

**Newstead Solar Farm  
Land: Captains Gully Road,  
Newstead, Victoria  
Acoustic Planning Report**

AC02

V1 | 13 May 2022

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Job number 276290-00




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# 1 Introduction

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Newstead 2021 Inc are seeking planning permit approval for the operation of a 3 MW Solar Farm with a 5MW/10MWhr Battery and Energy Storage System (BESS) located at Captains Gully Road, Newstead (the Subject Site) approximately 850m south of the Pyrenees Highway.

Arup Pty Ltd (Arup) has been instructed by Utilacor Pty Ltd, on behalf of Newstead 2021 Inc, to prepare a noise impact report as requested by the Responsible Authority suitable for achieving a Planning Permit. Arup has considered the following documents:

- *Solar Energy Facilities Design and Development Guideline*
- *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA publication 1826.4)*

A desktop assessment of the noise impact from the proposed development to adjacent noise sensitive receivers has been conducted. This assessment has been based on manufacturer's noise levels, Arup's noise database, and noise calculations and predictions.

Arup has previously completed an assessment of the Subject Site. This report incorporates:

- Changes to the site, including layout and proposed equipment.
- Changes to the noise policy that have occurred since the previous assessment.

Acoustic terminology used throughout this report is provided in Appendix A.

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## 2 Site Description

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### 2.1 Site Surroundings

The Subject Site comprises the property at Captains Gully Road, Newstead, which consists of the land parcel PC373222. The solar farm covers approximately 6.2 hectares and is bound by private property to the north, east, and south, and Captains Gully Road to the west (Figure 1). The site is located adjacent to Captains Gully Road and Clarke Lane. A site plan of the proposed facility is presented in Appendix B.

The Subject Site is zoned Farming Zone (FZ) and is bound by the following:

- **To the North** – Farming Zone (FZ) and Clarke Lane with additional Farming Zone (FZ) located to the north. The nearest identified residential property is located approximately 660 m from the Subject Site at 18 Captains Gully Road, Newstead.
- **To the East** – Farming Zone (FZ). The nearest identified residential property is located approximately 430 m from the Subject Site at 245 Clarke Lane, Newstead.
- **To the South** – Farming Zone (FZ). The nearest identified residential property is located approximately 1600 m from the Subject Site.
- **To the West** – Farming Zone (FZ), further Farming Zone (FZ) extends west.

A planning map of the area surrounding the Subject Site is presented in Appendix C.

The nearest residential receivers are located to the north and east. The layout of the site and the location nearby noise-sensitive receivers are shown in Figure 1.

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Figure 1: Location of subject site and surrounding noise-sensitive residential receivers.

## 2.2 Site Description

A 3 MW solar farm with a 5MW/10MWhr Battery Energy Storage System (BESS) is proposed to be installed at the Subject Site. Equipment specification for the plant is presented in Appendix D. The Subject Site is approximately 6.2 hectares.

The solar farm consists of:

- Approximately 5000 PV modules, mounted across approximately 55 motorised trackers.
- 4.95MVA containerised Power Conversion System (PCS) comprising 2 x 2475kVA inverters and 1 x 4.95MVA transformer.
- 5MW/10MWhr Battery Energy Storage System (BESS) comprised of 4 x 2752 kWh containerised battery units.
- Various cables to supply electricity to the grid.
- Other ancillary infrastructure

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## 2.3 Operations

The Subject Site is proposed to operate during any period of the day, evening, or night. As such, compliance will be assessed for the most noise sensitive time-period.

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## 3 Noise Criteria

### 3.1 Noise Legislation & Regulation

On July 1, 2021, the new environmental protection (EP) legislation, the *Environment Protection Act 2017* (the Act) as amended by the *Environment Protection Amendment Act 2018*, was commenced. This new Act has superseded the previous *Environment Protection Act 1970*.

The centrepiece of the new EP legislation is the general environmental duty (GED). The GED requires Victorians to understand and reduce the risk of harm to human health and the environment from pollution and waste (including noise) resulting from their actions. Duty holders (in this instance, the Owner) need to comply with the general environmental duty (GED) under Section 25 of the *Environment Protection Act 2017* (the Act).

The Act introduces the concept of ‘unreasonable noise’, *Section 166 – Unreasonable noise*, to provide a legislative control for any noise emitted from a place or premises.

Part 5.3 – Noise of the *Environment Protection Regulations 2020* (the Regulations) prescribes situations which constitute ‘unreasonable noise’ from residential, commercial, industrial and trade premises, entertainment venues and outdoor entertainment events. The objective of the Regulations is to further the purpose of and give effect to the Act.

### 3.2 Criteria

The relevant noise criteria include:

- *Solar Energy Facilities Design and Development Guideline.*
- *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, EPA publication 1826.4. (The Noise Protocol)*

The *Solar Energy Facilities Design and Development Guideline* states that:

*“A facility should keep its noise impacts at or below the levels in EPA Victoria’s Noise from Industry in Regional Victoria guideline (NIRV).”*

NIRV has been superseded by the new EPA Regulations and Noise Protocol, however the method for calculating noise limits remains effectively unchanged. Compliance with the new Regulations is consistent with NIRV compliance.

