perceptible in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors.

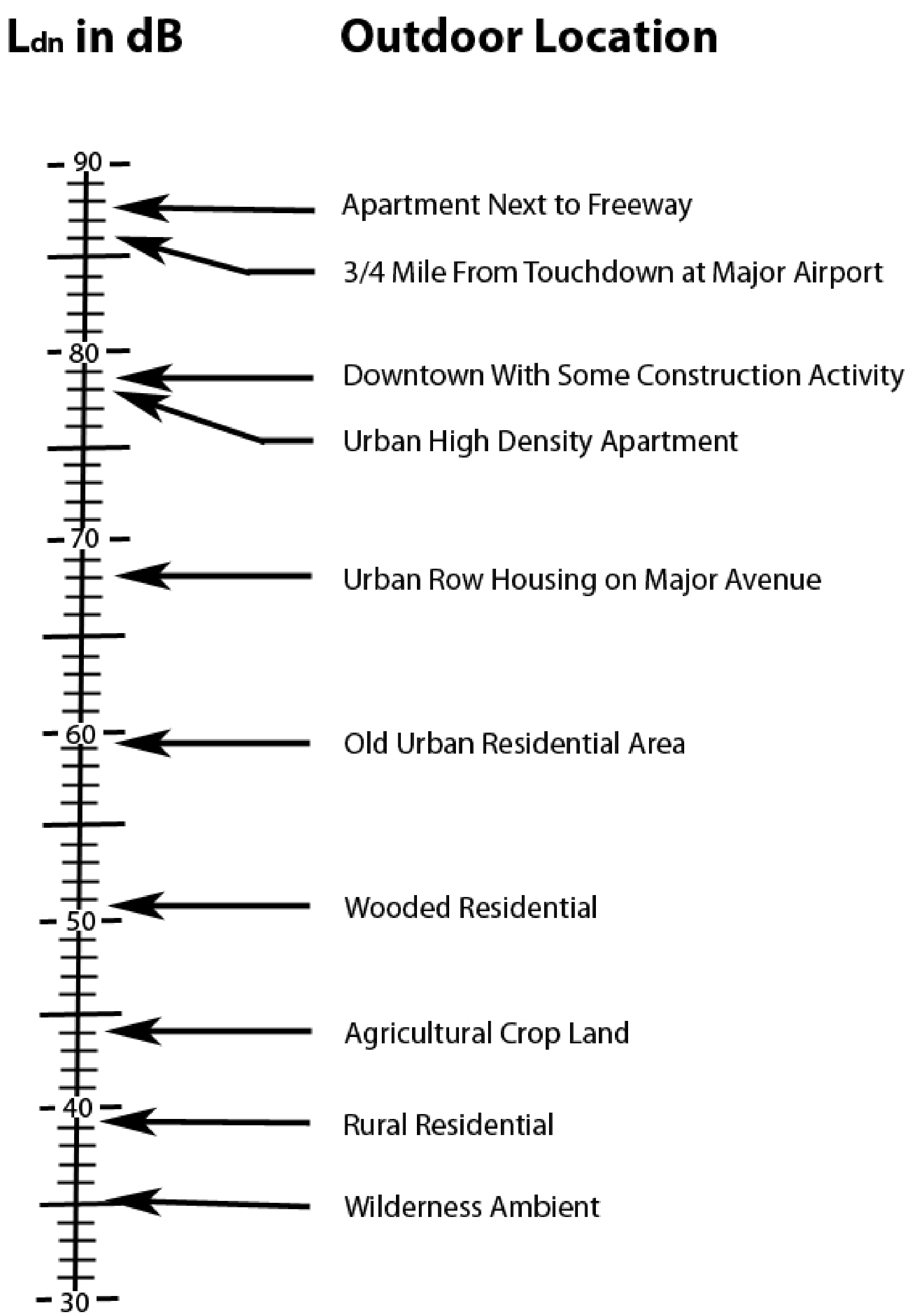
- 5 dBA increase or decrease is described as a perceptible change in sound level and is a discernible change in an outdoor environment.

- 10 dBA increase or decrease is a tenfold increase or decrease in acoustic pressure level but is perceived as a doubling or halving in loudness (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).

While the concept of sound is defined by the laws of physics, the term "noise" has further qualities of being excessive or loud. The perception of sound as noise is influenced by technical factors as intensity, sound quality, tonality, duration, and the existing background levels. The effects of noise on people can be classified into three general categories: (1) subjective responses such as annoyance, nuisance, and dissatisfaction; (2) activity interference, e.g., speech, sleep, and learning; and (3) physiological effects such as startling or hearing loss. According to the United States Department of the Interior Bureau of Land Management (BLM), "Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States," the sound levels associated with environmental noise (to the extent that any adverse impacts are produced) have been found to generally produce effects limited to the first two categories, only. At typical wind turbine setback distances, the comparatively low level sound generated by wind farms is expected to cause no discernible impact or fall principally within the subjective response category.

Sound can be measured, calculated, and presented in various formats, with a 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 environmental acoustic assessments. The L_{eq} is often further defined by the time period (T) it is measured over $L_{eq(T)}$, for instance $L_{eq,24}$ would indicate the equivalent sound level over a 24-hour period. 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. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Table 1. Table 2 provides additional reference information on acoustic terminology.

Table 1 Various Outdoor Sound Pressure (L_P) Levels



<u>Notes</u>:

