Project No: 201913R

Noise and Vibration Impact Assessment
Proposed Solar Farm
Caerleon, via Mudgee, NSW

Prepared for:
Mid Western Regional Council
86 Market Street,
Mudgee, NSW 2850

Author:

Ross Hodge
B.Sc.(Hons), MAAS
Principal / Director

Review:

Neil Pennington
B.Sc., B. Math.(Hons), MAAS
Principal / Director

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EXECUTIVE SUMMARY

Spectrum Acoustics has prepared this report on behalf of Mid Western Regional Council to prepare a noise and vibration impact assessment (NVIA) for the operation of the proposed solar farm (Facility) at 33 Blain Road, Caerleon, via Mudgee, NSW.

The objective of the NIA was to assess the potential noise and vibration impacts associated with construction, operation and transport activity associated with the Facility.

Noise criteria were established in accordance with procedures in the “Noise Policy for Industry”, “Interim Construction Noise Guideline” and “Assessing Vibration: a technical guideline”.

Noise levels associated with the construction and operation of the Facility were theoretically determined by noise modelling using ENM noise modelling software for applicable atmospheric conditions.

Operational noise levels due to emissions from the Facility were predicted to comply with the project noise trigger levels at all receivers. No specific noise control measures were considered to be required.

Noise levels associated with the construction of the Facility were found to comply with the construction noise management levels at all receivers. No specific noise mitigation measures for construction noise were considered to be required.

The predicted vibration levels associated with the construction of the Facility were found to comply with the adopted human comfort criteria and be significantly lower than any building damage criteria.

1.0 - INTRODUCTION

This report presents the results, findings and recommendations arising from a noise and vibration impact assessment (NVIA) of the operation of a solar farm at 33 Blain Road, Caerleon, via Mudgee, NSW as shown, indicatively, in **Figure 1**.

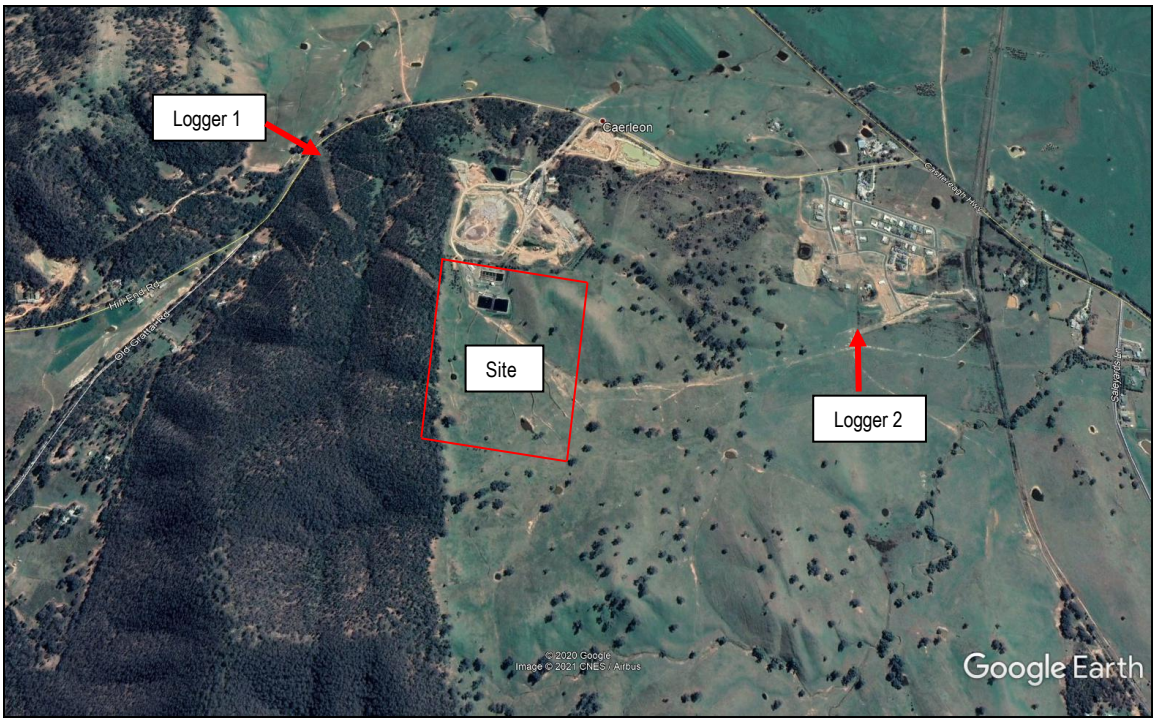


Figure 1 – Indicative Site Location

The proposed solar farm is to be located to the south of the existing Mudgee Waste Facility (MWF) and Sewage Treatment Works (STP). There are isolated residential receivers to the north and west and a residential subdivision, currently being developed, approximately 1km away to the east.

The proposal is to construct and operate a solar photovoltaic (PV) plant with associated infrastructure. The PV panels will be installed on trackers in a series of arrays which will cover approximately 8.6 hectares.

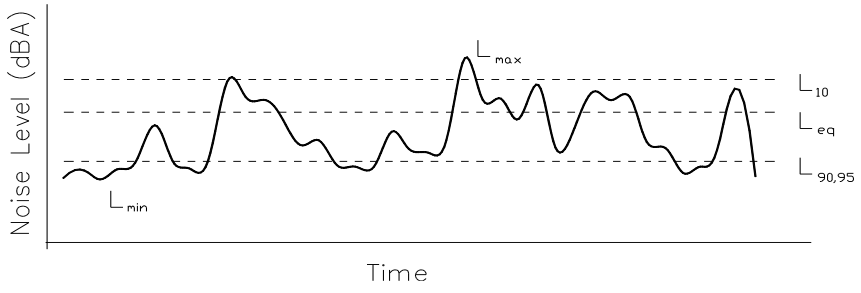
The site is on land that was previously used for agricultural purposes but is currently unused. It is well cleared and has no significant vegetation.

2.0 - TERMS AND DEFINITIONS

Table 1 contains the definitions of commonly used acoustical terms and is presented as an aid to understanding this report.

TABLE 1
DEFINITION OF ACOUSTICAL TERMS

Term	Definition
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL or Lp	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
SWL or Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L10	Average Maximum Noise Level - the level exceeded for 10% of the monitoring period.
L90	Average Minimum Noise Level - the level exceeded for 90% of the monitoring period and recognised as the Background Noise Level. In this instance, the L90 percentile level is representative of the noise level generated by the surrounds of the residential area.
RBL	Rating Background Level (RBL) + 5dB. RBL is the median value of each ABL (Assessment Background Level) over the entire monitoring period. The ABL is a single figure representing the "L_{90} of the $L_{90's}$" for each separate day of the monitoring period.



3.0 – NOISE ASSESSMENT CRITERIA

3.1 Operational Noise

The approval and control of noise emissions from commercial and industrial premises in NSW is usually based on procedures and criteria detailed in the *Noise Policy for Industry* (NPfI).

The NPfI describes intrusive and amenity criteria applicable to potential impacts at residences as a result of industrial noise. These noise criteria depend on the existing background noise level at potentially affected residential receiver areas.

To quantify the existing acoustic environment of the area unattended noise logging was undertaken between 28th October and 3rd November, 2020.

Two noise loggers were programmed to continuously register environmental noise levels over the 15 minute intervals, with internal software calculating and storing Ln percentile noise levels for each sampling period.

