APPENDIX E
NOISE IMPACT ASSESSMENT

VALUE THROUGH INTEGRATION

Nillumbik Solar Farm

Location:	Nillumbik
Client:	LMS Energy
Date:	January 2022

DOCUMENT CONTROL

REVIEW RECORD

Revision	Date	Status	Prepared	Reviewed	Approved
0	24/06/2021	Draft	ARH	BH	ARH
1	29/06/2021	Draft 2	ARH		
2	5/08/2021	Final	ARH	BH	ARH
3	14/09/2021	Final – 28 MW size change	ARH	BH	ARH
4	13/1/2022	Final – Publication 1826.4 update	ARH	BH	ARH

APPROVAL / SIGN OFF

ISSUE				
	Name	Position	Signature	Date
Prepared by:	Asbjorn Hansen (RPEQ: 21838)	Senior Engineer	Asbjorn Hansen	13/1/2021
Reviewed by:	Ben Hall	Principal Consultant		13/1/2021
Approved by:	Asbjorn Hansen (RPEQ: 21838)	Senior Engineer	Asbjorn Hansen	13/1/2021
Comments:				

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EXECUTIVE SUMMARY

Matrix Acoustics was commissioned by LMS Energy Pty Ltd (LMS) to assess noise impacts of the proposed 2.8 MW Solar PV Facility at the Nillumbik landfill site at 290 Yan Yean Road, Plenty.

The noise assessment included noise monitoring at the boundary of the site to determine the existing ambient noise environment. The monitored noise data was used to determine the noise limits for the proposed development in accordance with the EPA VIC Publication 1826.4: "*Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*".

The noise assessment found that the noise levels experienced at the receptors surrounding the proposed facility would be in compliance with the noise limit for the construction period.

The noise emitted from the site during normal Stage 1 operations showed compliance with the noise limits for the day, evening and night-time period.

The noise emitted from the site during normal Stage 2 operations also showed compliance with the noise limits for the day, evening and night-time period.

The assessment noted that noise emitted from the facility possibly would be lower in the early morning hours and in the evening hours as the facility is not expected to operate at full capacity as a result of lower sun irradiation in these time periods. The margin of compliance with the noise limit is therefore expected to be better than indicated in this report.

1 INTRODUCTION

Matrix Acoustics was commissioned by LMS Generation Pty Ltd (LMS) to assess noise impacts of the proposed 2.8 MW solar PV facility at the Nillumbik landfill site at 290 Yan Yean Road, Plenty.

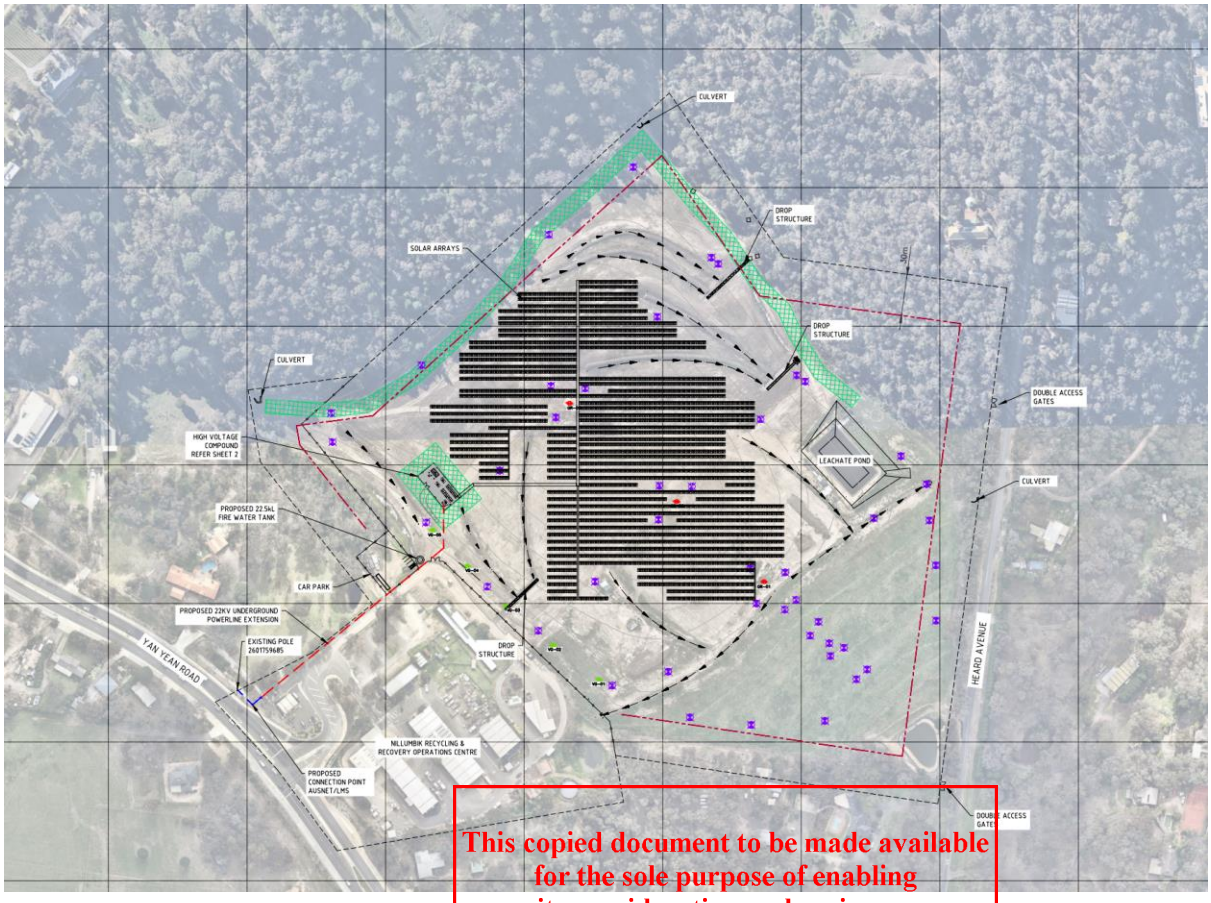
As the facility is located in Nillumbik Shire the assessment is required to comply with the following guidelines and policies:

- Solar Energy Facilities Design and Development Guideline August 2019
- Noise from industry in regional Victoria guideline no. 1411
- EPA VIC Civil construction, building and demolition guide no. 1834
- EPA VIC Publication 1826.4: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, May 2021

The proposed solar PV facility will be constructed in two stages. Stage 1 will include the installation of 1.2 MW of solar panels, 12 high power inverters, one transformer and one ring main unit (RMU) sited at the high voltage component. Stage 2 will involve the installation of up to an additional 1.6 MW of solar panels, an additional 16 high power 100 kVA inverters and one additional transformer within the high voltage compound for an ultimate capacity of 2.8 MW.

The site will be an unmanned facility. The number of vehicles and personnel accessing the site will therefore be limited to occasional maintenance staff, there are as such no set operational hours for staff. It should however be noted that the inverters only will be operating, and hence generating noise, during daylight hours. The proposed site layout is shown in Figure 1-1 below.

Figure 1-1 Proposed site layout



2 NOISE SENSITIVE RECEPTORS

The proposed site is surrounded by noise sensitive receptors in all directions. Figure 2-1 shows the noise sensitive receptors around the proposed site.

Figure 2-1 Noise sensitive receptors around the proposed site

The distance between the site and the receptors are approximately 150 to 300 m.

3 EXISTING ENVIRONMENT

3.1 NOISE MONITORING

Noise monitoring was conducted in July 2021 at a location adjacent to the site. Figure 3-1 shows the monitoring location and Image 3-1 shows a picture of the monitor installed at the site.

The noise monitoring location was approximately 150 m northeast of Yan Yean Road and represents the ambient noise levels for the noise sensitive receptors situated within 150 m of Yan Yean Road.

Noise monitoring was conducted using the following instruments:

- MH218 Type 1 environmental noise logger, serial number: MH218-29
- Pulsar Model 105 acoustic calibrator, serial number: 93095

Noise from Yan Yean Road is continuous at this location as well as occasional noise from Nillumbik Recycling Centre.

Figure 3-1 Location of the noise monitor

Image 3-1 Noise monitor at the site

Noise monitoring was conducted for 8 days commencing Monday 26 July and concluding Tuesday 3 August 2021. The noise monitor recorded the following parameters, L_{max}, L_{min}, L_{eq}, L_{01}, L_{10}, L_{90} for each 15 minute interval with a 'Fast' time weighting. The noise monitor was calibrated pre and post the measurement period with no variation greater than 0.1 dB observed. Some inclement weather (rainfall was above 3 mm/hr, or wind above 5 m/s) was observed during the monitoring period and these have been excluded from the background assessment. Elevated noise levels as a result of activity at the Recycling Centre were also excluded during the analysis of the noise data.

The arithmetic average noise levels in each period were determined for the duration of the monitoring.

Table 3-1 presents a summary of the day, evening, night-time, Saturday and Sunday average background noise levels. Noise logging graphs are presented in Appendix A.

Table 3-1 Summary of recorded noise levels

Period	Ave L_{A01} dBA	Ave L_{A10} dBA	Ave L_{Aeq} dBA	Median L_{90} dBA
Day	61	54	52	45
Evening	67	60	57	43
Saturday (1300 – 1800)	61	53	51	42
Sunday (0700 – 1800)	62	54	52	41
Night	59	51	49	33

The noise levels measured are typical of noise levels in a semi-rural setting in close vicinity to a significant transportation corridor.

3.2 LAND USE ZONINGS

Publication 1826.4 requires the classification of land use zonings in the determination of the project noise criteria. Image 3-2 the zones surrounding the monitoring location.

Image 3-2 Zones surrounding the project site

4 NOISE LIMITS

4.1 CONSTRUCTION AND DECOMMISSIONING NOISE LIMITS

Construction noise levels are governed by Victorian EPA Publication 1834, November 2020 *Civil construction, building and demolition guide* which specifies limits for construction and demolition noise. The guideline does not specify noise limits for normal working hours which are 7am – 6pm Monday to Friday and 7am – 1pm Saturday. The Saturday working hours applies to this project as this project is considered a major industrial project.

Though the guideline does not specify a noise limit for normal working hours it does state that: *"You are expected to minimise noise and vibration at all times"*. For the sake of this assessment, the target construction noise level during normal construction hours is taken to be 55 dBA, measured as an equivalent noise level (L_{Aeq}) outside of a dwelling. 55 dBA is based on a noise level where conversations easily can be held without having to raise the voice. Figure 4-1 shows the decibel scale including examples of how loud various noise sources are.

