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Operational Noise Impact Assessment
Proposed 4.95 Megawatts Solar Farm

At:-

290 Cosgrove-Caniambo Road,

Cosgrove, Vic 3631

Prepared for: -

BE Pro G Pty Ltd
C/- Habitat Planning Pty Ltd
409 Kiewa Street
Albury NSW 2640

Attention: Mr David Hunter

Reference: 2011010E-R

Prepared by: -

Matthew Harwood MAAS
16th March 2021

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Draft	MH	MH	16/03/2021
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Habitat Planning Pty Ltd on behalf of BE Pro G Pty Ltd commissioned Harwood Acoustics to carry out an Environmental Noise Impact Assessment for a 4.95 Megawatts Solar Farm proposed to be constructed on a portion of 290 Cosgrove – Caniambo Road, Cosgrove, Victoria.

Accordingly, Harwood Acoustics has prepared this report for the exclusive use of the Client identified on the title page. The report is prepared in accordance with the brief and scope of works agreed between the Client and Harwood Acoustics and may not be suitable for use beyond that scope.

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1. INTRODUCTION AND SUMMARY

Habitat Planning Pty Ltd on behalf of BE Pro G Pty Ltd commissioned Harwood Acoustics to carry out an Operational Noise Impact Assessment for a 4.95 Megawatts Solar Farm proposed to be constructed on a portion of land located at 290 Cosgrove – Caniambo Road, Cosgrove, Victoria, (the Site).

The Site is a large rural property located on the western side of Cosgrove – Caniambo Road, between Shepparton – Dookie College Road to the south and Kellows Road, approximately 20 kilometres east of the City of Shepparton.

The overall Site is approximately 33.5 hectares in size and is situated on land zoned FZ1 Farming Zone Schedule 1. The solar farm will be established on approximately 15.5 hectares at the southern extent of the land, as shown in Figure 2 in this Report.

The area surrounding the Site is predominantly rural farming land and there are rural residential receptors toward the south, north east, north and north west as shown in Figure 1. The nearest of these is located toward the south at approximately 520 metres from the proposed substation area.

It is proposed to establish a 4.95 Megawatts Solar Farm (referred to henceforth as the Facility) on the Site with access via Cosgrove – Caniambo Road at the northern end of the lease area. The Facility will comprise the installation of 16,500 solar photovoltaic panels (PV Panels) to be mounted in arrays on single axis trackers with cabling from the solar arrays to panel inverters and a substation, with connection into the local electricity network. The substation will be on the north eastern side of the of the development area as shown in Figure 2 in this Report and the two inverters will be located within the substation area adjacent to the transformer. There will also be battery storage capacity to be housed in containers located within the substation area.

The Facility will also include construction of a perimeter internal access track as well as perimeter fencing. The Facility will generate power during daylight hours with all infrastructure being operational at all times.

The facility is expected to take approximately 6 months to complete construction. It will operate for a period of up to 30 years, after which it will be subject to further operation or decommissioning and removal of all components.

It is a requirement of Shepparton City Council that an Operational Noise Impact Assessment be prepared to address the potential for noise impact arising from the operational phase of the project.

Acceptable noise levels are therefore derived from the Victorian EPA's guidelines 1411, Noise from Industry in Regional Victoria 2011 (NIRV). The NIRV Guidelines recommend maximum noise levels from commerce, industry and trade premises in regional Victoria and establish noise limits for various generating and receiving planning zones.

In this instance the generating and receiving zones, for all receptors, are each FZ1 Farming Zone Schedule 1 and the resultant noise limits are therefore 46 dBA ($L_{eq,\ 30\ minute}$) in the day time period, 41 dBA ($L_{eq,\ 30\ minute}$) in the evening period and 36 dBA ($L_{eq,\ 30\ minute}$) in the night time period.

The main sources of noise associated with the operational phase of the project are the inverters and the transformer within the substation.

Noise modelling has been undertaken based on noise data established for the inverters and the transformer. Noise data for each of the inverters has been provided by the manufacturer of SMA central inverter model SC2475. Noise data for the transformer has been established from noise measurements of similar transformers carried out by the author over the past 19 years.

An adjustment of + 5 dB is also applied to all predicted noise levels to account for a potential prominent tonal character to the noise from the transformer and inverters.