All logging measurements were done in accordance with relevant OEH guidelines and AS 1055-1997 "Acoustics – Description and Measurement of Environmental Noise". The noise loggers used comply with the requirements of AS 1259.2-1990 "Acoustics – Sound Level Meters", and had current National Association of Testing Authorities (NATA) calibration certification.

The logger locations are shown in Figure 1.

Logger 1 was located in the easement on the southern side of Hill End Road, at about 50m from the roadside. The relevant measured noise levels from Logger 1 are detailed in **Table 2** and shown graphically in **Appendix I**.

TABLE 2
MEASURED AMBIENT NOISE LEVELS dB(A)
LOGGER 1 – HILL END ROAD

Period	L90	Leq (15 min)
Day	31	46
Evening	27	38
Night	23	37

The results in Table 2 indicate that the acoustic environment of the location of Logger 1 is indicative of a rural residential area with some traffic during the day and little activity during the evening and night, resulting in low ambient noise levels.

Logger 2 was located in the open paddock at the western end of the Caerleon subdivision. At the time of the monitoring, this location was in an undeveloped section of the subdivision.

The relevant measured noise levels from Logger 2 are shown in **Table 3** and graphically in Appendix I.

TABLE 3
MEASURED AMBIENT NOISE LEVELS dB(A)
LOGGER 2 – CAERLEON ESTATE

Period	L90	Leq (15 min)
Day	33	46
Evening	33	45
Night	24	43

The results in Table 3 show that the Leq noise levels at the logger location were relatively constant throughout the day, evening and night time periods. The background noise level decreased significantly at night. The logger location was approximately 600m from, and with line of sight to, the Castlereagh Highway. Noise from traffic on the highway is a contributor to the measured noise levels at the logger location.

In setting noise goals for a particular project, the NPfI considers both Amenity and Intrusiveness criteria. The former is set to limit continuing increase in noise from industry, whilst the latter is set to minimise the intrusive impact of a particular noise source.

Amenity criteria are dependent upon the nature of the receiver area and the existing level of industrial noise.

Residential receivers to the north and west of the site, off Hill End Road and Old Grattai Road would be considered “rural” as per the definitions in the NPfI and shown below (extract from Table 2.3 of the NPfI).

Rural *– an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. (Note: Where background noise levels are higher than those presented in column 3 (for a typical rural area) due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.*

The Caerleon Estate subdivision to the east and north east of the project site is being progressively developed and occupied. This is located adjacent to the Castlereagh Highway and would be considered “suburban” as per the definition below (from the NPfI).

Suburban *– an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic:*

- *evening ambient noise levels defined by the natural environment and human activity.*

The project amenity noise level (as an Leq (15 min)) for an industrial development is equal to the recommended amenity noise level (from Table 2.2 in the NPfI, and detailed above) minus 2 dB(A) (as detailed in the notes to **Table 4**, below).

The intrusiveness criteria are based on the Rating Background Level (RBL) for the time period, plus 5 dB(A). The RBL (L90) is defined as the overall single figure background level representing each assessment period.

The Project Noise Trigger Level (criterion) is the lower of the intrusiveness and amenity noise levels as specified in Table 4 for each receiver area.

For assessing noise, the NPfI defines "day" as being 7:00am to 6:00pm Monday to Saturday and 8:00am to 6:00pm on Sundays and Public Holidays, "evening" as being 6:00pm to 10:00pm every day and "night" as all other times.

From an acoustic point of view, the most significant operation of the solar farm will occur during daylight hours. There may be some limited activity during other times, so this assessment considers potential impacts at all times.

TABLE 4
NOISE CRITERIA

Location	Criterion	Day	Evening	Night
Hill End Rd	Intrusiveness dB(A),Leq(15-min.)[1]	36	35[2]	35[2]
	Amenity dB(A),Leq(15 min)[3]	48	43	38
	Project Noise Trigger Level	**36**	**35**	**35**
Caerleon	Intrusiveness dB(A),Leq(15-min.)[1]	38	38	35[2]
	Amenity dB(A),Leq(15 min)[4]	53	43	38
	Project Noise Trigger Level	**38**	**38**	**35**

1 Rating Background Level (RBL) + 5dB.
2. Where the RBL is <30, it may be set at 30.
3. Project amenity noise level (ANL) is rural ANL (NPI Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.
4. Project amenity noise level (ANL) is suburban ANL (NPI Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

3.2 Sleep Disturbance

The potential for sleep disturbance from maximum noise level events from the site during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

The NPfI states that a detailed maximum noise level event assessment should be undertaken where the subject development/premises night-time noise levels at a residential location exceed:

- 40 dB(A) Leq (15 min) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- 52 dB(A) Lmax or the prevailing RBL plus 15 dB, whichever is the greater,

The logger data presented in Tables 3 and 4 show that the prevailing adopted night time RBLs at both logger locations is 30 dB(A) L90 and, therefore, the trigger level for a detailed sleep disturbance assessment is **40 dB(A) Leq (15 min)** and/or **52 dB(A) Lmax**.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the *NSW Road Noise Policy* (RNP).

3.3 Construction Noise

The assessment of potential construction noise impacts is undertaken in accordance with the *Interim Construction Noise Guideline* (ICNG, 2009) and *Assessing Vibration: A Technical Guideline* (AVTG, 2006). These guidelines are non-mandatory but are usually referred to by local councils and the NSW Department of Planning and Infrastructure (DP&I) when construction/demolition works require development approval.

The criteria in the ICNG cover all activities and machinery associated with construction on the site including, but not limited to, site preparation, excavation work and erection of related infrastructure. It is designed to ensure noise emissions resulting from the construction are maintained to minimise potential impacts to nearby receivers.

3.3.1 Interim Construction Noise Guideline (ICNG)

Section 1.5 of the ICNG outlines the steps for management of construction noise impacts as follows:

1. **identify sensitive land uses** that may be affected.
2. **identify hours** for the proposed construction works.
3. **identify impacts** at sensitive land uses.
4. **select and apply the best work practices** to minimise noise impacts.

Each of the above four points is assessed in detail in the following sections.

3.3.2 Surrounding Land Uses

The subject site is adjacent to the MWF and noise emissions from this would influence the acoustic environment of the residential areas near the site, particularly to the east (in Caerleon Estate and surrounds).

Reference and scaling from Google Earth indicates that the nearest residential receivers to the site are approximately 1km to the east of the closest boundary.

There are also residential receivers that are approximately 1km to the north and 850m to the west but these are separated from the site by some significant topographical relief.

Potential noise impacts at these receivers will require assessment.

3.3.3 Operating Hours

The recommended standard hours for construction works are shown in **Table 5** which is a reproduction of Table 1, section 2.2 of the ICNG.

TABLE 5
STANDARD CONSTRUCTION HOURS

Work Type	Recommended standard hours of work[1]
Normal construction	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Blasting	Monday to Friday 9 am to 5 pm Saturday 9 am to 1 pm No blasting on Sundays or public holidays

1 The relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours

Construction work outside the hours in Table 5 is normally only permissible for delivery of oversized structures, emergency works, public infrastructure works that are supported by the affected community or where the proponent demonstrates and justifies a need to work outside the recommended standard hours (ICNG, p9).

3.3.4 Impacts at Sensitive Land Uses

The ICNG provides two assessment methodologies for construction noise impacts: a 'qualitative' assessment where works occur for less than three weeks and a 'quantitative' assessment for works of longer duration.

