Preliminary Application for Site Certificate for the Speedway Energy Facility

Exhibit O. State and Local Laws and Regulations

Part 3. Noise and Cooling Towers

Submitted to
Oregon Energy Facility Siting Council

Prepared for

Speedway Energy

BGTF Speedway Project LLC

Prepared by

TETRA TECH

1750 S Harbor Way, Suite 400 | Portland, OR 97201

July 2026

Table of Contents

List of Tables

List of Figures

List of Attachments

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
Applicant	BGTF Speedway Project LLC
BESS	battery energy storage system
BPA	Bonneville Power Administration
CadnaA	Computer Aided Noise Abatement
dB	decibel
dBA	A-weighted decibel
EFSC	Oregon Energy Facility Siting Council
Facility	Speedway Energy Facility
gen-tie	generation tie
Hz	hertz
kV	kilovolt
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
L_{10}	intrusive noise level
L_{50}	median sound level
L_{90}	residual sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
L_n	statistical sound level
L_w	sound power level
MVA	megavolt-ampere
NSR	noise sensitive receptor
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
POI	point of interconnection
STE	serrated trailing edges

1.0 Introduction

BGTF Speedway Project, LLC (Applicant) proposes construction and operation of the Speedway Energy Facility (Facility), a renewable energy facility incorporating wind, solar, and battery energy storage, located on privately owned land in Sherman County, Oregon. The Facility's proposed point of interconnection (POI) to the regional electrical grid will be via a new Bonneville Power Administration (BPA) switchyard to be located adjacent to the existing BPA 500-kilovolt (kV)Ashe-Marion Transmission Line, which runs northeast/southwest through the site boundary.

Exhibit O3 presents information supporting demonstration of compliance with the State and Local Laws and Regulations approval standard for Oregon Administrative Rules (OAR) 345-022-00160.

1.1 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 defined as unwanted sound. 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. 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 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 since 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 dB 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. Conversely, sound power is commonly referenced to 1 picowatt, 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 often 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 bands (or 33 1/3 octave) ranging from 20 Hz (low) to 20,000 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 represent the frequency response of the human auditory system. Sound exposure in acoustic assessments is commonly measured and calculated as A-weighted dB (dBA). Unweighted sound levels are referred to as linear. Linear dB 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 can be measured, modeled, and presented in various formats. The sound metrics that were employed in the following noise assessment have the following definitions:

- L_{eq}: Conventionally expressed in dBA, the L_{eq} is the energy-averaged, A-weighted sound level for the complete time period. It is defined as the steady, continuous sound level over a specified time, which has the same total sound energy as the actual varying sound levels over the specified period.
- L_n: This descriptor identifies the sound level that is exceeded "n" percent of the time over a measurement period (e.g., L_{90} = sound level exceeded 90 percent of the time). The sound level exceeded for a small percent of the time, L_{10}, closely corresponds to short-term, higher-level, intrusive noises (such as vehicle pass-by noise near a roadway). The sound level exceeded for a large percent of the time, L_{90}, closely corresponds to continuous, lower-level background noise (such as continuous noise from a distant industrial facility). L_{50} is the level exceeded 50 percent of the time and is typically referred to the median sound level over a given period.
- L_{max}: The maximum sound level (L_{max}) can be used to quantify the maximum instantaneous sound pressure level over a given measurement period or maximum sound generated by a source.

2.0 Analysis Area

The analysis area for noise impacts is defined in OAR 345-021-0010 as including those noise sensitive receptors (NSRs) within 1 mile of the site boundary. Section 3.2 below includes the definition of an NSR. Figure O3-1 shows current site conditions and NSRs located within 1 mile of the site boundary.

3.0 Regulatory Environment

This section describes the noise-related requirements that may be applicable to the Facility at the federal, state, county and local levels.

3.1 Federal Noise Regulations

There are no federal environmental noise requirements specific to this Facility.

3.2 State Noise Regulations

OAR Chapter 340, Division 35 prescribes noise regulations applicable throughout the state of Oregon, with specific requirements in OAR 340-035-0035. This standard provides guidance for new noise sources on a previously used site:

> *OAR 340-035-0035(1)(b)(A) New Sources Located on Previously Used Sites. No person owning or controlling a new industrial or commercial noise source located on a previously used industrial or commercial site shall cause or permit the operation of that noise source if the statistical noise levels generated by that new source and measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, exceed the levels specified in Table 8, except as otherwise provided in these rules. For noise levels generated by a wind or solar energy facility of any size and any associated equipment or machinery, subparagraph (1)(b)(B)(iii) applies.*

Table O3-1 gives statistical noise limits as summarized below. All limits are presented in terms of A-weighted decibels (dBA). The L_{50} is the median sound level (50 percent of the measurement interval is above this level, 50 percent is below). The noise limits apply at "appropriate measurement points" on "noise sensitive property."[1] OAR 340-035-0035(3)(b) defines the appropriate measurement point as whichever of the following is farther from the noise source:

- 25 feet toward the noise source from that point on the noise sensitive building nearest the noise source; or
- The point on the noise sensitive property line nearest the noise source.

"Noise sensitive property" is defined in OAR 340-035-0015(38) as "real property normally used for sleeping, or normally used as schools, churches, hospitals or public libraries. Property used in industrial or agricultural activities is not Noise Sensitive Property unless it meets the above criteria in more than an incidental manner."

