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BLIND CREEK SOLAR FARM

Construction & Operational Noise & Vibration Assessment

24 February 2022

Blind Creek Solar Farm Pty Ltd.

TM244-01F02 Construction & Operational Noise & Vibration Assessment (r4).docx

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Contents

List of Tables

List of Figures

1 Introduction

Renzo Tonin & Associates was engaged to conduct an environmental noise and vibration assessment of the proposed Blind Creek Solar Farm, located approximately 8 kilometres (km) north of Bungendore in New South Wales (NSW) and 35 km north east of Canberra in the Australian Capital Territory (ACT), as part of the Environmental Impact Statement (EIS) for the project. Noise and vibration impacts from the construction and operation phases of the project will be addressed in this report in accordance with relevant Council and EPA requirements and guidelines

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Project Description

2.1 Background Information

The Blind Creek Solar Farm Project includes the construction and operation of a solar photovoltaic (PV) plant, Battery Energy Storage System (BESS) and associated infrastructure, with a capacity of up to 350 MW. The Project site is located along Tarago Road, located approximately 8 km north of Bungendore, NSW and 35 km north east of Canberra, ACT, within the Queanbeyan-Palerang Local Government Area (LGA).

Key development and infrastructure components would include:

- Up to 850,000 PV modules
- Single axis tracking systems, with up to 8m spacing between tables and up to 5m in height at full tilt
- Up to 85 inverters and transformers in containers, distributed throughout the array, for power conversion
- An onsite substation, with additional transformers and switchgear
- An electrochemical Battery Energy Storage System (BESS) with a capacity of up to 300 MW and 2 hour duration. The batteries may be configured in either a DC-coupled format by distributing batteries through the site, or in an AC-coupled layout by placing all batteries in a purpose-built facility
- Cabling network (preferably underground) between panels and substation
- Buildings to accommodate a site office, switchgear, protection and control facilities, maintenance facilities, storage and staff amenities
- A temporary construction laydown area

The Proposal would also be supported by ancillary infrastructure:

- Internal tracks for construction, operation, and maintenance activities
- Fencing for security and grazing
- On site water storage tanks and any other requirements of the Rural Fire Service
- A communications tower for high reliability grid operations

2.2 Regulatory Requirements

The Secretary's Environmental Assessment Requirements (SEAR) and Environment Protection Authority (EPA) Submission for the project nominate the following specific noise issues to be addressed in this assessment.

Secretary's Environmental Assessment Requirements (SEAR)	Section of Report Addressing SEAR Content
Noise – including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG), operational noise impacts in accordance with the NSW Noise Policy for Industry (2017), cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	Sections 4, 5, 6 and 7

Noise and vibration impacts are assessed in accordance with a number of policies, guidelines and standards, including:

- NSW 'Interim Construction Noise Guideline' (ICNG – DECC, 2009)
- NSW 'Noise Policy for Industry' (NPfI – EPA, 2017)
- 'Assessing Vibration: A Technical Guideline' (DECC, 2006)
- NSW 'Road Noise Policy' (RNP – DECCW, 2011).

2.3 Receiver Locations

The nearest affected receivers were identified through aerial maps and are presented in Table 2.1. It is noted that some of these receivers are owned by residents who are involved with the project identified as 'involved receivers'. The remaining receivers are identified as 'non-involved receivers'

Table 2.1 – Receiver Locations

ID	Address	Description
		Involved Receivers
R2	114 Currandooley Road, Lake George – Dwelling 1	Residential property located approximately 250m south of the development footprint.
R5	495 Currandooley road Lake George	Residential property located approximately in excess of 1km north east of the development footprint.
R6	714 Currandooley road Lake George	Residential property located approximately in excess of 1km north east of the development footprint.
R7	494 Currandooley Tarago	Residential property located approximately in excess of 1km north east of the development footprint.
R41	491 Currandooley Road, Lake George	Residential property located approximately 850m north east of the development footprint.
R42	494 Currandooley Road, Lake George – Dwelling 1	Residential property located approximately in excess of 1km north east of the development footprint.
R43	494 Currandooley Road, Lake George – Dwelling 2	Residential property located approximately in excess of 1km north east of the development footprint.

ID	Address	Description
R48	114 Currandooley Road, Lake George – Dwelling 2	Residential property located approximately 200m east of the development footprint.
	Non-involved Receivers	
R1	6 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R9	589 Tarago Road, Lake George	Bungendore Sands Quarry - Industrial property located approximately 950m south west of the development footprint.
R10	7 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R11	11 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R12	13 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R13	21 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R14	23 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R15	2 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R16	10 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R17	3 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R18	43 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R19	45 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R20	53 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R21	55 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R22	56 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R23	54 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R24	48 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R32	12 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south of the development footprint.
R36	800 Tarago Road, Lake George	Residential property located approximately in excess of 1km south east of the development footprint.
R37	866 Tarago Road, Lake George – Dwelling 1	Residential property located approximately in excess of 1km south east of the development footprint.
R38	866 Tarago Road, Lake George – Dwelling 2	Residential property located approximately in excess of 1km south east of the development footprint.
R40	996 Tarago Road, Lake George	Residential property located approximately in excess of 1km south east of the development footprint.

