Appendix B Acoustic report

RENZO TONIN & ASSOCIATES
Inspired to achieve

Acoustics
Vibration
Structural Dynamics

COROP SOLAR FARM

Acoustic Report

20 July 2022

Corop Solar Farm Pty

MD745-01F01 Acoustic Report (r1)

35 1983-2017 ACOUSTIC ENGINEERING EXCELLENCE

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Executive summary

Renzo Tonin & Associates was engaged by Corop Solar Farm Pty to undertake an acoustic assessment of the proposed 320MW AC (440 MW DC) Solar Farm in Corop, Victoria (Campaspe Shire) (the 'Proposal'). The assessment responds to the DELWP *'Solar Energy Facilities - Design and Development Guideline - August 2019'* (the Guideline). The Guideline states:

The design response should also include one or more written reports and assessments including an assessment of:

- *potential noise impacts: EPA Victoria's Noise from industry in regional Victoria* (EPA Pub 1411 'NIRV')
- *construction management plan: EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction.* (EPA Pub 480)

Renzo Tonin & Associates advises that the above documents have been superseded as follows:

- EPA Victoria's Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA Pub 1826.4) has superseded EPA Victoria's Noise from industry in regional Victoria (EPA Pub 1411)
- EPA Victoria's Civil construction, building and demolition guide (EPA Pub 1834) has superseded EPA Victoria's Environmental Guidelines for Major Construction Sites. (EPA Pub 480)

Renzo Tonin & Associates has based its assessment of the Subject Development on the following drawings:

- Drawing, No. CSF-001-004, Rev E entitled *'Solar Farm Layout Overview – 344 Old Corop Road Rushworth 3612'*, dated 13 July 2022, by Leeson Project Pty Ltd

The assessment comprised:

- Review of the surroundings, the Subject Site and Proposal
- Determination of relevant noise criteria:
  - EPA 1826 noise limits
  - Construction noise and vibration criteria
- Assessment of the operational noise from the Proposal
- Recommendations with respect to noise and vibration during the construction phase

On the basis of the assessed configuration, it considered that the 'Proposal' can operate without unreasonable acoustic impact on residential amenity.

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1 Introduction

Renzo Tonin & Associates was engaged by Corop Solar Farm Pty (the Proponent) to undertake an acoustic assessment of the proposed 320MW AC (440 MW DC) Solar Farm (the 'Proposal') with an area of 1,099.68 hectares. The subject land is comprised of two properties being 344 Old Corop Road, Rushworth (Stage 1) and Bedwell Road, Rushworth (Stage 2) in the Corop area of Victoria (the 'Site') (Campaspe Shire).

The assessment responds to the DELWP *'Solar Energy Facilities - Design and Development Guideline - August 2019'* (the Guideline).

Renzo Tonin & Associates has based its assessment of the Subject Development on the following drawings:

- Drawing, No. CSF-001-004, Rev E entitled *'Solar Farm Layout Overview – 344 Old Corop Road Rushworth 3612'*, dated 13 July 2022, by Leeson Project Pty Ltd

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 Overview of site and surrounds

2.1 The Proposal

Corop Solar Farm Pty is proposing to develop a 440MW (DC) 320MW (AC) solar energy facility (the 'Proposal'), located within the 'Farming Zone'.

The Subject Development is proposed to include the following items relevant to acoustics:

- Approximately 900,000 panels supported by approximately 13,580 x tracker motors
- Up to 85 solar inverters
- Up to 2 substations, including switch gears and ancillary equipment
- Up to 208 battery energy storage systems (BESS) containers with inverters and 104 transformers (servicing the battery area)

Renzo Tonin & Associates has been provided with the following briefing with respect to the 'Proposal'

- 85 inverters stations located throughout the Site (inverter stations);
- 400MW/800MWh battery System;
- Dedicated switching station;
- Internal and external access roads;
- Perimeter security fencing;
- Storage facility and site office;
- Carpark;
- Electrical Substation;
- Single axis tracking solar panel mounting system;
- 33kV internal reticulation cabling;
- Visual screens -native vegetation landscaping.