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 dependent on level, character, frequency or pitch, time of day, and sensitivity and perception of the listener. This word adds the subjective response of humans to the physical phenomenon of sound. It is commonly used when negative effects on people are known to occur.
Sound Pressure Level (L_P)	Pressure fluctuations in a medium. Sound pressure is measured in decibels referenced to 20 micropascals, 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 picowatts (one trillionth of a watt). Equipment specifications are provided by equipment manufacturers as sound power as it is independent of the environment in which it is located. A sound level meter does not directly measure sound power.
Frequency (Hz)	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kilohertz (kHz). One hundred Hz is a rate of one hundred times (or cycles) per second. The frequency of a sound is the property perceived as pitch. For comparative purposes, the lowest note on a full range piano is approximately 32 Hz and middle C is 261 Hz.
A-Weighted Decibel (dBA)	Environmental sound is typically composed of acoustic energy across all frequencies (Hz). To compensate for the auditory frequency response of the human ear, an A-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report.
Propagation and Attenuation	Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity and atmospheric conditions.
Octave Bands	The audible range of humans spans from 20 to 20,000 Hertz and is typically divided into octave band center frequencies (Hz) ranging from 31 to 8,000 Hz.
Broadband Sound	The audible range of humans spans from 20 to 20,000 Hz and is typically divided into center frequencies ranging from 31 to 8,000 Hz.
Masking	Interference in the perception of one sound by the presence of another sound. At elevated wind speeds, leaf rustle and noise made by the wind itself can mask wind turbine sound levels, which remain relatively constant.
Low Frequency Noise (LFN)	The frequency range of 20 to 200 Hz is typically defined as low frequency noise. Studies have shown that low frequency sound from modern wind turbines is generally below the threshold of human perception at standard setback distances.
Infrasound	The frequency range of infrasound is normally defined as below 20 Hz. Infrasound from wind turbines are significantly below recognized thresholds for both human perceptibility and standardized health.

Note: Compiled by Tetra Tech 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 state, county, or federal noise requirements specific to this Project or wind energy facilities in the state of North Dakota. Morton County does not have an ordinance with numerical decibel limits.

2.1 Environmental Protection Agency Environmental Noise Guidelines

In 1974, the U.S. Environmental Protection Agency (EPA) published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA 1974). This report represents the only published study that includes a large database of community reaction to noise to which a proposed project can be readily compared. The EPA has developed widely accepted recommendations for long term exposure to environmental noise with the goal of protecting public health and safety. The publication evaluates the effects of environmental noise with respect to health and safety, and provides information for state and local governments to use in developing their own ambient noise standards. For outdoor residential areas and other locations in which quiet is a basis for use, the recommended EPA guideline is an L_{dn} of 55 dBA. The EPA also suggests an $L_{eq(24)}$ of 70 dBA (24-hour) limit to avoid adverse effects on public health and safety at publicly accessible property lines or extents of work areas where extended periods public exposure is possible. The EPA cause-and-effect 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
Outdoor at residential structure and other noise sensitive receptors where a large amount of time is spent	55 dBA L_{dn}	Protection against annoyance and activity interference
Outdoor areas where limited amounts of time are spent, e.g., park areas, school yards, golf courses, etc.	55 dBA $L_{eq(24)}$	
Indoor residential	45 dBA L_{dn}	
Indoor non-residential	55 dBA $L_{eq(24)}$	

USEPA (U.S. Environmental Protection Agency). 1974

The application of the EPA noise guidelines is a common assessment tool to help ensure adequate protection of human health and welfare. The EPA sound level guidelines state that the levels identified are sufficiently stringent to be protective of public health and welfare with an adequate margin of safety. The EPA sound level guidelines do not impose federal requirements on the appropriateness of noise environments, nor are they a source of instructions for solving local noise problems. They are best viewed as a technical aid for local decision makers who seek to consider scientific information about effects of noise on people, and to reconcile local economic and political realities with cost and technical feasibility. While the EPA criteria limits cannot be used to infer audibility thresholds, designing to meet EPA guidelines will result in adequately minimizing potential impacts on noise sensitive receptors. When projected sound impacts meet the EPA guidelines there is no evidence that the general population will be at risk to any identified health effects. In addition, designing to meet EPA guidelines will ensure that annoyance and activity interference will also be minimized. The EPA guidelines are not regulatory limits but are intentionally conservative to protect sensitive populations with an adequate margin of safety.

2.2 Occupational Safety and Health Administration Noise Safety Standards

The Occupational Safety and Health Administration (OSHA) provides regulatory limits for worker and public safety exposure to high noise levels. The federal government has long recognized the potential hazards caused by noise to work health and safety. Onsite noise levels are regulated by the Occupational Safety and Health Act of 1970 (29 Code of Federal Regulations [CFR] 1910.95). This regulation establishes standards for permissible noise exposure in the workplace to guard against the risk of hearing loss.

Table 4 presents a sliding scale of permissible noise levels by duration of exposure. The exposure level is raised 5 dB for every halving of exposure duration. OSHA permits noise levels up to 90 dBA, over a time-weighted average eight-hour shift ($TWA_{8\text{-}hr}$), measured on the A-scale of a sound level meter set at slow response. If there are workers exposed to a $TWA_{8\text{-}hr}$ above 85 dBA, then the regulations call for a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage protection.

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

When employees are subjected to noise exposures exceeding those shown in Table 4, feasible administrative or engineering controls must be identified and implemented to lower employee noise exposure. If administrative controls fail to reduce sound to these acceptable levels, personal protective equipment must be provided and used to reduce noise exposure. In compliance with OSHA, Project contractors will be required to provide construction workers with readily available OSHA-approved hearing protection devices and to identify high noise areas and activities where hearing protection is needed. Sound generated from the Project during normal operation will be below 85 dBA and the OSHA noise exposure limits, even immediately at the base of the tower structure.

2.3 Summary of Acoustic Criteria

A summary of the pertinent acoustic criteria used to assess sound levels at existing receptors 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, e.g., 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 the protection of worker exposure and public safety.
- Morton County does not have a noise regulation or standard; however, the County has adopted a wind energy condition use permit regulation, which requires turbines to be sited at least 1.25 times the turbine height or 1,320 feet from nearby occupied structures, commercial buildings, or public structures.

These noise limits identified are absolute and independent of the existing acoustic environment; therefore, a baseline sound survey is not required to assess conformity.

3.0 ACOUSTIC MODELING METHODOLOGY

Sound generated by an operating WTG is comprised of both aerodynamic and mechanical sound with the dominant sound component from utility scale WTGs being largely aerodynamic. Aerodynamic sound refers to the sound produced from air flow and the interaction with the WTG tower structure and moving rotor blades. 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. Due to the improved design of WTG mechanical components and the use of improved noise damping materials within the nacelle, including elastomeric elements supporting the generator and gearbox, mechanical noise emissions have been minimized. The WTGs being considered for the Project are upwind variable speed-type WTG with an active yaw and pitch regulated with power/torque control capability. Sound reduction elements designed into the GE 1.6-100 include impact noise insulation of the gearbox and generator, sound reduced gearbox, sound reduced nacelle, and rotor blades designed to minimize noise generation.