ID	Address	Description
R45	42 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint.
R46	40 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint.
R47	34 Hope Drive, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint.
R49	17 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint
R50	16 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint
R51	14 Duncan Avenue, Bungendore	Residential property located approximately in excess of 1km south east of the development footprint
R106	Paragalli Sand Quarry	Industrial property located approximately 524m east of the development footprint

Figure 1 provides details of the site, surrounds and receiver locations.

2.4 Hours of Operation

2.4.1 Construction

Construction will occur during the following standard hours of construction:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- No work on Sundays or public holidays

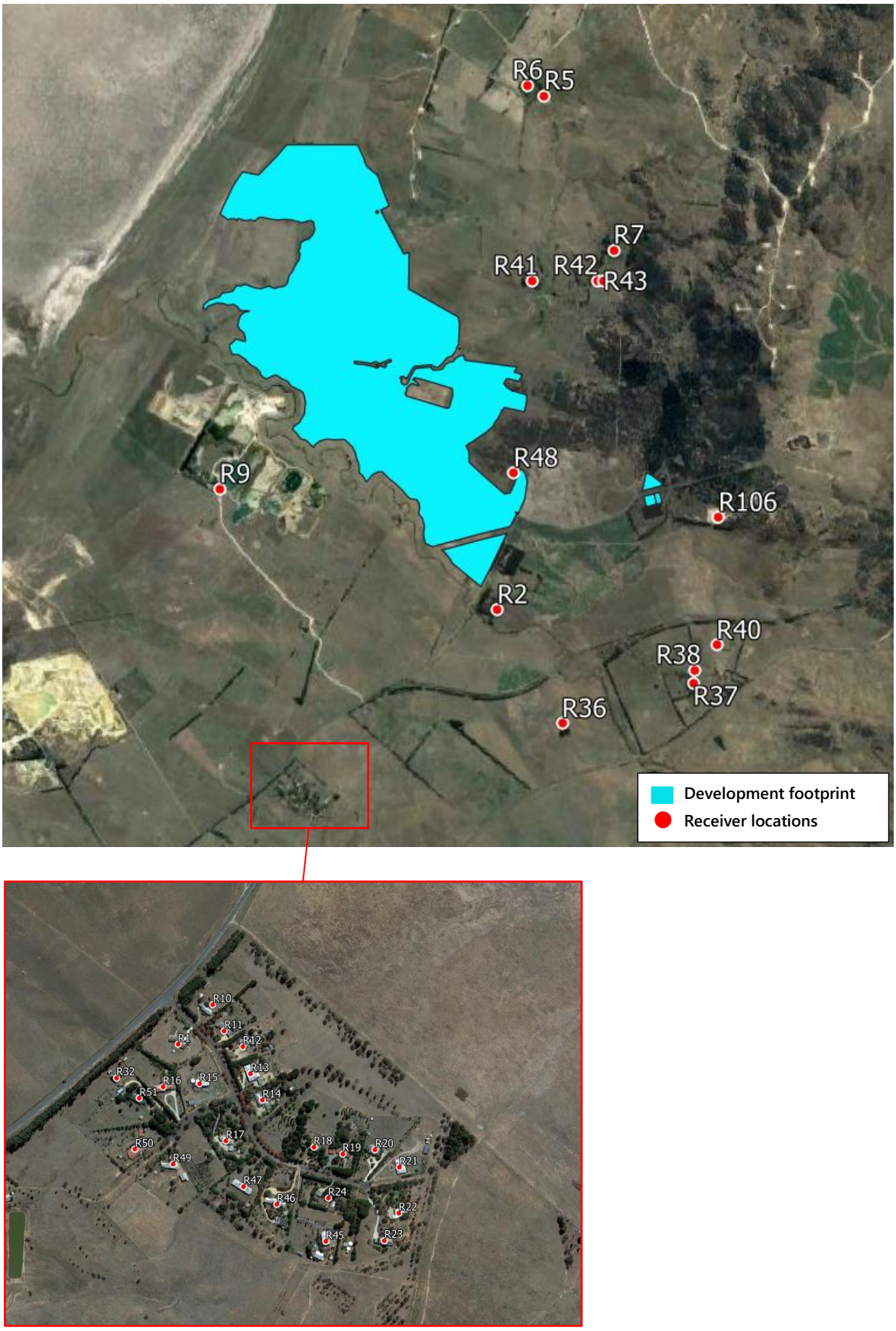
2.4.2 Operation

The solar farm will operate autonomously during times when there is sunlight. This will predominantly be during day and evening periods (7am-6pm and 6pm-10pm, respectively) throughout the year and potentially part of the night time period (prior to 7am) during the summer months.

Furthermore, there may be up to five (5) staff on site during the following standard hours:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm

Figure 1 – Site, Surrounds and Receiver Locations



3 Existing Noise Environment

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Therefore, the NPfI requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The NPfI defines these periods as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

The identified receivers surrounding the Project site are all classified as rural under NPfI guidelines. Based on Table 2.1 on page 10 of the NPfI, for a conservative assessment the minimum assumed Rating Background Levels (RBLs) are adopted for all receiver locations. Therefore, the applicable RBLs used for this assessment are presented in Table 3.1 below.

