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PROPOSED SOLAR FARM

RAYWOOD
VICTORIA

Town Planning Submission

Acoustic Report

Client Details:

ACEnergy Pty Ltd
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WMG Document Reference. 12639-2jg
Date of Issue. March 4, 2021

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EXECUTIVE SUMMARY

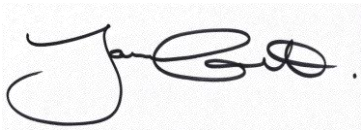
Watson Moss Growcott Acoustics (WMG) has undertaken an acoustic assessment for the proposed construction and operation of a Solar Farm facility to the south Bridgewater-Raywood Road, Raywood.

The purpose of the assessment has been to consider any potential noise emissions associated with the proposed use which may impact on residential receptors located nearby to the subject site.

Due to the location of the subject site, and based on previous experience involving similar proposals, the assessment has been undertaken in accordance with methodologies described within Environment Protection Authority Publication 1411 Noise from Industry in Regional Victoria – Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria.

The findings of the noise assessment have concluded that compliance with relevant Environment Protection Authority NIRV Recommended Maximum Noise Levels can be achieved at residential receptors located nearby to the subject site in the absence of any specific noise control measures.

Given that the final design including equipment selections for the proposal has not been completed, it is recommended that as part of detailed design for the project, an acoustic consultant is engaged to undertake a review of the final proposal and ensure that compliance with relevant criteria is achieved at each of the noise sensitive residential receptors



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1. INTRODUCTION

The proposal includes the construction and operation of a new solar farm facility to the south of Bridgewater-Raywood Road, Raywood.

The site land is currently vacant and is generally surrounded by farm zoned land including some scattered residential premises.

Equipment operating as part of the solar farm will generate noise emissions which have the potential to impact on the acoustic amenity of noise sensitive residential receptors located nearby to the subject site.

In consideration of the above, Watson Moss Growcott Acoustics (WMG) has been engaged to undertake an acoustic assessment for the proposal.

The assessment has been conducted in accordance with EPA Publication 1411: Noise from Industry in Regional Victoria Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria (NIRV).

This report presents a summary of the assessment, and where appropriate, includes indicative noise control strategies to achieve relevant criteria at noise sensitive receptors.

2. NOISE ASSESSMENT TERMINOLOGY

Noise assessment terminology used within this report is defined within Table 1 below:

Table 1: Noise Assessment Terminology

Terminology	Definition
dB(A)	Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character
L_{eq}	The equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.
Sound Power Level (Lw)	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. Lw = Lp + 10 log10 'a' dB, re: 1pW, (10-12 watts) where 'a' is the measurement noise-emission area (m2) in a free field.
Sound Pressure Level (Lp)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where LP = 10 log10 (Pa/Po)2 dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20 x 10-6 Pa) for airborne sound. Lp varies with distance from a noise source.

3. SUBJECT SITE AND SURROUNDING ENVIRONMENT

The site under consideration is located within farm zoned land and abuts Bridgewater-Raywood Rd to the north, and vacant farm zoned land to the to the east, west and south.

When considering noise sensitive receptors located within proximity of the proposed use, the closest and therefore most noise sensitive will be as shown below in Table 2.

Table 2: Receptor Summary

Receptor Reference	Receptor Address	Receptor Land Zoning
R1	21 Fogartys Rd	Farming Zone
R2	1980 Bendigo-Pyramid Rd	Farming Zone
R3	Bendigo-Pyramid Rd	Farming Zone
R4	7 Whittle Rd	Farming Zone

Due to the proximity of the described dwellings to the subject site, compliance with relevant noise criteria at the described dwellings will also result in compliance at all other dwellings.

The aerial photo shown below in Figure 1 identifies the subject site under consideration and the nearby noise sensitive receptors considered relevant for this assessment.

Figure 1: Aerial Photograph of Subject Site and Surrounds

4. PROPOSED SITE PLAN AND OPERATIONS

The proposal includes electrical infrastructure including battery storage containers, inverter units and transformers located within the boundaries of the subject site land.

