# Finley Solar Farm

Noise Impact Assessment

Prepared for RPS Group



Noise and Vibration Analysis and Solutions

Global Acoustics Pty Ltd PO Box 3115 | Thornton NSW 2322 Telephone +61 2 4966 4333 Email global@globalacoustics.com.au ABN 94 094 985 734

## **Finley Solar Farm**

#### Noise Impact Assessment

Reference: 17261\_R01 Report date: 16 August 2017

#### **Prepared for**

RPS Group 241 Denison Street Broadmeadow NSW 2292

#### Prepared by

Global Acoustics Pty Ltd PO Box 3115 Thornton NSW 2322

kyas barris

Prepared: Ryan Bruniges Scientist (Acoustics)

Wee

QA Review: Jeremy Welbourne Civil Engineer(Acoustics)

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

## Table of Contents

1 INTRODUCTION	1
1.1 Background	1
1.2 Site Details	1
1.3 Development Description	1
1.4 Terminology & Abbreviations	5
2 CRITERIA	6
2.1 Construction Noise Criteria	6
2.2 Operational Noise Criteria	7
2.3 Project Specific Noise Levels	8
2.4 Road Traffic Noise	
3 METHODOLOGY	9
3.1 Noise Sensitive Receptors	9
3.2 Meteorology	9
3.3 Construction Noise Sources	9
3.4 Operational Noise Sources	
3.5 Road Traffic Noise	
3.6 Sound Power Levels	
4 RESULTS	
4.1 Construction Noise	
4.2 Operational Noise	14
4.3 Road Traffic Noise	
4.3.1 Riverina Highway	
4.3.2 Canalla Road	
5 DISCUSSION	
5.1 Construction Noise Impacts	16
5.2 Construction Noise Management Plan	
5.3 Operational Noise Impacts	

6 CONCLUSION	18

## 1 INTRODUCTION

### 1.1 Background

Global Acoustics was engaged by the RPS Group to undertake a noise assessment for the proposed Finley Solar Farm (the Project). This assessment considers noise impacts from the construction and operational stages of the development.

The primary purpose of this assessment is to determine potential noise impacts at the nearest residential receptors to the site, as per the Secretary's Environmental Assessment Requirements (SEARs). The SEARs requires that the Environmental Impact Statement (EIS) addresses the issue of noise, 'including an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and operational noise impacts in accordance with the NSW Industrial Noise Policy (INP). A draft noise management plan is also required if the assessment shows construction noise is likely to exceed applicable criteria.

This assessment is based on plans and information provided by RPS Group and the applicant.

#### 1.2 Site Details

The location for the proposed development is approximately 6 km west of Finley in the Berrigan Local Government Area (LGA). The Project area is bounded to the north and south by Broockmans and Broughans Road respectively. The nearest major road is the Riverina Highway located approximately 1.5 km to the north.

Access to the site during the construction and operational phases is expected to be from the Riverina Highway via Canalla Road as shown in Figure 1.

### 1.3 Development Description

The proposed development is a solar photovoltaic plant capable of generating up to 170 MW of renewable energy. The solar farm will comprise up to 500,000 solar photovoltaic modules (PV modules) and associated infrastructure.

The development will operate Monday to Saturday during daylight hours and will be staffed by up to 3 people.

The Project layout and nearby noise sensitive receivers are shown in Figure 2 and Figure 3.



**Figure 1: Proposed Project Location and Access** 

Global Acoustics Pty Ltd | PO Box 3115 | Thornton NSW 2322 Telephone +61 2 4966 4333 | Email global@globalacoustics.com.au ABN 94 094 985 734



Figure 2: Proposed Project Layout

Global Acoustics Pty Ltd | PO Box 3115 | Thornton NSW 2322 Telephone +61 2 4966 4333 | Email global@globalacoustics.com.au ABN 94 094 985 734



Figure 3: Site Map and Nearby Noise Sensitive Receptors

Global Acoustics Pty Ltd | PO Box 3115 | Thornton NSW 2322 Telephone +61 2 4966 4333 | Email global@globalacoustics.com.au ABN 94 094 985 734

### 1.4 Terminology & Abbreviations

Some definitions of terminology and abbreviations, which may be used in this report, are provided in Table 1.1.