Table O3-1. New Industrial and Commercial Noise Standards

Statistical Descriptor	Maximum Permissible Statistical Noise Levels (dBA)	
	Daytime (7:00 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
L_{50}	55	50
L_{10}	60	55
L_{1}	75	60
Source: OAR 340-035-0035, Table 8.		

The standard also provides guidance for new noise sources on a previously unused site, which is defined in OAR 340-035-0015(47) as "property which has not been used by any industrial or commercial noise source during the 20 years immediately preceding commencement of

[1] OAR 340-035-0035(3)(b)

construction of a new industrial or commercial source on that property." The standard reads as follows:

OAR 340-035-0035(1)(b)(B) New Sources Located on Previously Unused Site:

(i) No person owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour, or exceed the levels specified in Table 8, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule, except as specified in subparagraph (1)(b)(B)(iii).

(ii) The ambient statistical noise level of a new industrial or commercial noise source on a previously unused industrial or commercial site shall include all noises generated or indirectly caused by or attributable to that source including all of its related activities. Sources exempted from the requirements of section (1) of this rule, which are identified in subsections (5)(b)–(f), (j), and (k) of this rule, shall not be excluded from this ambient measurement.

(iii) For noise levels generated or caused by a wind or solar energy facility:

(I) The increase in ambient statistical noise levels is based on an assumed background L50 ambient noise level of 26 dBA or the actual ambient background level. The person owning the wind or solar energy facility may conduct measurements to determine the actual ambient L10 and L50 background level.

(II) The "actual ambient background level" is the measured noise level at the appropriate measurement point as specified in subsection (3)(b) of this rule using generally accepted noise engineering measurement practices. Background noise measurements shall be obtained at the appropriate measurement point, and for wind energy facilities synchronized with wind speed measurements of hub height conditions at the nearest wind turbine location. "Actual ambient background level" does not include noise generated or caused by the proposed wind or solar energy facility.

(III) The noise levels from a wind or solar energy facility may increase the ambient statistical noise levels L10 and L50 by more than 10 dBA (but not above the limits specified in Table 8), if the person who owns the noise sensitive property executes a legally effective easement or real covenant that benefits the property on which the wind or solar energy facility is located. The easement or covenant must authorize the wind or solar energy facility to increase the ambient statistical noise levels, L10 or L50 on the sensitive property by more than 10 dBA at the appropriate measurement point.

(IV) For purposes of determining whether a proposed wind energy facility would satisfy the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are predicted assuming that all of the proposed wind facility's turbines are operating between cut-in speed and the wind speed corresponding to the maximum sound power level established by IEC 61400-11 (version 2002-12). These predictions must be compared to the highest of either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured. The facility complies with the noise ambient background standard if this comparison shows that the increase in noise is not more than 10 dBA over this entire range of wind speeds.

(V) For purposes of determining whether an operating wind energy facility complies with the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are measured when the facility's nearest wind turbine is operating over the entire range of wind speeds between cut-in speed and the wind speed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled. The facility complies with the noise ambient background standard if the increase in noise over either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured, is not more than 10 dBA over this entire range of wind speeds.

(VI) For purposes of determining whether a proposed wind energy facility would satisfy the Table 8 standards, noise levels at the appropriate measurement point are predicted by using the turbine's maximum sound power level following procedures established by IEC 61400-11 (version 2002-12), and assuming that all of the proposed wind facility's turbines are operating at the maximum sound power level.

(VII) For purposes of determining whether an operating wind energy facility satisfies the Table 8 standards, noise generated by the energy facility is measured at the appropriate measurement point when the facility's nearest wind turbine is operating at the wind speed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled.

For the Facility's acoustic assessment, the Applicant uses the assumed allowed ambient sound level of 26 dBA for wind energy facility compliance screening under OAR 340-035-0035(1)(b)(B)(iii). The Facility will be assessed against Oregon's applicable 10 dBA ambient increase criterion, as well as the Table 8 limits, at the appropriate measurement point on noise-sensitive property.

3.3 Exemptions to State Noise Regulations

OAR 340-035-0035(5) specifically exempts construction activity from the state noise standards and regulations, as indicated below. This section also provides an exemption for maintenance of capital equipment and the operation of aircraft (such as helicopters used in project construction).

> *OAR 340-035-0035 (5) Exemptions: Except as otherwise provided in subparagraph (1)(b)(B)(ii) of this rule, the rules in section (1) of this rule shall not apply to:*
>
> [section abridged for brevity]
>
> *(b) Warning devices not operating continuously for more than 5 minutes;*
>
> *(g) Sounds that originate on construction sites.*
>
> *(h) Sounds created in construction or maintenance of capital equipment;*
>
> *(j) Sounds generated by the operation of aircraft and subject to pre-emptive federal regulation. This exception does not apply to aircraft engine testing, activity conducted at the airport that is not directly related to flight operations, and any other activity not pre-emptively regulated by the federal government or controlled under OAR 340-035-0045;*
>
> *(k) Sounds created by the operation of road vehicle auxiliary equipment complying with the noise rules for such equipment as specified in OAR 340-035-0030(1)(e);*

OAR 340-035-0035(6) allows for some exceptions to the state noise regulations:

> *OAR 340-035-0035(6) Exceptions: Upon written request from the owner or controller of an industrial or commercial noise source, the Department may authorize exceptions to section (1) of this rule, pursuant to rule 340-035-0010, for:*
>
> *(a) Unusual and/or infrequent events;*
>
> *(b) Industrial or commercial facilities previously established in areas of new development of noise sensitive property;*
>
> *(c) Those industrial or commercial noise sources whose statistical noise levels at the appropriate measurement point are exceeded by any noise source external to the industrial or commercial noise source in question;*
>
> *(d) Noise sensitive property owned or controlled by the person who controls or owns the noise source;*
>
> *(e) Noise sensitive property located on land zoned exclusively for industrial or commercial use.*

The Facility does not implicate any of these exemptions with the exception of applicable construction-related provisions.