Table 3.1 – Applicable RBLs, dB(A)

Time of Day	Minimum RBL, dB(A)[1]	Applicable RBL, dB(A)
Day	35	**35**
Evening	30	**30**
Night	30	**30**

Notes: 1. In accordance with Table 2.1 of the NSW NPfI

4 Construction Noise Assessment

4.1 Construction Noise Management Levels

The NSW 'Interim Construction Noise Guideline' (ICNG, 2009) provides guidance for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- *Use of L_{Aeq} as the descriptor for measuring and assessing construction noise*

  NSW noise policies, including the NPfI, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- *Application of reasonable and feasible noise mitigation measures*

  As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice and is practical to build given the project constraints.

  Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Given the length of the construction works proposed is approximately nine months, a quantitative assessment is carried out herein, consistent with the ICNG requirements.

Table 4.1 reproduced from the ICNG, sets out the noise management levels and how they are to be applied for residential receivers.

Table 4.1 – Noise Management Levels (NML) at Residential Receivers, dB(A)

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) • if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 4.2 presents the construction noise management levels established for the nearest noise sensitive residential receivers based upon the nominated RBLs presented in Table 2.1, the proposed construction hours and the above ICNG requirements. Given that construction works are to occur during the daytime period as presented in Section 2.4.1, only the daytime period will be assessed.

Table 4.2 – NML at Residential Receivers, dB(A)

Location Description	Day L_{A90} Background Noise Level (RBL)	Day NML $L_{Aeq(15min)}$
All residential receivers	35[1]	**45**

Notes: 1. Construction works occur during the daytime period only; hence, only the day period is assessed

Table 4.3 sets out the ICNG noise management levels for other noise sensitive receiver locations.

Table 4.3 – NML at other noise sensitive land uses

Land use	Where objective applies	NML $L_{Aeq\ (15\ min)}$
Industrial premises	External noise level	75 dB(A)

Notes: NML apply when receiver areas are in use only.

4.2 Construction Noise Sources

The following table lists typical plant and equipment likely to be used by the contractor to carry out the necessary construction works for the project.

Table 4.4 – Typical Construction Equipment & Sound Power Levels, dB(A) re. 1pW

Plant Item	Plant Description	Number of Items	L_{Aeq} Sound Power Levels, dB(A) re. 1pW (single item)
1	Small pile driving rig	6	114
2	Crane	2	110
3	Drum roller	2	109
4	Padfoot roller	2	109
5	Wheeled loader	2	109
6	Dump truck	4	108
7	30t Excavator	8	107
8	Grader	4	107
9	Chain trencher	2	104
10	Water truck	4	104
11	Telehandler	4	98
12	Forklift	4	90

The sound power levels for the majority of activities presented in the above table are based on maximum levels given in Table A1 of Australian Standard 2436 - 2010 'Guide to Noise Control on Construction, Demolition and Maintenance Sites', the ICNG, information from past projects and/or information held in our library files.

4.3 Construction Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2021 MR 1) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations
- Height of sources and receivers

- Separation distances between sources and receivers
- Ground type between sources and receivers (soft)
- Attenuation from barriers (natural and purpose built).

Noise levels at any receptors resulting from construction would depend on the above and the type and duration of construction being undertaken. Furthermore, noise levels at receivers would vary substantially over the total construction program due to the transient nature and large range of plant and equipment that could be used.

Table 4.4 presents construction noise levels likely to be experienced at the nearby affected receivers based on the construction activities and plant and equipment associated with the Project. The noise level ranges represent the noise source being located at the furthest to the closest proximity to each receiver location.

Table 4.5 – Predicted $L_{Aeq,15min}$ Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels																										
		Involved Receivers								Non-involved Receivers																		
		R2	R5	R6	R7	R41	R42	R43	R48	R1	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R32	R36
Noise Management Level (NML)[1]		*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*75*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*
1	Small pile driving rig	<20-45	<20	<20	<20-26	<20-31	<20-28	<20-23	<20-**47**	<20-20	<20-33	<20-20	<20-20	<20-20	<20-20	<20-20	<20-20	<20	<20	<20-20	<20-20	<20-20	<20-20	<20-20	<20	<20-20	<20	<20-27
2	Crane	<20-41	<20	<20	<20-22	<20-27	<20-24	<20	<20-43	<20	<20-29	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-23
3	Drum roller	<20-40	<20	<20	<20-21	<20-26	<20-23	<20	<20-42	<20	<20-28	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-22
4	Padfoot roller	<20-40	<20	<20	<20-21	<20-26	<20-23	<20	<20-42	<20	<20-28	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-22
5	Wheeled loader	<20-40	<20	<20	<20-21	<20-26	<20-23	<20	<20-42	<20	<20-28	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-22
6	Dump truck	<20-39	<20	<20	<20-20	<20-25	<20-22	<20	<20-41	<20	<20-27	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-21
7	30t Excavator	<20-38	<20	<20	<20	<20-24	<20-21	<20	<20-40	<20	<20-26	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-20
8	Grader	<20-38	<20	<20	<20	<20-24	<20-21	<20	<20-40	<20	<20-26	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-20
9	Chain trencher	<20-35	<20	<20	<20	<20-21	<20	<20	<20-37	<20	<20-23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
10	Water truck	<20-35	<20	<20	<20	<20-21	<20	<20	<20-37	<20	<20-23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
11	Telehandler	<20-29	<20	<20	<20	<20	<20	<20	<20-31	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
12	Forklift	<20-21	<20	<20	<20	<20	<20	<20	<20-23	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently		<20-**47**	<20	<20	<20-29	<20-33	<20-30	<20-25	<20-**50**	<20-22	<20-35	<20-23	<20-22	<20-23	<20-22	<20-22	<20-22	<20-21	<20-22	<20-22	<20-22	<20-23	<20-23	<20-22	<20-21	<20-22	<20-16	<20-29