#### Table 1.1: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition		
LA	The A-weighted root mean squared (RMS) noise level at any instant		
L <sub>A10</sub>	The noise level which is exceeded for 10 percent of the time, which is approximately the average of the maximum noise levels		
L <sub>A90</sub>	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The $L_{A90}$ level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes.		
L <sub>Aeq</sub>	The average noise energy during a measurement period		
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to describe human response to noise.		
LW	Sound power level, 10 times the logarithm of energy radiated from a source (as noise) divided by a reference power, the reference power being 1 picowatt		
SPL	Sound pressure level (SPL), fluctuations in pressure measured as 10 times a logarithmic scale, the reference pressure being 20 micropascals		
ABL	Assessment background level (ABL), the 10 <sup>th</sup> percentile background noise level for a single period (day, evening or night) of a 24 hour monitoring period		
RBL	Rating background level (RBL), the background noise level for a period (day, evening or night) determined from ABL data		
Day	This is the period 7.00 am to 6.00 pm		
Evening	This is the period 6.00 pm to 10.00 pm		
Night	The period 10.00 pm to 7.00 am		

## 2 CRITERIA

### 2.1 Construction Noise Criteria

The EPA 'Interim Construction Noise Guideline' (July, 2009) specifically relates to construction, maintenance and renewal activities.

The guideline specifies standard construction hours as:

- Monday to Friday, 7.00 am to 6.00 pm;
- Saturday, 8:00 am to 1:00 pm; and
- No construction work on Sunday and public holidays.

There are no specific criteria applicable to a qualitative assessment and calculation of construction related noise levels is not required. Instead, a check list should be completed which considers (but is not limited to) work practices, community consultation, alternative plant and equipment, on-site considerations, work scheduling and barriers. Qualitative assessment can be undertaken for short term construction projects, defined in the ICNG as those with duration of up to three weeks.

For major construction projects, a quantitative assessment is required, with comparison to relevant criteria. With a proposed construction timeline of approximately 9 months this project would be considered a major construction project. The criteria for work undertaken in the standard construction hours are:

- Noise affected management level LAeq,15minute equal to background plus 10 dB; or
- Highly noise affected management level LAeq,15minute 75 dB.

An LAeq criterion of background plus 5 dB is specified for work outside the standard construction hours.

On this basis, a noise affected management level of 40 dB and a highly noise affected management level of 75 dB will be used for construction work undertaken during standard construction hours.

### 2.2 Operational Noise Criteria

The Environment Protection Authority (EPA) NSW Industrial Noise Policy (INP) was published in 2000. The INP states that objectives for environmental noise are 'to account for intrusive noise and ... to protect the amenity of particular land uses'. To achieve these objectives, limits are specified where the 'intrusiveness criterion essentially means that the equivalent continuous (energy-average) noise level of the source should not be more than 5 decibels (dB) above the measured background level'. Amenity is protected by 'noise criteria specific to land use and associated activities'.

Applicable intrusiveness and amenity limits are derived independently. These are then compared to determine project specific noise levels (PSNL).

The intrusiveness criterion is expressed as:

 $L_{Aeq,15minute} \le RBL + 5$ 

where the  $L_{Aeq,15minute}$  is the  $L_{Aeq}$  noise level from the source, measured over 15 minutes and RBL is the rating background level. Where the RBL is less that  $L_{A90}$  30 dB, a value of  $L_{A90}$  30 dB can be adopted.

RBL noise levels are determined for day, evening and night periods.

An amenity criterion caps industrial noise levels. The subject site is characterised as "rural" in accordance with definitions in the INP. Recommended amenity limits from the INP for residences in a rural area are shown in Table 2.1. It should be noted that these criteria apply for the energy average noise level over the entire period.