The 'Proposal' will have the capacity to generate electricity during day light hours. 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. Batteries could potentially operate at all times.

2.2 Sensitive Receivers

Nearby dwellings relevant for the assessment were identified using aerial maps and are presented in Table 1. As noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings.

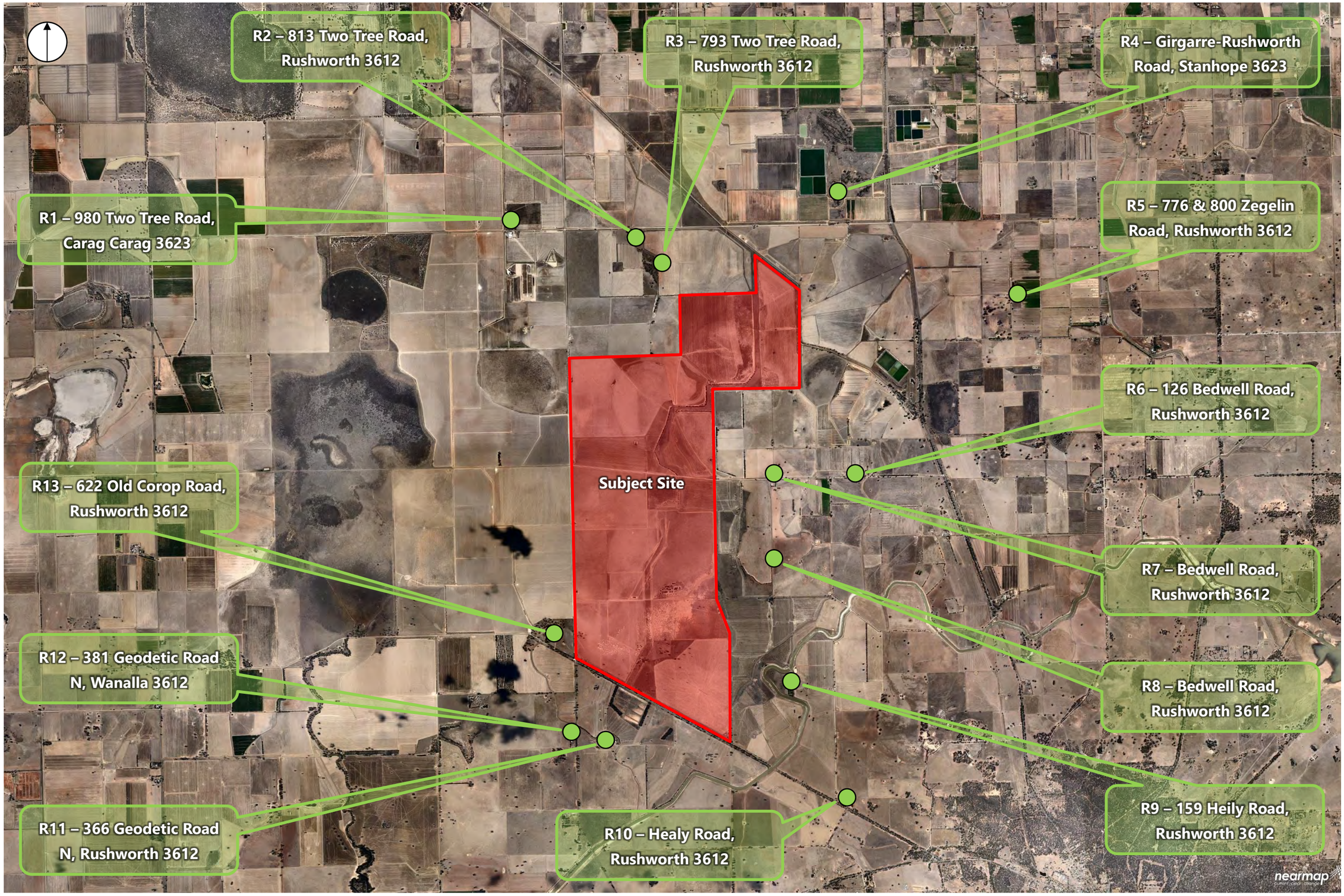
Table 1: Dwellings near the Proposal

ID	Address	Approximate distance to site boundary	Zone
R1	980 Two Tree Road, Carag Carag 3623	1930 m	Farm Zone 1 (FZ1)
R2	813 Two Tree Road, Rushworth 3612	1050 m	Farm Zone 1 (FZ1)
R3	793 Two Tree Road, Rushworth 3612	600 m	Farm Zone 1 (FZ1)
R4	Girgarre-Rushworth Road, Stanhope 3623	1450 m	Farm Zone 1 (FZ1)
R5	776 & 800 Zegelin Road, Rushworth 3612	3000 m	Farm Zone 1 (FZ1)
R6	126 Bedwell Road, Rushworth 3612	1530 m	Farm Zone 1 (FZ1)
R7	Bedwell Road, Rushworth 3612	780 m	Farm Zone 1 (FZ1)
R8	Bedwell Road, Rushworth 3612	735 m	Farm Zone 1 (FZ1)
R9	159 Heily Road, Rushworth 3612	835 m	Farm Zone 1 (FZ1)
R10	Heily Road, Rushworth 3612	1865 m	Farm Zone 1 (FZ1)
R11	366 Geodetic Road N, Rushworth 3612	800 m	Farm Zone 1 (FZ1)
R12	381 Geodetic Road N, Wanalla 3612	940 m	Farm Zone 1 (FZ1)
R13	622 Old Corop Road, Rushworth 3612	300 m	Farm Zone 1 (FZ1)

Notes: As noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings.

Figure 1, overleaf, presents an overview of the Subject Site and surrounding land uses.

Figure 1: Overview of the site and dwellings assessed



3 Noise criteria

3.1 Planning scheme

With respect to Campaspe Planning Scheme Clauses, the following are with respect to acoustics:

- Clause 13.05-1S references the following acoustic criteria documents:
  - *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues* (Publication 1826.2, Environment Protection Authority, March 2021)
    - EPA Publication 1826.4 supersedes 1826.2
- Clause 53.13-3 sets out the following decision guidelines with respect to acoustics:
  - *"The effect of the proposal on the surrounding area in terms of noise, …"*
    - Addressed in this acoustic report.
