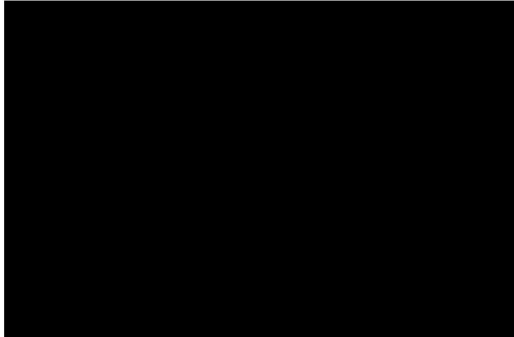


1 July 2021



HAWKESDALE AND RYAN CORNER SUBSTATION ENVIRONMENTAL NOISE LEVELS

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The Hawkesdale Wind Farm and Ryan Corner Wind Farm are consented projects located in Moyne Shire.

A separate planning permit was issued in 2018 for the development of a new off-site substation facility for the wind farms. It is understood that the planning permit was not acted upon and subsequently expired.

A revised application is to be submitted to DELWP, accounting for changes to the proposed arrangement of the substation.

An assessment of noise levels associated with the substation was previously prepared by Marshall Day Acoustics Pty Ltd (MDA) to support the original application¹. This letter presents an updated assessment for the revised application.

PROPOSED DEVELOPMENT

The off-site substation is proposed to be located within the existing Tarrone Terminal Station, located approximately 5 km south of Willatook, as indicated in the site plan in Figure 1.

The main existing source of environmental noise is a 600 MVA transformer associated with the Macarthur Wind Farm, located at the west end of the Tarrone Terminal Station. Other plant at the terminal station comprises ancillary equipment such as circuit breakers and 132 kV switchgear. However, the noise emissions of ancillary equipment are typically much lower than that of transformers, such that the transformers represent the primary consideration with respect to substation noise levels.

The Hawkesdale Wind Farm and Ryan Corner Wind Farm (HDRC) substation is proposed to be located at the east end of the Tarrone Terminal Station. The substation is to comprise a single 420 MVA transformer and associated ancillary equipment. As per the existing equipment at the Tarrone Terminal Station, the primary noise consideration for the proposed HDRC substation is the transformer.

A review of aerial photography for the area indicates noise sensitive areas (receivers) consisting of four (4) existing residential dwellings located to the east of the Tarrone Terminal Station.

The locations of the existing Macarthur transformer, the proposed HDRC transformer, and the identified receivers are indicated in Figure 1.

¹ Reference MDA letter Lt 001 R01 20170909 dated 24 January 2018

Figure 1: Location map - receivers, existing Macarthur Wind Farm transformer, and proposed HDRC transformer



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LEGISLATION & GUIDANCE

Legislation and guidance relevant to the proposed substation is detailed in Table 1.