#### Table 2.1: STANDARD RURAL AMENITY CRITERIA FROM NSW INP

Period	Acceptable L <sub>Aeq</sub> dB	Maximum L <sub>Aeq</sub> dB
Day (7:00 am to 6:00pm)	50	55
Evening (6:00 pm to 10:00 pm)	45	50
Night (10:00 pm to 7:00 am)	40	45

Notes:

1. Day: 7.00 am to 6.00 pm ~ Evening: 6.00 pm to 10.00 pm ~ Night: 10.00 pm to 7.00 am.

### 2.3 Project Specific Noise Levels

Table 2.2 summarises intrusiveness and amenity criteria that apply for day, evening and night periods. The lower of the two (intrusiveness or amenity) applies, where applicable, and is adopted as the project specific noise level (PSNL).

Background noise monitoring was not undertaken as part of this assessment. It has been assumed that background levels may be less than  $L_{A90}$  30 dB during all time periods, which is typical of a rural environment. In accordance with the INP, where background levels are less than 30 dB, a default minimum RBL of 30 dB is adopted.

Period <sup>1</sup>	RBL <sup>2</sup>	Intrusiveness Criterion L <sub>Aeq</sub> dB	Acceptable Amenity Criterion L <sub>Aeq</sub> dB	Project Specific Noise Level L <sub>Aeq</sub> dB
Day	30	35	50	35
Evening	30	35	45	35
Night	30	35	40	35

#### Table 2.2: DETERMINATION OF PROJECT SPECIFIC NOISE LEVELS BASED ON NSW INP

Notes:

1. Day: 7:00 am 6:00 pm ~ Evening: 6:00 pm to 10:00 pm ~ Night: 10:00pm to 7:00 am; and

2. An RBL of 30 dB has been assumed for a rural environment.

### 2.4 Road Traffic Noise

In 2011 the NSW state government department responsible for the environment (the then Department of Environment, Climate Change and Water) released the '*NSW Road Noise Policy*' (RNP). The RNP outlines traffic noise criteria applicable to this project. The policy applies different noise limits dependent upon the road category and type of project/ land use. These criteria are detailed in Table 2.3.

#### Table 2.3: NSW GOVERNMENT TRAFFIC NOISE CRITERIA

Road Category	Type of Project/Land use	Day	Night
Freeway/arterial/sub- arterial	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	L <sub>Aeq′</sub> (15 hour) 60 (external)	L <sub>Aeq′</sub> (9 hour) 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L <sub>Aeq'</sub> (1 hour) 55 (external)	L <sub>Aeq′</sub> (1 hour) 50 (external)

## 3 METHODOLOGY

Acoustic modelling for road traffic, construction and operational noise sources was undertaken using CadnaA, noise prediction software developed by DataKustic. Modelling considers the height and location of each source and receiver and takes into account meteorological effects, ground type, air absorption and barrier effects. No topographical information was available and the site has conservatively been modelled as being flat.

Road traffic noise predictions were undertaken in CadnaA in accordance with Calculation of Road Traffic Noise (CRTN) methodology development by the UK Department of Transport.

#### 3.1 Noise Sensitive Receptors

Sixteen Noise Sensitive Receptors (NSR) (R1-16) were assessed for operational and construction noise impact. The NSR locations were outlined in the preliminary environmental assessment and are shown in Figure 3. These NSR have been selected because they are the nearest to the noise generating activities and equipment on site during the construction and operational stages of the Project.

Of these receptors R3, R4 and R5 are the nearest to the Riverina Highway and Canalla Road and will be considered for road traffic noise impacts. These receptors are located over 350 metres from the Riverina Highway and more than 650 metres from Canalla Road.

### 3.2 Meteorology

Meteorological effects were calculated using the CONCAWE calculation methodology within the CadnaA software.

The applicant has advised that construction and operational activities will occur during daylight hours only. Temperature inversion conditions have not been considered.

Neutral day-time conditions have been assessed for all noise models. A worst-case scenario for operational and construction noise has also been assessed, which considers source to receiver gradient wind speeds of 3 m/s, in accordance with the INP.