#### 3.2.1 Rural Area Method

Outside of metropolitan and Major Urban Areas, noise emissions from commercial, industrial and trade (CIT) premises are governed by the Regulations, and noise limits are to be calculated using the ‘rural method’. The Regulations supersede the *Noise from Industry in Regional Victoria (NIRV)* Publication 1411.

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Both the Subject Site and the nearest residential property are located outside any metropolitan or Major Urban Area. As such, the project is assessed in accordance with the rural method.

Applicable time periods from the Noise Regulations are presented in Table 1.

Table 1: Operating time periods

Period	Day of week	Time period
Day	Monday – Saturday	0700-1800hrs
Evening	Monday – Saturday	1800-2200hrs
	Sunday, Public Holidays	0700-2200hrs
Night	Monday – Sunday	2200-0700hrs

### 3.3 Project Noise Criteria

The first step in the rural method of the Noise Protocol is to determine the zoning levels of the Subject Site and the surrounding noise sensitive receivers. The following zoning has been identified:

- Farming Zone (FZ)

The land is not required to be re-zoned as part of the planning process, with the majority of solar farms in Victoria being located on Farming Zoned land. The Planning Zone Map for the Subject Site is provided in Appendix C.

The operational noise limits determined at the most critical identified residential properties are presented in Table 2. Compliance with the more onerous night-time noise levels demonstrates compliance with the noise limits during other time periods. Compliance at the nearest sensitive receivers indicates compliance at all other receivers.

Table 2: Noise limits at most sensitive residential properties (dB re 20µPa).

Time Assessment Period	Address	Noise Limit, dBL <sub>Aeq</sub>
Day	245 Clarke Lane	46
	18 Captains Gully Road	
Evening	245 Clarke Lane	41
	18 Captains Gully Road	
Night	245 Clarke Lane	36
	18 Captains Gully Road	

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## 4 Noise Assessment

The following noise sources have been assessed:

- 1x Power Conversion Station inverters and transformers (Sungrow SG2475HV).
- 55x Tracking solar panel motors (NexTracker).
- 4x BESS containers (Sungrow ST2752UX).

Noise data was obtained from the manufacturer and supplemented by noise data from Arup's database. Appendix D presents the specification from the equipment suppliers. Noise from all equipment operating simultaneously has been considered.

The noise spectrum from Arup's database levels of transformers/inverters has been adjusted match the broadband noise level for the proposed equipment. The noise levels for the equipment are provided in Table 3.

Table 3: Noise levels of proposed solar farm plant.

Equipment	Leq dB(A)	Modelled Sound Power Level, dB re 1 pW Octave Band Centre Frequency, Hz						
		63	125	250	500	1k	2k	4k
4.95MVA Power Conversion System	90	86	90	94	88	84	80	72
Battery Energy Storage System container	83	79	75	82	81	76	75	70
Solar Panel tracking motor	49	37	40	42	45	45	44	39

### 4.1 Noise to nearest affected residential properties

Operational noise to the nearest affected residential properties has been considered in accordance with the Noise Policy. A 2 dB(A) penalty has been applied to the noise levels to account for any tonality present in the noise from the operation of the Subject Site.

Distance propagation formulae and atmospheric attenuation have been applied to predict noise levels at the nearest impacted residential properties. The predicted noise levels at the nearest affected residential receivers with the solar farm operating at full capacity are presented in Table 4.

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Table 4: Predicted noise levels at residential receivers.

Location	Noise limit, $L_{eq}$ dB(A)	Predicted noise level, $L_{eq}$ dB(A)	Complies?
245 Clarke Lane	36	30	✓
18 Captains Gully Road	36	26	✓

Arup's assessment demonstrates that operational noise from the Subject Site complies with the Noise Policy at the nearest affected residential properties, during the most noise sensitive time-period. As such, compliance is expected for other receivers and during other time-periods.

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## 5 Summary

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Arup has completed a desktop noise assessment to establish noise limits for noise emitted from the Subject Site. Noise limits have been determined through use of Noise Protocol Commercial Industrial and Trade rural assessment methodology.

Noise levels from Arup's database and noise levels supplied by the manufacturer have been used to assess noise from the Subject Site.

As the night-time represents the most noise-sensitive period, demonstrating compliance with the night-time noise limits demonstrates compliance with other time periods. The proposed operation of the solar farm at the Subject Site is predicted to comply with the night-time noise limits at the nearest residential receivers. Compliance at the nearest residential receivers demonstrates compliance at other receivers.

The proposed operation of the Subject Site is predicted to comply with noise limits proposed as part of the permit approval process.