As construction works on the site will take longer than three weeks, the quantitative methodology is applicable.

Noise Management Levels

Table 6 sets out noise management levels for a quantitative assessment of construction works, (as reproduced from section 2.2 of the ICNG).

TABLE 6
NOISE AT RESIDENCES USING QUANTITATIVE ASSESSMENT

Time of day	Management level Leq (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 + 10 dB	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 level and duration, as well as contact details.
	Highly noise affected 75 dB(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: 1. 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, 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

TABLE 6 NOISE AT RESIDENCES USING QUANTITATIVE ASSESSMENT (cont.)		
Outside recommended standard hours	Noise affected RBL + 5 dB	• 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 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

* 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.

The day time ambient Leq and background noise level, obtained from the unattended logging are summarised in **Table 7**.

TABLE 7 MEASURED AMBIENT NOISE LEVELS dB(A)				
Period	Hill End Road		Caerleon	
	L90	Leq (15 min)	L90	Leq (15 min)
Day	31	46	33	46

Based on the daytime background noise levels (RBL), the construction noise management levels are;

- **41 dB(A),Leq (15 min)**, at residential receivers in the vicinity of Hill End Rd, and
- **43 dB(A),Leq (15 min)**, at residential receivers in the vicinity of Caerleon Estate.

3.4 Assessing Vibration: A Technical Guideline (AVTG)

The AVTG recommends goals for assessing human response and potential disturbance to the occupants of buildings. **Table 8** presents a summary of acceptable levels (rms) relevant to third-octave frequency bands adjusted by multiplying factors (in brackets) for residential receptors referenced to human response (as sourced from British Standard BS 6472-1992, Figure B1.4).

TABLE 8 ACCEPTABLE VIBRATION LEVELS FOR ASSESSMENT OF HUMAN COMFORT				
Frequency (Hz)	Vibration level, mm/s			
	Continuous Vibration		Intermittent Vibration	
	Day (2)	Night (1.4)	Day (60)	Night (20)
1	3.2	2.2	95	31
1.25	2.3	1.6	68	22
1.6	1.6	1.1	47	15
2	1.1	0.8	33	11
2.5	0.8	0.6	24	8.0
3.15	0.6	0.4	17	5.8
4	0.4	0.3	19	4.0
5	0.3	0.2	9.5	3.2
6.6	0.3	0.2	7.6	2.5
8	0.2	0.1	6.0	2.0
10	0.2	0.1	6.0	2.0
12.5	0.2	0.1	6.0	2.0
16	0.2	0.1	6.0	2.0
20	0.2	0.1	6.0	2.0
25	0.2	0.1	6.0	2.0
31.5	0.2	0.1	6.0	2.0
40	0.2	0.1	6.0	2.0
50	0.2	0.1	6.0	2.0
63	0.2	0.1	6.0	2.0
80	0.2	0.1	6.0	2.0

Table 2.1 of AVTG defines vibration from construction works or passing heavy vehicles as an intermittent source, so the day time values in Table 8 for intermittent vibration will be adopted as a worst case for potential construction vibration impacts. For a comparison of vibration levels in terms of human response, **Table 9** presents a summary of vibration levels and likely perception.

TABLE 9 HUMAN PERCEPTION of VIBRATION	
Vibration Levels, mm/s	Likely Perception
0.15	Perception threshold
0.35	Barely noticeable
1.0	Noticeable
2.2	Easily noticeable
6.0	Strongly noticeable
14.0	Very strongly noticeable
Ref: German Standard DIN 4150 (1986)	

4.0 - NOISE ASSESSMENT

4.1 Site Operations and Noise Levels

The layout of the site is shown in **Figure 2**.

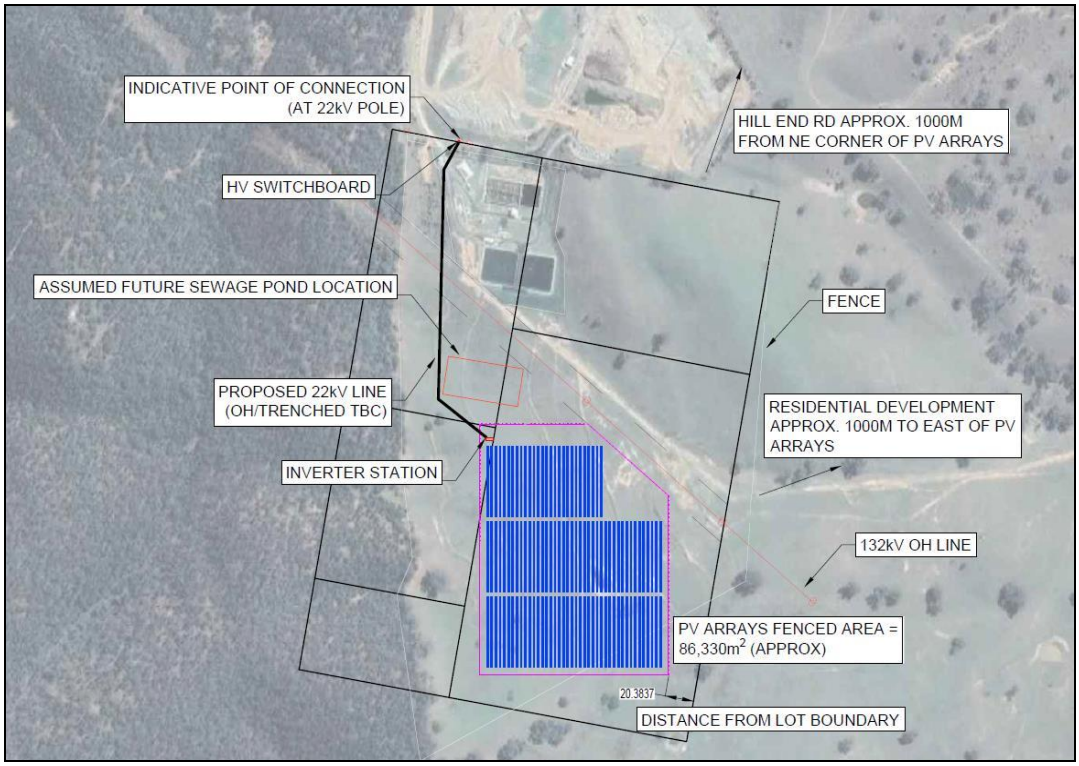


Figure 2 – Indicative Site Layout

Table 10 shows the sound power level spectra of each of the modelled operational noise sources. In keeping with convention, spectral data are presented as unweighted (linear) decibel levels and the total is A-weighted.

Sound pressure levels for the plant and equipment to be used at the facility were sourced from data obtained by the proponent, supplemented with spectral information in the Spectrum Acoustics technical database which contains data for similar plant items in typical operating conditions.

TABLE 10
POWER LEVEL SPECTRA OF MEASURED NOISE SOURCES, Leq (15 min)

	TOTAL	Octave Band Centre Frequency, Hz							
Noise source	dB(A)	63	125	250	500	1k	2k	4k	8k
Tracking Motors (x20)	79	71	71	79	77	74	71	65	65
Inverter	91[1]	83	85	94	88	84	84	77	76
Light Vehicle	97	92	102	89	94	92	91	85	81

1 see text regarding corrections for noise characteristics

The proposed solar farm will operate approximately 9,500 solar panels which would be installed on single axis trackers. The tracking system involves the panels being driven by motors to track the path of the sun throughout the day, to maximise the solar effect.