3.4 County and Municipal Noise Regulations

While there are no specific quantitative noise limits for Sherman County, the Sherman County Zoning Ordinance defers to the Oregon Department of Environmental Quality (ODEQ) noise standards as discussed above (County 2017).

4.0 Existing Conditions

A wide range of noise settings occur within the acoustic analysis area. The background sound level will vary spatially and is related to various physical characteristics such as topography, land use, proximity to transportation corridors, and terrain coverage including extent and height of exposed vegetation. The acoustic environment will also vary due in part to surrounding land use and population density. Areas in proximity to major transportation corridors such as interstate highways and areas with higher population densities are expected to generally have higher existing ambient sound levels as compared to open and rural lands. Table O3-2 shows the relative A-weighted noise levels of common sounds measured in the environment and industry.

Table O3-2. Sound Pressure Levels and Relative Loudness

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (Perception of Different Sound Levels)
Jet aircraft takeoff from carrier (50 ft.)	140	Threshold of pain	64 times as loud
50-hp siren (100 ft.)	130		32 times as loud
Loud rock concert near stage Jet takeoff (200 ft.)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 ft.)	110		8 times as loud
Jet takeoff (2,000 ft.)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft.)	90		2 times as loud
Garbage disposal Food blender (2 ft.) Pneumatic drill (50 ft.)	80	Loud	Reference loudness
Vacuum cleaner (10 ft.)	70	Moderate	1/2 as loud
Passenger car at 65 mph (25 ft.)	65		
Large store air-conditioning unit (20 ft.)	60		1/4 as loud
Light auto traffic (100 ft.)	50	Quiet	1/8 as loud
Quiet rural residential area with no activity	45		
Bedroom or quiet living room Bird calls	40	Faint	1/16 as loud
Typical wilderness area	35		
Quiet library, soft whisper (15 ft.)	30	Very quiet	1/32 as loud

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (Perception of Different Sound Levels)
Wilderness with no wind or animal activity	25	Extremely quiet	
High-quality recording studio	20		1/64 as loud
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	
Adapted from: Beranek 1988 and EPA 1971.			

Ambient sound measurements have not been collected to characterize the pre-construction ambient acoustic environment for the proposed Facility. Therefore, per OAR 340-035-0035(1)(b)(B)(iii), a baseline ambient sound of 26 dBA has been assumed. If pre-construction ambient sound measurements are collected at a later time, they will be incorporated into the compliance assessment.

5.0 Predicted Noise Levels – OAR 345-022-0160(2)(a)

OAR 345-022-0160(2) Information about noise generated by operation of the proposed facility, providing evidence to support a finding by the Council that the proposed facility complies with the Oregon Department of Environmental Quality's noise control standards in OAR 340-035-0035, including:

(a) Predicted noise levels resulting from construction and operation of the proposed facility;

5.1 Construction Noise Assessment

Potential noise impacts associated with Facility construction were reviewed; however, according to OAR 340-035-0035(5)(g), sound originating from construction sites is exempt from state noise regulations.

Construction of the Facility will require the use of equipment that may have the potential for localized sound on a temporary basis, as construction activities progress through certain locations within the Facility site boundary. The list of construction equipment that may be used for the Facility and estimates of construction sound levels are presented in Table O3-3 using a semi-qualitative approach based on equipment sound levels provided in the *Federal Highway Administration Roadway Construction Noise Model* (FHWA 2006). This equipment is also used in renewable energy projects, so the Federal Highway Administration's sound levels are applicable to incorporate in this analysis.

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. Table O3-3 lists the typical sound levels associated with common construction equipment at various distances. Periodically, sound levels may be higher or lower; however, the overall sound levels should generally be lower due to excess attenuation.

Table O3-3. Estimated L_{max} Sound Pressure Levels from Construction Equipment

Equipment	L_{max} Equipment Sound Level at 50 feet (dBA)	Usage Factor (%)[1]	Equipment Sound Level at 50 feet, L_{eq} (dBA)	Equipment Sound Level at 2,000 feet, L_{eq} (dBA)	Composite Equipment Sound Level at 2,000 feet, L_{eq} (dBA)
Crane	85	16	77	34	48
Forklift	80	40	76	33	
Backhoe	80	40	76	33	
Grader	85	40	81	38	
Man basket	85	20	78	35	
Dozer	88	40	84	41	
Loader	88	40	84	41	
Scissor Lift	85	20	78	35	
Truck	85	40	81	38	
Welder	73	40	69	26	
Compressor	80	40	76	33	
Concrete Pump	77	50	74	31	

Note: Data compiled in part from the following sources: FHWA 2006, Beranek 1988.
1. Percentage of time during operation that a piece of construction equipment is operating at full power.

Reasonable efforts will be made to minimize the impact of noise resulting from construction activities. Candidate construction noise mitigation measures include scheduling louder construction activities during daytime hours and equipping internal combustion engines with appropriately sized muffler systems to minimize excessive noise emissions.