  - *"Solar Energy Facilities Design and Development Guideline (Department of Environment, Land, Water and Planning, August 2019)"*
    - Addressed in this acoustic report.

3.2 DELWP Solar Energy Facilities – Design and Development Guideline

The Department of Environment Land Water and Planning (DELWP) *Solar Energy Facilities – Design and Development Guideline, 2019* (the 'Guideline') provides an overview of the policy, legislative and statutory planning arrangements for solar energy facilities in Victoria. The Solar Facilities Guideline states the following in relation to acoustics:

- *"Noise*

  A facility should keep its noise impacts at or below the levels in EPA Victoria's Noise from industry in regional Victoria guideline [see Section 3.3]. *Noise attenuation measures could include:*
  • ensuring any components operate to relevant standards
  • acoustic housing or baffles at the noise source
  • conducting maintenance and other operational activity during the daytime
  • using landscaping or locating noisier components centrally within a site"
- *"Construction noise and dust management*

  To address impacts on nearby sensitive land uses, a proponent should reduce the potential noise from vehicles servicing the site, from fixed machinery onsite and from construction activities, for example by limiting times when noisy operations are allowed. It should also engage with stakeholders to address any potential impacts…
  The EMP should outline measures to address noise and the disturbance of dust and sediment during construction and operation of the facility.
  EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction" [see Section 3.4.2.]

3.3 EPA Publication 1826 industrial noise

From 1 July 2021, EPA Publication 1826 *'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues'* (EPA Pub. 1826) superseded:

- *State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1), and
- EPA Publication 1411, *'Guidelines: Noise from Industry in Regional Victoria'* (NIRV)

For this assessment's application, EPA Publication 1826 (1826-P1) uses the same methods to assess noise impacts as the superseded noise policies, but with slight amendments to the durations of day, evening & night.

