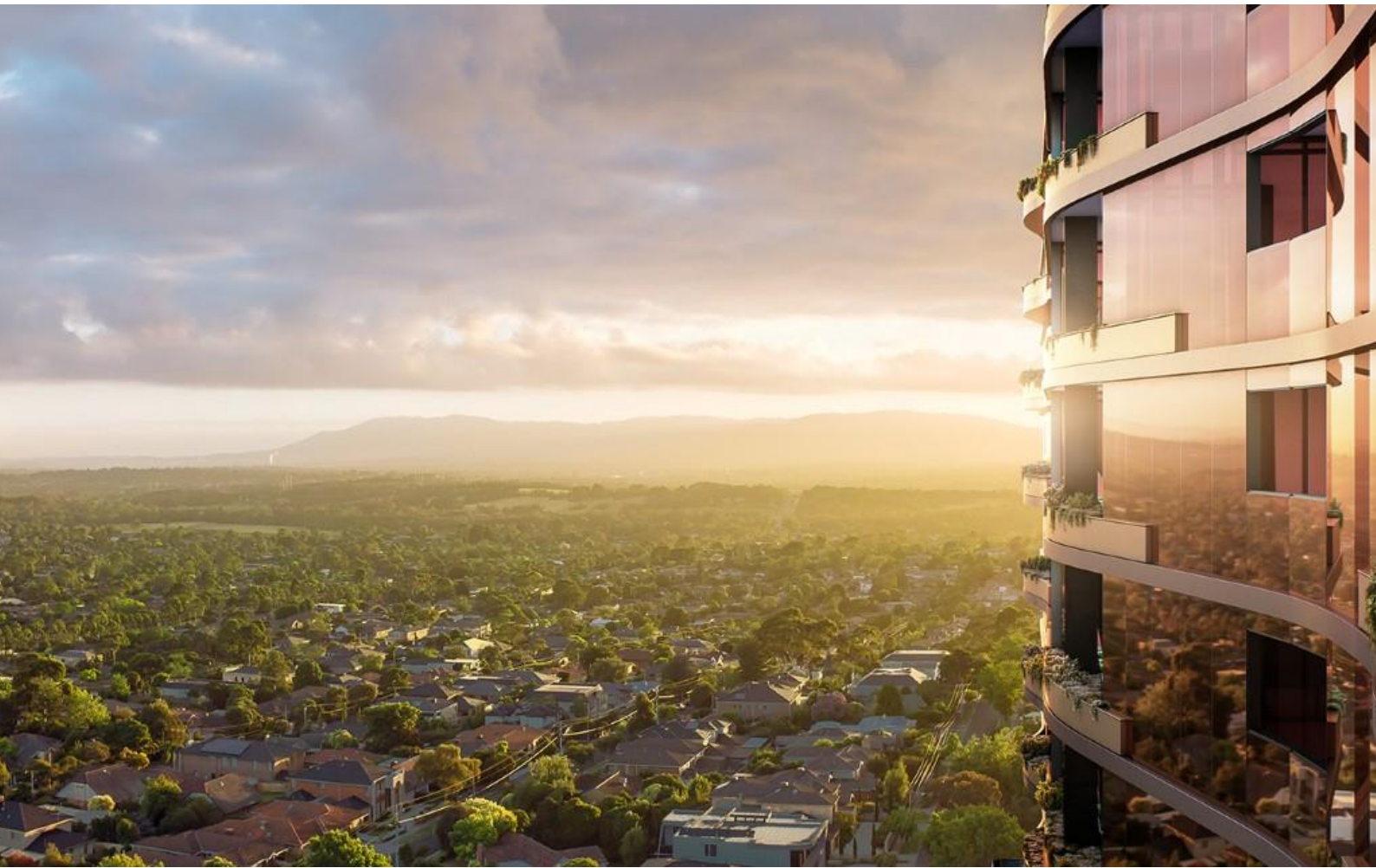
ADP
Consulting : Engineering

Solar Farm Inverter Station – 574 Hendys Road, Numurkah, VIC

Noise Impact Assessment

Prepared for: Green Gold Energy

Project No: MEL2132
Date: 24 November 2020
Revision: 03



Creating great environments with great people

Project:	Solar Farm Inverter Station – 574 Hendys Road, Numurkah, VIC
Location:	574 Hendys Rd Numurkah, VIC, 3570
Prepared by:	ADP Consulting Pty Ltd Level 3, 8 Spring Street Sydney NSW 2000
Project No:	MEL2132
Revision:	03
Date:	24 November 2020

Rev	Date	Comment	Author	Signature	Technical Review	Signature	Authorisa-tion & QA	Signature
01	16.04.2020	DRAFT – Issued for client comment	TC		JM		TC	
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03	24.11.20	Final – minor changes	TC		JM		TC	

Project Team	
Client / Principal	Green Gold Energy
Project Manager / Planners	Chris Smith & Associates

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1. Introduction

1.1 Document purpose

ADP Consulting Pty Ltd has been retained by Green Gold Energy to undertake a noise impact assessment for the proposed 574 Hendys Rd, Numurkah solar project.