5.2 Operational Noise Assessment

The Applicant has conducted initial modeling for anticipated noise sources from the Facility to demonstrate that operation of the Facility will comply with the ODEQ Noise Rules. Inputs for the acoustic model included the maximum proposed number of wind turbines, inverters and transformers for the solar arrays, battery energy storage system (BESS) components, substation transformers, and above ground collector and transmission lines. This analysis presents the noise outputs from the full build-out of the Facility.

The Applicant calculated broadband sound pressure levels for expected, normal Facility operation, assuming that identified components operate continuously and concurrently at the representative manufacturer-rated sound level during the daytime and nighttime.

5.2.1 Acoustic Modeling Software and Calculation Methods

To assess the noise emissions of Facility operation, it is necessary to have prediction models with which a noise emission source level measured at a given reference point can be certified. The modeling methodology employed the American National Standards Institute/American Clean Power (ANSI/ACP) Standard 111-1-2022, Wind Turbine Sound Modeling (ACP 2022). This standard provides a method for predicting sound levels based on the International Organization for Standardization (ISO) 9613-2, "Attenuation of Sound during Propagation Outdoors" (ISO 2024), and utilizes wind-turbine model-specific sound power level determined in accordance with International Electrotechnical Commission (IEC) 61400-11 for the downwind location. These standards provide methods to enable noise levels in the community to be predicted from sources of known sound emission and provides a summary of existing knowledge on outdoor sound propagation as published by ISO, a worldwide federation of national standards bodies. The calculation methodologies described are relied on by professionals in the field of acoustics and are expected by regulatory agencies.

Standard acoustic engineering methods that conform to ISO 9613-2 were used in the noise analysis for the Facility using DataKustic GmbH's Computer-Aided Noise Abatement (CadnaA), the computer-aided noise abatement program (version 2026). 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 U.S. Geological Survey digital elevation dataset to accurately represent terrain in three dimensions (USGS 2023). 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 (G) 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). A mixed (semi-reflective) ground factor of G=0.5 was used in the Facility acoustic modeling analysis and is considered standard engineering practice. 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. To be conservative, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was not included in this modeling analysis.

Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, the temperature of 10 degrees Celsius (50 degrees Fahrenheit) and 70 percent relative humidity parameters were selected for this analysis and are considered standard engineering practice. 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. Though a physical impracticality, the ISO 9613-2 standard simulates omnidirectional downwind propagation. In addition, 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 propagation path and increase effects of attenuation.

5.2.2 Acoustic Modeling Inputs

5.2.2.1 Wind Components

Sound generated by an operating wind turbine comprises both aerodynamic and mechanical sound, with the dominant sound component from modern utility-scale wind turbines being largely aerodynamic. Aerodynamic sound refers to the sound produced from air flow and the interaction with the wind turbine 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 wind turbine 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. Sound reduction elements designed as a part of the wind turbines include impact noise insulation of the gearbox and generator, sound reduced gearbox, sound reduced nacelle, and rotor blades designed to minimize noise generation.

Wind energy facilities, in comparison to other energy-related facilities, are unique in that the sound generated by each individual wind turbine 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 this condition, the wind turbine maximum sound power level will be reached at approximately 9 meters per second and greater according to the wind turbine manufacturer specifications. It is important to recognize that, as wind speeds increase, the background ambient sound level will generally increase as well, resulting in acoustic masking effects; however, this trend is also affected by local contributing sound sources. As such, during periods of elevated wind speeds when higher wind turbine sound emissions occur, the sound produced from a wind turbine operating at maximum rotational speed may 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 wind turbine noise. This relationship is expected to further minimize the potential for any adverse noise effects of the Facility. Conversely, these acoustic masking effects may be limited during periods of unusually high wind shear or at receiver locations that are sheltered from the prevailing wind direction.

The operational acoustic assessment was performed using the Facility site layout, which includes 44 wind turbines. As described in Sections 2.1.2 and 2.3.1 in the Background Exhibit, the Applicant is considering various wind turbine options. The specific model and manufacturer used will be determined near the time of construction based on technical and economic feasibility and commercial availability considerations. Thus, for purposes of this initial modeling, a representative wind turbine model that is a highly likely candidate for use at the Facility and among the larger turbine options was evaluated:

- **Vestas V163-4.5 –** Wind turbine with a rotor diameter of 163 meters and a hub height of 113 meters.

Each turbine model provides different options for noise mitigation, if and when warranted. For example, the Vestas V163-4.5 can also be equipped with serrated trailing edges (STE), which reduce noise from the wind turbines. The serrations are capable of suppressing the turbulent trailing edge noise induced by rotating wind turbine blades. The noise reduction is achieved by small eddies in the thin boundary layer. Sound Optimized modes can also be applied to further reduce noise from these wind turbines. Once the final wind turbine model and manufacturer are selected, the Applicant will evaluate and implement necessary noise mitigation options to ensure full compliance with ODEQ regulations. To assist Facility developers and acoustical engineers, wind turbine manufacturers report wind turbine sound power data at integer wind speeds referenced to the effective hub height, ranging from cut-in to full-rated power per IEC standard 61400-11:2006 Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques. This accepted IEC standard was developed to ensure consistent and comparable sound emission data of utility-scale wind turbines between manufacturers. Table O3-4 presents a summary of sound power data for the Vestas V163-4.5 with and without STE correlated to wind speeds at 10 meters above ground level using a roughness length coefficient of 0.05 meters. The roughness length describes the vertical wind profile per IEC specification in a neutral atmosphere with the wind profile following a logarithmic curve.