There will be a total of 112 tracking motors. These motors operate to turn the panels through approximately five degrees every 15 minutes. The motors will, therefore, operate for no more than one minute out of every 15 minutes assessment period.

At the end of the day the panels are moved to a horizontal position. The typical night time operation of the trackers is to move the panels once to be in position for the day time operation.

The site will operate one central inverter which will be located near the northern extent of the solar panels.

As described previously, the tracking motors drive the panels through about 5 degrees every 15 minutes throughout the day. The motors are, therefore, only in use briefly during any 15 minute period. To assess a worst case the motors were considered to be operating for one minute out of every 15 minutes.

There will be a total of 112 tracking motors. As shown in Figure 2 the panels are laid out in lines in arrays across the site, and there will be a motor associated with each line of panels. The motors were modelled as four “banks” of 20, and one of 30 as depicted as sources 1 to 5 on **Figure 3**.

The combined Lw for a bank of 20 tracking motors is shown in Table 10. Note that source “5” is of 30 motors with a modelled Lw of 80 dB(A) Leq (15 min).

The inverter was modelled at the level shown in Table 10 for the full 15 minute period.

On occasion there may be a light vehicle (LV) moving about the site undertaking maintenance duties. For the noise modelling a light vehicle was located at the eastern side of the site. The light vehicle was modelled at the location for five minutes out of 15 with an Leq (15 min) Lw as shown in Table 10. The noise source is shown as “LV” on Figure 3.

There will be very limited activity on site at night.

The layout of the proposed facility and the location of the modelled noise sources are shown in Figure 3.

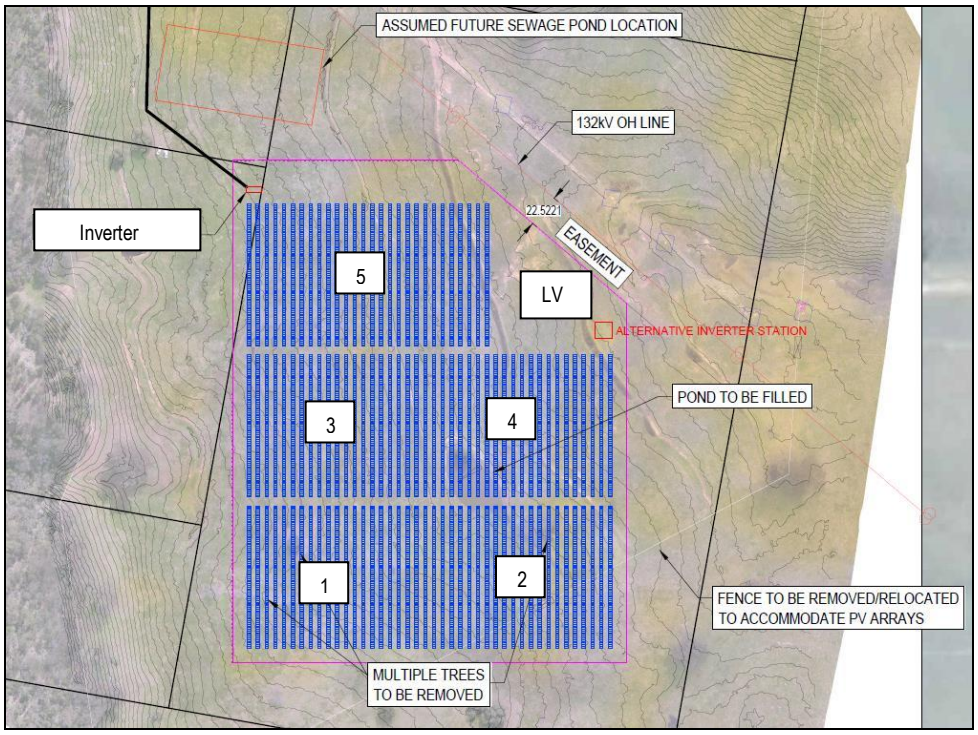


Figure 3 – Site Layout and Noise Source Locations

4.2 Predicted Operational Noise Levels

Assessment of operational noise was conducted using RTA Technologies Environmental Noise Model (ENM) v3.06. Noise contours of equal sound pressure level (as Leq (15 min) were generated out to the 20 dB(A) contour.

The atmospheric conditions most relevant to noise assessments are temperature inversions, gentle winds (indicative of possible wind shear) and relative humidity.

The following meteorological features are, therefore, the most significant with respect to noise propagation for the proposal:

- Extremes of relative humidity (RH) are rarely experienced. For modelling purposes, a value of 70% RH was adopted;

- The NPfI states that wind from any direction need only be considered in the assessment process if it occurs for more than 30% of the time (at wind speeds of less than 3m/s).

Wind speed data for 9 am and 3 pm from the nearby weather station at Mudgee Airport (approximately 6.5 km to the east) were obtained from the Bureau of Meteorology web site (as shown in Appendix II).

A statistical analysis of the data showed that the vector components occurred for greater than 30% of the time from the south east in the morning for most months and from the west in the afternoon, particularly in winter and spring.

Noise levels for the typical day time operation of the solar farm were modelled using ENM for each of the atmospheric conditions described below;

- ***Scenario 1*** – "Prevailing Conditions" - A wind speed of 3m/s (at 10m above ground level) from the south east (**Figure 4**),
- ***Scenario 2*** – "Prevailing Conditions" - A wind speed of 3m/s (at 10m above ground level) from the west (**Figure 5**), and
- ***Scenario 3*** – "Neutral Atmospheric" - Calm wind, 70% RH and a temperature of 20ºC (**Figure 6**).