Wind farms, in comparison to conventional energy projects, are somewhat unique in that the sound generated by each individual WTG will increase as the wind speed across the site increases. Wind turbine sound is negligible when the rotor is at rest, increases as the rotor tip speed increases, and is generally constant once rated power output and maximum rotational speed are achieved. Under maximum rotational wind speed the assumed maximum sound power level will be reached, generally occurring at approximately 7 to 10 meters per second [m/s] depending on WTG type and according to manufacturer specifications. It is important to recognize, as wind speeds increase, the background ambient sound level will likely increase as well, resulting in acoustic masking effects. The net result is that during periods of elevated wind when higher WTG sound emissions occur, the sound produced from a WTG operating at maximum rotational speed may well be largely or fully masked due to wind generated sound in foliage or vegetation. In practical terms, this means a nearby receptor would tend to hear leaves or vegetation rustling rather than WTG noise. This relationship is expected to further minimize the potential for any adverse noise effects of the Project. Conversely, acoustic masking effects may be limited during periods of unusually high wind shear or at receiver locations that are particularly sheltered from prevailing winds.

3.1 Acoustic Modeling Software and Calculation Methods

The operational acoustic assessment was performed using the planned Project turbine layout dated September 13, 2012, which consisted of the 30 planned WTGs and 3 alternative WTG locations. The WTG sound specifications were obtained from the 2011 GE Specification documentation. It is expected that the GE WTGs installed will have similar sound profiles to what was used in the acoustic modeling analysis; however, it is possible that the final warranty sound power levels may vary slightly. The acoustic modeling analysis employed the most recent version of DataKustic GmbH’s CadnaA, the computer-aided noise abatement program (v 4.2.140). 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 full (1/1) octave band algorithms that incorporate geometric spreading due to wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of both sources and receptors, seasonal foliage effects, and meteorological conditions.

Topographical information was imported into the acoustic model using the official USGS digital elevation dataset to accurately represent terrain in three dimensions. Terrain conditions, vegetation type, 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 G=0 for acoustically hard, reflective surfaces and G=1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, bare rock or for sound traveling over water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in 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 mixed (semi-reflective) ground factor of G=0.5 was used in the acoustic modeling. In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. Sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings were ignored under all acoustic modeling scenarios.

Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, the temperature of 10^{o}C (50^{o}F) and 70 percent relative humidity parameters were selected as reasonably representative of conditions favorable to sound propagation. Atmospheric absorption depends on temperature and humidity and is most important at higher frequencies. Over short distances, the effects of atmospheric absorption are minimal. The ISO 9613-2 standard calculates attenuation for meteorological conditions favorable to propagation, i.e., downwind sound propagation or what might occur typically during a moderate atmospheric ground level inversion, which is assumed to be regulatory worst case. Though a physical impracticality, the ISO 9613-2 standard simulates omnidirectional downwind propagation and worst-case WTG source directivity factors. For receivers located between discrete WTG locations or WTG groupings, the acoustic model may result in over-prediction. The acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix. This conservative assumption does not take into consideration turbulent eddies and micrometeorological inhomogeneities that may form when winds change speed or direction, which can interfere with the sound wave propagation path and increase attenuation effects.

Conversely, there may be meteorological conditions from time to time that will aid in the long range propagation of sound. These anomalous meteorological conditions may include well-developed moderate ground-based temperature inversions, such as commonly occurs at nighttime and during early morning hours, and wind gradients which can bend sound downwards, which may occur at any time depending on weather conditions. Per ISO 9613-2, the effects of meteorological conditions on sound propagation are small for short distances, and also small for longer distances at greater source and receptor heights. Over extended distances when the influences of wind or temperature gradients are most prevalent, atmospheric effects may cause fluctuations in received sound levels, but will typically attenuate noise to levels below those predicted. Levels significantly above those predicted are defined as exceptional events under the ISO 9613-2 standard. Propagation for anomalous meteorological conditions are presented to show, that for comparatively short periods of time, received sound levels may be higher than the mean.

3.2 Acoustic Modeling Input Parameters

In order to assist project developers and acoustical engineers, wind turbine manufacturers report WTG sound power data at integer wind speeds referenced to the effective hub height, ranging from cut-in to full rated power per International Standard IEC 61400-11:2006 Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques. This accepted International Electrotechnical Commission

(IEC) standard was developed to ensure consistent and comparable sound emission data of utility-scale WTGs between manufacturers. Table 5 presents a summary of sound power data during normal mode as opposed to noise restricted operation. Sound data is correlated by integer wind speeds, referenced at WTG hub height with a stated roughness length of 0.03 to 0.05 meters which is representative of level, grass covered terrain. The roughness length describes the vertical wind profile per IEC specification in a neutral atmosphere with the wind profile following a logarithmic curve. (Wind profile refers to the increase in wind speed that normally occurs with height above the ground.) Sound power data presented are inclusive of both mechanical and aerodynamic source components.

The specification for the GE 1.6-100 turbine model presents an expected warranty confidence interval of k=2 dB, which added to the nominal sound power level. This confidence interval incorporates the uncertainty in independent sound power level measurements conducted, the applied probability level and standard deviation for test measurement reproducibility, and product variability. It is expected that the WTG version installed will be similar to the sound data that was used in the acoustic modeling. However, it is possible that the warranty sound data could vary slightly.

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

10-meter AGL Wind Speed	WTG L_{max} Sound Power Level (L_W) at Reference Wind Speed							
	11.2 mph (5 m/s)	12.3 mph (5.5 m/s)	13.4 mph (6 m/s)	14.5 mph (6.5 m/s)	15.9 mph (7 m/s)	17.9 mph (8 m/s)	20.1 mph (9 m/s)	22.4 mph (10 m/s)
GE 1.6-100	94.8	97.2	99.5	101.5	103.3	104.9	105	105

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 it is assumed that WTG directivity and sound generating efficiencies are inherently incorporated in the sound source data and used in the acoustic model development. A summary of sound power data for the GE 1.6-100 by octave band center frequency is presented in Table 6 (spectral frequency data provided with stated intended use limited for informational purposes only).