Table O3-4. Broadband Sound Power Levels (dBA) Correlated with Wind Speed

Turbine	Wind Turbine L_{max} Sound Power Level (L_W) at Reference Wind Speed (meters per second / miles per hour)										
	3/ 6.7	4/ 8.9	5/ 11.2	6/ 13.4	7/ 15.7	8/ 17.9	9/ 20.1	10/ 22.4	11/ 24.6	12/ 26.8	13/ 29.1
Vestas V163-4.5	92.8	93.8	97.6	101.5	105.0	107.5	108.4	108.4	108.4	108.4	108.4
Vestas V163-4.5 with STE	91.9	92.4	95.5	99.1	102.4	105.2	106.3	106.3	106.3	106.3	106.3
Vestas V163-4.5 with STE + Sound Optimized Mode (SO13)	91.9	92.0	92.0	92.0	92.8	94.3	95.7	96.5	96.8	96.9	97.0

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 wind turbine directivity and sound generating efficiencies are inherently incorporated in the sound source data and used in acoustic model development. The specification for the wind turbines includes an expected warranty confidence interval, or k-factor, which was added to the nominal sound power level in the acoustic model. A confidence interval of k = 2 dBA was applied to account for the uncertainty in independent sound power level measurements conducted, the applied probability level and standard deviation for test measurement reproducibility, and product variability. A summary of sound power data by octave band center frequency for wind turbines operating at maximum rotation is presented in Table O3-5 (1/1 octave band frequency data provided with stated intended use limited for informational purposes only).

5.2.2.2 Solar Components

The principal sources of noise are associated with the electrical components of the inverters and the step-up transformer associated with each power conversion station. Noise associated with the solar facility is generally limited to equipment that operates continuously or periodically during daytime and nighttime hours. Inverters may generate a low-level humming or tonal sound associated with the conversion of direct current to alternating current and the operation of associated electrical components and internal cooling fans. This sound is typically steady-state in nature and may vary depending on electrical loading, ambient temperature, and equipment configuration. Step-up transformers associated with inverter skids also produce a characteristic low-frequency hum, generally attributable to magnetostriction and load-related electrical vibration. These sources are typically tonal and most noticeable at close distances, with sound levels decreasing as distance from the equipment increases.

Overall, the noise sources associated with the solar facilities are expected to be relatively uniform and predictable during operation. Because the equipment is distributed throughout the site and mounted at ground level, sound emissions are anticipated to attenuate with distance and be influenced by site layout, equipment spacing, and surrounding topography.

It is expected that Facility equipment would potentially operate consistently during both daytime and nighttime hours. The projected operational noise levels are based on Applicant-supplied manufacturer sound power level data. It is assumed that the solar equipment will have similar sound power profiles as those used in the acoustic modeling analysis; however, it is possible that the final manufacturer warranty values may vary slightly. Table O3-5 summarizes the equipment sound power level data used as inputs to the initial modeling analysis.

5.2.2.3 Battery Energy Storage System

The principal sources of noise associated with the BESS are the cooling units. The battery storage units are mounted on pads at grade level and produce noise primarily from thermal management systems, including ventilation fans, compressors, and other cooling equipment necessary to maintain battery performance and operating temperature. This sound is typically broadband in character and may be cyclical or continuous depending on ambient temperature, system demand,

and the operating status of the battery containers or enclosures. In addition, the BESS enclosures may contain internal electrical components that contribute minor tonal or broadband noise, although such emissions are generally secondary to the cooling systems. Overall, the noise sources associated with the BESS facilities are expected to be relatively uniform and predictable during operation.

The projected operational noise levels are based on Applicant-supplied manufacturer sound power level data. It is assumed that the BESS equipment will have similar sound power profiles as those used in the acoustic modeling analysis, which is based on a system that is highly likely to be selected; however, it is possible that the final manufacturer warranty values may vary slightly. Table O3-5 summarizes the equipment sound power level data used as inputs to the initial modeling analysis.

5.2.2.4 Substations

The primary ongoing noise sources at substations are the transformers, which generate 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.

Transformer noise varies with transformer dimensions, voltage rating, and design, and attenuates with distance. 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 (60 Hz). 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 three or four harmonics (240, 360, 480, and 600 Hz).

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 and expected to occur no more than a few times throughout the year. Because of its short duration and infrequent occurrence, circuit breaker noise was not considered in this analysis.

The Facility will include up to six collector substations at various locations within the micrositing area, and each collector substation will consist of one 230-kV transformer with a rating of 250 megavolt ampere (MVA), which corresponds to a National Electrical Manufacturers Association (NEMA) rating of 88 dBA. One central substation will be located adjacent to the POI, which will be next to the existing BPA 500-kV Ashe-Marion Transmission Line. The central substation will consist of up to six 500-kV generator step-up transformers. The central substation will include up to 6 transformers, each with a rating of 285 MVA, which corresponds to a NEMA rating of 84 dBA. The L_w for the substation generator step-up transformers were calculated using the methodology recommended by the Electric Power Plant Environmental Noise Guide (Volume 1, 2nd edition) (Edison Electric Institute 1983). Table O3-5 presents the transformer sound source data by octave band center frequency input to the acoustic modeling analysis.

