BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY DEUEL HARVEST WIND ENERGY SOUTH LLC FOR ENERGY FACILITY PERMITS OF A WIND ENERGY FACILITY AND A 345 KV TRANSMISSION FACILITY IN DEUEL COUNTY, SOUTH DAKOTA FOR THE SOUTH DEUEL WIND PROJECT

SD PUC DOCKET EL24-___

PRE-FILED DIRECT TESTIMONY OF MICHAEL HANKARD ON BEHALF OF DEUEL HARVEST WIND ENERGY SOUTH LLC

June 28, 2024

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name, employer and business address.

A. My name is Michael Hankard. I am the president and principal of Hankard Environmental, Inc. ("Hankard Environmental"). My business address is 211 East Verona Avenue, Verona, Wisconsin 53593.

Q. On whose behalf are you providing this testimony?

A. I am providing this testimony on behalf of Deuel Harvest Wind Energy South LLC ("South Deuel Wind") in support of its Facility Permit Application ("Application") to the South Dakota Public Utilities Commission. The Application is for a permit to construct and operate a wind energy facility which will have a nameplate capacity of up to 260 megawatts ("MW") and deliver up to 250 MW to the point of interconnection ("Wind Energy Facility"), and a transmission facility which will operate at 345 kilovolts ("kV") and be approximately 6 miles in length ("Transmission Facility"). The Wind Energy Facility and the Transmission Facility are collectively referred to as the Project.

Q. Briefly describe your educational background and professional experience.

A. I have been measuring, analyzing, researching, and reporting on environmental noise levels for more than 30 years. My focus over the last 15 years has been noise from utility-scale wind turbines, but I also have extensive experience with noise from mining operations, industrial plants, roadways, rail lines, commercial developments, and a host of other sources. I have worked on projects across the United States, as well as internationally, and have been principally responsible for noise measurements, analysis, and control on over 500 projects. I have interacted with a wide cross-section of project participants, including the public, local and state agencies, owners, operators, designers, and planners. I have a B.S. in electrical engineering from the University of Maine with a specialization in acoustics. I am a full member of the Institute of Noise Control Engineering and the Acoustical Society of America, and a member of the ANSI/ACP 111-1 Wind

Turbine Sound Modeling Standard Subcommittee. My statement of qualifications is attached as **Exhibit 1**.

Q. Expand on your professional expertise regarding sound from wind turbines, and how it is relevant to these proceedings.

A. I have conducted some of the most in-depth noise measurement studies of operating wind turbines in the United States. This experience includes spending many days and nights at residences located within wind farms listening to and measuring turbine noise and has given me a first-hand understanding of the characteristics of wind turbine noise emissions. In addition, I have spent hundreds of hours reviewing measured noise levels, listening to audio recordings, and have developed time- and frequency-based methods for separating wind turbine noise from that of the wind blowing through vegetation, traffic, insects/frogs, etc. I used the results of these real-world studies to validate the accuracy of the noise model I employed to predict noise emissions from the Project. Thus, the model of wind turbine noise emissions I use is accurate and is calibrated to predict the maximum wind turbine noise level over a one-hour period that is expected to occur at each residence. Finally, I have participated in public and agency hearings regarding wind turbines at which the full spectrum of wind turbine noise issues was debated. This includes audible noise, low frequency noise, and infrasound. In preparation for these proceedings, I have read the relevant and significant research papers on these subjects published by acoustical consultants, government agencies, university researchers, and health professionals.

II. PURPOSE OF TESTIMONY

Q. What is your role with respect to the Project?

A. Hankard Environmental was retained to conduct noise modeling for the Project. The firm conducted acoustic modeling of the Project's proposed layout and prepared an associated report entitled Noise Analysis, which is provided in Appendix M of the Application.

Q. What is the purpose of your Direct Testimony?

A. The purpose of my testimony is to discuss the methodology and results of the acoustic modeling Hankard Environmental conducted for the Project. In addition, I will discuss how the modeling demonstrates that the Project will comply with applicable acoustic regulations.

Q. Identify the sections of the Application that you are sponsoring for the record.

A. I am sponsoring the following portions of the Application:

- Section 11.3: Sound
- Appendix M: Noise Analysis

Q. What exhibits are attached to your Direct Testimony?

A. I am sponsoring the following exhibit:

- **Exhibit 1**: Michael Hankard Statement of Qualifications

III. ACOUSTIC ANALYSIS

Q. What was the purpose of the acoustic modeling and analysis discussed in the Noise Analysis?

A. The purpose of the Noise Analysis was to model the sound level to be produced by the Project and determine through analysis whether the noise generated by the Project will comply with the applicable noise standard in Deuel County, which establishes a maximum dBA level at non-participating residences. To ensure compliance with that requirement, my modeling was designed to assess the maximum sound level that could be generated by each turbine in any given hour (one-hour L_{eq}). Consistent with these goals, the Noise Analysis describes the results of the acoustic modeling we conducted, which demonstrates that Project sound levels will meet Deuel County's 45 dBA noise standard at the perimeter of existing, non-participating residences.