Noise modelling and calculations show that the level of noise emission from the operational phase of the development will be within the EPA's NIRV Guidelines at all receptor locations during the day time, evening time and night time periods without the need for noise controls.

2. SITE AND DEVELOPMENT DESCRIPTION

2.1 Site Description

The Site is a large rural property located on the western side of Cosgrove – Caniambo Road, between Shepparton – Dookie College Road to the south and Kellows Road, approximately 20 kilometres east of the City of Shepparton.

The overall Site is approximately 33.5 hectares in size and is situated on land zoned FZ1 Farming Zone Schedule 1. The solar farm will be established on approximately 15.5 hectares at the southern extent of the land, as shown in Figure 2 in this Report.

The area surrounding the Site is rural farming land and there are rural residential receptors toward the south, north east, north and north west as shown in Figure 1.

The closest residential receptors to the Site are shown in Figure 1 below and as follows:-

R1 – 640 Shepparton Dookie College Rd (circa 530 metres)

R2 – 265 Cosgrove Caniambo Rd (circa 760 metres)

R3 – 290 Kellows Road (circa 985 metres)

R1 – 530 Kays Road (circa 1,590 metres)

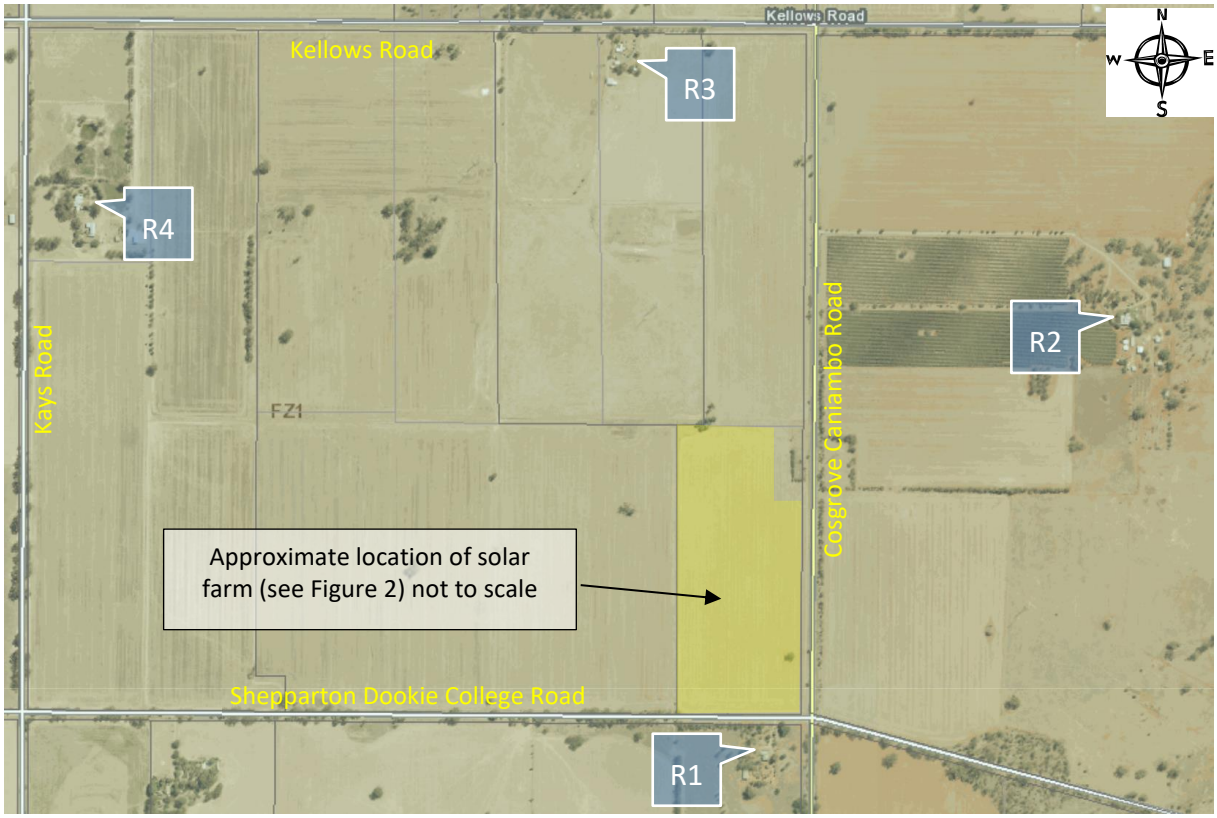

Figure 1. Location Plan – 290 Cosgrove Caniambo Road, Cosgrove, Vic

(source: VicPlan – Victoria State Government)