Figure 4-1 Decibel scale

Decibels	Example
0	Silence
10	Breathing, ticking watch
20	Rustling leaves, mosquitos
30	Whispering
40	Light rain, computer hum
50	Quiet office, refrigerator
60	Normal conversation, air conditioner
70	Shower, toilet flush, dishwasher
80	City traffic, vacuum cleaner
90	Music in headphones, lawn mower
100	Motorcycle, hand drill
110	Rock concert, chain saw
120	Thunderclap
130	Maximum stadium crowd noise
140	Aeroplane taking off
150	Fighter jet take off
160	Shot gun
170	Fireworks
180	Rocket launch

Construction works is not planned outside normal construction hours.

4.2 OPERATIONAL NOISE LIMIT

As the site is situated in metropolitan Melbourne the urban area method outlined in publication 1826.4 was used to determine the noise limits for the proposed development. Publication 1826.4 prescribes that the existing ambient background noise levels must be used to determine the whether the background noise levels in the area are high, neutral or low. The noise limits are then derived from this information. Table 4-1 shows the operational noise limits for the proposed development.

Table 4-1 Operational noise limits

Period	Zoning Levels, dBA	Background Level, dBA	Noise Limit, dBA
Day	57	45 (neutral)	57
Evening	51	43 (neutral)	51
Saturday (1300 – 1800)	51	42 (neutral)	51
Sunday (0700 – 1800)	51	41 (low)	49 » (51+41)/2+3
Night	46	33 (low)	43 » (46+33)/2+3

5 ASSESSMENT

The proposed site is a newly capped landfill site. A requirement for the development of this site is that no works is undertaken to the capping which includes drilling holes in the capping. It therefore follows that drilling for mounting of the solar panel frames is not possible. The solar panel frames for this project will be fabricated offsite. The frames consist of a concrete footed metal structure that is placed on the capping which of the time of construction will be planted with grass. Once the solar frames are placed in the correct locations the solar panels are mounted on the frames using hand tools. It should be noted that the solar panel frames are static frames, hence solar tracking will not occur.

The construction of the solar PV facility is likely to occur over a few months, however for much of the time the construction works is likely to generate relative low noise levels as the works predominantly will consist of mounting of solar panels to the solar panel frames as well as clip and fastening of power cables to the solar panel frames. The noisiest activities are therefore likely to be the construction of the high voltage compound and the directional drilling machine for the connection of the facility to the grid.

The noise sources used during the construction will include delivery trucks, a directional drilling machine, a telehandler, a crane and hand tools. Construction activities are anticipated to only occur during normal construction hours of 7am to 6pm Monday to Friday and Saturday 7am to 1pm.

The proposed facility will only generate noise during daylight hours as all the electronic components turn off once the sun stops shining on the solar panels. At the proposed location of the site the sun rises between the hours of 5:50am and 7:36am depending on the time of the year and the sun sets between the hours 5:07pm and 8:45pm. It therefore follows that the facility is likely to generate noise both during the day, evening and the night-time period during the operational stage of the facility.

It should however be noted that the facility is not likely to operate at full capacity in the early morning and just before sunset due to the shading provided by parallel rows of solar panels and low intensity light in these periods. The cooling fans are as such not likely to operate at full speed, as the system is not operating at full capacity. It therefore follows that the system is likely to generate less noise in the early morning and in the evening periods.

5.1 SOUND POWER LEVELS

The noise impacts associated with the construction phase have been modelled with the sound power levels presented in Table 5-1

Table 5-1 Construction equipment sound power levels

Equipment	Sound power level, dBA
Delivery truck	98
Concrete truck	100
Crane	101
Telehandler	99
Hand tools	92
Directional drilling machine	103

The only items generating noise during the operational phase will be the inverters as well as maintenance staff when present. The maintenance staff is likely to drive around the site to look for issues and use hand tools where issues are identified. The noise impacts associated with maintenance works are considered minimal. Maintenance works has as such not been assessed.

Table 5-2 and Table 5-3 lists the sound power levels used for the assessment of the two operational stages of the project.

Table 5-2 Sound power levels of the equipment at the facility for stage 1

Equipment	Sound power level, dBA	Number of items
100 kVA inverter	77	12

Table 5-3 Sound power levels of the equipment at the facility for stage 2

Equipment	Sound power level, dBA	Number of items
100 kVA inverter	77	28

It should be noted that the sound power level of the Sunny Highpower PEAK3 100kVA inverter is based on the assumption that the 69 dBA noise emission data level as provided in the data sheet is the noise level 1 m from the inverter when it is operating at full capacity. This assumption is based on information found in an earlier version of the data sheet for this inverter.

5.2 NOISE MODEL INFORMATION

Noise levels from the proposed construction and plant operations have been predicted with the proprietary software package SoundPLAN version 8.1 using the in-built ISO 9613-2:1996 *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* prediction method.

Elevation data for the site and the surrounding area was obtained from the Victoria State Governments Vicmap Elevation 10 m grid resolution raster model. The elevation contours have been used to construction a 3D terrain model for the area which was imported into SoundPLAN.

Noise predictions have been calculated conservatively with the ISO 9613 method which incorporates downwind propagation or equivalently propagation under a well-developed moderate ground-based temperature inversion.

Table 5-4 presents the meteorological conditions used in the noise model.