5.2.2.5 Collector and Transmission Lines

Noise generated by transmission lines typically contributes little to area noise levels when compared to other common sources such as vehicles, aircraft, and agricultural and industrial sources. Transmission line sound sources will consist primarily of corona noise in addition to Aeolian noise, and noise associated with maintenance activities. Transmission line noise (also known as corona noise) is caused by the partial electrical breakdown of the insulating properties of air around the electrical conductors and overhead power lines. Audible noise generated by corona on transmission lines is composed of two major components. The higher frequencies of the broadband component distinguish it from more common outdoor environmental noise.; the random phase relationship of the pressure waves generated by each corona source along a transmission line results in a characteristic sound commonly described as hum or crackling. The second component is a lower-frequency sound that is superimposed over the broadband noise. The corona discharges produce positive and negative ions that, under the influence of the alternating electric field around alternating current conductors, are alternately attracted to and repelled from the conductors. This motion establishes a sound-pressure wave having a frequency twice that of the voltage (i.e., 120 Hz for a 60-Hz system). Higher harmonics (e.g., 240 Hz) may also be present, but they are generally of lower significance (EPRI 2015). Corona activity increases with increasing altitude, and with increasing voltage in the line, but is generally not affected by system loading. The relative magnitude of hum and broadband noise may be different depending on weather conditions at the line. According to the Electric Power Research Institute, when the line is wet (such as during rainy weather conditions), the broadband component typically dominates; however, under icing conditions, the lower frequency components may be more prevalent (EPRI 2015).

Corona noise levels during precipitation may vary over a wide range. During the initial stages, when the conductors are not thoroughly wet, there may be considerable fluctuation in the noise level as the precipitation intensity varies. When the conductors are thoroughly wet, the noise fluctuations will often be less significant, because even as the intensity of precipitation diminishes the conductors will still be saturated, which can result in corona discharge. The variation in noise levels during rain depends greatly on the condition of the conductor surface and on the voltage gradient at which the conductors are operating. At high operating gradients, the audible noise is less sensitive to rain rate than at low gradients. Consequently, the variation in noise levels is less for the higher gradients. In different weather conditions the relative magnitudes of random noise and hum may be different. Noise levels in fog and snow usually do not attain the same magnitude as compared to rain, and elevated noise levels during fog and snow are usually for a shorter duration in proportion to the event (EPRI 1982).

During fair weather conditions, corona occurs only at scratches or other imperfections in the conductor surface or where dust has settled on the line. These limited sources are such that the corona activity is minimal, and the audible noise generated is very low. Generally, the fair-weather audible noise of transmission lines cannot be distinguished from ambient noise at the edge of the right-of-way.

Corona noise is not generally an issue at substations. The presence of equipment such as circuit breakers, switches, and measuring devices reduces the electromagnetic field gradient on the buses to a great extent. In addition, the distance from most of the buses to the perimeter of the substation is considerable (on average, greater than 100 meters). Consequently, low levels of corona noise would likely not be readily detectable immediately outside the substation fence line (EPRI 1982).

In addition to corona noise, wind blowing across power lines and power poles can generate noise when airflow is non-laminar or turbulent. Aeolian, or wind, noise is produced when a steady flow of wind interacts with a solid object, such as a tower. The interaction produces oscillating forces on the object that in turn can radiate sound as a dipole source at a given frequency.

The occurrence of aeolian noise is dependent on several factors and is difficult to predict. Wind noise from a stationary source requires perfect conditions: to produce any sound, the wind must blow for enough time in a specific direction at a specific speed; a slight deviation in either direction or intensity would disrupt the conditions necessary to produce noise. Wind can create a variety of sounds, ranging from a low hum to a snapping sound to a high whistle. Aeolian noise is not considered a significant contributor to noise disturbance and has not been considered further in the acoustic analysis.

The Facility proposes aboveground 230-kV collector lines to connect the six collector substations to the one central substation. The 230-kV collector lines will be designed to maintain a minimum conductor-to-ground clearance of 28 feet. The 230-kV collector lines will interconnect to the central substation. The POI at the BPA switchyard is located within the micrositing area. Therefore, the Facility does not propose a generation-tie transmission line (gen-tie transmission line) that extends outside of the site boundary. There will be a short stretch of 500-kV gen-tie transmission line that spans aboveground from the central substation to the BPA switchyard. This aboveground gen-tie transmission line will be approximately 650 feet in length based on the current design. The height of the gen-tie transmission line will conform to the NESC minimum of 50 feet, although it could be higher depending on BPA's final switchyard location.

Table O3-5. Modeled Octave Band Sound Power Level Facility Equipment

Equipment	Octave Band Sound Power Level (dBA) by Frequency (Hz)									Broadband (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Wind Turbine Vestas V163-4.5	77.5	86.2	96.4	100.1	102.0	103.8	100.7	93.7	72.1	108.4
Wind Turbine Vestas V163-4.5 w/ STE	75.4	85.0	93.8	95.4	99.2	102.2	99.9	91.5	83.4	106.3
Wind Turbine Vestas V163-4.5 w/ STE + Sound Optimized Mode	68.6	82.3	83.7	86.3	90.0	92.7	90.7	81.3	74.2	97.0
Photovoltaic Solar Inverter/Transformer	53.6	63.5	78.3	86.6	94.4	90.8	91.9	96.6	81.4	100.3
BESS Unit			66.0	74.3	85.7	84.7	84.0	80.8	73.3	90.4
Collector Substation Transformer (250 MVA)	60.1	79.4	91.5	94.0	99.4	96.7	92.9	87.6	78.5	103.0
Main Substation Transformer (285 MVA)	63.7	83.0	95.1	97.6	103.0	100.3	96.5	91.2	82.1	106.6
230 kV Collector Line	-	-	21.0	28.2	39.5	48.4	50.5	51.4	46.2	55.7
500 kV Gen-Tie Transmission Line	31.3	53.1	78.4	85.6	96.9	105.8	107.9	108.8	103.6	113.1