Notes: 1. **Bold** font represents exceedance of the NML

Table 4.5 – Predicted $L_{Aeq,15min}$ Construction Noise Levels at Receiver Locations, dB(A) – Continued

Plant Item	Plant Description	Predicted $L_{eq(15min)}$ Construction Noise Levels									
		Non-involved Receivers									
		R37	R38	R40	R45	R46	R47	R49	R50	R51	R106
Noise Management Level (NML)[1]		*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*45*	*75*
1	Small pile driving rig	<20-28	<20-29	<20-29	<20	<20	<20	<20	<20	<20	<20-38
2	Crane	<20-24	<20-25	<20-25	<20	<20	<20	<20	<20	<20	<20-34
3	Drum roller	<20-23	<20-24	<20-24	<20	<20	<20	<20	<20	<20	<20-33
4	Padfoot roller	<20-23	<20-24	<20-24	<20	<20	<20	<20	<20	<20	<20-33
5	Wheeled loader	<20-23	<20-24	<20-24	<20	<20	<20	<20	<20	<20	<20-33
6	Dump truck	<20-22	<20-23	<20-23	<20	<20	<20	<20	<20	<20	<20-32
7	30t Excavator	<20-21	<20-22	<20-22	<20	<20	<20	<20	<20	<20	<20-31
8	Grader	<20-21	<20-22	<20-22	<20	<20	<20	<20	<20	<20	<20-31
9	Chain trencher	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-28
10	Water truck	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-28
11	Telehandler	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20-22
12	Forklift	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently		<20-30	<20-31	<20-31	<20	<20-22	<20-22	<20	<20	<20	<20-41

Notes:

Based on the predicted construction noise levels presented in the table above, the construction NML will be exceeded when construction works are conducted at the closest proximity to two (2) involved receiver, R2 and R48. Predicted construction noise levels at all privately owned receivers will comply with the construction NML.

Furthermore, construction noise levels at all receivers are predicted to be below the highly noise affected level of 75dB(A).

Further details on construction noise management measures are provided in Section 4.4 below.

4.4 Construction Noise Management Measures

The following recommendations provide in-principle feasible and reasonable noise management measures to reduce noise impacts to sensitive receivers. Where actual construction activities differ from those assessed in this report, more detailed design of noise control measures may be required once specific items of plant and construction methods have been chosen and assessed on site.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

For construction works conducted within close proximity to the dwelling / building of involved receivers R2 and R48, notwithstanding that both belong to involved receivers, potential noise exceedances to these locations would be managed by implementing time restrictions and/or providing periods of repose for residents, where feasible and reasonable. For example, between 10am and 3pm (with one-hour break for lunch between 12pm and 1pm), activities that may cause an exceedance of the NML could occur with no noise level restrictions over a limited time period. Also, allowing the construction activities to proceed, despite the noise exceedance, may be the preferred method in order to complete the works expeditiously, with noise exceedances occurring over only two to three days. Residents would be consulted to determine appropriate respite periods and will be notified of the potential noise impact during this time period so that they can organise their day around the noisy period.

In addition, the following noise management measures should be considered.

- Plant and equipment should be properly maintained.
- Avoid any unnecessary noise when carrying out manual operations and when operating plant.
- Any equipment not in use for extended periods during construction work should be switched off.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of the project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

5 Operational Noise Assessment

5.1 Operational Noise Criteria

Noise impact from the general operation of the proposed solar farm is assessed against the NSW 'Noise Policy for Industry' (NPfI). The assessment procedure in terms of the NPfI has two components:

- Controlling intrusive noise impacts in the short-term for residences; and
- Maintaining noise level amenity for residences and other land uses.

In accordance with the NPfI, noise impact should be assessed against the project noise trigger level which is the lower value of the project intrusiveness noise levels and project amenity noise levels.

5.1.1 Intrusive Noise Impacts

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

$L_{Aeq,15minute}$ Intrusiveness noise level = Rating Background Level (RBL) plus 5dB(A)

Based on the RBLs established in Table 3.1, the intrusiveness noise levels for the residential receivers are determined in Table 5.1.