Table 5-4 Modelled meteorological conditions

Meteorological condition	Value
Air pressure	1013 mbar
Relative humidity	70%
Temperature	10°C

5.3 CONSTRUCTION AND DECOMMISSIONING

Three scenarios were modelled for the construction and decommissioning of the site:

- Scenario 1 includes a cement truck pouring the slab for the high voltage compound.
- Scenario 2 includes a crane lifting the large inverter into place, a delivery truck delivering solar panels, a telehandler unloading the solar panels and two groups of people installing panels using hand tools. It is expected that the decommissioning of the solar PV facility will include hand tools, a telehandler and trucks, hence noise levels for the decommissioning of the site is expected to be very similar to the noise levels generated during the construction of the site.
- Scenario 3 includes a directional drilling machine used for drilling an underground power line required to connect the solar PV facility to the grid.

Figure 5-1 shows the receptors surrounding the site and the expected noise levels from the cementing activities.

Figure 5-1 Pouring of concrete slab

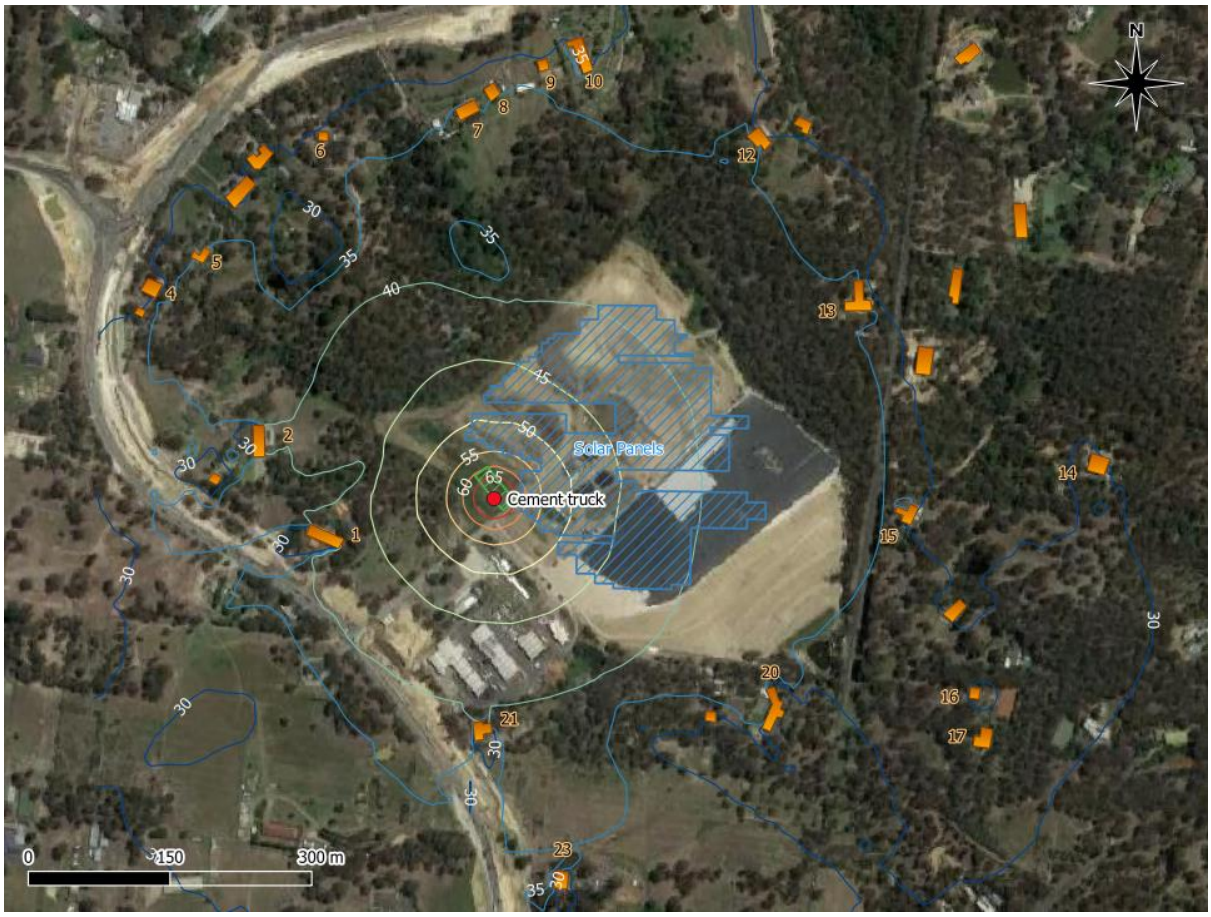


Figure 5-1 shows that none of the receptors are predicted to experience noise levels above 45 dBA.

Figure 5-2 shows the predicted noise levels as a result of the installation of the solar panels and the inverters.