Table 6 GE 1.6-100 Sound Power Level by Octave Band Center Frequency

	Octave Band Sound Power Level (dB)								Broadband (dBA)
Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	
GE 1.6-100	86.2	95.2	96.9	95.5	99.8	99.3	90.5	71.6	105

4.0 PROJECT OPERATING NOISE LEVELS

Operational broadband (dBA) sound pressure levels were calculated assuming that all WTGs are operating continuously and concurrently at the maximum manufacturer-rated sound level at the given operational condition. The sound energy was then summed to determine the equivalent continuous A-weighted downwind received sound pressure level at each modeled receptor.

4.1 Results

Acoustic modeling for the final Project layout was completed for WTG cut-in and full maximum rotational operating conditions, thereby describing sound pressure levels over the entire range of future Project operational conditions. Table 7 presents the results of the Oliver III Wind Energy Center acoustic modeling analysis and includes the ID, status, Universal Transverse Mercator (UTM) coordinates, receptor status and the received sound levels. The receptor status is based on a farmstead report provided by NextEra dated February 11, 2010. Sound energy contribution from the Project substation was also included in the acoustic calculations. Results are presented to tenths of decibels for comparison with the EPA criterion level, which is given to one decimal place; however, the generally accepted level of accuracy for this calculation procedure is typically to the nearest whole decibel.

Sound contour plots displaying Project operational sound levels in color-coded isopleths are provided in Figures 2 through 4. Figure 2 shows the broadband (dBA) operational sound levels under low-level wind speeds sufficient for the WTGs to operate at initial cut-in rotational speeds. Figure 3 shows the broadband (dBA) operational sound levels at wind speeds sufficient to sustain WTG operation at maximum rotational speeds for moderate downwind propagation. Figure 4 shows the broadband (dBA) operational sound levels at wind speeds sufficient to sustain WTG operation at maximum rotational speeds under anomalous meteorological conditions. Acoustic modeling was completed for all WTGs operating concurrently. The tabulated results and contour plots are independent of the existing acoustic environment, i.e. are representative of expected Project-generated sound levels only. Table 7 presents a summary of the WTG acoustic modeling output, which indicates that the received sound levels are all below the most stringent EPA guideline, except for one receptor (noted in bold), which may potentially exceed the most stringent EPA guideline during anomalous meteorological conditions. This potential exceedance is at receptor ID 6003, which is a Project participant and has been identified as unoccupied structure. Receptor ID 6006 showed a modeled received sound level of 48.6 dBA, corresponding to the 48.6 dBA EPA criterion but is not considered an exceedance. Receptor ID 6006 is also a Project participant.

Table 7 Acoustic Modeling Results

Receptor ID	Receptor Status	UTM Coordinates (m)		Received Sound Levels (dBA)		
		Easting (X)	Northing (Y)	Cut-in Wind Speed	Maximum Wind Speed	Anomalous Meteorological Conditions
6003	Unoccupied*	335434	5204641	34.8	45.0	**49.1**
6006	Occupied*	335875	5202206	34.6	44.8	48.6
6005	Occupied*	335894	5202102	34.1	44.3	48.1
300008	Unoccupied*	337179	5202968	36.2	46.4	47.3
30008	Unoccupied*	337240	5201768	36.2	46.4	47.2
7007	Occupied	338286	5203461	33.9	44.1	44.8
7004	Unoccupied*	339106	5200837	32.0	42.2	43.1
6008	Occupied*	338714	5201739	30.5	40.7	43.0
6009	Unoccupied*	338753	5201759	30.4	40.6	42.9
7002	Occupied*	339472	5200083	31.9	42.1	42.9
6004	Occupied*	334582	5203847	29.5	39.7	42.9
6014	Unoccupied*	337857	5198463	31.6	41.8	42.9
6011	Occupied*	336821	5199125	30.8	41.0	42.5
6002	Unoccupied*	335368	5206778	25.5	35.7	40.3
7010	Occupied	338391	5204385	26.8	37.0	40.1
7016	Occupied	337949	5204464	26.9	37.1	40.1
6010	Occupied*	335722	5198836	23.7	33.9	37.0
7020	Occupied*	341032	5200597	22.9	33.1	36.6
6012	Unoccupied*	335789	5197882	21.8	32.0	35.6
6013	Occupied	336785	5196966	20.6	30.8	34.4
7029	Occupied	341907	5197106	21.0	31.2	34.1
7027	Occupied	342143	5197130	20.2	30.4	33.5
7023	Occupied	342191	5197153	20.0	30.2	33.4
5021	Occupied*	334144	5206664	18.6	28.8	33.2
5020	Occupied*	334149	5206673	18.6	28.8	33.1
5013	Occupied	331662	5210195	<20	<20	<20
5015	Occupied	335015	5210254	<20	<20	<20
5016	Occupied	335270	5210159	<20	<20	<20
5017	Occupied	335141	5210664	<20	<20	<20
5018	Occupied*	334958	5209903	<20	<20	<20
5026	Occupied	331919	5207710	<20	<20	<20

*** = Participating receptor**

Reported sound pressure levels are representative of receptors located downwind of the WTGs; lower sound levels are expected in other directions dependent on wind velocities, speed, direction, and gustiness. The acoustic modeling results were compared to 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, 365 days a year), which was used as a Project acoustic design goal. The EPA guideline limits presented in Section 2.1 are based on the yearly L_{dn}. To calculate the yearly L_{dn}, consideration of the variation in atmospheric conditions is necessary over an extended time period to determine the long term sound exposure. The approach employed in this Project acoustic assessment assumed a sustained wind speed at WTG hub height sufficient to result in full rotation WTG operation over a continuous one year period. Actual wind speeds and directions over the course of a year will vary. The yearly L_{dn} is calculated using the following equation per the EPA guidance document:

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

To calculate yearly L_{dn}, the $L_{eq\ (1\text{-hour})}$ in the above equation was assigned the value of the Project-generated sound level for the WTG operating condition under analysis (cut-in or at full rotational speed). Under real world meteorological conditions wind speed and direction will be variable. Over the course of a year, the actual received sound pressure levels as a result of Project operations will fluctuate from periods of calm or low level wind speeds, to wind speeds ranging from cut-in up to maximum rotational. During periods of calm and low level wind speeds below the rated cut-in wind speeds when WTGs will not operate, the Project will generate negligible sound. For time-varying sources, including wind energy projects, assessing sound levels generated during maximum rotational is a worst case assessment approach and will ensure compliance during all other WTG operational conditions. Though this long term operational operating scenario is not a realistic condition, the intention of employing this calculation methodology is to provide a further level of conservatism in the calculation sound impacts.