### 3.3 Construction Noise Sources

The construction period for the Project is expected to take approximately 9 months in total. The construction timeline is expected to include approximately 4 months of piling and installation of the mounting structures and approximately 9 months of installation of the PV modules and inverter assemblies. Noise sources included in the construction noise model include:

• Piling drill rig;

- Franna crane;
- Trencher;
- Loader;
- Generator;
- Forklift; and
- Power hand tools.

Construction noise has been assessed assuming that one of each plant item listed above is operating concurrently with the sound power and acoustic usage data listed in Table 3.1. Modelling was undertaken with construction occurring at each of the 4 corners of the development, with the highest result for each NSR presented. These results are likely to represent a worst-case construction impact for the majority of the construction work.

Site clearing and preparation works will also be required during the development and will include a bulldozer, excavator, grader and mulcher. The applicant has advised that clearing works will be relatively short in duration compared to other construction activities and will occur intermittently throughout the construction phase. As these activities are unlikely to cause ongoing nuisance for residents they have not be specifically assessed.

Light and heavy vehicles accessing the site during the construction phase have been considered in the road traffic noise assessment.

#### 3.4 Operational Noise Sources

The proposed development is a solar photovoltaic plant capable of generating up to 170 MW of renewable energy. The solar farm will comprise up to 500,000 solar photovoltaic modules (PV modules). The solar panels will be fixed to a horizontal mounting structure which slowly track the movement of the sun. The PV modules are set out in regular arrays connected by cabling to centrally located inverters enclosed in modified shipping containers. An office workshop and substation, that houses the main step-up transformer will be located to the north of site.

Based on information available to date, the applicant has advised that the main operational noise generating activities on site will include:

- Approximately 5,600 NexTrack motors that allow the solar panels on the horizontal mounting structure to track the sun across the sky. These motors will be evenly spread across the arrays of PV modules;
- 46 central inverters that are located in containers at the end of each block of PV modules; and

• The main step-up transformer in the switchyard.

Each of the sources described above will operate continuously during daylight hours only.

The exact location and orientation of inverters is expected to be finalised on site but the units will be centrally located in rows, with the nearest units approximately 600 metres from the nearest NSR. Noise from the inverter units will receive significant shielding from the arrays of PV modules and other inverters. Inverters have been modelled with 5 dB attenuation which is a typical assessment based on removal of line of site. The inverters at the end of each row have conservatively been modelled with no attenuation. In reality these inverters will likely have some shielding to some NSR.

NexTrack units have been modelled assuming no shielding.

The applicant has advised that the development will operate Monday to Saturday during daylight hours and will be staffed by up to 3 people who will undertake general operation and maintenance activities. Any traffic movements and general maintenance activities are unlikely to be noticed by surrounding residents and have not been included in this assessment.

#### 3.5 Road Traffic Noise

Road traffic data for this assessment was sourced from the traffic impact assessment for the development, prepared by Pavey Consulting Services.

Traffic generated by the development is expected to access the site via the Riverina Highway and Canalla Road. Canalla road is a local dirt road with low existing traffic volumes. The Riverina Highway is an arterial road estimated to have an Annual Average Daily Traffic (AADT) of 1,780 with 19% heavy vehicles in 2017.

The average traffic generation, during the peak of the construction phase, is predicted to be up to 82 movements per day (including arrivals and departures). These movements will be primarily heavy vehicles delivering materials and equipment, but also include light vehicle movements for construction workers.

The proposed development is expected to generate relatively low ongoing traffic movements during the operational phase of the Project. The average operational traffic movements are expected to be up to 28 movements per week or 4 movements per day (including arrivals and departures). The noise impact of operational traffic is expected to be minor in comparison to construction traffic and has not been included in this assessment.

#### 3.6 Sound Power Levels

Sound power data for noise sources and estimated acoustic usage factor were provided by the applicant (sourced from equipment suppliers). Sound power totals used in the noise models are shown in Table 3.1.