3.3.1 Industrial noise limits (Rural area method)

Since the Subject Site is not located in a Major Urban Area (ie. <7,000 population), applicable noise limits for commercial activity are set out in Part 1, Section 2 of EPA Publication *1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues'* (1826-P1) following the 'rural area method'. Table 2 presents the applicable EPA 1826-P1 noise limits, which are applicable for mechanical services and on-site commercial activities.

Table 2: EPA 1826-P1 noise limits

Period	Generating zone	Receiving zone	EPA 1826-P1 limit, L_{eq} dB(A)
Day	Farming Zone 1 (FZ1)	Farming Zone 1 (FZ1)	**46**
Evening			**41**
Night			**36**

EPA 1826-P1 period definitions:			
	Day:	Monday-to-Saturday 7am-to-6pm;	Sundays NA
	Evening:	Monday-to-Saturday 6pm-to-10pm;	Sundays or Holidays 7am-to-10pm
	Night:	All days 10pm-to-7am	

EPA 1826-P1 night-time noise limits are more stringent than that of the day or evening periods. As such, compliance during the night-time period implies compliance during the day and evening periods, provided that emitted noise levels do not vary. For this assessment the applicable location of assessment is outside surrounding dwellings, assessed over a 30-minute period.

3.4 Construction noise and vibration

3.4.1 Legislation

There are currently no objective legislative requirements to limit noise and vibration from construction in Victoria however there are Guidelines that set out best practice and are considered below.

Renzo Tonin & Associates advises that the above documents have been superseded as follows:

- *EPA Victoria's Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (EPA Pub 1826.4) *has superseded EPA Victoria's Noise from industry in regional Victoria* (EPA Pub 1411)
- *EPA Victoria's Civil construction, building and demolition guide* (EPA Pub 1834) *has superseded EPA Victoria's Environmental Guidelines for Major Construction Sites.* (EPA Pub 480)

3.4.2 EPA Civil construction, building and demolition guide, Publication 1834

From November 2020, EPA Publication 1834 *'Civil construction, building and demolition guide'* (EPA Pub. 1834) superseded:

- EPA Publication 480, *'Environmental Guidelines for Major Construction Sites* (EPA Pub 480)
- Section 2 of EPA Publication 1254 *Noise Control Guidelines (October 2008)* (EPA Pub 1254)

Per Section 3.2, the DELWP *Solar Energy Facilities – Design and Development Guideline* states that "…*EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction"*

The Civil construction, building and demolition guide (EPA Pub 1834) states:

"New environment protection laws mean that anyone engaging in an activity that poses risk of harm to human health and the environment, from pollution or waste, must eliminate or reduce that risk. The ***general environmental duty*** *applies to all Victorians.*

It is your responsibility to understand and assess your risks. This includes understanding how your activities can impact land, water and air quality, or cause harm from waste or excessive noise.

You also need to eliminate or reduce risk as far as reasonably practicable. You can do this by putting appropriate controls in place that are proportionate to the risk.

Your approach to managing risk will depend on the complexity and scale of your activities or project, as well as the nature of the risks you need to manage."

Section 4.2 of EPA Pub. 1834 sets out the following key aspects to consider when planning a project:

- *Identifying people and sensitive environments (sensitive receivers) that could be affected by your activities*
- *Carrying out appropriate engagement as early as possible*
- *Avoiding the generation of noise and vibration*
- *Facilitating construction during normal working hours, where possible*
- *Reducing noise and vibration by using the most appropriate equipment and work practices for your activities*
- *Choosing alternative equipment or methods that generate less noise or vibration*
- *Maintaining equipment and vehicles according to manufacturer's instructions*
- *Attenuating noise by obstructing the path between noise source and receiver*
- *Mitigating offsite noise with measures such as respite offers and acoustic treatment*
- *Considering alternatives if noise and vibration cannot be reduced through avoidance, reduction or attenuation*

Section 4.3 of EPA Pub. 1834 provides (within Table 4.1) the working hours schedule for construction, building and demolition noise, reproduced below:

Minimise noise and vibration as far as possible in any situation

Normal working hours for all civil construction, building and demolition activities.