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## Appendix A

### Acoustic Glossary

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## Ambient Noise Level

The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, birds, people talking and other nearby fans on other buildings.

## Background Noise Level

The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.

## Decibel

The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore a logarithmic scale, the decibel (dB) scale, is used to describe sound levels.

An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.

## dB(A)

dB(A) denotes a single-number sound pressure level that includes a frequency weighting (“A-weighting”) to reflect the subjective loudness of the sound level.

The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).

Some typical dB(A) levels are shown below.

Sound Pressure Level dB(A)	Example
130	Human threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside nightclub

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Sound Pressure Level dB(A)	Example
90	Heavy trucks at 5 m
80	Kerbside of busy street
70	Loud stereo in living room
60	Office or restaurant with people present
50	Domestic fan heater at 1m
40	Living room (without TV, stereo, etc)
30	Background noise in a theatre
20	Remote rural area on still night
10	Acoustic laboratory test chamber
0	Threshold of hearing

## L<sub>90</sub>

The L<sub>90</sub> statistical level is often used as the “average minimum” or “background” level of a sound level that varies with time.

Mathematically, L<sub>90</sub> is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB L<sub>A90,15min</sub> is a sound level of 45 dB(A) or higher for 90% of the 15 minute measurement period.

## L<sub>eq</sub>

The ‘equivalent continuous sound level’, L<sub>eq</sub>, is used to describe the level of a time-varying sound or vibration measurement.

L<sub>eq</sub> is often used as the “average” level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dB(A) weighting is applied, the level is denoted dB L<sub>Aeq</sub>. Often the measurement duration is quoted, thus L<sub>Aeq,15 min</sub> represents the dB(A) weighted energy-average level of a 15 minute measurement.

## Frequency

Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as “pitch”. Sounds towards the lower end of the human hearing frequency range are perceived as “bass” or “low-pitched” and sounds with a higher frequency are perceived as “treble” or “high pitched”.

## Sound Power and Sound Pressure

The sound power level (L<sub>w</sub>) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L<sub>p</sub>) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a

source (analogous to its mass), which is not affected by the environment within which the source is located.

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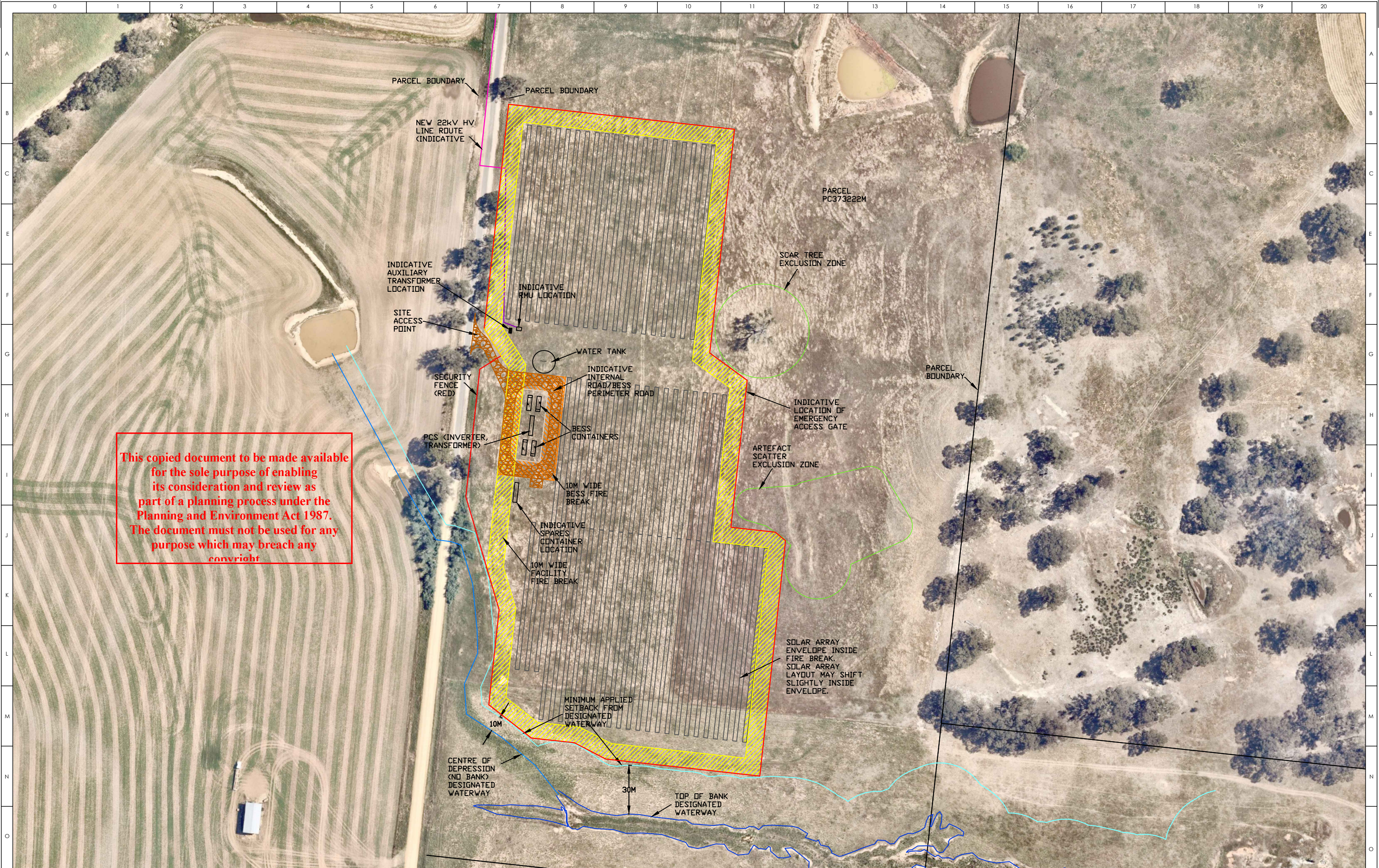
# Appendix B