The client has advised that the facility will operate 24 hours per day, 7 days per week and the assets associated with the operation of the solar farm will include:

- 5 no. battery storage containers including associated air conditioning equipment.
- 2 no. inverter unit.
- 1 no. transformer unit associated with inverter unit operation.

In addition to the above, each of the solar panel rows (total 176no.) installed at the subject site will utilise a 'NEXTracker' panel tracking system which is powered by a small 24V DC motor and operates five to ten seconds every few minutes.

Figure 2 below provides the site plan for the proposal.

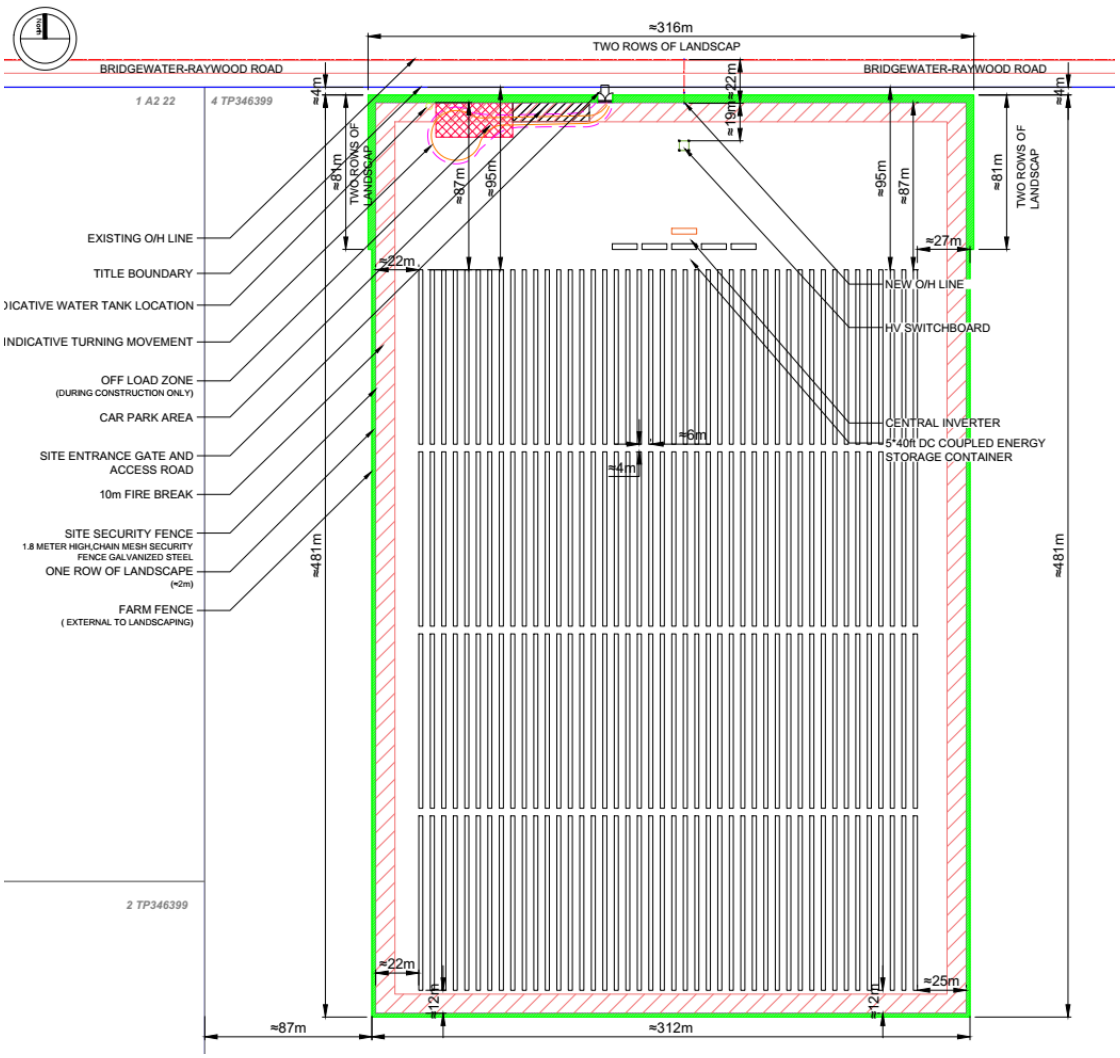

Figure 2: Site Plan

When considering noise emissions associated with the proposed use, the relevant noise sources will include:

- 5 no. battery storage containers including associated air conditioning equipment.
- 2 no. inverter unit.
- 1 no. transformer unit associated with inverter unit operation.