This report is prepared to provide acoustic design advice for documentation by others and addresses the impact on nearby sensitive receivers from the operation of the proposed development. These impacts include noise emission from equipment associated with solar farms and namely the photovoltaic inverters and solar tracking motors.

It is understood that this document will be submitted to the Department of Environment, Land, Water and Planning to satisfy requirements of a noise impact assessment against the EPA's NIRV.

It is the responsibility of the relevant contractor to ensure the implementation of the acoustic design intent of this document; including compliance with criteria, codes, standards, specifications etc.

1.2 Referenced drawings, codes and standards

The following drawings, conditions and other project-specific information has been referenced in preparing this report:

- Golden Next Site Plan dated 27 February 2020
- NEXTracker Motor Sound Test Summary, dated March 2017
- Green Gold Energy Electrical Equipment Elevations, dated 13 March 2020
- Voyager – Single Axis Tracker | Installation Manual, Version 1.0, revision E, dated 20 September 2019
- TBEA Inverter Noise Test Report
- FTC Solar Voyager Tracker datasheet

The following guidelines, standards and regulatory requirements have been used to define the site-specific acoustic criteria for the development:

- Noise from Industry in Regional Victoria, dated 11 October 2011 – EPA Victoria (NIRV Guidelines)
- State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1, dated 15 June 1989 (SEPP N-1)

1.3 Department of Environment, Land, Water and Planning requirements

This report satisfies typical requirements set out in other similar projects which state that the acoustic assessment of the Solar Farm should be against EPA's *Noise from Industry in Regional Victoria* (NIRV) as It is DELWP's understanding that infrastructure associated with solar energy facilities (e.g. inverters and solar tracking motors) do generate some level of noise, and therefore an assessment is required.

1.4 Project summary

The following is understood by ADP Consulting regarding the proposed 574 Hendys Road, Numkurkah solar project:

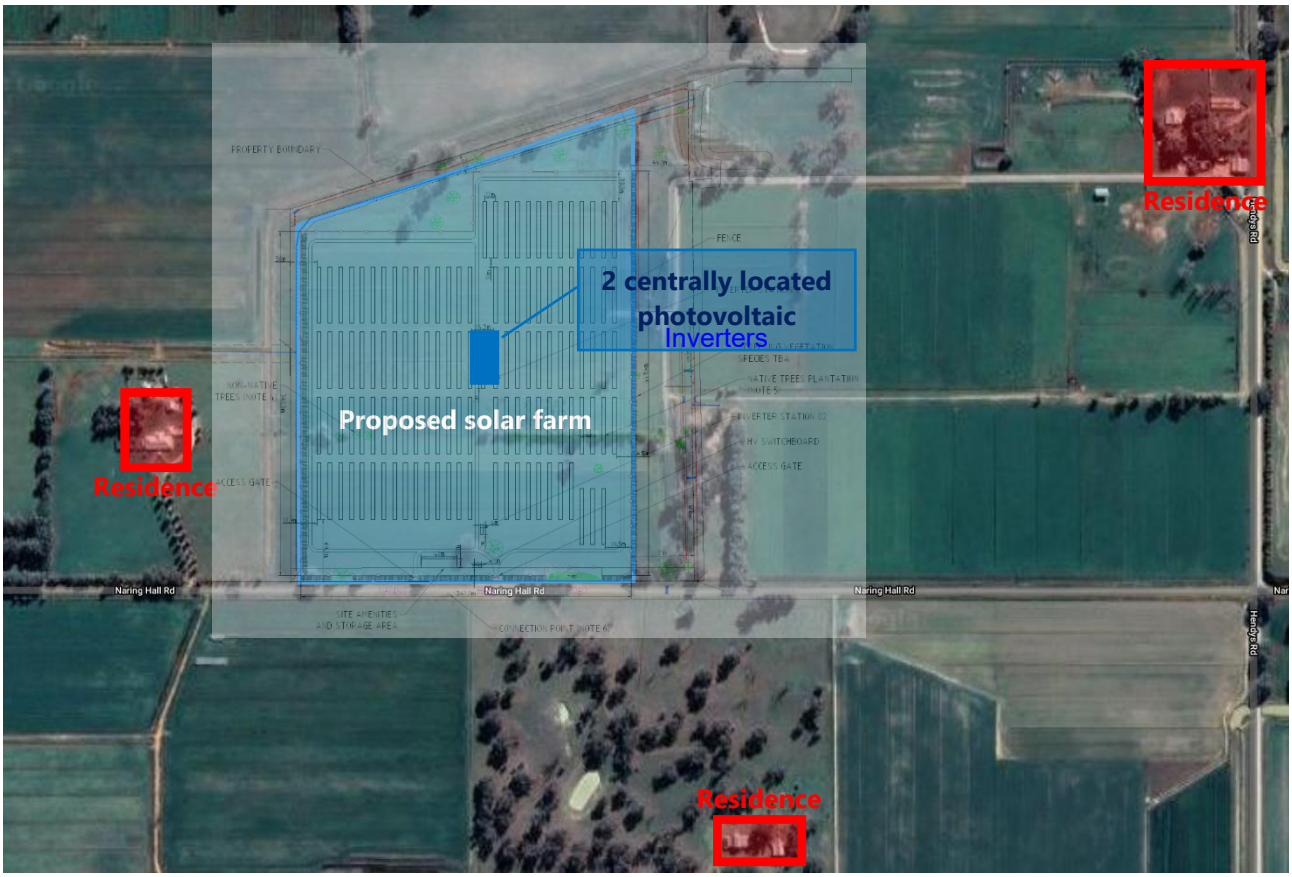
- A maximum of 2 centrally located photovoltaic inverters will be utilised (shown in Figure 1)
- We understand that the photovoltaic inverters will begin operation from 6am daily and the solar tracking motors will be operational during the day and reset of an evening or morning
- One set of tracking motors for the solar panels will be installed for each row of solar panels (total being approx. 132 motors).
- The sound power of each tracking motor is 49dB(A) and will operate for 5-10 seconds every few minutes.
- The proposed development and all sensitive receivers are located in zones characterised as Farming FZ
- Each photovoltaic inverter will have a maximum sound pressure level of 63 dB(A) at 1m
- Photovoltaic inverters will only operate during daylight hours
- Tracking motors will all operate during daylight hours and reset at night (we have assumed that a worst case scenario that all tracking motors are running at the same time)