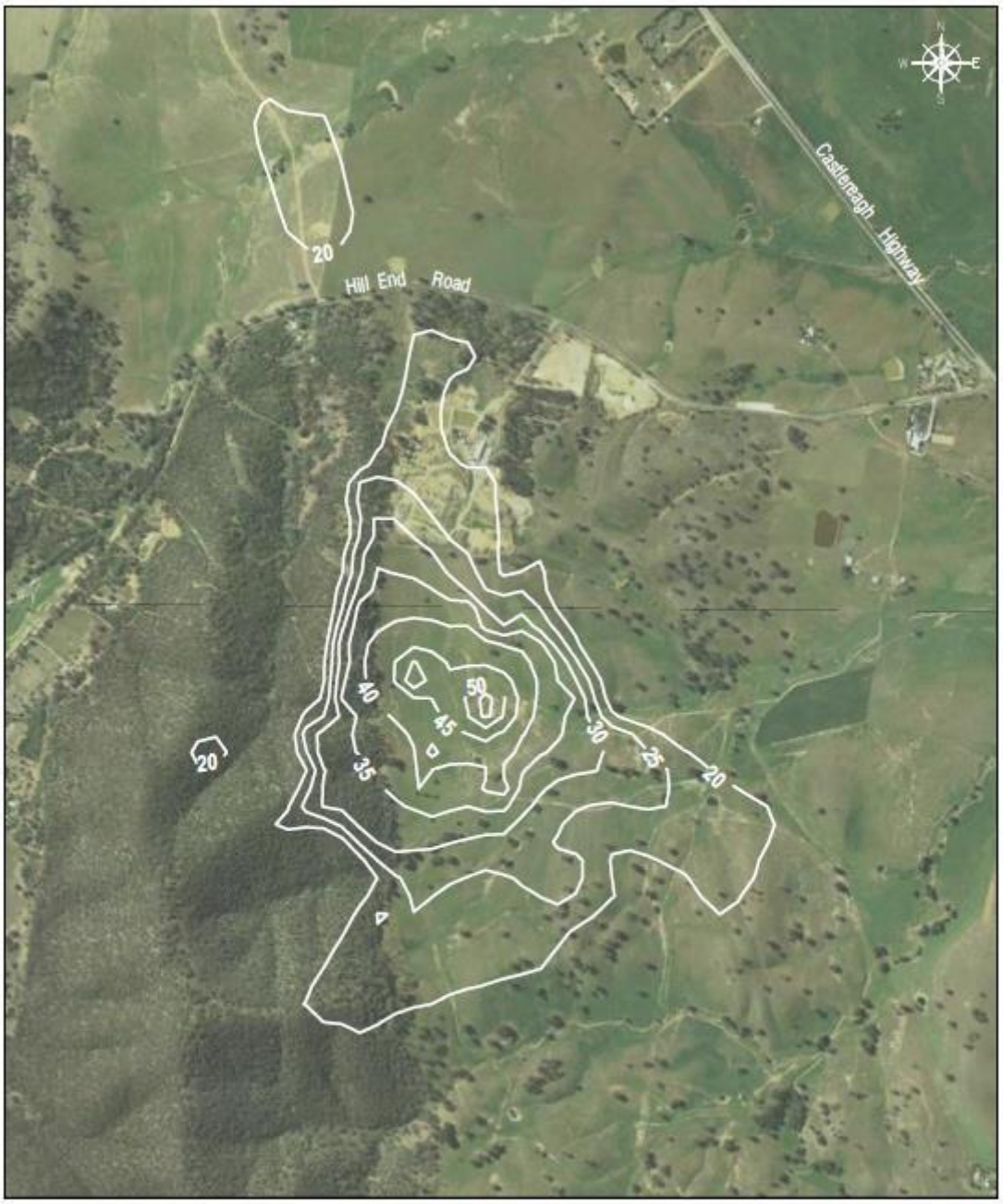


FIGURE 4

Noise Contours dB(A)
Scenario 1 – Operations, South East wind, LEQ (15 min)

Base Source: maps.six.nsw.gov.au

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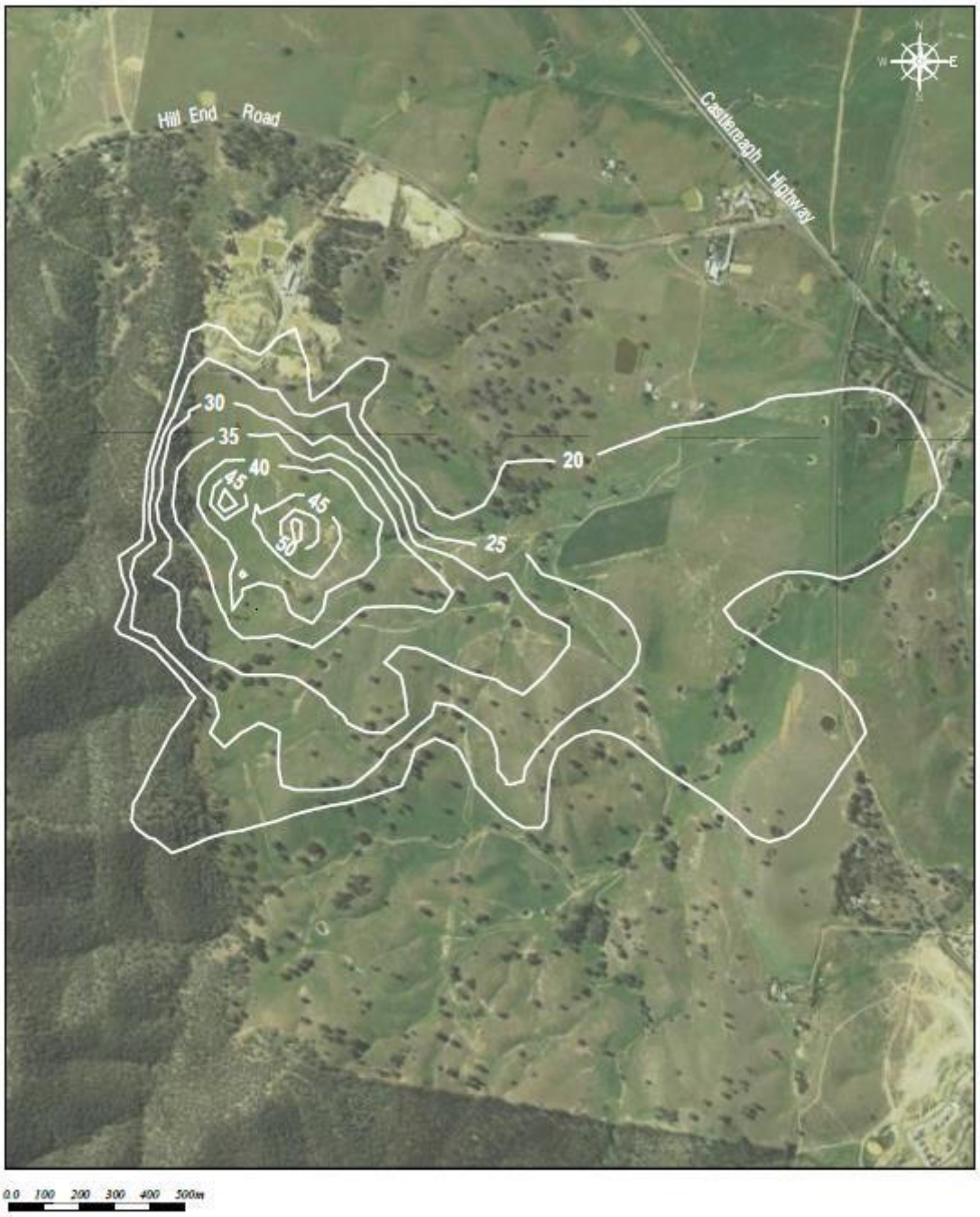

FIGURE 5

Noise Contours dB(A)
Scenario 2 – Operations, West wind, Leq (15 min)

Base Source: maps.six.nsw.gov.au

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FIGURE 6

Noise Contours dB(A)
Scenario 3 – Operations, Neutral Atmospheric, Leq (15 min)

Base Source: maps.six.nsw.gov.au

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The results in Figures 4, 5 and 6 show that there will be no adverse noise impacts at any receivers due to the assessed noise emissions from the operation of the solar farm.

The theoretical noise contours for the day time operation of the solar farm show that the predicted noise will be at levels that are significantly lower than the adopted noise criteria for the various receiver locations.

As detailed above, there will be very limited operation of the solar farm at night. The operation will be limited to the single movement of the panels into position for the start of day time tracking of the sun. The noise from this will be limited to a single 15 minute period and will be at lower levels than those shown in Figures 4 to 6. The received noise will be less than 20 dB(A) Leq (15 min) at any receiver.

The ENM noise model was also utilised in point calculation mode to determine the actual predicted noise level at the two noise logger locations (as shown in Figure 1). These locations are considered representative of the residential receiver locations in the vicinity of the site.

The results of the point calculations for the modelled south easterly wind, westerly wind and neutral atmospheric scenarios are shown in **Table 11**.