AM → PM: **Monday to Friday, 7 am – 6 pm**	
AM → PM: **Saturday, 7 am – 1 pm**	AM → PM: **Saturday, 9 am – 1 pm**
Normal working hours for: • works for commissioning or construction of **major infrastructure projects** • commercial and industrial construction and demolition sites • demolition works on an existing commercial or industrial site that is intended for residential redevelopment • construction works for **large-scale residential developments** in non-residential zones • commercial and industrial land subdivision.	Normal working hours for: • residential construction and demolition sites • residential or mixed-use development in **residential zones**, including urban infill and redevelopments • land preparation on infill and smaller residential developments • land preparation for residential subdivision, not including works to construct or upgrade a road • residential construction in a **large-scale fringe residential subdivision**, once the road servicing the residential development is complete.

Minimise noise and vibration as far as possible in any situation

Outside normal working hours for all civil construction, building and demolition activities.

PM → PM: **Monday to Friday, 6 pm – 10 pm**	
PM → PM: **Saturday, 1 pm – 10 pm**	PM → PM: **Saturday, 1 pm – 8 pm**
AM → PM: **Sundays and public holidays, 7 am – 10 pm**	AM → PM: **Sundays and public holidays, 9 am – 8 pm**
Applies to: • works for commissioning or construction of **major infrastructure projects** • commercial and industrial construction and demolition sites • demolition works on an existing commercial or industrial site that is intended for residential redevelopment • construction works for **large-scale residential developments** in non-residential zones • commercial and industrial land subdivision. See section 4.4 for conditions to apply within these hours and for works outside these hours.	Working hours providing that the activities do not result in **unreasonable noise** for: • residential construction and demolition sites • residential or mixed-use development in **residential zones**, including urban infill and redevelopments • land preparation on infill and smaller residential developments • land preparation for residential subdivision • residential construction in a **large-scale fringe residential subdivision**. See section 4.4. No works to be conducted after 8 pm unless they are inaudible.

Section 4.3.3 of EPA Pub. 1834 sets out the following noise source controls to help achieve the objectives:

- *Undertake preparatory work offsite where there is low potential for impacting people (e.g., formwork, cutting or prefabrication of materials offsite prior to transporting to the construction site)*
- *Connect to the electricity grid as early as possible to avoid the use of diesel generators.*
- *Restrict areas where mobile plant can operate so that it is away from people who could be affected by noise.*
- *Locate site vehicle access and waiting areas away from people who could be affected by noise.*
- *Plan vehicle movements to avoid manoeuvres and idling at location nearest to nearby people.*
- *Use quieter equipment or methods. This may require considering*
  - *buying or leasing quieter equipment*
  - *avoiding metal-to-metal and metal-to-stone contact*
  - *installing mufflers*
  - *reducing throttle and turning off equipment when not in use*
  - *placing things down rather than throwing*
  - *educating drivers to use driving practices that minimise noise*
- *Use low noise saw blades*
- *Use electrical equipment rather than equipment driven by a diesel generator.*
- *Use low noise emitting generators*
- *Use effective alternatives to 'beeper' alarms (e.g., broadband alarms, proximity sensors).*
- *Avoid using reversing alarms by designing site layout to avoid reversing (e.g., drive-through for parking and deliveries).*
- *Maintain equipment by:*
  - *inspecting regularly and maintaining equipment to ensure good working order*
  - *checking machines with enclosures, including doors & door seals and that the door closes properly against seals*
  - *maintaining air lines on pneumatic equipment so they do not leak.*
- *Maintain vehicles by:*
  - *considering good working conditions of mufflers*
  - *securing loose parts that may rattle.*
- *Limit noise caused by people onsite. This may include procedures to:*
  - *avoid yelling and shouting onsite (note: if people onsite need to shout to hear each other over the site ambient noise, it is possible the noise level may be putting their hearing at risk)*
  - *minimising the use and volume of any electrical amplified sound-reproducing equipment, for example radios, stereos, televisions, or public address systems*
- *Plan transport and haulage routes to minimise the number of trucks/vehicles. Where there are large numbers of truck movements, consider truck route and truck waiting protocols (e.g., engines on/off and restart requirements).*
- *Implement substitute methods taking into consideration:*
  - *alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fractures. The suitability of alternative methods should be considered on a case-by-case basis, including what potential risks they involve.*
  - *alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electrical generator located away from nearby people*