Information from the product supplier has indicated that the a 'NEXTracker' panel tracking system will have a very low sound power level relative to noise emissions associated with the inverter units and battery storage container air conditioning units.

Due to the relatively short duration of noise emission associated with the tracker units, the noise contribution will be insignificant when assessed against the noise criteria at receptor locations.

The final design including the relevant equipment selections has not been completed.

However, based on information provided by the client, Table 2 below provides a summary of the different equipment types and the associated sound power levels adopted as the basis for this assessment.

Table 3: Summary of Noise Sources

Noise Source	Description	Adopted Sound Power / Pressure Level
Battery Storage Container air conditioning units	SMA Energy Storage Station HVAC System	58 dB(A) at 10m – per unit
Inverter units	1no. Sungrow SG4950 comprised of 2no SG2475 units.	95 dB(A) – combined
Inverter transformer	N/A	56 dB(A) – per unit

The sound power and pressure level information provided by the client has been documented as an overall dB(A) figure. For the purpose of this assessment, WMG has adopted noise level spectrum data associated with the relevant noise sources from previous investigations involving similar equipment types.

From previous experience, with the exception of the outdoor air conditioning unit it is expected that each of the relevant noise sources will likely include a tonal character.

The tonal character associated with the noise sources will require consideration when assessing noise impacts at residential receptors.

5. NOISE EMISSION ASSESSMENT CRITERIA

5.1 NOISE FROM INDUSTRY IN REGIONAL VICTORIA

When addressing noise emissions associated with site operations at residential receptors, the relevant assessment criteria will be Environment Protection Authority (EPA) Publication 1411 – Noise from Industry in Regional Victoria (NIRV).

The NIRV document was introduced in 2011 to provide guidance on noise assessments in regional areas located outside Metropolitan Melbourne and includes Recommended Maximum Noise Levels (RMNL) which are determined based on the land zoning associated with the commercial noise emissions, and the land zoning of the noise sensitive residential receptor.

The RMNLs described within the NIRV document are treated as guideline values for consideration unless they form part of a commercial Planning Permit or Operating License.

When assessing impacts at residential receptors outside Metropolitan Melbourne but within major urban centres of regional Victoria (defined as having a population greater than 7000), RMNLs are calculated using methodologies described within SEPP N-1.

For sites located outside major urban centres of regional Victoria, RMNLs are calculated based on set methodologies described within NIRV including consideration of the land zoning types.

This approach is applicable for the subject site under consideration.

Using NIRV methodology, noise targets vary depending on the time of the day, evening, or night, with the highest permitted values typically occurring during week daytimes, and the lowest during the night period.

The relevant day, evening, and night assessment periods are shown below in Table 4.

Table 4: EPA Assessment Periods

EPA Assessment Period	Relevant Days	Relevant Time Periods
Day	Monday to Friday	7:00am to 6:00pm
	Saturday	7:00am to 1:00pm
Evening	Saturday	1:00pm to 6:00pm
	Sunday, Public Holidays	7:00am to 6:00pm
	All Days	6:00pm to 10:00pm
Night	All Days	10:00pm to 7:00am

When determining RMNL values, the NIRV document includes 'Table 1' which is essentially a matrix of zoning types that enables derivation of suitable baseline 'Zone Levels' using the land zoning associated with the 'noise generating zone' and 'noise receiving zone'.

Once the described 'Zone Levels' are derived, the values are further adjusted to account for:

- The presence of increased ambient background levels at noise sensitive receptors. This is typically only relevant where receptors are located within proximity of major roadways with relatively continuous traffic flows and will not be applicable for the subject site.
- Distance adjustment due to the separation between the noise sensitive dwelling and the boundary of the land zoning associated with the 'noise generating zone'.