BESS = battery energy storage system; dBA = A-weighted decibel; dBL = linear decibel; Hz = hertz; Hz = hertz

6.0 Assessment of Compliance with Applicable Noise Regulations – OAR 345-022-0160(2)(b)

(b) An analysis of the proposed facility's compliance with the applicable noise regulations in OAR 340-035-0035, including a discussion and justification of the methods and assumptions used in the analysis;

Construction activities are categorically exempted under OAR 340-35-0035(5)(g). Construction noise is short term and not expected to result in significant long-term impacts.

The acoustic modeling analysis evaluated simultaneous operation of Facility components including the proposed wind facilities, solar facilities, BESS facilities, collector substation and gen-tie line. Resultant received sound levels were evaluated at the closest residences within 1 mile relative to the applicable ODEQ noise regulations. The acoustic model contains a number of conservative assumptions, and actual sound levels during Facility operation may be lower than modeled.

A sound contour plot displaying modeled operational sound levels in color-coded isopleths is provided in Figure O3-1. The resultant sound contour plot is independent of the existing acoustic environment (i.e., indicates project-generated sound levels only).

Attachment O3-1 presents the predicted received sound levels at each identified NSR as resulting from operations on a cumulative basis. Sound levels are rounded to the nearest whole decimal for consistency with the ODEQ noise regulations. The assumed background sound level of 26 dBA is given as well as the sound contribution from the proposed Facility, and the resultant combined sound level of the background in conjunction with the proposed Facility. The incremental increase in sound level relative to background as a result of Facility operations is also presented.

Modeling results indicate that the Facility successfully demonstrates compliance with the 50 dBA L_{50} nighttime maximum permissible noise level prescribed by ODEQ. Though there are 12 predicted exceedances of the 10 dBA ambient degradation standard, all but one (NSR ID 13) of those NSRs are considered participants (see Attachment O3-1, NSR IDs 1, 2, 3, 6, 7, 8, 14, 15, 19, 20, and 22).The Applicant has executed a legally effective easement with each of those participating landowners that benefits the relevant properties and authorizes the anticipated change in noise level, in compliance with OAR 340-035-0035(1)(b)(B)(iii)(III). While initial modeling indicates an exceedance of the 10 dBA ambient degradation standard at NSR ID 13, that modeling is based on (1) conservative turbine model and mitigation utilization assumptions that may not represent the actual sound levels associated with the final design and equipment selections and (2) an assumed baseline ambient sound level of 26 dBA, which may be reassessed at a later time per OAR 340-035-0035(1)(b)(B)(iii)(I) based on the actual ambient level. These sound levels will be re-evaluated during final design and any potential exceedances of applicable noise standards at NSRs will be addressed through mitigation options, engineering controls, or real estate solutions, such as executing an easement or real covenant with the affected landowner(s) per OAR 340-035-0035, to ensure compliance before construction.

7.0 Measures to Reduce Noise Levels or Impacts to Address Public Complaints – OAR 345-022-0160(2)(c)

> *(c) Any measures the applicant proposes to reduce noise levels or noise impacts or to address public complaints about noise from the facility;*

Construction noise is exempt from OAR regulations. Thus, no construction noise measures are planned beyond restricting construction activities to daytime periods and ensuring any potential noise complaints, while not expected, are tracked and resolved appropriately.

Prior to construction of each phase, the final Facility design, equipment specifications, and noise warranty data will be modeled and reviewed by an acoustician to demonstrate compliance with OAR 340-035-0035. Based on the results of the modeling, the Applicant will provide legally effective easements or real covenants (as available under ODEQ Noise Rules), or noise mitigation implementation, as necessary, to demonstrate compliance with OAR 340-035-0035.

8.0 Noise Monitoring – OAR 345-022-0160(2)(d)

(d) Any measures the applicant proposes to monitor noise generated by operation of the facility; and

Noise monitoring is not proposed for the Facility during operations. For any potential exceedances of the OAR 340-035-0035 anti-degradation rule or the fixed thresholds, the Applicant will implement noise mitigation or obtain a legally effective easement or real covenant, as necessary, prior to construction. In addition, the Energy Facility Siting Council has authority under OAR 345-026-0010(1), which states that under Oregon Revised Statute 469.430, "the Council has continuing authority over the site for which a site certificate is issued and may inspect, direct the Department of Energy to inspect, or ask another state agency or local government to inspect, the site at any time to ensure that the certificate holder is operating the facility in compliance with the terms and conditions of the site certificate."

9.0 Owners of Noise Sensitive Properties – OAR 345-022-0160(2)(e)

(e) A list of the names and addresses of all owners of noise sensitive property, as defined in OAR 340-035-0015, within one mile of the proposed site boundary.