Section 4.3.4 of EPA Pub. 1834 sets out the following vibration and regenerated noise source controls to help achieve the objectives:

- *Use alternative lower-impact equipment or methods (e.g., substitute impact piling with bored piling, grip jacking or the use of hammer cushion when driving steel piles that minimise the vibration).*
- *Use non-explosive demolition agents and/or chemical agents to facilitate concrete/rock breaking activities to reduce the noise generated.*
- *Substitute demolition methods not involving impact where feasible (e.g., use hydraulic rock splitters rather than rock breakers).*
- *Schedule the use of vibration-causing equipment such as jackhammers, demolition, earthmoving, and ground-impacting operations at the least sensitive time of day.*
- *Routing, operating, or locating high vibration sources as far away from people who could be affected by noise.*
- *Sequencing operations so that vibration-causing activities do not occur simultaneously.*
- *Isolate equipment causing vibration on resilient mounts.*
- *Isolate activities from adjoining structures.*
- *Maintain equipment in accordance with manufacturer's specifications.*

Section 4.3.5 of EPA Pub. 1834 sets out the following noise reduction between noise source and receiver controls to help achieve the objectives:

- *Plan to have as much distance as possible between plant, equipment or other noisy activities and people who could be affected by noise.*
- *Maximise shielding taking into consideration:*
  - *topography of the site (e.g., use of earth mounds as barriers)*
  - *existing structures, temporary buildings, and material stockpiles*
  - *early construction of permanent walls so they can be used as early as possible as noise barriers*
  - *avoiding placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.*
- *Prioritise construction of structures such as buildings and walls that can contribute to shielding noise from the construction site.*
- *Obstruct the transmission path of sound (e.g., using acoustical walls or barrier, flexible noise barriers such as noise curtain or blankets, acoustic sheds, or enclosures. See Figure 4.2 and Figure 4.3.*
- *Protect noise sensitive receivers (e.g., increasing window sound insulation by retrofitting acoustic glazing or suitable double glazing).*

Table 3: EPA Pub. 1834 - operation schedule and noise guidelines

Normal working hours	Weekend/evening work hours	Night period
Monday to Friday, 7am – 6pm Saturday, 7am – 1pm	Noise level from non-residential construction at any residential premises is not to exceed background noise by: • 10dB(A) or more for up to 18 months after project commencement • 5dB(A) or more after 18 months during the hours of: • 6pm – 10pm Monday to Friday • 1pm – 10pm Saturdays • 7am – 10pm Sundays and public holidays	Noise inaudible (see definition below) within a habitable room of any residential premises during the hours of: • 10pm – 7am Monday to Friday • 10pm – 7am Saturdays, Sundays and public holidays

3.4.3 Construction vibration

Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy, however, Australian Standard AS 2187.2 *'Explosives—Storage and use'*, refers to British Standard BS 7385.2 '*Evaluation and measurement of vibration in buildings'* for prevention of minor or cosmetic damage occurring in structures from ground vibration.

Regarding application to heritage buildings, British Standard 7385.2 notes that *"a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

German Standard DIN 4150.3 '*Structural vibration in buildings - Effects on Structure*' also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative. Per DIN450.3 "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the values in table 1* [provided in Table 6 below] *does not necessarily lead to damage; should they be significantly exceeded; however, further investigations are necessary."*

The tables overleaf present summaries of applicable BS 7385 and DIN 4150.3 criteria.

Table 4: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	25[(1)]	25[(1)]	25[(1)]
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	7.5[(1)] to 10[(1)]	10[(1)] to 25[(1)]	25[(1)]

Note: 1. Presented noise levels are 50% lower than presented in BS 7385.2, as per BS 7385.2 Section 7.3.3 *"Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values … may need to be reduced by up to 50%"*

Table 5: DIN 4150-3 structural damage criteria (recognised to be conservative)

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. buildings under a preservation order)	3	3 to 8	8 to 10	8

Table 6: DIN 4150-3 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Note: For gas and water supply pipes within 2 m of buildings, the levels given in Table 13 should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

For long-term vibration the guideline levels presented should be halved.