For the subject site, the ambient background noise environment has been considered, and determined not to be relevant for the assessment.

In addition, due to the land zoning for both the subject site and residential receptors being within a continuous farming zone (FZ), a distance adjustment will also not be relevant.

In consideration of the above, Table 5 below presents as summary of the adopted RMNL values applicable for the proposed operations associated with the subject site.

Table 5: Calculated Distance Adjusted RMNL values.

EPA Assessment Period	Relevant Days	Relevant Time Periods	Calculated NIRV RMNL Values
Day	Monday to Friday	7:00am to 6:00pm	46
	Saturday	7:00am to 1:00pm	
Evening	Saturday	1:00pm to 6:00pm	41
	Sunday, Public Holidays	7:00am to 6:00pm	
	All Days	6:00pm to 10:00pm	
Night	All Days	10:00pm to 7:00am	36

5.2 NIRV Assessment Adjustments

When considering noise impacts on residential receptors, NIRV methodology includes relevant adjustment factors which account for the potential for the noise source to impact on the acoustic amenity of the noise sensitive receptor. The relevant adjustments include:

- Impulsive adjustment.
- Intermittency adjustment.
- Reflection Adjustment.
- Duration Adjustment.
- Tonal Adjustment

Clarification regarding each of the adjustments is shown below in Table 6.

Table 6: NIRV Assessment Adjustments

Relevant Adjustment	Description
Impulsive Adjustment	When the noise is impulsive in character then an adjustment shall be made as follows: ▪ When the impulsive character of the noise is just detectable then + 2 dB(A). ▪ When the impulsive character of the noise is prominent then + 5 dB(A).
Intermittency Adjustment	When the noise emission is intermittent or variable and the noise emission increases in level rapidly on at least two occasions during a 30 minute period and maintains the level for at least one-minute duration, then an adjustment will be applied as follows: ▪ When the level increase is >10 dB during the day period, then apply an adjustment of +3 dB(A). ▪ When the level increase is 5-10 dB during the night period, then apply an adjustment of +3 dB(A). ▪ When the level increase is >10 dB during the night period, then apply an adjustment of +5 dB(A).
Reflection Adjustment	When the measurement point is located outdoors and the microphone is located from 1 to 2 metres from an acoustically reflecting surface, an adjustment of -2 dB shall be made.
Duration Adjustment	When the noise emission is not audible over the whole of a continuous 30-minute period, then a duration adjustment based upon the total amount of time for which the noise is audible over that continuous 30-minute period shall be determined.
Tonal Adjustment	When the noise is tonal in character than an adjustment shall be made as follows: ▪ When the tonal character of the noise is just detectable then + 2 dB(A). ▪ When the tonal character of the noise is prominent then + 5 dB(A).

The above adjustments are applied to the measured / predicted values at residential receptors to determine the 'effective' noise level impacting on the residential receptor.

6. PREDICTED NOISE IMPACTS ASSOCIATED WITH PROPOSAL

6.1 NOISE PREDICTION METHODOLOGY

Modeling of operational noise emissions associated with the proposal has been conducted using DataKustik CadnaA 2020 environmental noise modelling software.

Relevant information regarding site elevations, site buildings and the surrounding environment has been provided by the client and sourced from online databases including Nearmaps and VicMaps.

The model has been developed and configured with sufficient detail for appropriate noise emission calculations to be undertaken.

For this assessment, the modelling software has implemented the calculation procedures defined within International Standard *ISO 9613-2: 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613).

The described standard has been considered and approved as part of many previous projects requiring noise emission assessment works.

Through implementation of the Standard through CadnaA 2020, the noise emission modelling considers the following attenuation measures:

- Geometrical spreading.
- Atmospheric absorption.
- Ground attenuation.
- Meteorological effects.
- Source/Receiver height effects.
- Attenuation due to the surrounding environment including existing buildings/structures.

The noise modelling input parameters have been adjusted to reflect the Environmental Protection Authority (EPA) Victoria assessment methodology requirements. These include:

- Residual noise levels at noise sensitive receivers have been considered when weather conditions assist with propagation of emissions in the direction of the relevant receptor.
- In accordance with NIRV methodology, predicted noise levels have been assessed over a continuous 30-minute assessment period. Predicted values have been considered within 10 metres of relevant noise sensitive residential external facades.