TABLE 11
ENM POINT CALCULATION RESULTS (dB(A) Leq (15 min))

Location	Scenario 1	Scenario 2	Scenario 3
R1	15	<10	<10
R2	<10	20	<10

The results of the point calculations can be seen to vary slightly from the contours. This is due to the manner in which the ENM noise model deals with the various modelling procedures. Point calculations are carried out to a specific ground location, whereas the contours are an interpolation of noise values between arbitrary radial calculation points. For this reason, the point calculations are considered more accurate and the contours should be viewed as indicative only.

The results of the point calculations show that, under the assessed atmospheric conditions, the predicted noise levels at all receivers will be in compliance with the relevant noise trigger levels.

4.3 Sleep Disturbance

As described previously, there will be very little operational activity on the site at night. The operation of the individual tracking motors does not create any significant noise emissions that would warrant sleep disturbance assessment.

It is possible that, very occasionally, there may be a vehicle on site in early mornings (i.e. before 7am) undertaking maintenance, for example.

For consideration of a worst case, a source representing an impact noise at a vehicle was modelled, at 110 dB(A) Lmax at the eastern side of the site (LV on Figure 3). The modelled was run under night time temperature inversion conditions of a +4 ºC/100m positive temperature gradient.

The results of the sleep disturbance noise modelling are shown in **Figure 7**.

FIGURE 7

Noise Contours dB(A)
Sleep Disturbance, Lmax

Base Source: maps.six.nsw.gov.au

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The results in Figure 7 show that, under the modelled conditions, the maximum noise levels will be well below the screening criteria, at all receivers, and, therefore, no further assessment of sleep disturbance is considered warranted.

4.4 Construction Noise Assessment

The proponent has advised that the construction works will be carried out over several phases.

This will entail;

- Site preparation, including ground clearing and levelling, or modifying of existing contour banks,
- Construction of roadways and electrical infrastructure, including trenching etc.
- Erection of mounting structures and installation of panels, and
- Delivery of materials.

The Spectrum Acoustics technical database has been referenced to determine the sound power level most applicable to the equipment proposed to be used on the site as shown in **Table 12**.

TABLE 12
CONSTRUCTION PLANT NOISE LEVELS as dB(A) Leq

Equipment	Range of Indicative Lw dB(A)	Lw for Assessment as Leq (15 min)
Dozer	102 - 114	105
Grader	105	105
Excavator	97 - 117	102
Light Vehicle	95 - 100	97
Piling Rig	100 - 110	105
Trencher	100	100
Crane	102 - 107	105
Powered Hand Tools	90 - 100	95
Generator	95 - 100	97
Road Truck (deliveries)	103	103

The construction of the facility will involve the installation of the solar panels and associated infrastructure.

The initial phase of the construction will be site clearing and levelling of the existing contour banks. This would be undertaken using a dozer and or grader and dump trucks. The solar panels would then be

installed on a series of frames which would involve the driving or screwing of piles into the ground and mounting of each panel.

Underground cabling would be required to connect the panels to the inverter and to the electrical grid.

Noise emissions from the construction works will vary throughout individual days and also throughout the length of the overall project. The noise level at individual receivers will also be dependent upon the location of the various works, relative to those receivers, at different times.

During the construction work the mobile plant, such as that detailed in Table 14 will, by definition, move about and will be, be at various operating levels (and thus producing various levels of noise) throughout any 15 minute period.

To gauge some potential construction noise impacts a representative scenario was modelled where a piling rig, crane, light vehicle and workers with power tools were all working in close proximity to each other near the eastern side of the site (at the location shown for noise source 4 on Figure 3). All three items were considered to be at the worst case Leq (15 min) noise levels shown in Table 12.

The construction noise was modelled under the prevailing 3m/s westerly wind as this is considered to be the worst case with respect to the most potentially affected receivers (in Caerleon Estate).

The results of the construction noise modelling are shown in **Figure 8**.

FIGURE 8

Noise Contours dB(A)
Construction Noise, Leq (15min)

Base Source: maps.six.nsw.gov.au

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The contours in Figure 8 show that the predicted construction noise levels will be significantly below the noise affected levels (from Table 6) at all receivers. Under such circumstances there is no requirement to undertake construction noise management or for the development of a construction noise management plan for the project.

4.5 Vibration Assessment

Energy from construction equipment is transmitted into the ground and transformed into vibrations, which attenuates with distance. The attenuation of vibration through the ground is dependent upon site specific factors relating to the strata between the vibration source and receivers. In obtaining an initial indication of likely vibration levels, it can be assumed that the vibration level is inversely proportional to distance. That is, at double the distance from the source the vibration level will be halved.

Table 13 presents some published typical values of vibration for construction equipment sources, in terms of peak particle velocity (ppv) expressed as mm/sec, for various ground types at a distance of 30m from the source.

TABLE 13
GENERAL VIBRATION LEVELS ppv mm/sec (at 30m)

	Hard Competent Rock	Hard soils, dense compacted sands	Competent soils, most sands, gravel	Weak or soft soils, top soil
Vibratory Roller	1.3	1.2	0.9	0.8
Large Bulldozer	0.6	0.5	0.4	0.3
Loaded Trucks	0.5	0.4	0.3	0.3
Small Piling Rig	0.7	0.5	0.3	0.3

The worst case vibration levels, shown in Table 13, are for the operation of a vibratory roller. The use of such a roller may occur on site, say, for compacting the base for hardstands or road way construction.

It is generally accepted that the attenuation of vibration through most ground types is inversely proportional to distance (that is, a halving of vibration with doubling of distance).

Based on the data presented in Table 13 this indicates that the vibration levels from the vibratory roller working about on the site will be “noticeable” at distances of about 30m as per the detail in Table 9. This will decrease to be “barely noticeable” at distances greater than about 100m. The closest any construction work will be to a residence is approximately 750m.

The vibration associated with other plant items that may be used during the construction will be at lower levels than those for a vibratory

roller. As such, vibration from the other plant will be less than those detailed above.

The vibration levels will be significantly lower than any building damage criteria.

No further assessment of vibration is, therefore, considered warranted.

5.0 – CONCLUSION

An assessment has been carried out into the potential for adverse noise impacts due to the operation of a proposed solar farm at 33 Blain Road, Caerleon, via Mudgee, NSW.

A typical operational scenario has been modelled, under various atmospheric conditions, and the results have shown that the predicted levels will not exceed the relevant noise criteria at any residential or industrial receivers.