2.2 Development Description

It is proposed to establish a 4.95 Megawatts Solar Farm (referred to henceforth as the Facility) on the Site with access via Cosgrove – Caniambo Road at the northern end of the lease area. The Facility will comprise the installation of 16,500 solar photovoltaic panels (PV Panels) to be mounted in arrays on single axis trackers with cabling from the solar arrays to panel inverters and a substation, with connection into the local electricity network. The substation will be on the north eastern side of the of the development area as shown in Figure 2 in this Report and the two inverters will be located within the substation area adjacent to the transformer. There will also be battery storage capacity to be housed in containers located within the substation area.

The Facility will also include construction of a perimeter internal access track as well as perimeter fencing. The Facility will generate power during daylight hours with all infrastructure being operational at all times.

The Facility is expected to take approximately 6 months to complete construction. It will operate for a period of up to 30 years, after which it will be subject to further operation or decommissioning and removal of all components.

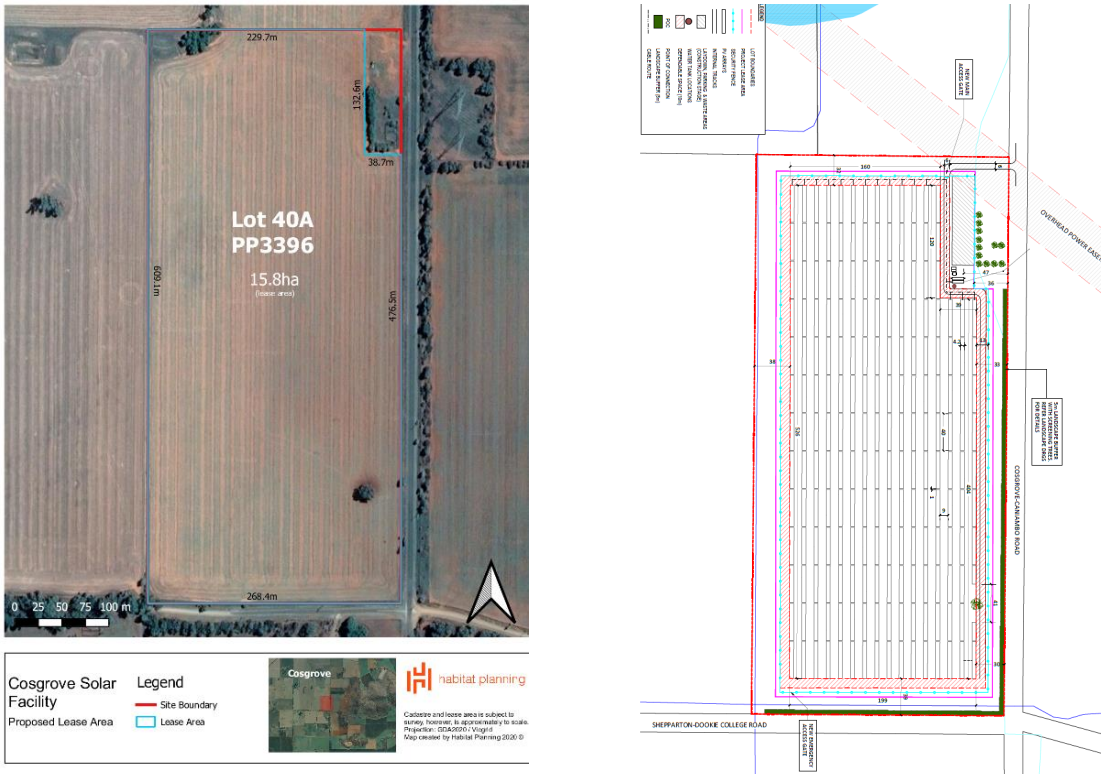

Figure 2. Solar Farm Lease Area and Layout

(source: Habitat Planning Pty Ltd)

3. NOISE CRITERIA

This section outlines the noise guidelines applicable to this proposal and establishes the project specific noise trigger levels and noise design goals / acceptable noise limits.