Figure 5-2 Installation of solar panels and inverters

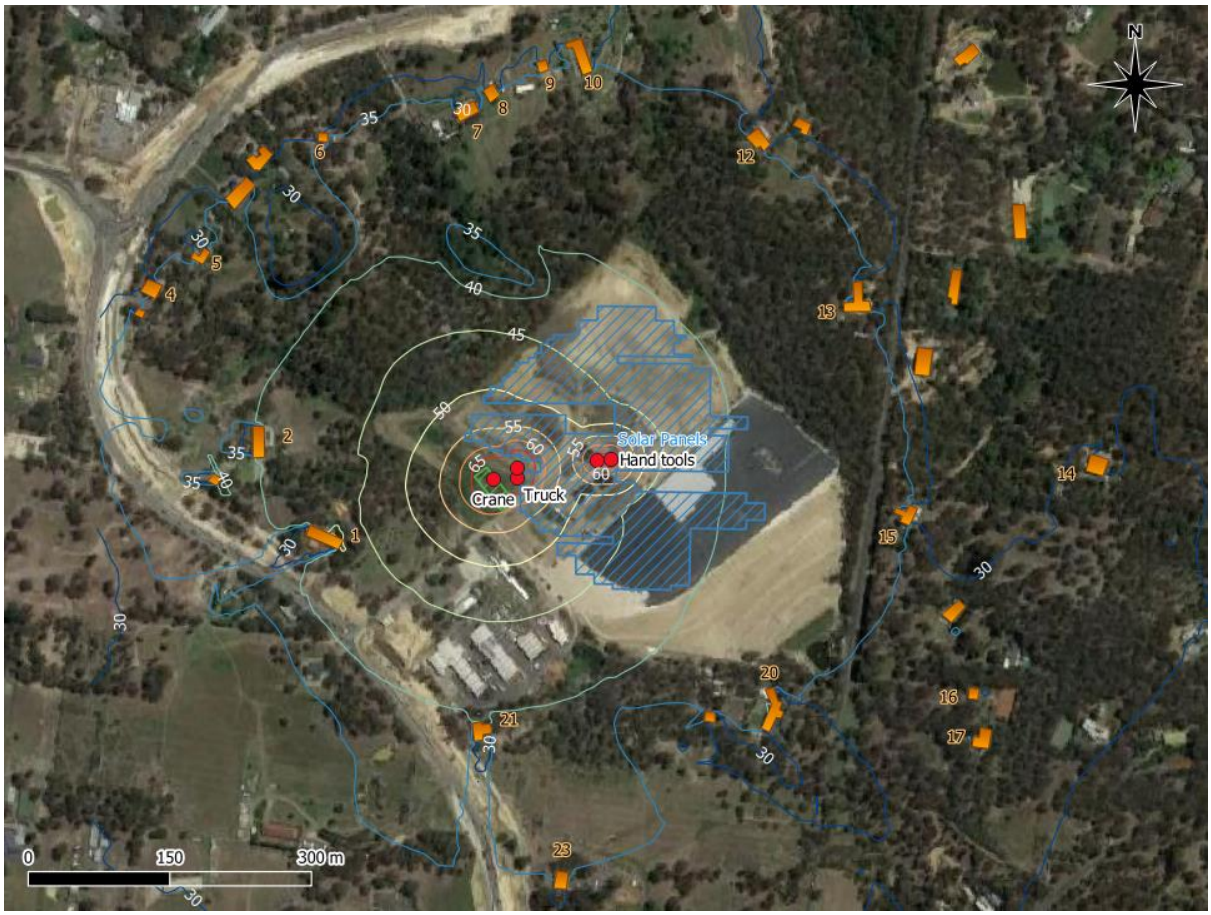


Figure 5-2 shows that none of the receptors are predicted to experience noise levels above 45 dBA.

Figure 5-3 shows the predicted noise levels for the directional drilling works.