Attachment O3-1 has a list of the NSR IDs and Universal Transverse Mercator coordinates of all owners of noise sensitive property within 1 mile from the Facility site boundary, as defined in OAR 340-035-0015. Attachment O3-2 includes the names and addresses of all owners of noise sensitive property within 1 mile of the site boundary, as defined in OAR 340-035-0015.

10.0 Evaporative Cooling Towers – OAR 345-022-0160(3)

OAR 345-022-0160(3) If the proposed facility has an evaporative cooling tower, information about the cooling tower plume, including:

(a) The predicted size and frequency of occurrence of a visible plume and an assessment of its visual impact;

(b) The predicted locations and frequency of occurrence of ice formation on surfaces and ground level fogging and an assessment of significant potential adverse impacts, including, but not limited to, traffic hazards on public roads;

(c) The predicted locations and rates of deposition of solids released from the cooling tower (cooling tower drift) and an assessment of significant potential adverse impacts to soils, vegetation and other land uses;

(d) Any measures the applicant proposes to reduce adverse impacts from the cooling tower plume or drift;

(e) The assumptions and methods used in the plume analysis; and

(f) The applicant's proposed monitoring program, if any, for cooling tower plume impacts.

The Facility does not include an evaporative cooling tower, so OAR 345-022-0160(3) is not applicable.

11.0 References

ACP (American Clean Power Association). 2022. ANSI/ACP 111-1-2022. "Wind Turbine Sound Modeling".

Beranek, L. 1988. Noise and Vibration Control, Chapter 7 - Sound Propagation Outdoors. Institute of Noise Control Engineering, Washington, D.C.

County. 2017. Sherman County Zoning Ordinance. https://www.shermancountyor.gov/233/Planning-Department. Accessed June 2026.

DataKustik (DataKustik GmbH). 2026. Computer-Aided Noise Abatement Model CadnaA, Munich, Germany.

Edison Electric Institute. 1983. Electric Power Plant Environmental Noise Guide (Volume 1, 2nd edition, Report 3637. 1983 Update). Prepared by Bolt Beranek and Newman Inc.

EPA (U.S. Environmental Protection Agency). 1971. Community Noise. NTID300.3 (N-96-01 IIA-231). Prepared by Wylie Laboratories.

EPRI (Electric Power Research Institute). 1982. Field Effects of Overhead Transmission Lines and Stations.: Transmission Line Reference Book: 345 KV and Above. Second ed., Palo Alto, California.

EPRI. 2015. The Integrated Grid – a Benefit-Cost Framework. Palo Alto, California.

FHWA (Federal Highway Administration). 2006. Federal Highway Administration Roadway Construction Noise Model User's Guide, FHWA-HEP-05-054, January 2006.

ISO (International Organization for Standardization). 2024. Standard ISO 9613-2 Acoustics – Attenuation of Sound during Propagation Outdoors. Part 2 General Method of Calculation. Geneva, Switzerland.

USGS (U.S. Geological Survey). 2023. National Geospatial Program, USGS National Elevation Dataset 1/3 arc-second.

12.0 Approval Standards and Submittal Requirements

Table O3-6. Approval Standards and Submittal Requirements Matrix

Requirements	Location
OAR 345-022-0160 State and Local Laws and Regulations	–
Submittal Requirements	
To assist the Council in determining compliance with all state and local laws and regulations applicable to EFSC and the siting process, submit the following, as directed by the project order described in OAR 345-015-0160:	–
(2) Information about noise generated by operation of the proposed facility, providing evidence to support a finding by the Council that the proposed facility complies with the Oregon Department of Environmental Quality's noise control standards in OAR 340-035-0035, including:	Section 5.0
(a) Predicted noise levels resulting from construction and operation of the proposed facility;	Section 5.0
(b) An analysis of the proposed facility's compliance with the applicable noise regulations in OAR 340-035-0035, including a discussion and justification of the methods and assumptions used in the analysis;	Section 6.0
(c) Any measures the applicant proposes to reduce noise levels or noise impacts or to address public complaints about noise from the facility;	Section 7.0
(d) Any measures the applicant proposes to monitor noise generated by operation of the facility; and	Section 8.0
(e) A list of the names and addresses of all owners of noise sensitive property, as defined in OAR 340-035-0015, within one mile of the proposed site boundary.	Section 9.0; Attachment O3-2
(3) If the proposed facility has an evaporative cooling tower, information about the cooling tower plume, including:	Section 10
(a) The predicted size and frequency of occurrence of a visible plume and an assessment of its visual impact;	Section 10
(b) The predicted locations and frequency of occurrence of ice formation on surfaces and ground level fogging and an assessment of significant potential adverse impacts, including, but not limited to, traffic hazards on public roads;	Section 10
(c) The predicted locations and rates of deposition of solids released from the cooling tower (cooling tower drift) and an assessment of significant potential adverse impacts to soils, vegetation and other land uses;	Section 10
(d) Any measures the applicant proposes to reduce adverse impacts from the cooling tower plume or drift;	Section 10
(e) The assumptions and methods used in the plume analysis; and	Section 10
(f) The applicant's proposed monitoring program, if any, for cooling tower plume impacts.	Section 10

Figure

Note that Figure O3-1 is Confidential and provided under separate cover

Attachment O3-1. Tabulated Summary of Acoustic Modeling Results by Receptor Location

(Confidential–provided under separate cover)

Attachment O3-2. Owners of Noise Sensitive Properties

(Confidential–provided under separate cover)