Generally, the surrounding residential receptors include single level dwellings. Receptor locations have therefore been based on an assessment height 1.5m above ground level.

6.2 NOISE MODELLING INPUT PARAMETERS

Table 7 below presents a summary of the equipment operations adopted as the basis for the assessment during the EPA defined day, evening, and night periods.

Table 7: Summary of Adopted Operating Parameters

Assessment Period	Noise Source Description
Day	▪ 1 no. Inverter transformer units operating continuously. ▪ 2 no. Inverter units operating continuously. ▪ 5 no. Battery storage container air conditioning units operating at full capacity.
Evening	
Night	

6.3 NOISE PREDICTION RESULTS

The results of the noise modelling including the measured and predicted noise levels at the relevant off-site residential receptors are presented below in Table 8, 9, 10 and 11.

Table 8: Predicted noise levels associated with proposed facility operation at Receptor R1

Noise Sensitive Receptor (R1)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	25 dB(A)	25 dB(A)	25 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	27 / 30 dB(A) L_{eq}	27 / 30 dB(A) L_{eq}	27 / 30 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✔ ***(Note 1)***	✔ ***(Note 1)***	✔ ***(Note 1)***

Table 9: Predicted noise levels associated with proposed facility operation at Receptor R2

Noise Sensitive Receptor (R2)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	23 dB(A)	23 dB(A)	23 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	25 / 28 dB(A) L_{eq}	25 / 28 dB(A) L_{eq}	25 / 28 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✔ ***(Note 1)***	✔ ***(Note 1)***	✔ ***(Note 1)***

Table 10: Predicted noise levels associated with proposed facility operation at Receptor R3

Noise Sensitive Receptor (R3)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	< 20 dB(A)	< 20 dB(A)	< 20 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	< 22 / 25 dB(A) L_{eq}	< 22 / 25 dB(A) L_{eq}	< 22 / 25 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✔ ***(Note 1)***	✔ ***(Note 1)***	✔ ***(Note 1)***

Table 11: Predicted noise levels associated with proposed facility operation at Receptor R4

Noise Sensitive Receptor (R4)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	23 dB(A)	23 dB(A)	23 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	25 / 28 dB(A) L_{eq}	25 / 28 dB(A) L_{eq}	25 / 28 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✔ ***(Note 1)***	✔ ***(Note 1)***	✔ ***(Note 1)***

(Note 1)

Given the distance separation between the site land and the noise sensitive receptor, the required tonal adjustment for the potential noise impacts at the receptor has not been confirmed.

It is noted that compliance with relevant assessment criteria is predicted to be achieved at the critical noise sensitive receptors with both a + 2 dB(A) and a + 5 dB(A) adjustment

7. NOISE CONTROL STRATEGIES

The findings of the acoustic assessment and associated noise modelling have concluded that compliance with relevant Environment Protection Authority NIRV Recommended Maximum Noise Levels can be achieved at residential receptors located nearby to the subject site.

It is noted that at this early stage of the design, equipment selections associated with the proposed use have not been finalised.

The primary recommendation will therefore be that once equipment selections are finalised, the proposal is reviewed by a suitably qualified acoustic consultant to ensure that compliance with relevant criteria is achieved at nearby noise sensitive receptors.

8. CONCLUSIONS

WMG has carried out an acoustic assessment for the Solar Farm facility proposed to be constructed and operated to the south Bridgewater-Raywood Road, Raywood.

The purpose of the assessment has been to consider any potential noise emissions associated with the proposed use which may impact on residential receptors located nearby to the subject site.

Noise emissions associated with the proposed use have been considered in accordance with methodologies described in Environment Protection Authority Publication 1411 Noise from Industry in Regional Victoria – Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria (NIRV).

Based on the assessment, WMG has concluded that compliance with relevant Environment Protection Authority NIRV Recommended Maximum Noise Levels can be achieved at residential receptors located nearby to the subject site in the absence of any specific noise control measures.