There are primarily two publications provided by the Victorian State Government via the Environment Protection Authority (EPA) to address noise emission from industry in Victoria. These are: -

- *State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1), and
- *Noise from Industry in Regional Victoria* 2011 (NIRV)

SEPP N-1 and NIRV manage the impact of noise from commercial, industrial and trade premises on residential and other noise sensitive uses and should be consulted to determine the acceptable noise levels from industry.

SEPP N-1 provides the method for setting noise limits for all industry noise in the Melbourne metropolitan region and is mandatory under Section 46 of the *Environment Protection Act 1970*.

NIRV has two approaches to setting recommended levels, depending on the area where the industry is located. In larger cities, NIRV uses the procedures in SEPP N-1 to set recommended levels. In rural areas, including small towns, NIRV has a separate procedure for setting recommended noise levels. Where NIRV uses the procedures of SEPP N-1 in larger cities, the recommended levels established are not legally binding.

An overview of the noise assessment process in Victoria is shown in Figure 3 below.

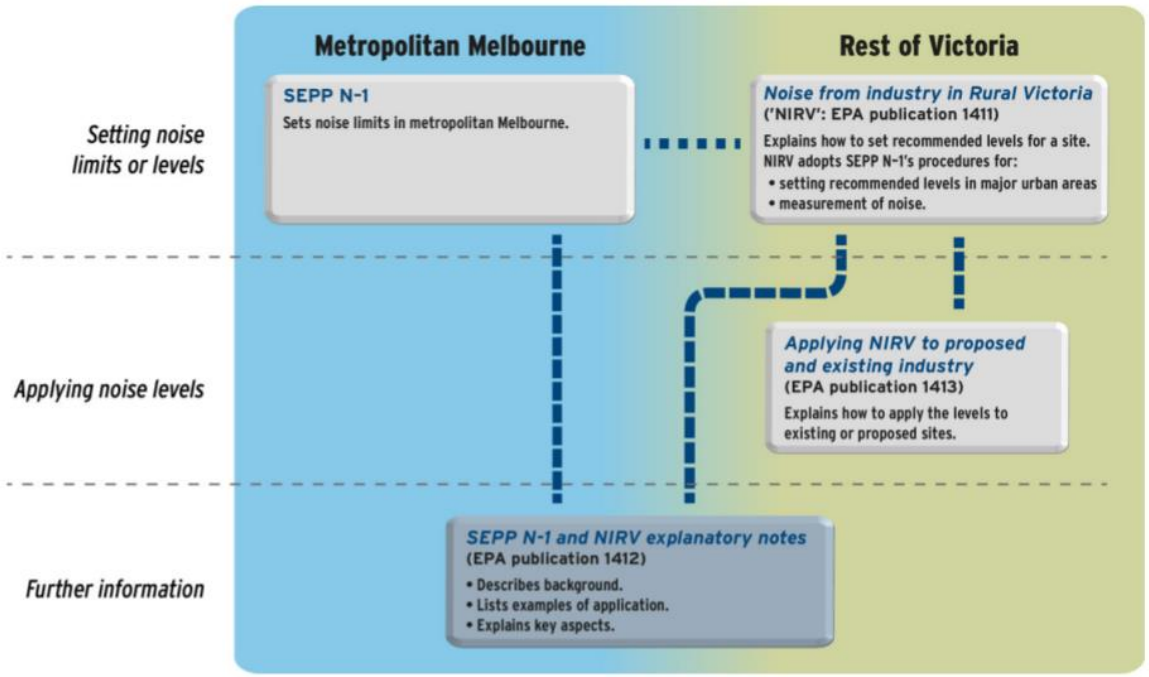

Figure 3. Industrial Noise Assessment Process in Victoria

(source: EPA Publication 1412, October 2011 – Figure 1.)

In this instance the Site is not located in urban area SEPP N-1 applies and consequently consideration is given to the EPA Guideline *Noise form Industry in Regional Victoria.*

3.1 NOISE FROM Industry in Regional Victoria 2011 (NIRV)

3.1.1 Step 1 – Zone Levels

The guidelines *Noise from Industry in Regional Victoria* was produced by the Victorian EPA in October 2011. Table 1 of the guidelines provides noise design goals for various generating and receiving planning zones. The relevant parts of Table 1 of the guidelines are replicated in Figure 4 below.