Table 5.1 – NPfI Intrusive Noise Level at Residential Receivers, dB(A)

Period	RBL, dB(A)	Intrusiveness Noise Level, $L_{Aeq,15min}$, dB(A)
Daytime	35	35+5 = **40**
Evening	30	30+5 = **35**
Night-time	30	30+5 = **35**

5.1.2 Protecting Noise Amenity

The project amenity noise levels for different time periods of a day are determined in accordance with Section 2.4 of the NSW NPfI. The NPfI recommends amenity noise levels ($L_{Aeq, period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These "recommended amenity noise levels" represent the objective for **total** industrial noise experienced at a receiver location. However, when assessing a **single** industrial development and its impact on an area, "project amenity noise levels" apply.

To ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level that applies for each new industrial noise source is determined as follows:

$$\mathbf{L_{Aeq,period}\ Project\ amenity\ noise\ level = L_{Aeq,period}\ Recommended\ amenity\ noise\ level - 5dB(A)}$$

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods.

$$\mathbf{L_{Aeq,15min} = L_{Aeq,period} + 3dB(A)}$$

The policy, in accordance with the NPfI, applies an adjustment of (+3 dB) to the recommended noise levels ($L_{Aeq,\ period}$) in order to standardise the time periods for the intrusiveness and amenity noise levels. The project amenity noise levels ($L_{Aeq,\ 15min}$) applied for this project are reproduced in Table 5.2.

It is noted that the residential receivers in the vicinity of the site have been categorised as being in a 'rural' area in accordance with Table 2.3 of the NPfI.

Table 5.2 – NPfI Project Amenity Noise Levels, dB(A)

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended Noise Level	
			$L_{Aeq,Period}$	$L_{Aeq,15min}$
Residence	Rural	Day	50 – 5 = 45	45 + 3 = **48**
		Evening	45 – 5 = 40	40 + 3 = **43**
		Night	40 – 5 = 35	35 + 3 = **38**
Industrial Premises		All	When in use	70 – 5 = 65	65 + 3 = **68**

Notes: 1. The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

5.1.3 Summary of Project Noise Trigger Levels

In accordance with the NPfI the project noise trigger level, which is the lower (ie. more stringent) value of the project intrusiveness noise level and project amenity noise level, has been determined and reproduced in Table 5.3 below.

Table 5.3 – Project Noise Trigger Levels, dB(A)

Receiver Location	$L_{Aeq,15min}$ Project Noise Trigger Levels		
	Day	Evening	Night
Involved Receivers			
Residential Receivers: R2, R5, R6, R7, R41, R42, R43, R48	40	35	35
Non-involved Receivers			
Residential Receivers: R1, R10 to R24, R32, R36 to R38, R40, R45 to R47, R49 to R51	40	35	35
Industrial Receivers: R9, R106	68 (when in use)		

5.2 Operational Noise Sources

The proposed solar farm will utilise single axis tracking PV panels, where the panels would be in rows configured to track the sun from east to west throughout the day. Indicatively, up to a total of 2,400 tracking units (IDEEMATEC's Horizon L:TEC PV tracker or equivalent) will be distributed across the array inclusion zone.

In addition to the trackers, the indicative quantities of plant include 85 inverters (SMA MV Power Station 4600-S2 or equivalent), 170 batteries (Tesla Megapack or equivalent) and 1,020 converters (SMA DC-DC Converters or equivalent) will be distributed across the array inclusion zone.

Three (3) 150 MVA transformers will be placed side by side in the substation facility located to the east of the array inclusion zone. An additional 200 batteries will be evenly spaced in the designated battery storage system area near to the substation.

During operations, it is assumed that five (5) staff members will attend site daily during the day time period to inspect the equipment. It is also assumed that each staff member will travel around the Project site in a light vehicle.

Based on the above, the following table lists associated plant and equipment likely to be used for the operation of the proposed Project and their corresponding sound power levels.

Table 5.4 – Typical Operational Plant and Equipment & Sound Power Levels

Plant Item	Plant Description	L_{Aeq} Sound Power Levels, dB(A) re. 1pW
1	Tracker motor (2,400 in total)	81 (each)[1]
2	Inverters (85 in total)	91 (each)[1]
3	Batteries (array inclusion zone) (170 in total)	86 (each)[1]
4	Converters (1020 in total)	92 (each)[1]
5	Batteries (battery storage system area) (200 in total)	86 (each)[1]
6	150 MVA Transformers (3 in total)	95 (each)[1]
7	Light vehicle (5 in total)	88 (each)[1]

Notes: 1. Based on sound power level data from manufacturer's data, past projects and/or RT&A's acoustic database

The sound power levels for the plant and equipment presented in the above table are provided by the manufacturer, information from past projects and/or information held in our library files.

5.3 'Modifying Factor' Adjustments

Further to the above and in accordance with the NPfI, where the character of the noise in question is assessed as particularly annoying (i.e. if it has an inherently tonal, low frequency, impulsive or intermittent characteristic), then an adjustment of 5dB(A) for each annoyance aspect, up to a total of 10dB(A), is to be added to the predicted value to penalise the noise for its potential increase in annoyance. Table C1 in Fact Sheet C of the NSW NPfI provides definitive procedures for determining whether a penalty or adjustment should be applied from increased annoyance.