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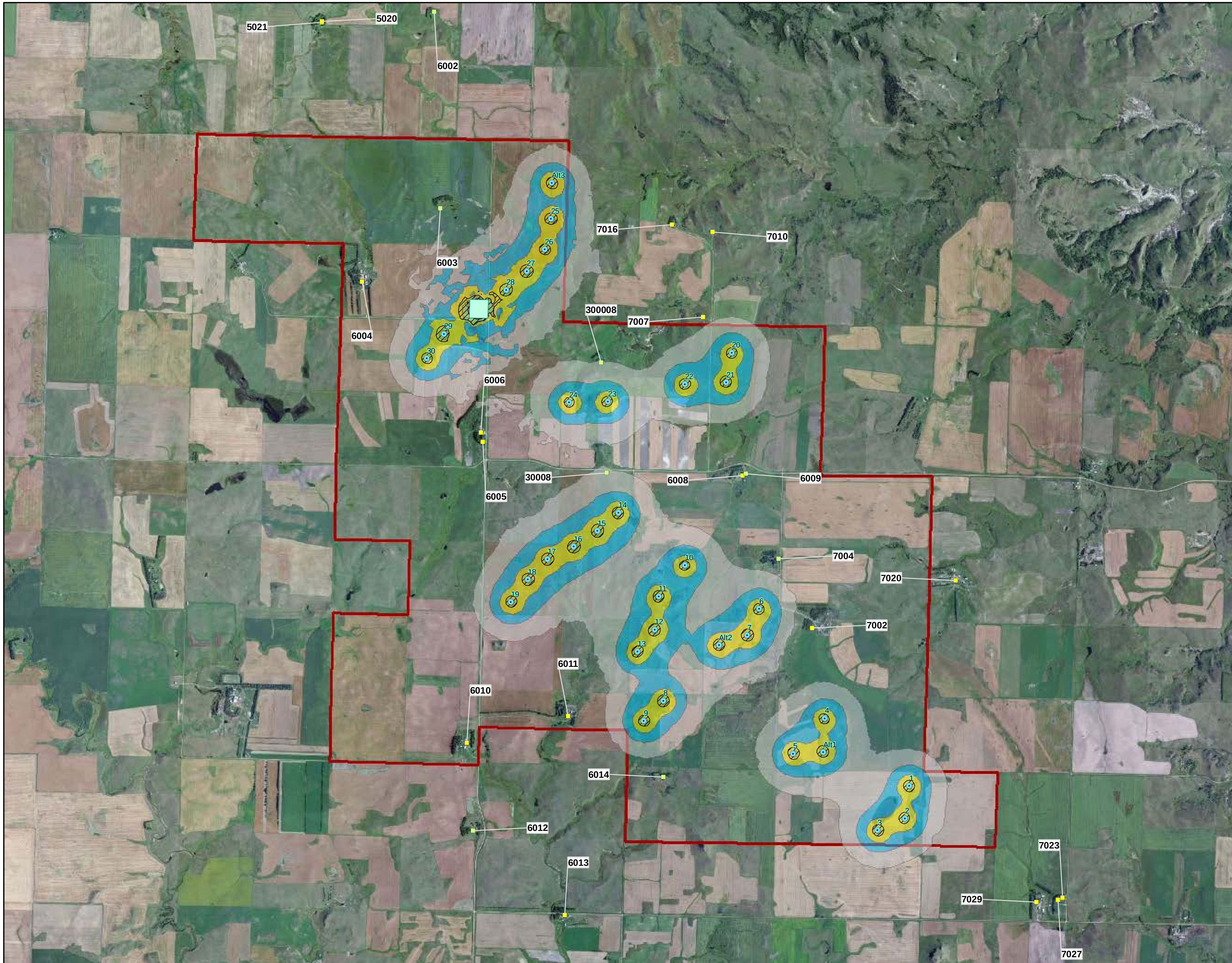
FIGURE 2
RECEIVED SOUND LEVELS:
WIND TURBINES AT CUT-IN WIND SPEED

October, 2012



Legend

- Oliver III WTG (9/13/2012)
- Receptor - Occupied
- Receptor - Unoccupied
- Substation
- Project Boundary (6/5/2012)

Isopleth Ranges (dBA)

35 - 40, 40 - 45, 45 - 50, 50 - 55, > 55

Isopleth Range Exceeding EPA Guideline (>48.6 dBA)

N W E S

0 0.5 1 Miles

REFERENCE MAP

Path: P:\GIS\NextEra_OliverIII\GIS\Spatial\MXD\20121105_Noise\OliverIII_Noise_Fig2_Cut-In.mxd