Plant Item	L <sub>WA</sub>	Acoustic Usage Factor (%)			
	<b>Operational Sources</b>				
NexTracker (each)	58	100			
SC2200 Inverter (each)	94	100			
Transformer	75	100			
	Construction Sources				
Piling Drill Rig	105	20			
Franna Crane	107	16			
Trencher	97	40			
Loader	107	40			
Generator	73	50			
Power Hand Tools	95	50			

#### Table 3.1: SOUND POWER DATA FOR OPERATIONAL AND CONSTRUCTION SOURCES dB

No 1/3 octave sound power data was available at the time of this assessment for SC2200 Inverters. Electrical noise sources such as inverters often exhibit tonal characteristics. As these inverters are container mounted with fan systems it is expected that any tonality, if present, will be masked by fan noise. Inverters have been assumed to not be tonal in accordance with the INP for the purpose of this assessment.

The INP considers noise to be tonal when the level of one-third octave band exceeds the level of the adjacent bands on both sides by;

- 5 dB or more if the centre frequency of the band containing the tone is is above 400Hz;
- 8 dB or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive; or
- 15 dB or more if the centre frequency band containing the tone is below 160 Hz.

## 4 RESULTS

### 4.1 Construction Noise

Operational noise results are shown in Table 4.2.

Table 4.1:	CONSTRU	ICTION	NOISE,	LApor 15	minute G	ĺΒ
			,	-Aeu.IJ	mmule ~	

Location	Construction Noise Limit (Noise affected)	Model Predictions – Neutral Conditions	Model Predictions – Enhancing Conditions	Exceedance Neutral/Enhancing
R1	40	47	51	7/11
R2	40	26	31	Nil/Nil
R3	40	26	31	Nil/Nil
R4	40	30	35	Nil/Nil
R5	40	24	29	Nil/Nil
R6	40	22	27	Nil/Nil
R7	40	28	33	Nil/Nil
R8	40	23	28	Nil/Nil
R9	40	39	44	Nil/ <mark>4</mark>
R10	40	33	38	Nil/Nil
R11	40	38	43	Nil/ <mark>3</mark>
R12	40	58	59	18/19
R13	40	39	44	Nil/ <mark>4</mark>
R14	40	<20	<20	Nil/Nil
R15	40	<20	<20	Nil/Nil
R16	40	<20	<20	Nil/Nil

Notes:

1. Bold results in red indicate an exceedance (if applicable); and

2. Enhancing conditions include 3m/s source to receiver gradient wind.

Exceedances of up to 19 dB of the noise affected construction limit are predicted. No exceedances of the highly affected noise limit of 75 dB are predicted. These results represent the predicted worst-case impact that will occur when construction near the site boundaries is taking place.

### 4.2 Operational Noise

Operational noise results are shown in Table 4.2.

#### Table 4.2: OPERATIONAL NOISE, LAeq,15 minute dB

Location	PSNL (Day/Evening/Night)	Model Predictions – Neutral Conditions	Model Predictions – Enhancing Conditions	Exceedance Neutral/Enhancing
R1	35	31	35	Nil/Nil
R2	35	<20	<20	Nil/Nil
R3	35	22	27	Nil/Nil
R4	35	22	27	Nil/Nil
R5	35	<20	20	Nil/Nil
R6	35	<20	<20	Nil/Nil
R7	35	20	25	Nil/Nil
R8	35	<20	<20	Nil/Nil
R9	35	24	29	Nil/Nil
R10	35	24	28	Nil/Nil
R11	35	25	30	Nil/Nil
R12	35	30	35	Nil/Nil
R13	35	28	33	Nil/Nil
R14	35	<20	<20	Nil/Nil
R15	35	<20	<20	Nil/Nil
R16	35	<20	<20	Nil/Nil

Notes:

1. Bold results in red indicate an exceedance (if applicable); and

2. Enhancing conditions include 3m/s source to receiver gradient wind.

No exceedances of adopted PSNL are predicted for operational noise.

### 4.3 Road Traffic Noise

#### 4.3.1 Riverina Highway

The Riverina Highway is estimated to have an Annual Average Daily Traffic (AADT) of 1,780 with 19% (338) heavy vehicles in 2017. The proposed development is predicted to have an average of 82 movements per day during the peak of the construction period. For the purpose of this assessment all construction movements will be assumed to be heavy vehicles, however the estimated count also includes light vehicles for construction staff.