Planning zone for noise-receiving location

Planning zone for noise-generating use	Green Wedge A GWAZ; Rural Conservation RCZ; Rural Living RLZ	Low Density Residential LDRZ; Public Conservation and Resource PCRZ; Public Park and Recreation PPRZ; Public Use 2,5 PUZ; Urban Floodway UFZ	Farming FZ†; Green Wedge GWZ; Residential 1 R1Z; Residential 2 R2Z; Residential 3 R3Z; Rural Activity RAZ; Township TZ; Urban Growth UGZ‡	Business 1 B1Z; Business 2 B2Z; Business 5 B5Z; Comprehensive Development CDZ‡; Mixed Use MUZ; Priority Development PDZ‡; Public Use 1,3,4,6,7 PUZ; Road RDZ	Industrial 3 IN3Z; Special Use SUZ‡	Business 3 B3Z; Business 4 B4Z	Industrial 1 IN1Z; Industrial 2 IN2Z
Low Density Residential LDRZ; Public Conservation and Resource PCRZ; Public Park and Recreation PPRZ; Residential 1 R1Z; Residential 2 R2Z; Residential 3 R3Z; Urban Floodway UFZ	Day: 45 Evening: 37 Night: 32	Day: 45 Evening: 39 Night: 34	Day: 45 Evening: 40 Night: 35	Day: 47 Evening: 42 Night: 37	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 53 Evening: 48 Night: 43
~~Business 5 B5Z~~; Farming FZ†; Green Wedge GWZ; Green Wedge A GWAZ; Public Use 2,5 PUZ; Rural Activity RAZ; Rural Conservation RCZ; Rural Living RLZ; Urban Growth UGZ‡	Day: 45 Evening: 38 Night: 33	Day: 45 Evening: 40 Night: 35	Day: 46 Evening: 41 Night: 36	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 54 Evening: 49 Night: 44
Business 1 B1Z; Business 2 B2Z; Comprehensive Development CDZ‡; Mixed Use MUZ; Priority Development PDZ‡; Public Use 1,3,4,6,7 PUZ; Road RDZ; Township TZ	Day: 45 Evening: 40 Night: 35	Day: 47 Evening: 42 Night: 37	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45
Industrial 3 IN3Z; Special Use SUZ‡	Day: 46 Evening: 41 Night: 36	Day: 49 Evening: 44 Night: 39	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46
Business 3 B3Z; Business 4 B4Z	Day: 48 Evening: 43 Night: 38	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 54 Evening: 49 Night: 44	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46	Day: 57 Evening: 52 Night: 47
Industrial 1 IN1Z; Industrial 2 IN2Z	Day: 50 Evening: 45 Night: 40	Day: 52 Evening: 47 Night: 42	Day: 53 Evening: 48 Night: 43	Day: 55 Evening: 50 Night: 45	Day: 56 Evening: 51 Night: 46	Day: 57 Evening: 52 Night: 47	Day: 58 Evening: 53 Night: 48

Figure 4. NIRV Table 1 in part *(source: Noise from Industry in Regional Victoria 2011 - Table 1)*

For all receptors in proximity to the Site, the recommended noise levels are: -

- **46 dBA** ($L_{eq,\ 30\ minute}$) in the day,
- **41 dBA** ($L_{eq,\ 30\ minute}$) in the day, and
- **36 dBA** ($L_{eq,\ 30\ minute}$) in the day.

3.1.2 Step 2 – Distance Adjusted Levels

Step 2 in determining the noise criteria is to adjust the Zone Levels based on the distance from the noise sensitive receiver to the boundary of the zone in which the noise-emitting premises is located. The distance adjustment is 1 dB for every 100 metres from the boundary of the zone on which the noise emitter is located, to the noise sensitive receptor.

NIRV prescribes that where the noise-emitting premises and the receptor are in the same continuous zone, the distance adjustment is zero. NIRV also states that:

If there is a zone for a road or a railway line that divides a noise-emitting zone, this road/railway zone would be ignored (i.e., the zone should be treated as one contiguous zone for the receiver distance adjustment).

In this instance, all receivers in proximity of the Site are in the same continuous zone, therefore for these receptors the distance adjustment is zero.

3.1.3 Step 3 – Base Noise Level Check

Step 3 requires a comparison of the distance adjusted levels established after Steps 1 against the following base noise levels:-

- **45 dBA** ($L_{eq,\ 30\ minute}$) in the day time period,
- **37 dBA** ($L_{eq,\ 30\ minute}$) in the evening time period, and
- **32 dBA** ($L_{eq,\ 30\ minute}$) in the night time period.