## Site Plan

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NEWSTEAD  
VIC 3462**

PROJECT:  
**NEWSTEAD SOLAR FARM**  
TITLE:  
**SITE LAYOUT OVERVIEW**

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DATUM: 12/05/2022	SIZE: A3 Paper Size
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# Appendix C

## Planning Map

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# Planning Map

## Property

- Properties
- Parcel
- All Zones

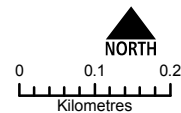
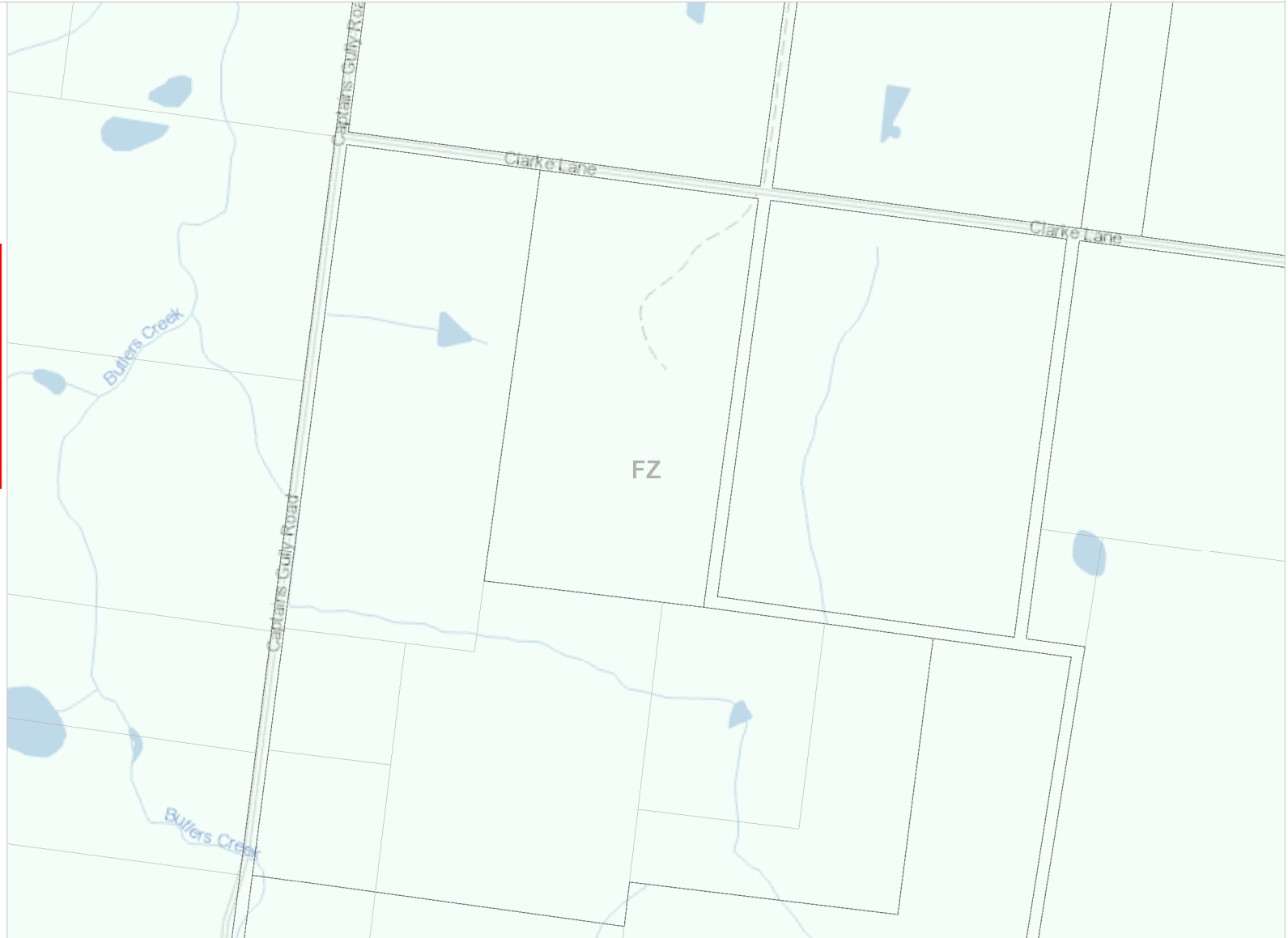
## Planning Scheme Zones