82 movements per day would represent a 20% increase in heavy vehicles on the Riverina Highway and less than 1 dB increase in existing road traffic noise. A 1 dB increase is considered insignificant and would not be perceptible to the human ear.

#### 4.3.2 Canalla Road

Traffic noise impacts from heavy vehicles on Canalla Road have been estimated at R3, R4 and R5. Given 82 heavy vehicle movements per day are predicted, the noise impact for up to 50 movements during a worst case hour have been considered. Results are shown in Table 4.3.

#### Table 4.3: NOISE FROM ROAD TRAFFIC GENERATED BY THE DEVELOPMENT – CANALLA ROAD LAeg, Ihour dB

Location	Traffic Noise Criteria (Day/Night)	Heavy Vehicle Movements (worst-case hour)	Road traffic Noise Prediction	Exceedance
R3	55/50	50	<35	Nil/Nil
R4	55/50	50	<35	Nil/Nil
R5	55/50	50	<35	Nil/Nil

Notes:

1. Bold results in red indicate an exceedance (if applicable).

No exceedances of road traffic noise criteria are predicted for traffic generated by the development.

## 5 DISCUSSION

### 5.1 Construction Noise Impacts

Construction noise levels are predicted to exceed the noise affected construction limit at five receptors when construction activities are being undertaken near the closest site boundary. Construction noise levels are expected to remain in compliance with the highly noise affected construction limit at all locations.

These construction noise levels should be considered typical worst-case that will occur only when construction is being undertaken near the site boundaries.

Site clearing activities have not been specifically included in this assessment as the applicant has advised they will be relatively short in duration and sporadic across the construction period. However, consideration should be given to these activities if they are likely to occur near the site boundaries. Particular consideration should be given to strategically locating mulchers or tub grinders away from NSR, and avoiding use near the site boundary.

### 5.2 Construction Noise Management Plan

As detailed in the SEAR's, given that construction noise levels are predicted to exceed the relevant limits at certain receptors it is recommended that a construction noise management plan (CNMP) be developed for the site.

The objectives of the CNMP will be to:

- ensure that construction noise from the Project is minimised;
- maintain compliance with conditions of the project approval and legislation relating to noise;
- provide a protocol for monitoring and assessing construction noise impacts on surrounding private receptors; and
- ensure effective communication with the local community and regulators regarding construction of the proposed Project.

General mitigation measures for the construction period such as working within specified hours, maintaining equipment in good working order and minimising noise should be included where possible.

Operational noise impacts are predicted to comply with PSNL at all NSR. During worst-case source to receiver gradient wind conditions noise levels are predicted to be at the PSNL for NSR R1 and R12. These results represent the upper limit of predicted noise levels under strongly enhancing gradient wind conditions. Noise levels during less enhancing weather conditions would be lower than predicted in this assessment.

It is important to note that these results are primarily driven by noise from the modular inverters. Inverters have been modelled at a minimum distance of approximately 600 metres from the nearest NSR as shown in Figure 2. Detailed sound power data for the inverters was not available at the time of this assessment. It is noted that all sources in this assessment have been assumed not to be tonal in accordance with the INP definition. Electrical componentry such as inverters can exhibit tonal noise, however as these inverters are container mounted with fan systems it is expected that any tonality, if present, will be masked by fan noise. If the inverters selected are tonal, in accordance with the INP definition, further consideration would need to be given to the location of inverters or requirement for additional attenuation.

## 6 CONCLUSION

An operational, construction and road traffic noise impact has been undertaken for the proposed Finley Solar Farm, located approximately 6 km west of Finley in the Berrigan Local Government Area (LGA).

Results in Section 4 show that:

- operational Noise impacts are predicted to comply with PSNL at all NSR;
- construction noise levels are predicted to exceed the noise affected construction limit at five receptors when construction activities are being undertaken near the site boundary. Construction noise levels are expected to remain in compliance with the highly noise affected construction limit at all locations; and
- noise from traffic generated by the development is predicted to comply with road traffic noise criteria.

#### **Global Acoustics Pty Ltd**