Q. Are you aware of any federal or state sound level regulations for wind energy conversion facilities located in South Dakota?

A. No. There are no federal noise regulations that apply to this Project. One noise-related requirement at the state level is South Dakota Administrative Rule 20:10:22:33.02(5), which requires that an application for an Energy Facility Permit include "Anticipated noise levels at the exterior of all occupied residences located within the affected area during construction and operation." The Noise Analysis satisfies this requirement.

Q. Has Deuel County established sound level requirements for wind energy facilities?

A. Yes. Section 1215.03(13)(a) of the Deuel County Zoning Ordinance provides that the "Noise level for non-participating residences shall not exceed 45 DBA, average A-Weighted Sound pressure. The noise level is to be measured at the perimeter of existing non-participating residences." This is the only numerical noise limit applicable to wind energy systems in Deuel County, South Dakota.

Q. Could you provide an overview of the methodology used in conducting the acoustic modeling analysis for the Project?

A. Noise levels from the Project were predicted using the modeling method set forth in the International Organization for Standardization ("ISO") Standard 9613-2:2024: Attenuation of Sound During Propagation Outdoors. The method was implemented using the SoundPLAN (v8.2) acoustical modeling program.

Three different turbine models were included in the analysis: Siemens Gamesa ("SG") model 4.4-164 wind turbines, utilizing 71 turbine locations, and all turbines to be equipped with low-noise blades; Vestas model V163-4.5 wind turbines, utilizing 71 turbine locations, and all turbines to be equipped with serrated trailing edge ("STE") blades; and General Electric ("GE") Sierra model 3.8-154 wind turbines, utilizing 73 turbine locations, and all turbines to be equipped with low

noise trailing edge ("LNTE") blades.[1] For each analysis, two 150 mVA main power transformers for the collector substation were also modeled.

In the SoundPLAN model, each turbine was represented as an acoustical point source located at its hub height, which is 98 meters above the ground for the GE 3.8-154 and V163-4.5 units, 97.5 meters for the SG 4.4-164 units, and three meters for the main power transformers. No directivity was applied to any noise source, thus assuming maximum acoustic output in all directions. All turbines were assumed to be operating in full, normal, and continuous operation and the main power transformers (two 150 MVA) were assumed to be operating fully. The locations of the turbines and main power transformers were provided by South Deuel Wind. Also, in the SoundPLAN model, 132 receptors (residences) were located within approximately 1.25 miles of any turbine or the substation. The geographic locations of the residences were provided by South Deuel Wind and reviewed by Hankard Environmental.

Q. Please summarize the results of the analysis.

A. Noise levels from the Project are predicted to not exceed 45 dBA at all non-participating residences within 1.25 miles of the Project turbines and main power transformers. At non-participating residences within the study area, predicted noise levels are as follows:

- SG 4.4-164 Low Noise: range of 31 to 42 dBA with an average of 37 dBA.
- V163-4.5 STE: range of 35 to 44 dBA with an average of 40 dBA.
- GE Sierra 3.8-154 LNTE: range of 36 to 45 dBA with an average of 41 dBA.

The modeling approach employed in the Noise Analysis consistently overpredicts measured levels. That is, actual noise levels from the Project are expected to be less than those listed in the Noise Analysis and lower than the Deuel County limits. Moreover, a majority of the time, noise levels will be lower than predicted when the

[1] The SG and Vestas turbine models do not include proposed turbine locations 69 and 76 to match the corresponding Shadow Flicker Analysis prepared for the Project. All turbine models at all proposed turbine locations can be constructed in compliance with Deuel County's 45 dBA limit at all non-participating residences.

turbines are not producing full acoustic output due to low winds, and/or atmospheric conditions are not as conducive to sound propagation as assumed in this analysis.

Q. Are you aware of any post-construction noise studies for other wind farms that support the accuracy and conservativeness of the pre-construction noise modeling you conducted for the Project?

A. Yes. The noise level modeling method employed on this Project has been validated by many acoustical consultants, including Hankard Environmental. Hankard Environmental has conducted numerous wind turbine noise level compliance surveys, and routinely compares the results of these measurements with corresponding predicted levels using the same methods employed on this Project. The noise modeling method used in the Noise Analysis has been demonstrated by Hankard Environmental and other acoustical consultants to over-predict actual maximum one-hour L_{eq} levels by at least 1 dBA.

IV. CONCLUSION

Q. Does this conclude your testimony?

A. Yes.

Dated this 28th day of June, 2024

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Michael Hankard