The higher level is to be adopted. In this case that remains the levels established in Step 1.

3.1.4 Step 4 – Background Level Check and Adjustment

This final step requires consideration of the existing background noise levels if the Site is deemed to be in a background relevant area. Background relevant area is defined in the NIRV as follows:-

> *'Background-relevant area' means a noise-sensitive area where background levels may be higher than usual for a rural area. This includes areas where freeway or highway traffic is a significant audible background noise source. It also includes coastal areas, where representative background levels are elevated by surf.*

Harwood Acoustics visited the Site on Wednesday 30 December 2020 and Monday 1 March 2021 to undertake short-term background measurements and survey the area. The area is a quiet rural area with low background noise levels. Example photographs taken of the Site and surrounding area shown in Figures 5 and 6 below.

Background noise level measurements were taken at the northern end of the property at the corner of Cosgrove Caniambo Road and Kellows Road near receptor R3. The lowest background noise levels measured in the absence of strong winds were found to be below 36 dBA $L_{90,\ 30\ minute}$ and up to 41 dBA $L_{90,\ 30\ minute}$ when affected by strong winds.

The area is not considered to be a background affected area as defined by the NIRV Guidelines.

Instrumentation used during the background noise surveys is shown in Appendix A.


Figure 5. Site Photographs Taken During Background Noise Survey

3.1.5 Project Specific Maximum Nosie Levels

Following Steps 1 to 4 above the recommended maximum levels at all receptor locations are the distance adjusted levels of:-

- **46 dBA** ($L_{eq,\ 30\ minute}$) in the day period,
- **41 dBA** ($L_{eq,\ 30\ minute}$) in the evening period, and
- **36 dBA** ($L_{eq,\ 30\ minute}$) in the night period.

The periods are defined as follows:-

- Day – 7 am to 6 pm weekdays and 7 am to 1 pm Saturdays,
- Evening – 6 pm to 10 pm weekdays, 1 pm to 10 pm Saturdays and 7 am to 10 pm on Sundays and Public Holidays, and
- Night – 10 pm to 7 am.

4. OPERATIONAL NOISE EMISSION

4.1 Operational Source Noise Level Predictions

The main sources of noise associated with the proposed Solar Farm will be as follows: -

- 2 x SMA SC2475 Inverters systems,
- Transformer at solar substation, and
- Battery container storage.

Noise data has been supplied by the manufacturer of the inverters and the measured sound pressure levels have been used to establish the 'A' frequency weighted sound power levels, in decibels re: 1 pW, shown in Table 1 below. Table 1 also shows the sound power level of the transformer which is derived from our database of carrying out noise assessments of similar items of plant and equipment over the past 19 years.

Table 1 $L_{eq,\ 15\ minute}$ Sound Power Levels – Mechanical Plant & Equipment

Equipment Description	Individual Sound Power Level $L_{eq,\ 15\ minute}$ (dBA)
SMA SC 2475 Inverter	**96**
Transformer	**80**
Battery container storage	**< 70**

A noise model has been developed using *SoundPLAN* Essential version 5.1.

Table 2 below provides details on the specific parameters used to develop the noise model.

Table 2 Computer Noise Model Parameters

Parameter	Details
Noise Sources	Inverters • Assumes that inverters operate a nominal power with 100% fan sped at any given time*, • Manufacturer's stated height of 2.3 metres is given to the noise source in the model • * This is a worst-case scenario as the units may operate at lesser capacity during the night time period. Transformer • Operating at full sound power of 80 dBA ($L_{eq,\ 15\ minute}$) at any given time, • Source height of 2.5 metres.
Algorithm & Meteorological conditions	Noise sources are modelled in accordance with the International Standard ISO 9613-2 (1996(E)) *'Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation'*. The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of attenuation. The method allows for downwind propagation conditions namely:- • wind direction within an angle of ± 45° of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and • wind speed between approximately 1 m/s and 5 m/s measured at a height of 3 m to 11 m above the ground, The equations for calculating downwind sound pressure level, including the equations for attenuation… are the average for meteorological conditions within these limits. These equations also hold, equivalently, for average propagation under well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights.

Table 3 below shows the predicted noise levels at each receptor for the ongoing operation of the facility.