### Rural Zones

- FZ - Farming Zone

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## Appendix D

### Manufacturer Data

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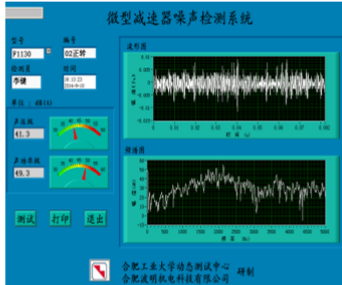
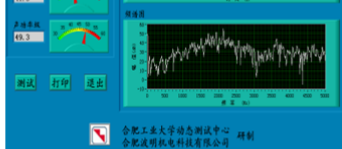
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## NEXTracker Motor Sound Test Summary

Each NEXTracker row uses a small 24V DC motor powered by a NEXTracker controller. To track the row, the motor runs for five to ten seconds every few minutes. The noise level of the motors is tested by the manufacturer. Test reports from the manufacturer show that the sound power level is ~50dB. The sound level produced is very low and essentially inaudible to surrounding site noises such as wind or generators.

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### Sound testing report

applying date: Sep, 10 <sup>th</sup> , 2014		report NO.: 2014091001			
Sample from	Reducer department	P/N	BL-65150-710/5	Applying department	Quality department
Sample	Motor reducer	NO.	02 (CW)	QTY	2Pcs
purpose	check the sound of motor reducer in no-load condition				
Testing environment	1. anechoic chamber inner size: 2850x2750x2100mm; 2. anechoic chamber LF cut-off frequency about 100Hz; 3. inside background noise during work: about 26dB(A)以下; 4. outside vibration transmission less than 5%; 5. motor reduce was under no-load condition when testing.				
level	Conform to standard GB/T3767-1996、ISO3744-1994				
oscilloscope					
spectrograph					
Testing result (away from sound source by 1 meter)	unit: db(A)				
Sound power level	49.30				

Manufacturer sound test report

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Inverse distance law for acoustics shows sound decrease with distance:

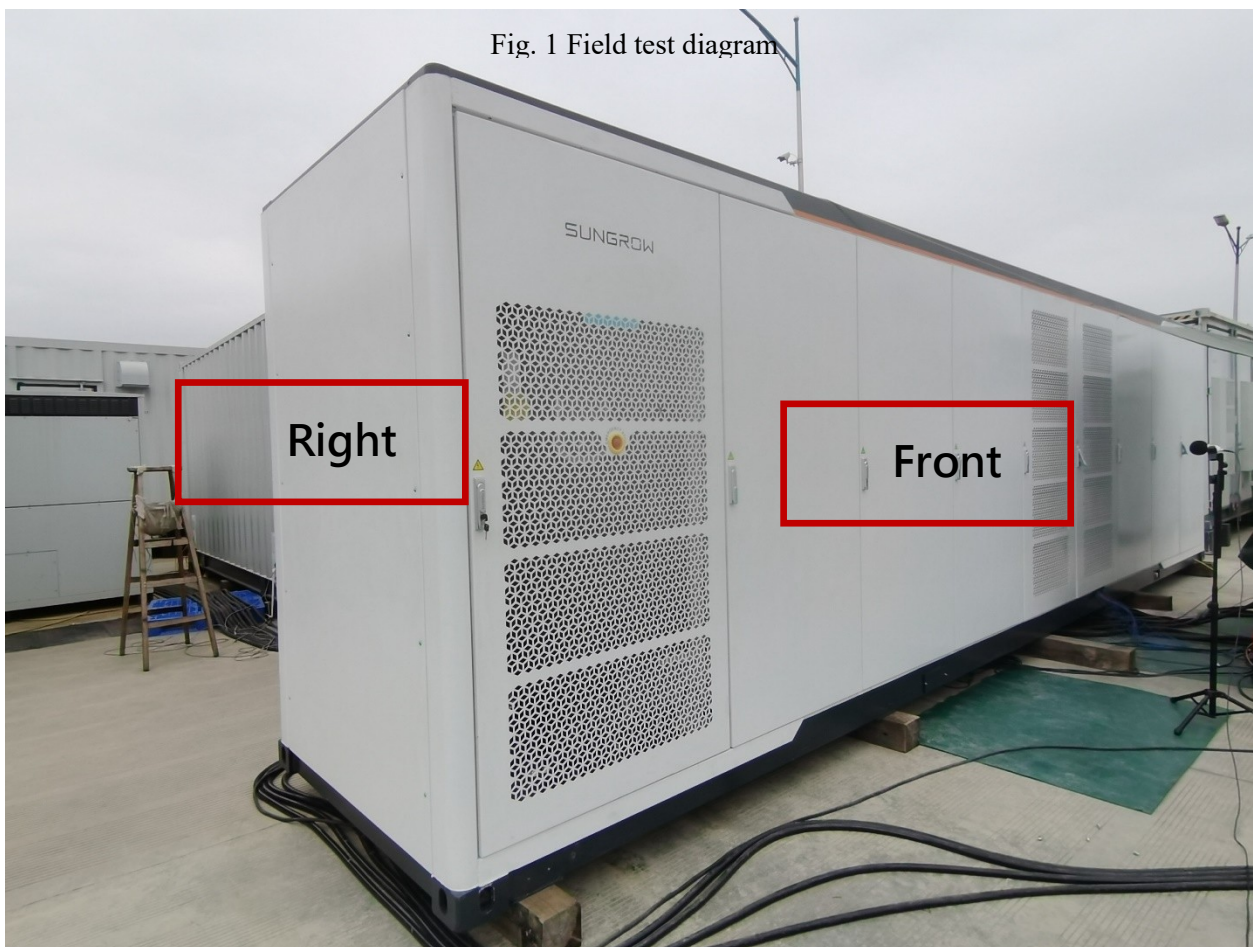
Distance	Sound Level	Equivalent sound
3 m (9.8 ft)	~ 40 dB	Library
30 (98 ft)	~20 dB	Rustling leaves
300 m (980 ft)	~0 dB	Inaudible