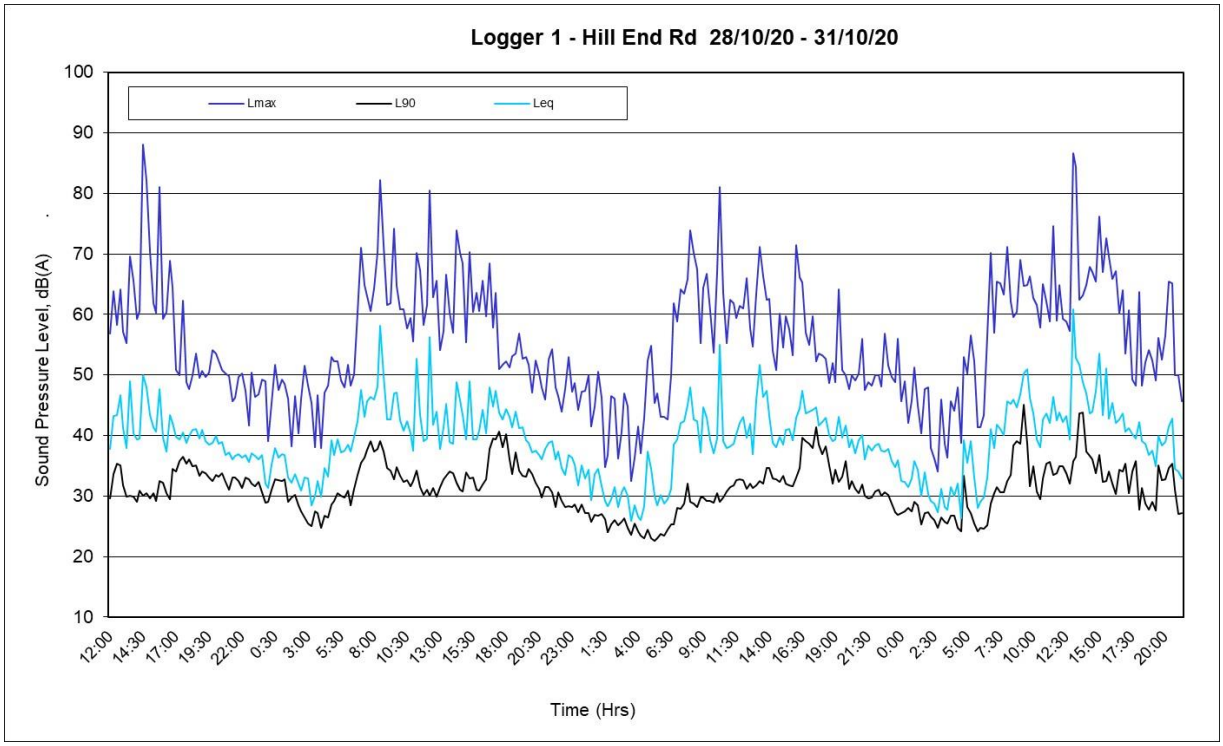
Noise modelling has also shown that there will be no potential for sleep disturbance impacts due to maximum noise emission from the site.

Further noise modelling has also shown that noise levels from typical construction activities will comply with the relevant construction noise management levels.

Calculations of the predicted vibration levels from typical construction activities have shown that vibration levels will be barely perceptible and will be significantly lower that any building damage criteria.

APPENDIX I

NOISE LOGGER CHARTS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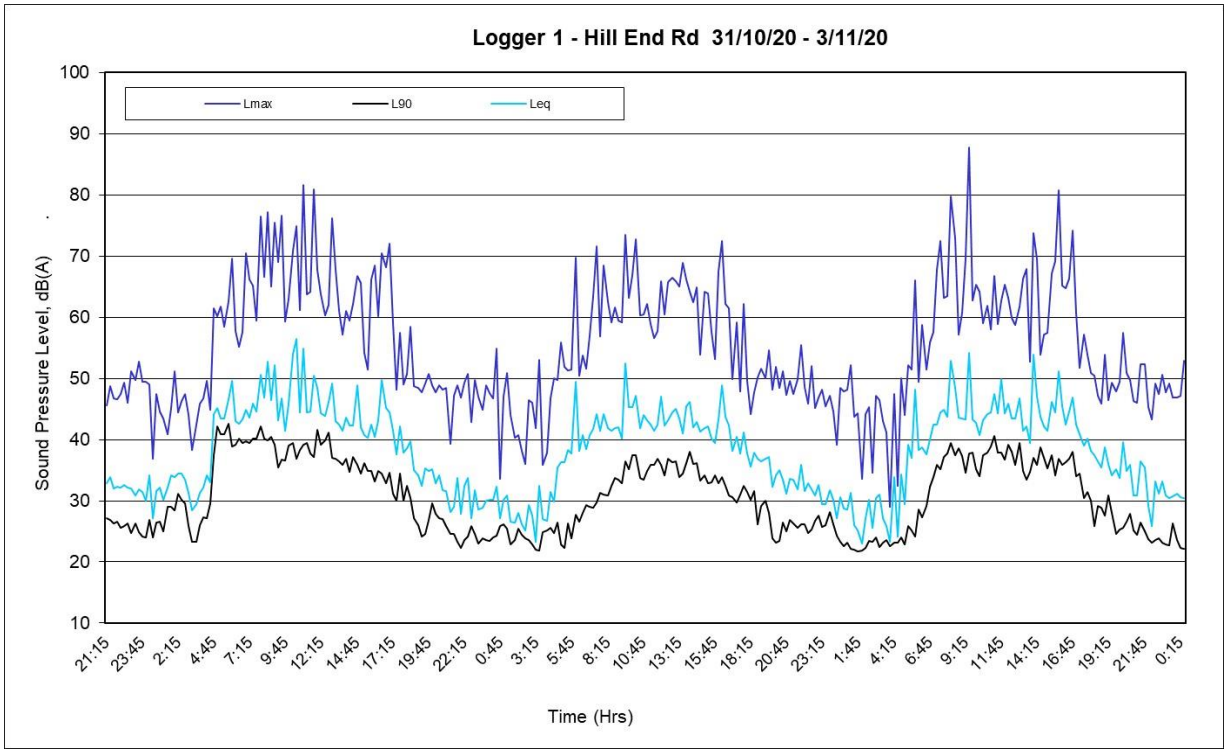
Lmax
L90
Leq
Sound Pressure Level, dB(A)
Time (Hrs)