For the assessment of the solar farm, the noise from the inverters and transformers are considered to be tonal in nature. Therefore, a 5dB(A) penalty has been applied to the predicted noise contributions from the inverters and transformers.

5.4 Operational Noise Assessment

Noise emissions were predicted by modelling the noise sources, receiver locations, topographical features of the intervening area, and possible noise control treatments using the CadnaA (version 2021 MR 1) noise modelling computer program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models takes into account:

- Location of noise sources and receiver locations
- Height of sources and receivers
- Separation distances between sources and receivers
- Ground type between sources and receivers (soft)
- Attenuation from barriers (natural and purpose built).

Furthermore, in accordance with the NPfI noise predictions were prepared for each of the following meteorological conditions:

1. Calm & isothermal conditions (acoustically neutral) – 0.5m/s wind and no temperature inversion. Wind direction based on wind travelling from the source to the receiver.
2. Slight to gentle breeze – 3m/s wind velocity at 10m from ground level between each noise source and each noise receiver (as per NPfI default wind conditions). Wind direction was based on wind travelling from the source to the receiver.
3. Moderate temperature inversion – applicable for noise predictions during night time periods only

Table 5.5 below presents the predicted noise levels for the worst case scenario based on concurrent operation of all the plant and equipment shown in Table 5.4.

Table 5.5 – Predicted $L_{Aeq,15min}$ Operational Noise Levels at Receiver Locations, dB(A)

Receiver Location	Project Noise Trigger Levels			Predicted Operational Noise Levels			Compliant? (Yes/No)
	Day	Evening	Night	Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion[1]	
Involved Receivers							
Receiver R2	*40*	*35*	*35*	**39**	**40**	**40**	**No**
Receiver R5	*40*	*35*	*35*	<20	<20	<20	Yes
Receiver R6	*40*	*35*	*35*	20	20	20	Yes
Receiver R7	*40*	*35*	*35*	32	32	32	Yes
Receiver R41	*40*	*35*	*35*	32	32	32	Yes
Receiver R42	*40*	*35*	*35*	33	33	33	Yes
Receiver R43	*40*	*35*	*35*	32	33	33	Yes
Receiver R48	*40*	*35*	*35*	**46**	**47**	**47**	**No**
Non-involved Receivers							
Receiver R1	*40*	*35*	*35*	24	24	24	Yes
Receiver R9		*68 (When in use)*		37	38	38	Yes
Receiver R10	*40*	*35*	*35*	25	25	25	Yes
Receiver R11	*40*	*35*	*35*	25	25	25	Yes
Receiver R12	*40*	*35*	*35*	26	26	26	Yes
Receiver R13	*40*	*35*	*35*	26	26	26	Yes
Receiver R14	*40*	*35*	*35*	26	26	26	Yes
Receiver R15	*40*	*35*	*35*	26	26	26	Yes
Receiver R16	*40*	*35*	*35*	24	24	24	Yes
Receiver R17	*40*	*35*	*35*	27	27	27	Yes
Receiver R18	*40*	*35*	*35*	26	26	26	Yes
Receiver R19	*40*	*35*	*35*	27	27	27	Yes
Receiver R20	*40*	*35*	*35*	27	27	27	Yes
Receiver R21	*40*	*35*	*35*	27	27	27	Yes
Receiver R22	*40*	*35*	*35*	27	27	27	Yes
Receiver R23	*40*	*35*	*35*	26	26	26	Yes
Receiver R24	*40*	*35*	*35*	27	27	27	Yes
Receiver R32	*40*	*35*	*35*	22	22	22	Yes
Receiver R36	*40*	*35*	*35*	30	30	30	Yes
Receiver R37	*40*	*35*	*35*	29	29	29	Yes
Receiver R38	*40*	*35*	*35*	28	28	28	Yes
Receiver R40	*40*	*35*	*35*	29	30	30	Yes
Receiver R45	*40*	*35*	*35*	23	23	23	Yes

Receiver Location	Project Noise Trigger Levels			Predicted Operational Noise Levels			Compliant? (Yes/No)
	Day	Evening	Night	Calm & Isothermal Conditions	Slight to Gentle Breeze	Moderate Temperature Inversion[1]	
Receiver R46	*40*	*35*	*35*	27	27	27	Yes
Receiver R47	*40*	*35*	*35*	27	27	27	Yes
Receiver R49	*40*	*35*	*35*	22	22	22	Yes
Receiver R50	*40*	*35*	*35*	22	22	22	Yes
Receiver R51	*40*	*35*	*35*	23	23	23	Yes
Receiver R106	*68 (When in use)*			38	39	39	Yes

Notes:
1. Applicable for the night time period only
2. **Bold** font represents exceedance of the project noise trigger level

Table 5.5 indicates that the operational noise levels are exceeded at two (2) involved receiver locations but comply with the project noise trigger levels for all time periods for all non-involved receiver locations.

5.5 Sleep Disturbance Assessment

To assess the likelihood of sleep disturbance, the potential of maximum noise level events from premises during the night-time period has been considered in this assessment. In accordance with the NPfI, a detailed maximum noise level event assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

Where there are noise events found to exceed the initial screening level, further analysis is undertaken to identify:

- The likely number of events that might occur during the night assessment period,
- The extent to which the maximum noise level exceeds the rating background noise level.