EPA Pub. 480 stated:

- *"A British study has found that nuisance from ground vibration and building damage is unlikely to occur if the operation is conducted at distances greater than 50 metres.*
- *Complaints about air vibrations from blasting have been received from people 100 metres away from the activity."*

As it is understood that blasting is not proposed for the construction of the 'Proposal', vibration and noise distance thresholds for typical construction activities are considered to be much less onerous than the 50 metres and 100 metres thresholds respectively.

4 Noise impact assessment

4.1 Noise propagation model

A Cadna-A three-dimensional noise model, implementing ISO 9613 noise propagation algorithms was built, to calculate noise propagation from the 'Proposal' to surrounding residential premises during the operational period. The built form of the 'Proposal' and surrounding dwellings were integrated into the model. The following propagation effects were included in the predictive model:

- Mitigation of noise with distance, including geometrical spreading and air absorption (per ISO 9613)
- Reflections from buildings and environment (max. order 3 reflections)
- Barrier effects due to obstructions between noise sources and dwellings (predominantly due to topography)
- Ground absorption effects (G=0.5)
- Local topography (Topographic data for the Subject Site and surrounding area was in the form of 10-20m resolution contour lines from VicMaps.)

4.2 Operational noise

Table 7 provides details of typical equipment and corresponding sound power levels which have been incorporated into this assessment. Equipment has been assumed to be distributed uniformly across the site except where equipment locations have been indicated specifically in provided drawings.

Table 7: Typical equipment and associated sound power levels

Plant Item	Plant Description[1]	$L_{W,eq}$ Sound Power Levels, dB(A) re. 1pW
1	NEXTracker Gemini 2P tracker motors (13,580 in total)	57 (each)[3]
2	Inverter/power stations: SMA SC 4400-EV inverters (85 in total)	94 (each)[3]
3	Substation area: 250 MVA transformer (2 in total)	97 (each)[2,4]
4	Battery area: 800 MWh battery storage units (208 in total)	93 (each)[3]
5	Battery area: Transformers (104 in total)	83 (each)[2,4]

Notes:
1. The above equipment is understood to comprise typical equipment and corresponding sound power levels. Once the project has progressed to design development, the equipment shall be selected and installed such that EPA 1826-P1 noise criteria are conformed with at all times.
2. Based on sound power level data from past projects and/or RT&A's acoustic database.
3. Based on sound power level data provided by the client or manufacturer.
4. +5dB correction applied to plant during assessment to account for any tonality.

Table 8 presents the predicted noise levels at the nearest dwellings. Since noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings. As shown, noise levels conform with EPA 1826-P1 night time criteria and therefore also conform with day and evening EPA 1826-P1 criteria.

On the basis of the assessed configuration, without additional noise mitigation measures, it is considered that the Proposal can operate without unreasonable acoustic impact on residential amenity and is considered very low risk with respect to noise. This is because of the significant intervening

distances between the proposal and the nearest dwellings (approximately 300 metres to nearest dwelling).

Table 8: Predicted noise levels at dwellings from operation

Dwelling ID	Predicted noise levels, L_{eq} dB(A)	EPA 1826-P1 recommended night time noise limit (most stringent), L_{eq} dB(A)	Complies?
R1	<0	36	✓
R2	15	36	✓
R3	22	36	✓
R4	8	36	✓
R5	<0	36	✓
R6	6	36	✓
R7	24	36	✓
R8	25	36	✓
R9	31	36	✓
R10	<0	36	✓
R11	35	36	✓
R12	31	36	✓
R13	32	36	✓

Note:

4.3 Construction noise and vibration

It is understood that the construction of the 'Proposal' is likely to occur in one stage over 24 months, between the following hours:

- Mondays – Fridays: 7am – 6pm
- Saturdays: 7am – 1pm

During the standard building activity hours (Weekdays 7am-6pm; Saturdays 7am-1pm), there are no quantitative noise criteria and therefore noise monitoring is not mandatory during these hours.