Table 3 Predicted $L_{eq,\ 15\ minute}$ Noise Levels at Receptor Locations

Description	Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) at Receptor Location			
	R1	R2	R3	R4
Noise Limit - Day	**46**	**46**	**46**	**46**
Noise Limit - Evening	**41**	**41**	**41**	**41**
Noise Limit - Night	**36**	**36**	**36**	**36**
Predicted noise level (with + 5 dB adjustment) *	36	31	28	23
Complies	Yes	Yes	Yes	Yes

* Includes a plus 5 dB adjustment factor applied to the predicted noise level to account for potential prominent tonal characteristics, as outlined in Section 5 below.

Predictions in Table 3 assume the following:-

- Distance loss to each receptor,
- Sound power levels for each item of plant and equipment shown in Table 1,
- A + 5 dB adjustment to the predicted noise levels for tonal characteristics.

A diagrammatical representation of the predicted noise levels from the *SoundPLAN* model is provided in the attached Appendix A.

5. ANNOYING FACTORS

Under the EPA's SEPP N-1, which prescribes the noise measurement and assessment methodology adopted by NIRV, adjustments are to be applied to the measured pr predicted noise level at the receiver to account for a potential increase in annoyance due to the character of the noise. The resulting adjusted noise level becomes the Effective Noise Level.

One-third octave band data has been available for the inverters, however from our experience, there is potential for transformers and inverters to display tonal characteristics.

The level of adjustment that is required to be applied to the predicted noise level for tonal characteristics depends upon a number of factors and the EPA states:-

> *A noise is more annoying when it has a tonal component (a perceptible hum or whine). An adjustment is made to allow for the additional annoyance caused by the tone. Different procedures are used for major and minor premises. Where the noise sounds tonal, the adjustment for major premises is determined from one-third octave analyses of the noise. This procedure requires a recording to be analysed using suitable analysis equipment. Adjustments of between one and seven decibels apply for most tonal noises. The adjustment for minor premises is determined without recording and analysis equipment. The adjustment is based on a subjective assessment of the noise when the level is being measured. Two different adjustments of two and five decibels are applied for a slightly tonal or a prominently tonal noise, respectively.*

In this case, there is potential for a 5 dB adjustment to be applied to the predicted noise levels, if the inverters or transformers display prominent tonal characterises at the closest receptors.

Therefore predictions shown in Table 3 and the diagrammatical *SoundPLAN* noise map provided in Appendix B include the 5 dB adjustment as a worst-case scenario.

6. CONCLUSION

An assessment of the potential noise emission arising from the operational of a 4.95 Megawatts Solar Farm proposed to be established at 290 Cosgrove Caniambo Road, Cosgrove, Victoria, has been undertaken.

Calculations show that the level of noise emission from the ongoing operation of the facility will meet the Victorian EPA's maximum recommended noise levels derived from its *Nosie from Industry in Regional Victoria* 2011 Guidelines.

Matthew Harwood, MAAS

Principal Acoustical Consultant

Attachments: -
Important note
Appendix A – Noise survey instrumentation
Appendix B – *SoundPLAN* noise model depicting operational phase of the facility

Important Note

All products and materials suggested by Harwood Acoustics are selected for their acoustical properties only.

Recommendations made in this report are intended to resolve acoustical problems only, therefore all other properties such as aesthetics, air flows, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, fumes, grout or tile cracking, loading, shrinkage, smoke, ventilation etc. are outside Harwood Acoustic's fields of expertise and ***must*** *be checked with the supplier or suitably qualified specialist before purchase.*

Disclaimer

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Opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