During the night time period, only mechanical plant will be operating. Noise emissions from these plant items are considered to be continuous with no potential for high peak noise level events. Therefore, the L_{Amax} noise levels experienced at the identified receivers will be similar to the predicted $L_{Aeq,15min}$ noise levels shown in Table 5.5. Hence, it is expected that both the $L_{Aeq,15min}$ and L_{AFmax} will be well below the nominated sleep disturbance criteria of 40dB(A) and 52dB(A), respectively, at all non-involved receiver locations.

5.6 Cumulative Noise Assessment

Other noise generating developments in the area include the Capital Wind Farm, Bungendore Sands Quarry, Paragalli Sand Quarry and Holcim Sand quarry.

It is noted that wind farms are not considered as industrial noise sources in accordance with the NPfI and have specific noise criteria applicable to wind farms only, which are different to the noise criteria stipulated in the NPfI.

Furthermore, the NPfI establishes the project amenity noise levels to account for new industrial noise sources contributing to the total (cumulative) industrial noise level (existing plus new) experienced at a sensitive receiver.

Nevertheless, the predicted operational noise levels of the proposed solar farm at all non-involved receiver locations were at or below the minimum background noise levels, for all time periods and under all meteorological conditions. Therefore, operational noise from the proposed solar farm is unlikely to contribute or increase noise impacts from other existing noise generating developments currently experienced by the identified non-involved receiver locations.

6 Vibration Assessment

Vibration generating activities would occur only during the construction phase of the project. There are no vibration generating activities expected during the operational phase. As the nearest identified receivers are approximately 250m from the Project site, structural damage due to vibration is not expected. Assessment for construction vibration impact on human comfort is assessed in accordance with the EPA requirements.

6.1 Vibration Criteria

Assessment of potential disturbance from vibration on human occupants of buildings is made in accordance with the EPA's *'Assessing Vibration; a technical guideline'* (DECC, 2006). The guideline provides criteria which are based on British Standard BS 6472-1992 *'Evaluation of human exposure to vibration in buildings (1-80Hz)'*. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'. Table 6.1 provides definitions and examples of each type of vibration.

Table 6.1 – Types of Vibration

Type of Vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Source: Assessing Vibration; a technical guideline, Department of Environment & Climate Change, 2006

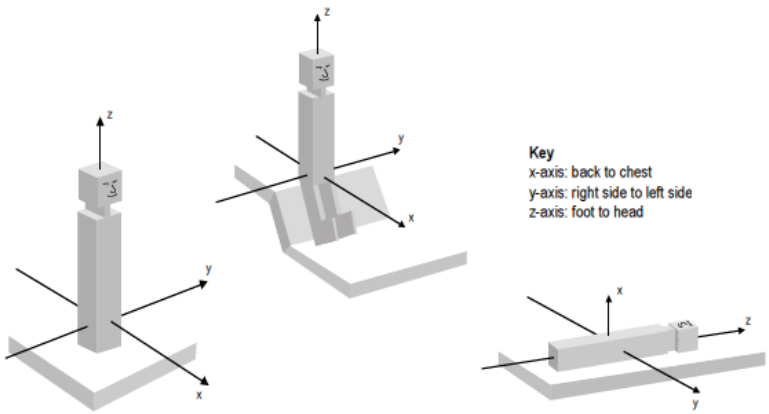
The vibration criteria are defined as a single weighted root mean square (rms) acceleration source level in each orthogonal axis. Section 2.3 of the guideline states:

> *"Evidence from research suggests that there are summation effects for vibrations at different frequencies. Therefore, for evaluation of vibration in relation to annoyance and comfort, overall weighted rms acceleration values of the vibration in each orthogonal axis are preferred (BS 6472)."*

When applying the criteria, it is important to note that the three directional axes are referenced to the human body, i.e. x-axis (back to chest), y-axis (right side to left side) or z-axis (foot to head). Vibration may enter the body along different orthogonal axes and affect it in different ways. Therefore,

application of the criteria requires consideration of the position of the people being assessed, as illustrated in Figure 2. For example, vibration measured in the horizontal plane is compared with x- and y-axis criteria if the concern is for people in an upright position, or with the y- and z- axis criteria if the concern is for people in the lateral position.

Figure 2 – Orthogonal Axes for Human Exposure to Vibration



The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in Table 6.2 for the applicable receivers.

Table 6.2 – Preferred and Maximum Levels for Human Comfort

Location	Assessment Period[1]	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
Workshops	Day- or night-time	0.64	0.46	1.28	0.92

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

The acceptable vibration dose values (VDV) for intermittent vibration are defined in Table 2.4 of the guideline and are reproduced in Table 6.3 for the applicable receiver type.

Table 6.3 – Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1. Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

6.2 Potential Vibration Impacts

Based on the proposed plant items presented in Table 4.4, vibration generated by construction plant was estimated and potential vibration impacts are summarised in Table 6.4 below. The assessment is relevant to the identified receiver locations.