Figure 5-3 Directional drilling works

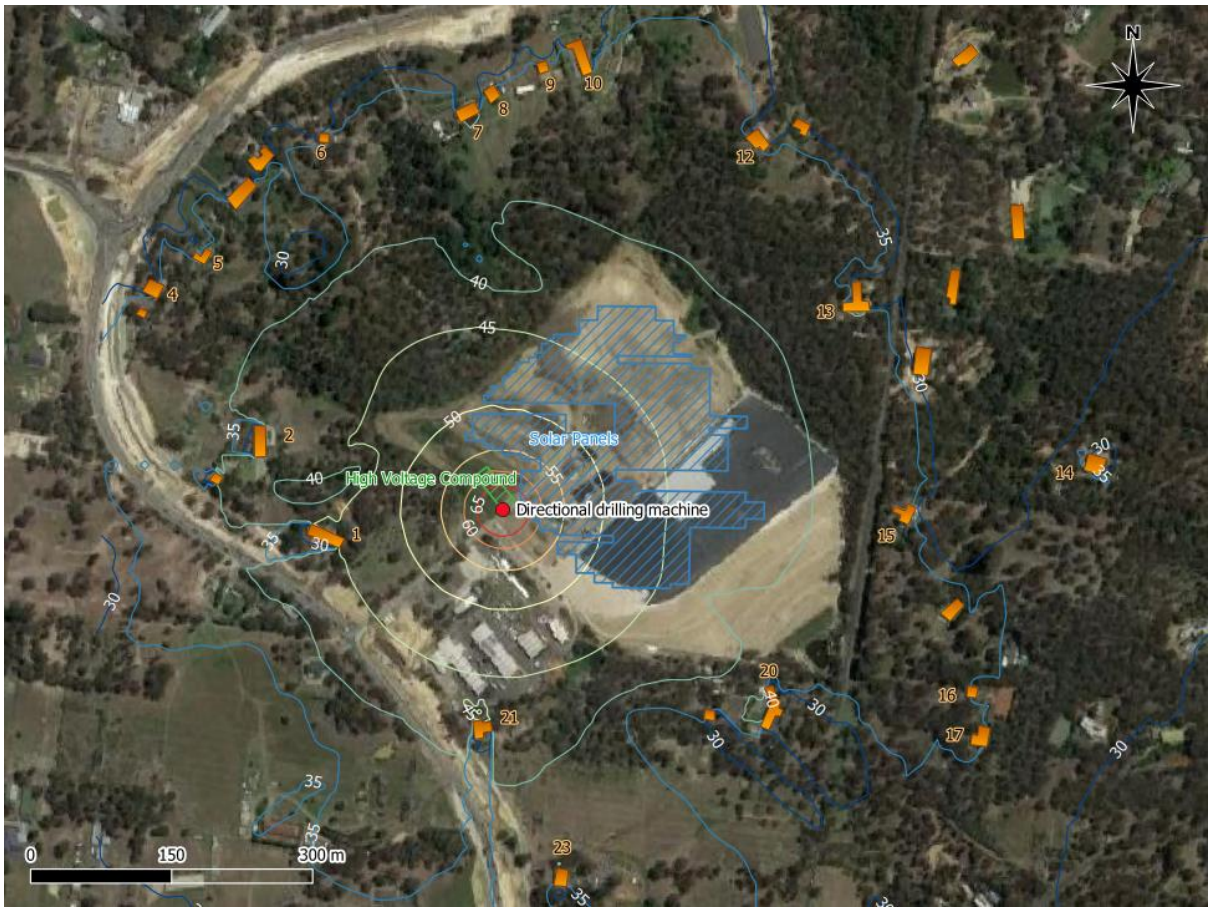


Figure 5-1 to Figure 5-3 shows that none of the receptors are predicted to experience noise levels in exceedance of the 55 dBA noise limit for the construction or the decommissioning of the solar PV facility.

5.4 OPERATIONAL PHASE

The noise model was used to determine the noise impacts for the situation where all inverters are generating maximum noise levels.

5.4.1 Stage 1

Figure 5-4 shows the predicted noise levels during periods where the 12 times 100 kVA inverters generate the highest noise levels.

Figure 5-4 Maximum predicted noise emission for Stage 1

Figure 5-4 shows that the most restrictive noise criteria (the night-time noise limit of 43 dBA) is not predicted to be exceeded at any of the noise sensitive receptors.

5.4.2 Stage 2

Figure 5-5 shows the predicted noise levels during periods where the 28 times 100 kVA inverters generate the highest noise levels.

Figure 5-5 Maximum predicted noise emission for Stage 2

Table 5-5 presents the predicted noise levels during periods where the 28 inverters generate the highest noise levels. The table also show whether the predicted noise levels are in compliance with the most restrictive noise limit, hence the 43 dBA night-time noise limit.

Table 5-5 Noise levels during maximum noise emission

Receiver	Predicted level during maximum noise emission, dBA	Complies with the 43 dBA noise limit?
1	33.9	Yes
2	30.8	Yes
4	25.6	Yes
5	25.9	Yes
6	25.0	Yes
7	26.3	Yes
8	25.7	Yes
9	26.4	Yes
10	24.9	Yes
12	25.4	Yes
13	26.5	Yes
14	19.8	Yes
15	25.9	Yes
16	23.2	Yes
17	22.7	Yes
20	26.9	Yes
21	30.1	Yes
23	25.7	Yes

Table 5-5 shows that the noise generated by the inverters when every single one of them generate the highest noise levels are predicted to comply with the noise limit for the night-time period and hence also for the day, the evening period as well as the Saturday and Sunday periods.

It is noted that noise emitted from the facility possibly would be lower in the early morning hours and in the evening hours as the facility is not expected to operate at full capacity as a result of lower sun irradiation in these time periods. The margin of compliance with the night-time noise limit of 3 dBA is therefore expected to be higher in the early morning hours, where the night-time noise limit is applicable.

6 CONCLUSION

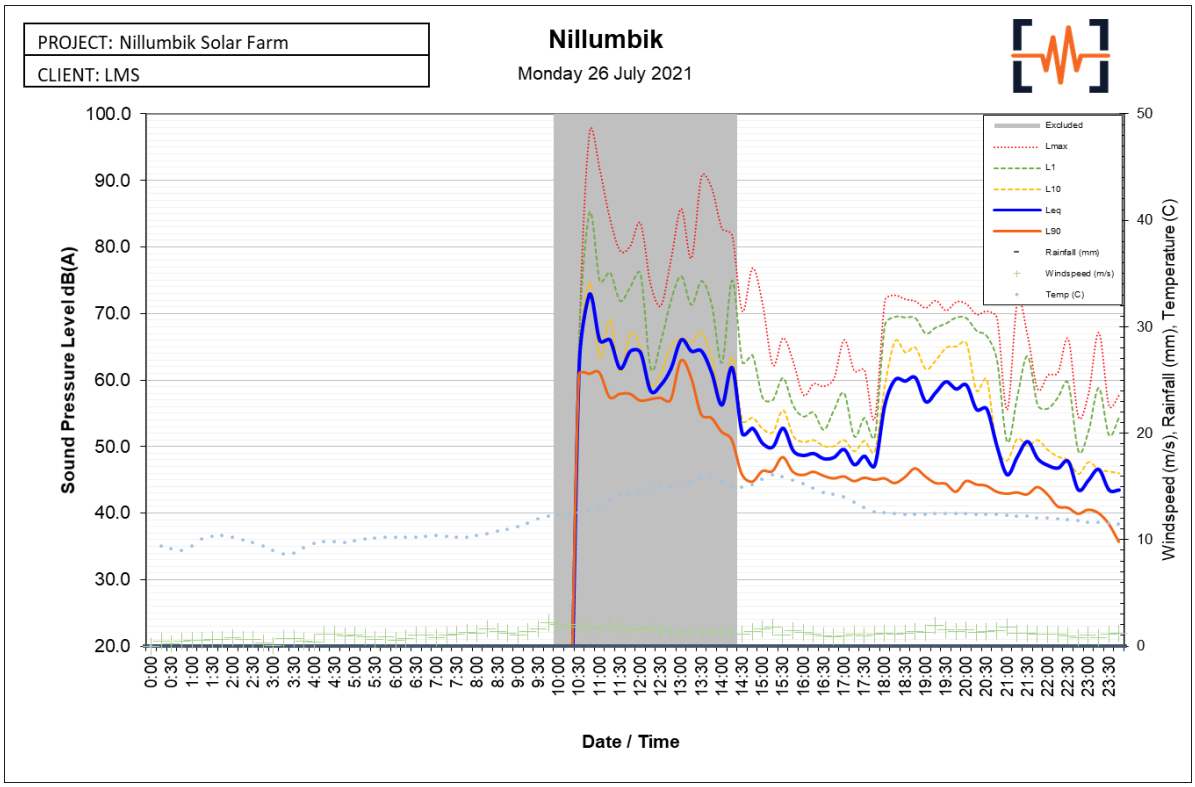
The noise assessment found that the noise levels experienced at the receptors surrounding the proposed facility would be in compliance with the noise limit for the construction period.