Logger 1 - Hill End Rd 31/10/20 - 3/11/20
Lmax
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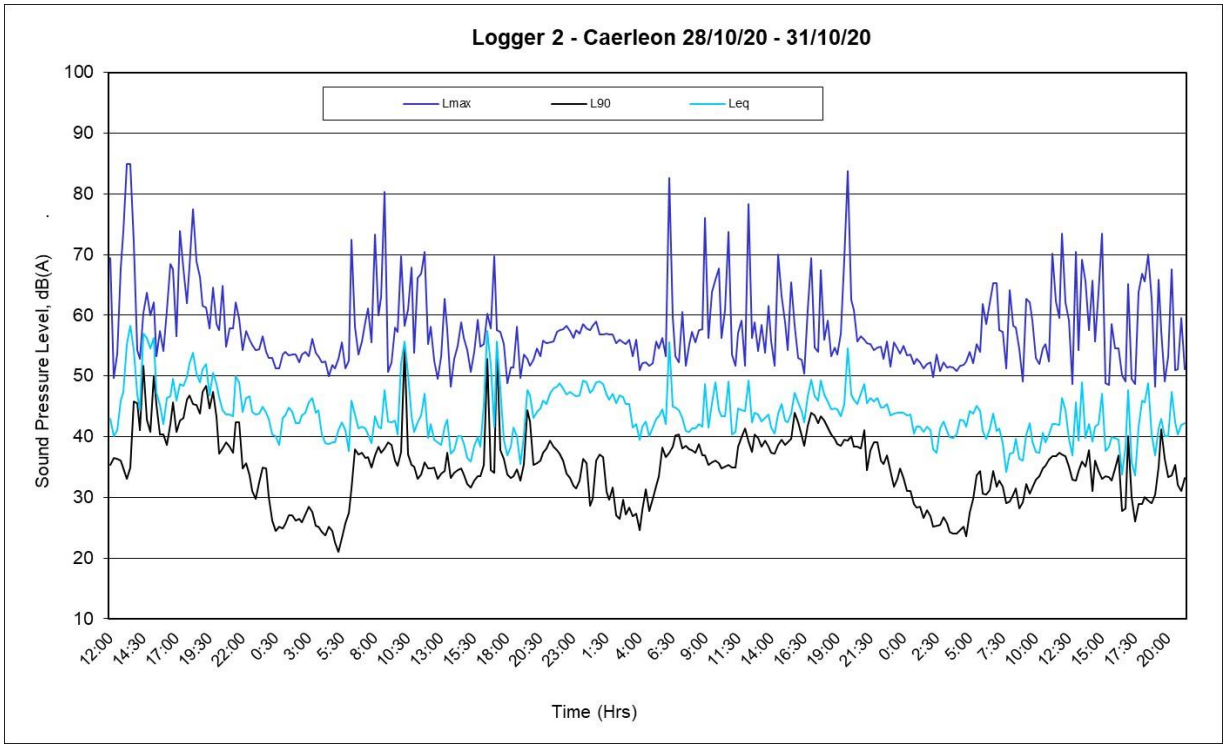
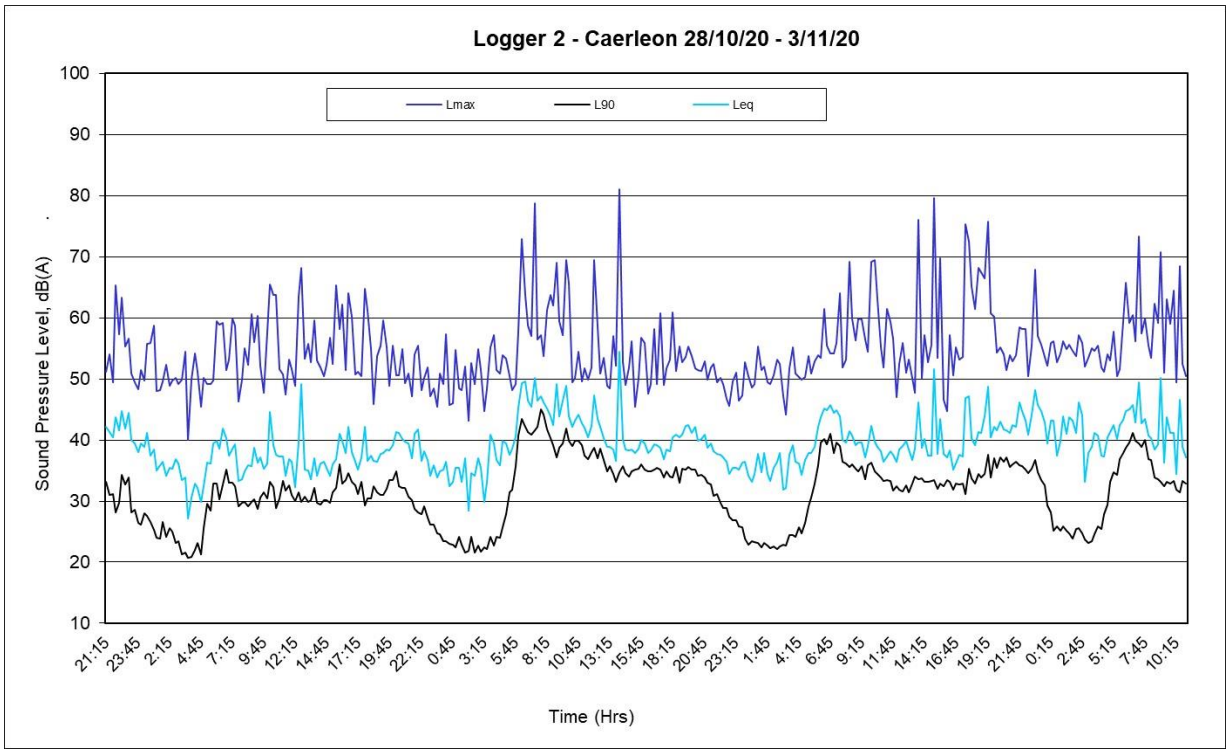
Leq
Sound Pressure Level, dB(A)
Time (Hrs)


Logger 2 - Caerleon 28/10/20 - 31/10/20
Lmax
L90
Leq
Sound Pressure Level, dB(A)
Time (Hrs)


Logger 2 - Caerleon 28/10/20 - 3/11/20
Lmax
L90
Leq
Sound Pressure Level, dB(A)
Time (Hrs)

APPENDIX II

WIND ROSES – MUDGEE AIRPORT

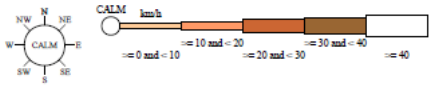
Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

Custom times selected, refer to attached note for details

MUDGEE AIRPORT AWS

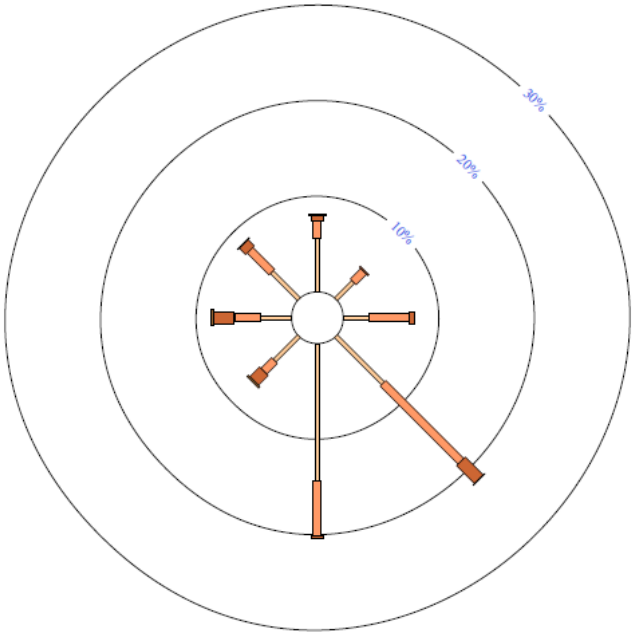
Site No: 062101 • Opened Nov 1968 • Still Open • Latitude: -32.5628° • Longitude: 149.6149° • Elevation 471m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
6701 Total Observations

Calm 14%



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Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

Custom times selected, refer to attached note for details

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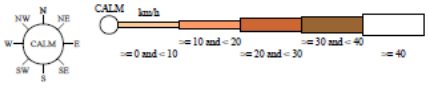
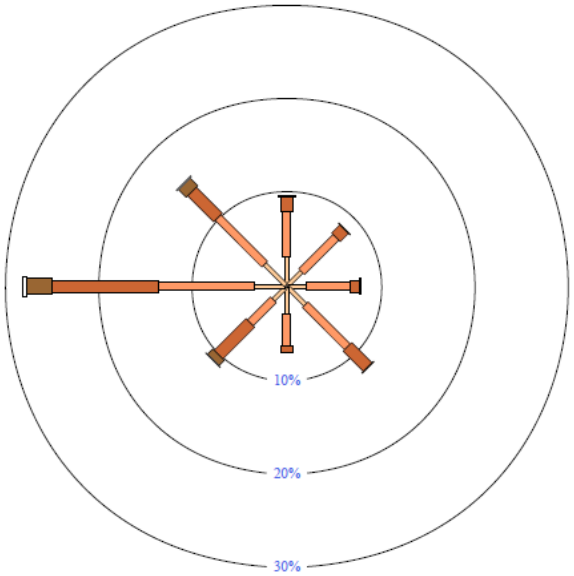


3 pm
6717 Total Observations

Calm 1%



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