Between 6pm and 8pm Mondays to Friday, 1pm and 8pm on Saturdays and 7am to 8pm on Sundays and public holidays, EPA Pub. 1834 recommends construction noise levels at dwellings be limited to:

- $L_{eq} \leq L_{90}$ + 10dB(A) **for** the first 18 months = 51[1]
- $L_{eq} \leq L_{90}$ + 5dB(A) **after** the first 18 months = 46[1]

Notes 1. In lieu of background monitoring the L_{90} is based on the EPA 1826-P1 limit from Table 2.

It is therefore recommended that only low noise works occur during the 'Weekend/Evening working hours' periods. In consideration of local stakeholders, it is understood that Heavy Goods Vehicles (HGV) will be managed to standard construction hours (Weekdays 7am-6pm; Saturdays 7am-1pm).

With consideration of the significant distance to dwellings, and with implementation of appropriate noise management strategies (see Section 3.4.2 for examples), construction of the 'Proposal' is considered low risk with respect to noise and adverse acoustic impact on residential amenity.

Referring to EPA Pub. 480 (previously stated in 3.4.3).

- *"A British study has found that nuisance from ground vibration and building damage is unlikely to occur if the operation is conducted at distances greater than 50 metres.*
- *Complaints about air vibrations from blasting have been received from people 100 metres away from the activity."*

As it is understood that blasting is not proposed for the 'Proposal', vibration and noise distance thresholds for typical construction activities are much less onerous than the 50 metres and 100 metres thresholds respectively.

The 'Proposal' is considered low risk with respect to construction noise and vibration impact on the basis of

- A 'Proposal' commitment to construction noise and vibration management strategies consistent with EPA Pub 1834
- The significant intervening distance between the 'Proposal' and nearest dwellings (approximately 300 metres)
- A 'Proposal' commitment to limit HGV construction movements and roadworks to standard construction hours.

5 Conclusion

Renzo Tonin & Associates was engaged by Corop Solar Farm Pty to undertake an acoustic assessment of the proposed 320MW AC (440 MW DC) Solar Farm in Corop, Victoria (Campaspe Shire) (the 'Proposal'). The assessment responds to the DELWP *'Solar Energy Facilities - Design and Development Guideline - August 2019'* (the Guideline). The Guideline states:

The design response should also include one or more written reports and assessments including an assessment of:

- *potential noise impacts: EPA Victoria's Noise from industry in regional Victoria* (EPA Pub 1411 'NIRV')
- *construction management plan: EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction.* (EPA Pub 480)

Renzo Tonin & Associates advises that the above documents have been superseded as follows:

- EPA Victoria's Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA Pub 1826.4) has superseded EPA Victoria's Noise from industry in regional Victoria (EPA Pub 1411)
- EPA Victoria's Civil construction, building and demolition guide (EPA Pub 1834) has superseded EPA Victoria's Environmental Guidelines for Major Construction Sites. (EPA Pub 480)

Renzo Tonin & Associates has based its assessment of the Subject Development on the following drawings:

- Drawing, No. CSF-001-004, Rev E entitled *'Solar Farm Layout Overview – 344 Old Corop Road Rushworth 3612'*, dated 13 July 2022, by Leeson Project Pty Ltd

The assessment comprised:

- Review of the surroundings, the Subject Site and Proposal
- Determination of relevant noise criteria:
  - EPA 1826 noise limits
  - Construction noise and vibration criteria
- Assessment of the operational noise from the Proposal
- Recommendations with respect to noise and vibration during the construction phase

On the basis of the assessed configuration, it considered that the 'Proposal' can operate without unreasonable acoustic impact on residential amenity.

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.

A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.		
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. 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 L_{A90} noise level if measured as an overall level or an L_{90} noise level when measured in octave or third-octave bands.		
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:		
	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. 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 is denoted as dB(A). Practically all noise is measured using the A filter.		
Reflection	Sound wave reflected from a solid object obscuring its path.		
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 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 of 1 pico watt.		
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 micro Pascals.		
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.		