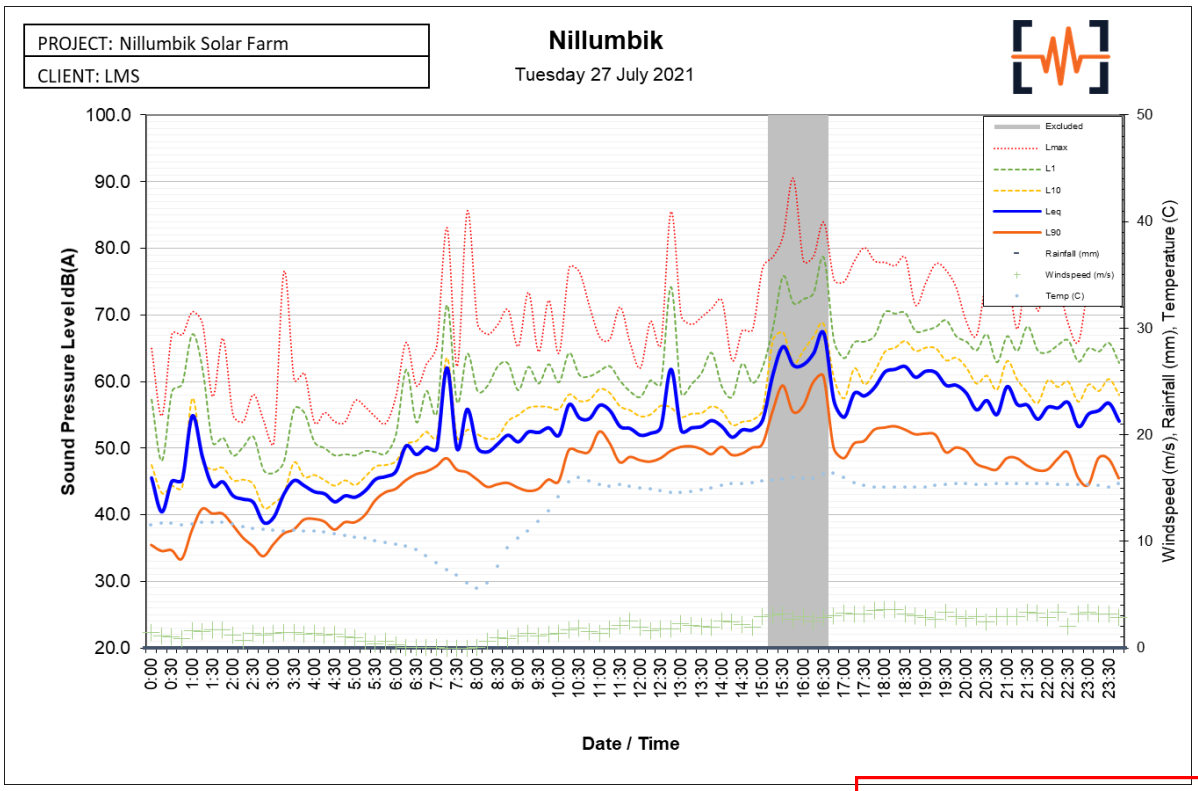
The noise emitted from the site during normal Stage 1 operations showed compliance with the noise limits for the day, evening and night-time period.

