

Memorandum

Subject: Noise and Shadow contour lines calculation for Westmolen and Noordmolen

To: [REDACTED]

From: Guidehouse WTTS B.V., [REDACTED]

Date: 01.07.2021

Version	Author	Date	Status
0.0.a	[REDACTED]	19.02.2020	concept
0.0.b		20.02.2020	QA
1.0		20.02.2020	For Client
2.0.0		01.07.2021	Updated calculations

Intocon Energie requested Guidehouse WTTS to perform an update of the noise and shadow calculations performed in February 2020 for the planned Eemshaven-West Wind Farm, located in the municipality of Het Hogeland, with the aim of supporting the related permit application.

Calculations for shadow and noise contours are performed for two wind turbine locations at the Eemshaven-West wind farm. The wind turbine type assumed for both positions is the Vestas V162-5.6MW with a hub height of 160 meters, understood as a worst-case scenario for noise and shadow at both turbine locations. The positions, coordinates and types are:

Wind Turbine	Type	Hub height	Coordinates (RD)
Westmolen	V162-5.6	160m	245668, 609507
Noordmolen	V162-5.6	160m	247012, 609115

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Shadow calculations:

The results of the combined shadow contour calculations for both wind turbines are shown in Appendix A. The figures show the shadow contour lines for 0 hours and for 5:40 hours per year. The maximum upper limit of 5:40 is prescribed by the *Activiteitenbesluit* (Article 3.14). The shadow calculation is based on the following data:

- The statistical number of hours of sunshine per day.
- The direction of rotation of the wind turbine. After all, a turbine casts shadow on a larger surface when it is rotated perpendicular to the sun.
- The wind speed at the site. The wind turbines are in standstill below the cut-in and above the cut-out wind speeds. The Vestas V162-5.6 has a cut-in wind speed of 3 m/s and a cut-out wind speed of 25 m/s.

The data from the nearby weather station in Norderney (1980-1993) has been used for the sunshine statistics. The wind direction and wind speed at hub height were obtained based on historical modeled mesoscale wind climate data (ERA5) (February 2004 to January 2020). Wind turbine rotation direction and operating hours are not calculated based on site wind measurements.

Noise calculations:

The results of the noise calculation for both turbines are shown in Appendix B. The figures show the contours of the average noise exposure of 47 dB(A) L_{den} en 41 dB(A) L_{night} .¹ According to the Dutch wind turbine noise legislation, noise-sensitive objects such as homes will be outside these noise contours (*"Bijlage 4 van Activiteitenregeling, nieuwe bijlage op grond van wijziging windturbines"*, January 2011).

For the noise calculations it is assumed that no standstill control strategy has been taken and that the wind turbine is operational in the standard Mode 0, resulting in the highest noise exposure (worst-case scenario). In addition, the accumulation of noise from nearby wind turbines has not been considered.

¹ L_{den} is the average noise level during the day, evening, and night. L_{night} is the average noise level at night.

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Appendix A. Shadow contour lines

Project:
212897 UPDATE 2021 Westmolen shadow and noise



SHADOW - Map

Calculation: Update Shadow Westmolen and Noordmolen



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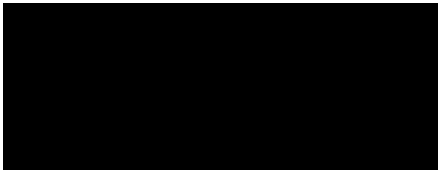
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Appendix B. Noise contour lines

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DECIBEL - Map Lden Aggregated

Calculation: Update Noise Westmolen and Noordmolen



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Project:
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DECIBEL - Map Lnight Aggregated

Calculation: Update Noise Westmolen and Noordmolen



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