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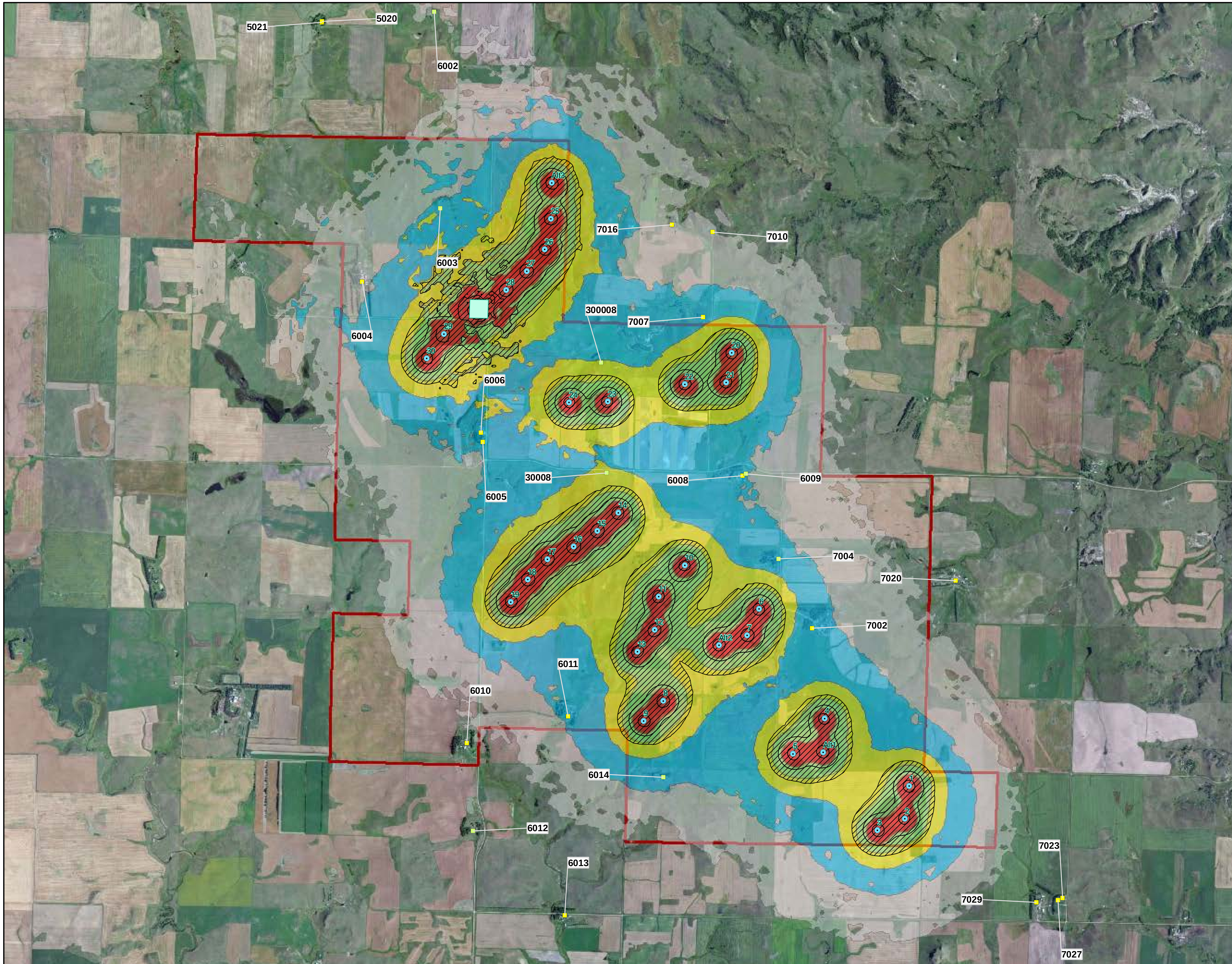
Morton County, North Dakota

FIGURE 3
RECEIVED SOUND LEVELS:
WIND TURBINES AT MAXIMUM
ROTATIONAL WIND SPEED

October, 2012



Legend

- Oliver III WTG (9/13/2012)
- Receptor - Occupied
- Receptor - Unoccupied
- Substation
- Project Boundary (6/5/2012)

Isopleth Ranges (dBA)

35 - 40, 40 - 45, 45 - 50, 50 - 55, > 55

Isopleth Range Exceeding EPA Guideline (>48.6 dBA)

N W E S

0 0.5 1 Miles

REFERENCE MAP

Path: P:\GIS\NextEra_OliverIII\GIS\Spatial\MXD\20121105_Noise\OliverIII_Noise_Fig3_MaxRot.mxd

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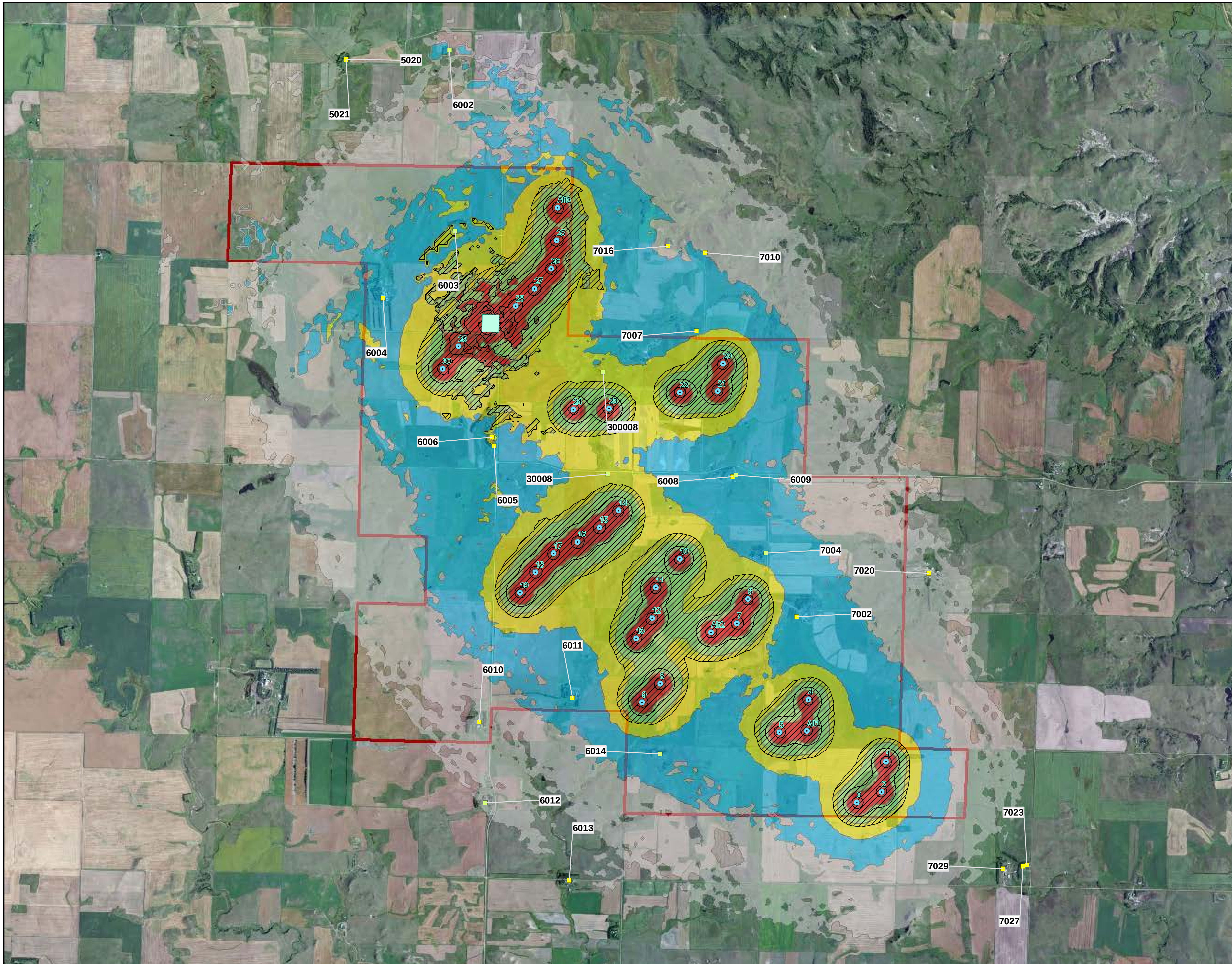
OLIVER III WIND ENERGY CENTER