## Noise test report of liquid cooled CATL energy storage container

### Test information

Noise test of liquid-cooled CATL energy storage container, the test place is Sunshine Samsung Outdoor, and the test time is October 2021

March 13. The site is shown in Fig. 1, and the distribution and orientation definition of measuring points are shown in Fig. 2.



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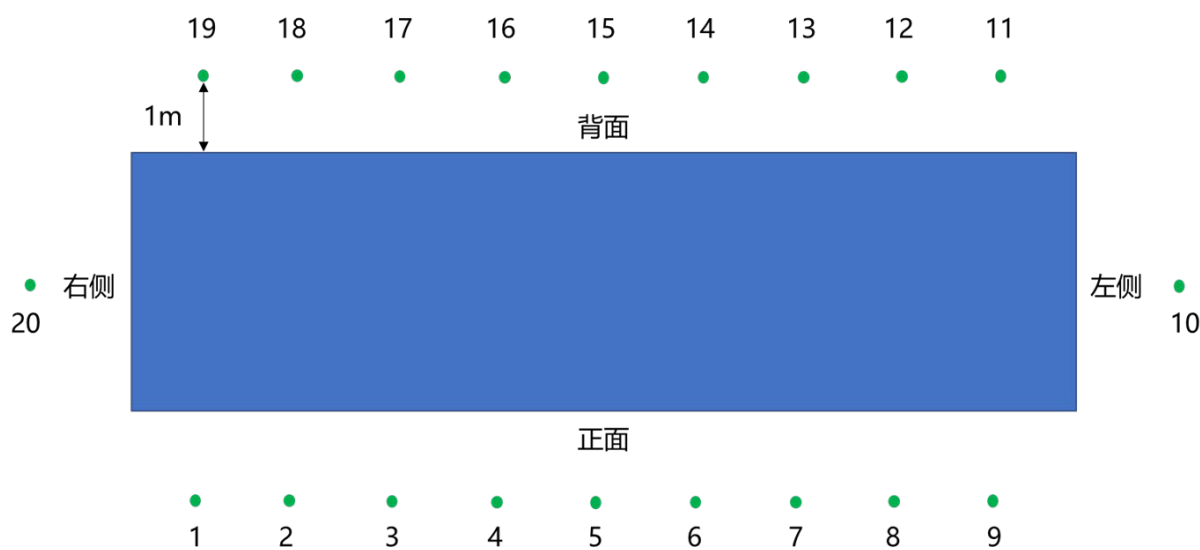


Fig. 2 Schematic diagram of measuring point distribution and azimuth definition

## 1. Test condition

### 1.1 Test information

- The whole machine runs at 100% power, reflecting the worst situation.
- Test the noise of each surface and record the 1/3 octave spectrum of each measuring point.

### 1.2 Test process

The noise at each measuring point as shown in Fig. 2 is tested separately, and the noise sensor is arranged at a position 1 m away from the wall of the whole machine and 1.5 m high.