Table 1: Relevant Victorian noise legislation and guidelines

Document	Overview
<i>Environment Protection Act 2017</i> (the Act), as amended by the <i>Environment Protection Amendment Act 2018</i>	<p>The Act provides the overarching legislative framework for the protection of the environment in Victoria. It establishes a general environmental duty to minimise the risks of harm to human health or the environment from pollution or waste, including noise, so far as reasonably practicable.</p> <p>The Act does not specify noise limit values, but prohibits the emission of unreasonable or aggravated noise from non-residential premises.</p> <p>The Act provides general definitions of unreasonable and aggravated noise; definitions that are specific to commercial, industrial and trade premises are provided in supporting publications (see below).</p> <p>Section 93 of the Act provides for the creation of an environmental reference standard to be used to assess and report on environmental conditions in the whole or any part of Victoria (see below).</p>
<i>Environment Protection Regulations 2021</i> (the Regulations)	<p>The objectives of the Regulations are to further the purposes of, and give effect to, the Act.</p> <p>Part 5.3 of the Regulations sets out requirements that are specific to environmental noise. It states that the prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or the Regulations, must be conducted in accordance with the Noise Protocol (see below).</p> <p>Division 3 of Part 5.3 stipulates requirements that are specific to commercial, industrial and trade premises. In particular, noise from these types of premises is prescribed as unreasonable if it exceeds a noise limit or alternative criterion determined in accordance with the Noise Protocol. Additional matters addressed in this Division include assessment time periods, minimum noise limit values, management of cumulative noise from multiple premises, noise sensitive areas where assessment requirements apply, definition of frequency spectrum as a prescribed factor, and a definition for aggravated noise.</p>
EPA Publication 1826.4 <i>Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues</i> dated May 2021 (Noise Protocol)	<p>The Noise Protocol defines the method for setting the noise limits for new and existing commercial, industrial and trade premises and entertainment venues in Victoria.</p> <p>It also outlines the steps that must be followed to undertake an assessment (measurement or prediction) of the effective noise level within a noise sensitive area or at an alternative assessment location. A comparison between the effective noise level and the relevant noise limit or the relevant alternative assessment criterion will determine whether the noise that is emitted from the premises is unreasonable under the Regulations.</p> <p>The noise limits for commercial, industrial and trade premises are determined on the basis of land zoning and background noise levels, and are separately designated for day, evening and night periods.</p>
<i>Environment Reference Standard</i> dated 25 May 2021 (ERS)	<p>The ERS is made under section 93 of the Act. The ERS sets out environmental values for ambient sound that are sought to be achieved and maintained in Victoria and standards to support those values. The indicators and objectives within the standard provide a benchmark for comparing desired outcomes to the actual state of the environment and a basis for assessing actual and potential risks to the environmental values.</p> <p>The ERS is not a compliance standard, and the values listed within the ERS for different land uses are explicitly not noise limits nor design criteria. The primary function of the ERS is to provide assessment and reporting benchmarks for environmental values.</p>

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NOISE LIMITS

In accordance with the Act, Regulations and Noise Protocol, an assessment of the predicted noise level of the proposed HDRC substation must be carried out in accordance with the method set out in the Noise Protocol.

The noise limits that apply at receivers near the proposed substation are determined using the rural area procedures detailed in the Noise Protocol.

The procedures for rural areas are based on determining the zone levels according to the land zoning of the area in which the noise source and receivers are located. These zone levels are then adjusted for a range of factors as required.

The zone levels are determined on the basis of the substation and the nearest receivers being located on land designated as Special Use Zone (SUZ6) and Farming Zone (FZ) respectively as shown in Figure 2.

Figure 2: Zoning map



The applicable zoning levels are detailed in Table 2.

Table 2: Zoning levels, dB LAeq

Period	Day	Evening	Night
Zoning level	58	48	43

Distance adjustments to the zone levels are applicable in this instance as the proposed substation and the receiver are not located in land use zones with the same zone codes. The distance adjustment is determined by accounting for the distance between the zone where the noise source is located and the location of the noise receiver in the noise sensitive area. Adjustments for 'background relevant areas' are not warranted in this instance, as the background noise levels during the relevant assessment conditions for the substation (i.e. low wind speeds) are expected to be low.

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The applicable distance adjustments are detailed in Table 3.

Table 3: Distance adjustments that apply to the zone levels

Receiver	Approximate development zone to receiver distance, m	Distance adjustment, dB
R1	490	-4
R2	150	-1
R3	770	-7
R4	820	-8

Based on the zone levels and distance adjustments, the Noise Protocol noise limits which apply to the effective noise level (ENL) are detailed in Table 4. The noise limits apply to the cumulative ENL, accounting for the noise of existing and proposed sources of noise at the terminal station.

Table 4: Noise Protocol noise limits, dB ENL

Receiver	Period		
	Day	Evening	Night
R1	49	44	39
R2	52	47	42
R3	46	41	36
R4	45	40	35

As the proposed HDRC substation would operate 24 hours a day and 7 days a week, the noise limits for the night period are used to assess the predicted noise levels.

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NOISE EMISSION DATA

Noise emission data for the existing Macarthur transformer and the proposed HDRC transformer has been provided for the assessment by AusNet Services. The sound power levels are presented in Table 5.