Noise Survey Instrumentation	Appendix A

The instrumentation used during the noise survey consisted of the following: -

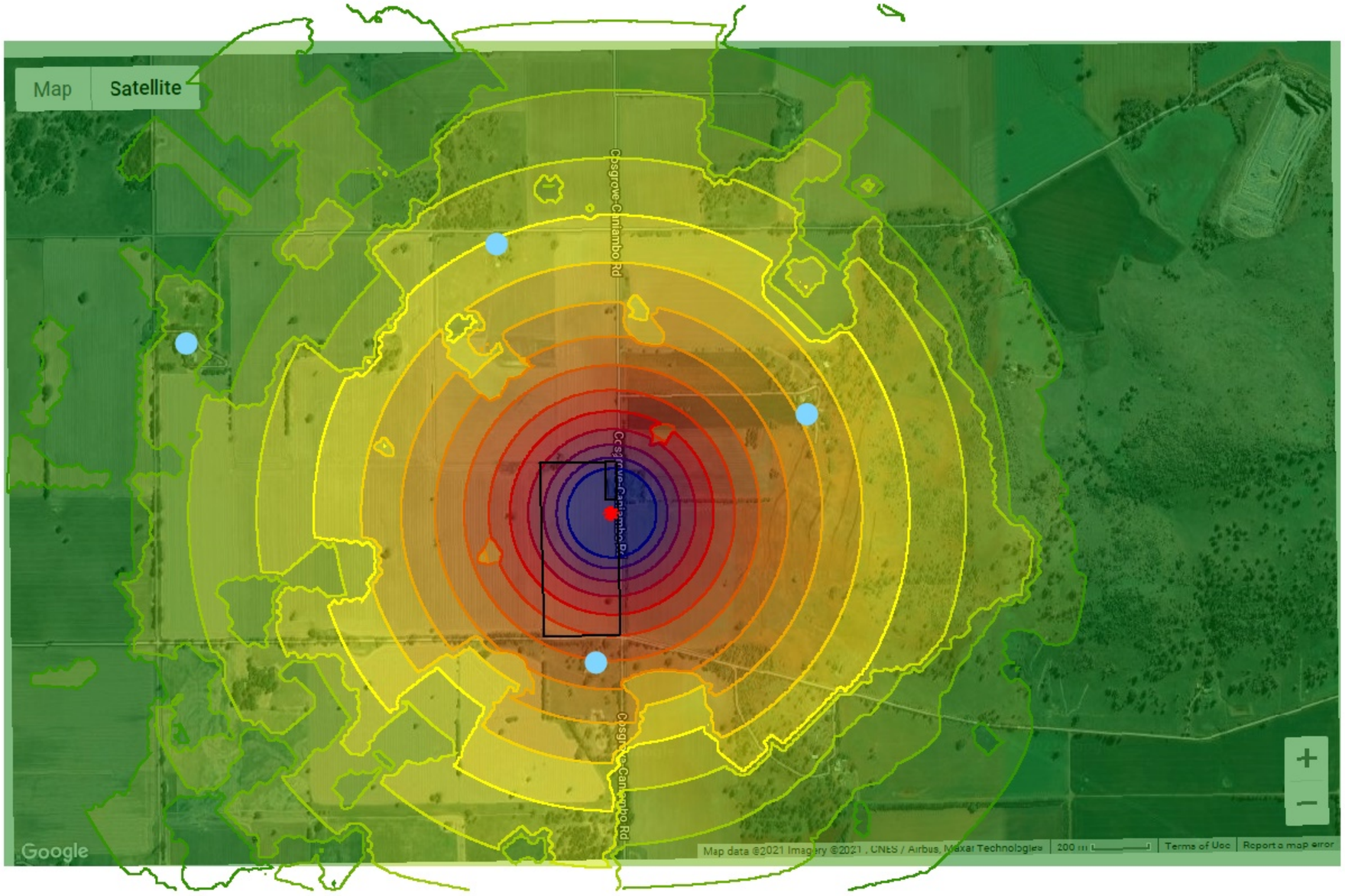
Description	Model No.	Serial No.
SVANTEK Sound Level Meter	SVAN 957	15395
Brüel & Kjaer Acoustical Calibrator	4321	3003242
Brüel & Kjaer Sound Level Meter	2250	3009198
Brüel & Kjaer Acoustical Calibrator	4321	2053044

The sound level meters conform to Australian Standard AS IEC 61672.1-2004: 'Electroacoustics - Sound Level Meters – Specifications' as a Class 1 precision sound level meter and has an accuracy suitable for both field and laboratory use.

The calibration of the sound level meters was checked before and after the measurement periods. No significant system drift occurred over the measurement period.

The sound level meter and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates as required by the regulations.

Cosgrove 5MW Solar Farm
Operational noise predictions
With tonal adjustment



Signs and symbols

Lease plan

Transformer and Inverters

Levels in dB(A)

< 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
36 - 38
38 - 40
40 - 42
42 - 44
44 - 46
46 - 48
>= 48

1 : 23303

0 125 250 500 750 1000 m

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