Morton County, North Dakota

FIGURE 4
RECEIVED SOUND LEVELS: WIND TURBINES AT MAXIMUM ROTATIONAL WIND SPEED, ANOMALOUS METEOROLOGICAL CONDITIONS

October, 2012



Legend

- Oliver III WTG (9/13/2012)
- Receptor - Occupied
- Receptor - Unoccupied
- Substation
- Project Boundary (6/5/2012)

Isopleth Ranges (dBA)

35 - 40
40 - 45
45 - 50
50 - 55
> 55

Isopleth Range Exceeding EPA Guideline (>48.6 dBA)

N
W E
S

0 0.5 1 Miles

REFERENCE MAP

Path: P:\GIS\NextEra_OliverIII\GIS\Spatial\MXD\20121105_Noise\OliverIII_Noise_Fig4_AnomMet.mxd

5.0 OTHER SOUND CONSIDERATIONS

5.1 Cumulative Effects

An assessment of cumulative environmental impacts considers the potential impact of a proposed Project in the context of existing developments to ensure that any potential environmental impacts are not considered in isolation. The cumulative effects can result from individually minor, but collectively more significant actions over a given period of time. Cumulative impacts are impacts that result from the incremental consequences of a project when added to other existing wind energy developments. A wind energy development would need to be located within approximately 2 to 3 km of the proposed wind farm in order to present a possible cumulative influence on sound. The nearest existing wind energy project is located approximately 10 miles away and, therefore, the Project was not considered with respect to cumulative effects.

5.2 Electrical Substation

Substations have switching, protection and control equipment and typically one or more transformers, which generate the sound generally described as a low humming. There are three main sound sources associated with a transformer: core noise, load noise and noise generated by the operation of the cooling equipment. The core vibrational noise is the principal noise source and does not vary significantly with electrical load. Transformers are designed and catalogued by megavolt ampere (MVA) ratings. Just as horsepower ratings designate the power capacity of an electric motor, a transformer's MVA rating indicates its maximum power output capacity. The National Electrical Manufacturers Association (NEMA) published NEMA Standards TR1-1993 (R2000), which establish the maximum noise level allowed for transformers, voltage regulators, and shunt reactors based on the equipment's method of cooling its dielectric fluid (air-cooled vs. oil-cooled) and the electric power rating.

Transformer noise is generated and will attenuate with distance at different rates depending on the transformer dimensions, voltage rating, and design. The noise produced by substation transformers is primarily caused by the load current in the transformer's conducting coils (or windings) and consequently the main frequency of this sound is twice the supply frequency. The characteristic humming sound consists of tonal components generated at harmonics of 120 Hz. Most of the acoustical energy resides in the fundamental tone (120 Hz) and the first 3 or 4 harmonics (240, 360, 480, 600 Hz). In addition to core vibration noise, transformer cooling fans may generate broadband noise, limited to periods when high heat loads require additional cooling capacity. The resulting audible sound is a combination of core noise and the broadband fan noise. Circuit-breaker operations may also cause audible noise, particularly the operation of air-blast breakers which is characterized as an impulsive sound event of very short duration. This is expected to occur only a few times throughout the year, and was therefore not considered in this analysis.

The American National Standards Institute (ANSI) and the International Electrotechnical Commission (IEC) have established methodologies for measurement of noise from transformers and other electrical devices. Measurements involve taking reference sound level measurements using microphones positioned 0.3 m (1 ft) from a tautly drawn string that encircles the device at a height above grade set at one-half the overall height of the device. The transformer noise output is the average of all measurements taken around the perimeter, incorporating contributions from both cooling fans and auxiliary equipment. The sound power radiated is calculated from the NEMA rating with total sound energy integrated over the total surface area of the transformer's four sides.

The proposed Oliver III substation will be located in the southeast corner of Section 4, Township 140 North, Range 83 West within the Project area. The closest occupied receptor (ID 6004) is approximately 1,300 meters (4,265 feet) west of the electrical substation. To assess potential impacts of substation operation on nearby residential receptors, a screening level acoustic analysis was conducted using the CadnaA model incorporating site-specific topographic and terrain data and modeled cumulatively with WTG operational scenarios. Currently, the Project substation design is only at a schematic level. Transformer sound source levels for the planned 60 MVA transformer were estimated for a NEMA sound rating of 76 dBA and are presented in Table 8. The octave band center frequencies were calculated linearly based on the estimate transformer NEMA rating using standard engineering technical guidelines.

Table 8 Transformer Sound Power Level (NEMA 76 dBA)

	Adjusted weighted Octave Band Sound Power Data (dBA)								
	31.5	63	125	250	500	1000	2000	4000	8000
NEMA Rating 76 dBA	99	105	107	102	102	96	91	86	79

Substations with transformer sizes of 10 to 150 MVA can present a noise concern if the separation distance is less than a few hundred feet between the transformer and noise sensitive receptors. The distance from the Project substation and transformer to the nearest noise sensitive receptor is over 4500 feet. Therefore, no adverse transformer noise impacts are expected. In very quiet rural areas where the nighttime ambient acoustic environment can reach levels of 20 to 25 dBA under calm wind conditions, the sound generated from transformers of this size may be periodically audible at distances of half a mile or greater. Therefore, the transformer may be periodically audible at the nearest occupied structures on infrequent occasions when background sound levels are very low.