Based on our desktop site investigations we have identified the following sensitive residential receivers as being the nearest noise sensitive premises to the proposed development.

- Residence to the west, on Naring Hall Road, located approximately 140 metres away
- Residence to the south, opposite Naring Hall Road, located approximately 300 metres away
- Residence to the east, on Hendys Road, located approximately 600 metres away

Figure 1 provides a site map of the proposed development and its surrounds.

Figure 1 Site plan



2. Noise emission criteria – NIRV

Noise emission restrictions apply to the operation of the proposed development. These must be planned, designed and installed to include suitable sound attenuation, and other necessary acoustic treatments. This report provides an approach that needs to be incorporated in the proposed development to meet the noise emission requirements of NIRV.

The below criteria are applicable at the nearest sensitive receivers. We note that these criteria are derived based on the characterisation of both the Generating Zone and the Receiving Zone as Farming FZ, as per Table 1 of the NIRV Guidelines.

Table 1 summarises the noise emission criteria presented in the NIRV Guidelines.

Table 1 Noise emission criteria summary

Day of operation	Time of operation	Noise Limit, dB(A)
Monday to Friday	Day (7am to 6pm)	46
	Evening (6pm to 10pm)	41
	Night (10pm to 7am)	36
Saturday	Day (7am to 1pm)	46
	Evening (1pm to 10pm)	41
	Night (10pm to 7am)	36
Sunday	Evening (7am to 6pm)	41
	Night (10pm to 7am)	36

It should be noted that the cumulative noise emission from the operations of the proposed development are to meet the specific noise criteria in Table 1.

3. Noise assessment

3.1 Plant and equipment noise levels

Table 2 presents the major plant and equipment sound power levels to be used in the development, as provided by Green Gold Energy. We should note that these sound power levels are assumed to be maximum and that any alternative plant is not to exceed these levels.

Table 2 Plant and equipment sound power levels

Equipment in use	Sound power level, dB(A)
TBEA Inverter noise (each, 2off)	80
NEXTracker Motor (each, approx. 132off)	49

We should also note that photovoltaic inverters typically generate noise which can be characterised as a hum and are likely to be tonal in nature (as defined in SEPP N-1).

3.2 Noise assessment

It is understood that the proposed development will encompass a maximum of two (2) centrally located photovoltaic inverters and approx. 132 tracking motors. The minimum separation distance between plant and neighbouring receivers was calculated to ensure compliance with the NIRV criteria (Section 2). In this assessment, the following was considered:

- Maximum sound power levels of plant, scheduled in Section 3.1
- Proposed hours of operation, scheduled in Section 1.4
- Noise emission penalties applied for the tonal characteristics of the photovoltaic inverters and intermittent use of the tracking motors

As the photovoltaic inverters are likely to be tonal in nature and the tracking motors will be intermittent and NIRV does not provide guidance on the offensive nature of tonal and intermittent noise sources, we have used the methodology presented in SEPP N-1 for photovoltaic inverter noise. This resulted in a total penalty adjustment of 5dB(A) (2dB(A) for tonality and 3dB(A) for intermittency) being applied to the overall noise emission levels from the solar farm.