Table 6.4 – Potential Vibration Impacts for Identified Receivers

Receiver Location	Approx. Distance to Nearest Buildings from Works	Type of Nearest Sensitive Buildings	Assessment on Potential Vibration Impacts	Vibration Monitoring
R2	250m	Residential	Very low risk of adverse comments	Not required
R9	950m	Industrial	Very low risk of adverse comments	Not required
R41	850m	Residential	Very low risk of adverse comments	Not required
R48	200m	Residential	Very low risk of adverse comments	Not required
R106	524m	Industrial	Very low risk of adverse comments	Not required
R1, R10 to R24, R32, R36 to R38, R40 to R43, R45 to R51	>1,000m	Residential	Very low risk of adverse comments	Not required

The potential for adverse comments to vibration impacts during the construction works was determined to be very low due to the large distances between the receiver locations and the construction activities. Therefore, additional vibration mitigation measures and vibration monitoring are not required at the identified receiver locations during construction works associated with the project.

7 Road Traffic Noise Assessment

Noise impact from the potential increase in traffic on the surrounding road network due to construction and operational activities is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the construction and operation of the Project site, with the aim of preserving the amenity appropriate to the land use.

7.1 Traffic volumes

A "Traffic Impact Assessment" was undertaken by Amber (ref. 167 rep 211006 final, dated October 2021), which presented 2021 traffic volume data for Tarago Road and the peak vehicle movements for the project. A summary of 2021 traffic volumes for Tarago Road is presented in the table below:

Table 7.1 – Summary of 2021 Traffic Volume Data for Tarago Road

Road	Daily Traffic Volume		Percentage Heavy Vehicle	Posted Speed (km/h)
	15hr (7am to 10pm)	9hr (10pm to 7am)		
Tarago Road	688	122	9%	100

The peak vehicle movements during the construction stage of the project are presented in the following table. Furthermore, vehicle movements will only occur during the day time period when construction works occur.

Table 7.2 – Summary of the Estimated Construction Traffic Volumes During Peak Construction

Vehicle Type	Vehicle Movements (two-way)	
	Daily	Peak hour
Light Vehicle (car / 4WD)	100	50
MRV/HRV	40	4
AV	20	2
B-Double	10	1
Total	**170**	**57**

During the operational stage, vehicle access to the site will be maintenance vans or delivery trucks which would occur on an irregular basis. Traffic noise impacts during the operational stage of the project would be minimal and insignificant and will not be assessed further.

7.2 Road Traffic Noise Criteria

Access to the site will be provided via an existing private access road from Tarago Road. For existing residences affected by additional traffic on existing arterial roads and local roads generated by land use developments, the following RNP road traffic noise criteria would apply.

Table 7.3 – RNP Road Traffic Noise Criteria, dB(A)

Road Category	Type of Project/Land Use	Assessment Criteria, dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeway/arterial/sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,(15\ hour)}$ 60 (external)	$L_{Aeq,(9\ hour)}$ 55 (external)

Further to the above, the RNP states the following for land use developments generating additional traffic:

> *"For existing residences and other sensitive land uses affected by **additional traffic on existing roads generated by land use development**, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."*

7.3 Predicted Road Traffic Noise

Results of the road traffic noise predictions are presented in the table below.

Table 7.4 – Predicted Road Traffic Noise Contribution Levels Along Public Roads, dB(A) $L_{Aeq(15\ Hour)}$

Receiver	Criteria	Traffic Movements	Posted Speed (km/h)	Distance to Road[1]	Predicted Noise Level without Project	Predicted Noise Level with Project	Increase in Noise Level with Project	Exceed?
Residences on Tarago Road	$L_{Aeq,\ (15\ hour)}$ 60	As per Table 7.1 and Table 7.2	100	20m	55.1	56.9	1.8	No

Notes: 1. Based on closest typical distance from facade of dwelling to the road

From the above table, it can be seen that road traffic noise level contributions from the vehicle movements associated with the construction works are within the applicable noise criteria based on dwellings being at the closest typical distance from the roads. Given that residences are located within a rural environment, distances between the road and the majority of dwellings would likely be significantly greater than 20m.

Furthermore, the construction vehicles would result in an increase the existing traffic noise levels of 1.8dB(A) which is within the allowable increase limit of 2dB(A).

Therefore, traffic noise levels as a result of the construction works for the project would not adversely contribute to the existing traffic noise levels at the most affected residences along the Tarago Road.

8 Conclusion

Renzo Tonin and Associates has completed an environmental noise and vibration assessment of the proposed Blind Creek Solar Farm.

Noise emissions from the construction and operational phases of the project were predicted to be within the nominated construction and operational noise criteria at all non-involved receiver locations.

Given the large separation distances between the nearest affected receivers and the Project site, vibration impacts resulting in structural damage to buildings at the nearest affected receivers are determined to be negligible and there is a very low risk of adverse comments from occupants of dwellings due to construction vibration.

Road traffic noise impacts due to additional traffic generated during the construction phase of the Project on residential properties along the access routes were found to comply with the relevant RNP criteria.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 110dB Operating a chainsaw or jackhammer 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.