5.3 Construction Noise

The development of the Oliver III Wind Energy Center will involve construction to establish access roads, excavate and form WTG foundations, prepare the site for crane-lifting and assemble and commission the WTGs. Work on large-scale wind projects such as the Oliver III Wind Energy Center is generally divided into four phases consisting of the following:

1. *Site Clearing*: The initial site mobilization phase includes the establishment of temporary site offices, workshops, stores, and other on-site facilities. Installation of erosion and sedimentation control measures will be completed as well as the preparation of initial haulage routes.

2. *Excavation*: This phase would begin with the excavation and formation of access roads and preparation of laydown areas. Excavation for the concrete turbine foundations would also be completed.

3. *Foundation Work*: Construction of the reinforced concrete turbine foundations would take place in addition to installation of the internal transmission network.

4. *Wind Turbine Installation*: Delivery of the turbine components would occur followed by their installation and commissioning.

Work on these construction activities is expected to overlap. It is likely that the wind turbines will be erected in small groupings. Each grouping may undergo testing and commissioning prior to commencement of full commercial operation. Other construction activities include those for the supporting infrastructure such as the substation, maintenance building, and the overhead transmission line.

The construction of the Project may cause short-term but unavoidable noise impacts. The sound levels resulting from construction activities vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. The list of construction equipment that may be used on the Project and estimates of near and far sound source levels are presented in Table 9.

Sounds generated by construction activities are typically exempt from state and local noise oversight provided that they occur within weekday, daytime periods as may be specified under local zoning or legal codes. All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. As the design of the Project progresses and construction scheduling is finalized, the construction engineer normally notifies the community via public notice or alternative method of the expected Project construction commencement and duration to help minimize the effects of construction noise. In addition, the location of stationary equipment and the siting of construction laydown areas should be carefully selected to be as far removed from existing noise sensitive receptors as is practical. Candidate construction noise mitigation measures include scheduling louder construction activities during daytime hours and equipping internal combustion engines with appropriate sized muffler systems to minimize noise excessive emissions.

Table 9 Estimated L_{max} Sound Pressure Levels from Construction Equipment

Equipment*	Estimated Sound Pressure Level at 50 feet (dBA)	Estimated Sound Pressure Level at 2000 feet (dBA)
Crane	85	53
Forklift	80	48
Backhoe	80	48
Grader	85	53
Man basket	85	53
Dozer	83 - 88	51 - 56
Loader	83 - 88	51 - 56
Scissor Lift	85	53
Truck	84	52
Welder	73	41
Compressor	80	48
Concrete Pump	77	45

Data compiled in part from the following sources:

Federal Highway Administration, "Roadway Construction Noise Model User's Guide," Report FHWA-HEP-05-054 / DOT-VNTSC-FHWA-05-01, January 2006.

Power Plant Construction Noise Guide, Bolt Beranek and Newman, Inc. 1977.

Federal Highway Administration, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." Code of Federal Regulations, Title 23, Part 772, 1992.

Construction activity will generate traffic having potential noise effects, such as trucks travelling to and from the site on public roads. At the early stage of the construction phase, equipment and materials will be delivered to the site, such as hydraulic excavators and associated spreading and compacting equipment needed to form access roads and foundation platforms for each turbine. Once the access roads are constructed, equipment for lifting the towers and turbine components will arrive. Traffic noise is categorized into two categories: (1) the noise that will occur during the initial temporary traffic movements related to turbine delivery, haulage of components and remaining construction; and (2) maintenance and ongoing traffic from staff and contractors, which is expected to be minor.

Federal laws prohibit state and local governments from regulating off-site sound levels generated by trucks and automobiles operating on a private site or public roadways. This federal regulatory preemption is specified in the Federal Noise Control Act of 1972 and in the Surface Transportation Assistance Act of 1982, both of which prohibit states and local authorities from regulating the noise emitted by trucks engaged in interstate commerce, i.e., truck deliveries. A federal OSHA preemption also prohibits local and state governments from regulating safety signals on trucks and construction equipment.

6.0 CONCLUSIONS

Project operational sound has been calculated and compared to relevant environmental noise guidelines as established by the EPA (i.e., a maximum instantaneous L_{eq} of 48.6 dBA) and OSHA (a maximum L_{eq} of 85 dBA under normal operation). Acoustic modeling analysis per ISO 9613-2 only indicated one potential exceedance of the EPA noise guideline under anomalous meteorological conditions. This exceedance occurred at receptor ID 6003, which is a Project participant and has been identified as an unoccupied structure.

The EPA guideline levels are not legally enforceable requirements, 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 a Project-generated sound level is below ambient conditions, the spectral and temporal characteristics of the new sound may result in perceptibility. The results of the acoustic modeling analysis 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 sound is largely subjective and therefore not easily predictable and may depend on several technical and non-technical factors, including predetermined perceptions of the Project and wind energy in general, individual and community economic incentives, existing background sound levels, the proximity of the listener to a single or grouping of WTGs, among other factors. Due to their support of Project development, Project participants have been found to be less likely to become annoyed by low-level WTG sound than non-participants. Non-participants that consider the development of renewable energy sources, and wind energy projects specifically, as beneficial will also be more likely to deem the low-level environmental noise as generally acceptable. Nonetheless, complaints about noise from wind energy projects may still occur, even when fixed standards or limits relative to existing ambient conditions are proposed and met. 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.

In conclusion, the acoustic modeling analysis, inclusive of a number of conservative assumptions, demonstrates the Project is adequately designed to meet EPA guidelines at all noise sensitive occupied structures. Sound from the Project when audible will likely not be deemed excessive or unusually loud at the setback distances and will be consistent with sound generated at similar wind energy projects successfully sited throughout the state of North Dakota employing similar criteria and WTG setback distances. The Oliver III Wind Energy Center is expected to generate sound levels that will be below EPA guideline limits and is therefore not expected to present an adverse noise impact with respect to public welfare, health and safety.

7.0 TECHNICAL REFERENCES

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