Given the proposed hours of operation, with photovoltaic inverters operating in daylight hours (with a worst case scenario in summer, between 6am and 9.30pm), the calculated noise levels were compared to the criteria scheduled in Section 2, which represents the most stringent criteria.

We have used distance sound attenuation formulas for the photovoltaic inverters and tracking motors in an unshielded (ie. buildings, barriers, mounds or hills, etc) free field. We believe that this is the most conservative approach as there shielding between the photovoltaic inverters and any sensitive receiver has not been included.

Table 3 schedules the calculated noise levels at the nearby sensitive receivers and checks for compliance with the noise criteria outlined in Section 2.

Table 3 Noise emission levels at closest sensitive receivers

Receiver location	Time of day	Receiver noise levels, dB(A)	Criteria, dB(A)	Compliance
Residence to the west, on Naring Hall Road	Day (7am to 6pm)	29	46	Yes
	Evening (6pm to 10pm)	29	41	Yes
	Night (10pm to 7am)	29	36	Yes
Residence to the south, opposite Naring Hall Road	Day (7am to 6pm)	22	46	Yes
	Evening (6pm to 10pm)	22	41	Yes
	Night (10pm to 7am)	22	36	Yes
Residence to the east, on Hendys Road	Day (7am to 6pm)	18	46	Yes
	Evening (6pm to 10pm)	18	41	Yes
	Night (10pm to 7am)	18	36	Yes

Table 3 presents noise levels at the worst affected locations. We note that compliance at these locations would mean compliance with other nearby noise sensitive receivers.

4. Conclusion

Current regulations and standards associated with the development have been reviewed and assessed in accordance with existing site constraints.

We have used distance sound attenuation formulas for the photovoltaic inverters and solar panel tracking motors in an unshielded (ie. buildings, barriers, mounds or hills, etc) free field. We believe that this is the most conservative approach as shielding between the noise sources and any sensitive receiver has not been included.

Based on the assessment detailed in Section 3.2, ADP Consulting believe there are no site conditions, statutory or other requirements that would preclude this development from complying with the criteria defined in this report.

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Appendix A
Glossary of acoustic terms

Air-borne sound

The sound emitted directly from a source into the surrounding air, such as speech, television or music.

Ambient sound

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far. This is normally taken to be the L_{Aeq} value.

Background noise level

The average of the lowest levels of the noise levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources. Usually the L_{A90} value represents the background noise level.

dB(A)

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Decibel scale

The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. Therefore, a 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. It is generally accepted that a 10 dB increase in the sound pressure level corresponds to a perceived doubling in loudness.

Examples of decibel levels of common sounds are as follows:

- 0 dB(A) Threshold of human hearing
- 30 dB(A) A quiet country park
- 40 dB(A) Whisper in a library
- 50 dB(A) Open office space
- 70 dB(A) Inside a car on a freeway
- 80 dB(A) Outboard motor
- 90 dB(A) Heavy truck pass-by
- 100 dB(A) Jackhammer / Subway train
- 110 dB(A) Rock Concert
- 115 dB(A) Limit of sound permitted in industry
- 120 dB(A) 747 take off at 250 metres

Frequency

The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

L_{90}, L_{10}, etc

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a measurement period (i.e. L_{90} is the level which is exceeded for 90 percent of a measurement period). L_{90} is commonly referred to as a basis for measuring the background sound level.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

L_{Amax}

The maximum sound pressure level measured over the measurement period.

L_{Amin}

The minimum sound pressure level measured over the measurement period.

Day

Referred to as the period between 7am and 6pm for Monday to Saturday and 8am to 6pm for Sundays and Public Holidays.

Evening

Referred to as the period between 6pm and 10pm for Monday to Sunday and Public Holidays.

Night

Referred to as the period between 10pm and 7am for Monday to Saturday and 10pm to 8am for Sundays and Public Holidays.

Assessment background level (ABL)

The overall background noise level on each day, evening and night periods for each day of the noise monitoring.

Rating background level (RBL)

The overall background level on each day, evening and night periods for the entire length of noise monitoring.

Reverberation

The persistence, after emission by the source has stopped, of a sound field in an enclosure.

Sound isolation

A reference to the degree of acoustical separation between two spaces. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term 'sound isolation' does not specify any grade or performance quality and requires the units to be specified for any contractual condition.

Sound pressure level, L_p, dB of a sound

A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the R.M.S. sound pressure to the reference sound pressure of 20 micro Pascals.

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