Table 5: Supplied transformer sound power data

Transformer	Rating	Sound power level, dB L _{WA}
Macarthur	600 MVA	92
Proposed HDRC	420 MVA	98

To gauge the suitability of the noise emission data detailed in Table 5, reference has been made to Australian Standard AS 60076-10² which provides a method for estimating transformer sound power levels. Reference has also been made to Marshall Day Acoustics' (MDA) database of measurements for comparable equipment. Comparison with this reference data indicates that the supplied sound power levels are consistent with the range of values expected for contemporary transformer units.

The available data relates to the total A-weighted sound power levels of the equipment, but does not include information about the frequency spectrum of the noise emissions, nor does AS 60076-10 provide example frequency spectrum information. In lieu of this data, and to provide a suitable basis for noise modelling, a frequency spectrum has been assigned using empirical data from MDA's own measurement database. For this purpose, a conservative frequency spectrum has been selected which is representative of the upper noise emission levels observed in the lower frequencies. The frequency spectra are provided in Table 6.

Table 6: Octave band sound power levels for noise modelling, dB L_w

Item	Octave band centre frequency, Hz							A-weighted total
	63	125	250	500	1000	2000	4000	
Macarthur	90	101	98	89	79	71	64	92
Proposed HDRC	96	107	104	95	85	77	70	98

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² AS 60076-10:2009 *Power transformers – Part 10: Determination of sound levels*

NOISE PREDICTIONS

Prediction method

Noise levels have been calculated using the International Standard ISO 9613-2³ for atmospheric conditions which increase receiver noise levels comprising either:

- a wind directed from the substation to the nearest receivers; or
- a moderate ground-based thermal inversion (a condition when temperatures increase with height above ground, as may occur on clear and still nights).

The following additional details of the modelling are noted:

- Ground conditions in the surrounding area were assigned a ground factor of $G = 0.5$

The adopted value of $G = 0.5$ assumes that 50 % of the ground cover is acoustically hard ($G = 0$) to account for variations in ground porosity. Flat ground conditions have been accounted for in the modelling.

- Receiver calculation height of 1.5 m

This corresponds to the normal measurement height for conducting compliance measurements at receiver locations.

- Temperature 10 °C and relative humidity 70 %

These represent conditions which result in relatively low levels of atmospheric sound absorption.

An adjustment of +2 dB has then been applied to the predicted noise levels to account for the potential tonal characteristics of transformer noise. The relevance and magnitude of the adjustment in practice is dependent on several variables. This is discussed below.

Predicted noise levels

The predicted total noise levels of the Macarthur and proposed HDRC transformer are presented in Table 7, along with the applicable night period noise limit and assessment of compliance.

Table 7: Predicted noise levels and compliance assessment

Receiver	Total predicted effective noise level, dB ENL	Night period noise limit	Compliance?
R1	26	39	✓
R2	26	42	✓
R3	24	36	✓
R4	25	35	✓

The predicted noise levels are low and expected to be comparable to or less than background noise levels, subsequently reducing the likelihood of tonality being an audible characteristic at receivers. The inclusion of the + 2 dB adjustment for tonality in the predictions is therefore conservative (i.e. the noise level would likely be lower).

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³ ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

CONCLUSION

The assessment demonstrates that the total noise levels of the existing Macarthur transformer and the proposed transformer for the Hawkesdale Wind Farm and Ryan Corner Wind Farm are predicted to comply with the applicable Noise Protocol night period noise limit by a margin of at least 10 dB.

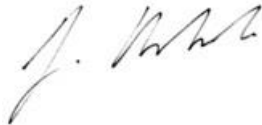
As the transformers are the primary sources of environmental noise, the results are representative for the overall changes to the Tarrone Terminal Station associated with the development of an off-site substation for the Hawkesdale Wind Farm and Ryan Corner Wind Farm.

Prior to development of the substation, we recommend that predicted noise levels are verified by revised noise modelling using updated noise emission data for the final transformer selection for the site.

We trust the above information is suitable for your immediate purposes.

Yours sincerely

MARSHALL DAY ACOUSTICS PTY LTD



Justin Adcock

Associate

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