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## 2. Data processing results and analysis

The background noise test results are as follows: the background noise is 48.43 dBA

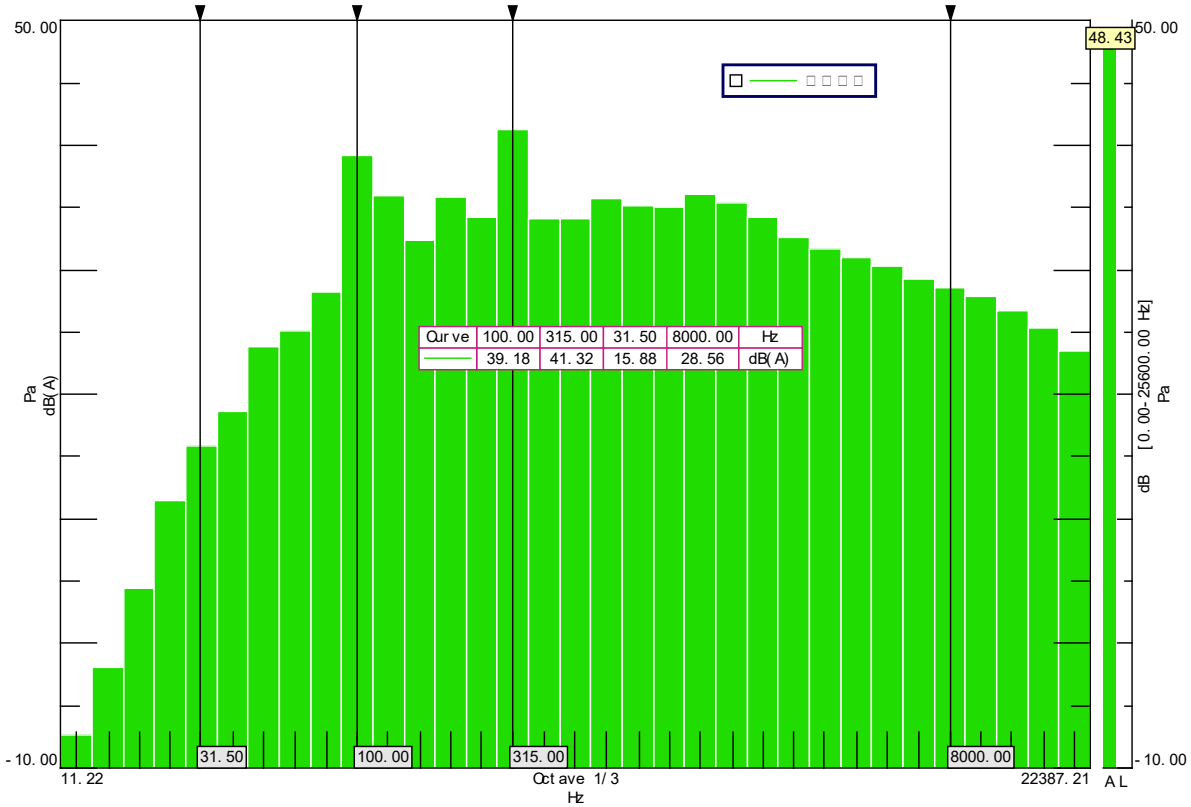
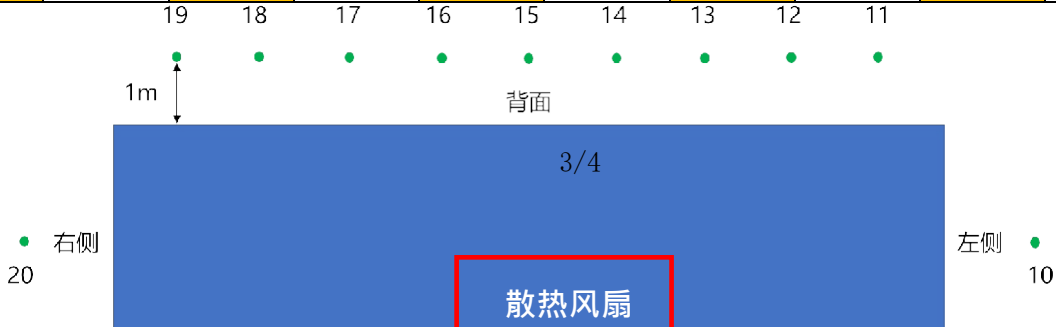


Fig. 3 Spectrum of background noise

The sound pressure level (dBA) test data of each measuring point are as follows. The noise of the measuring point is larger than the background noise by more than 10dBA, and no correction is needed:

Num	Noise	Num	Noise	Num	Noise	Num	Noise	Num	Noise
1	68.91	5	74.68	9	69.04	13	72.34	17	70.04
2	69.39	6	74.81	10	69.21	14	72.42	18	67.93
3	70.28	7	72.92	11	70.63	15	72.07	19	67.88
4	71.9	8	71.1	12	70.44	16	71.96	20	62.66



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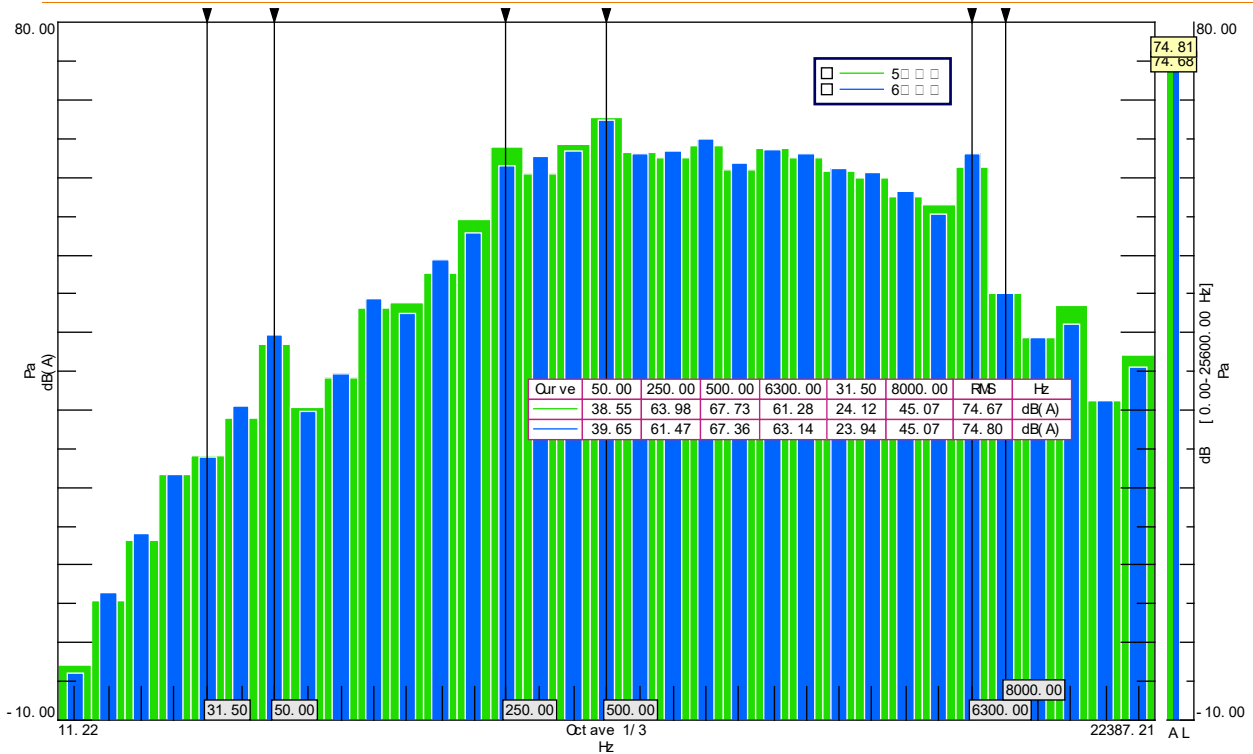


Fig.4 1/3 Octave Spectrum of Maximum Noise Position (No.5 and No.6 measuring points)

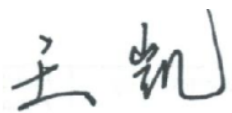
According to the noise data of all measuring points, the main noise source is the cooling fan of battery module, and the maximum noise is located at No.5 and No.6 measuring points, which are **74.68 dBA** and **74.81 dBA** respectively.

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# Noise Test Report

## TYPE TEST SHEET

<b>This Type Test sheet shall be used to record the results of the type testing of Generating Unit</b>			
Type Tested reference number		SG2475HV	
<b>Generating Unit</b> technology		Grid-connected PV Inverter	
System supplier name		Sungrow Power Supply Co., Ltd.	
Address		No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China	
Tel	+86 551 65327834	Fax	+86 551 6532 7800
E:mail	<a href="mailto:info@sungrow.cn">info@sungrow.cn</a>	Web site	<a href="http://www.sungrowpower.com">www.sungrowpower.com</a>
Maximum export capacity, use separate sheet if more than one connection option.	N/A	kW single phase, single, split or three phase system	
	2475	kW three phase	
	N/A	kW two phases in three phase system	
	N/A	kW two phases split phase system	
Compiled by		On behalf of	Sungrow Power Supply Co., Ltd.
		Test Date	2020-05-08
<p>Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.</p> <p>Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.</p>			

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The aim of this test is to determine the noise level when the PV Grid inverter in rated working condition

Used settings of the measurement device for Noise measurement

Measurement device	Date of measurement
AWA6228	2018-11-30

The conditions during testing are specified below:

PGU operation mode	Rated Working Condition
Voltage range	800-1500V
Grid frequency range	50Hz/ 45-55Hz
Distance	1m
Date	2020-05-08

The system noise level please check the table below.

Orientation	Noise (dB)
Front	77.2
Behind	78.9
Sidepiece	73.4
Average Noise	76.5

Additional comments

N/A

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