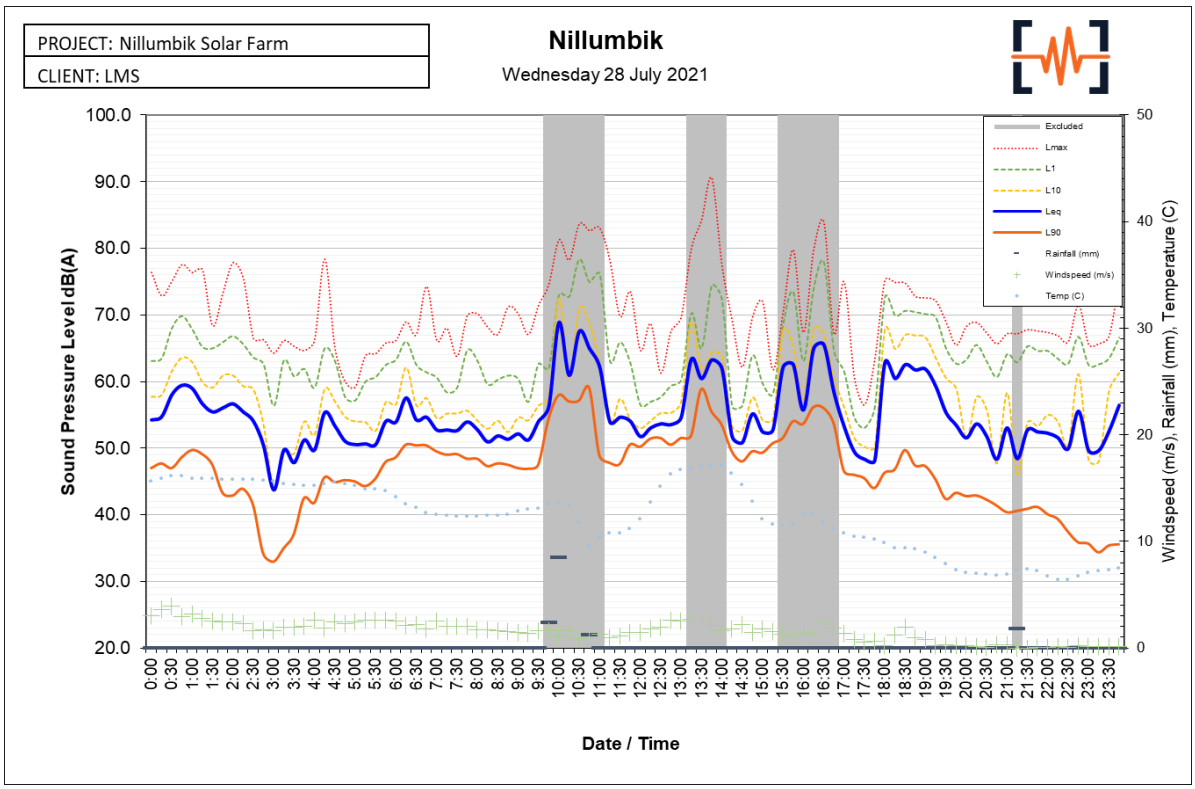
The noise emitted from the site during normal Stage 2 operations also showed compliance with the noise limits for the day, evening and night-time period.

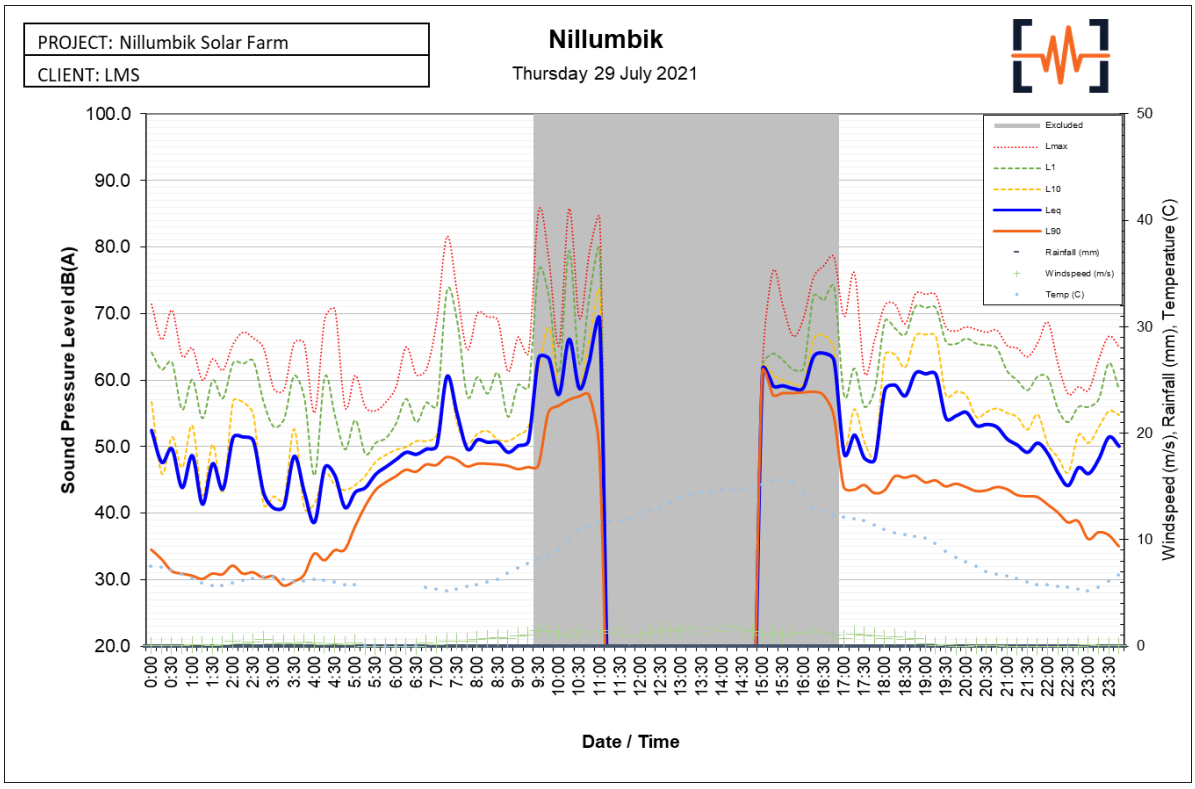
The assessment noted that noise emitted from the facility possibly would be lower in the early morning hours and in the evening hours as the facility is not expected to operate at full capacity as a result of lower sun irradiation in these time periods. The margin of compliance with the noise limit is therefore expected to be better than indicated in this report.

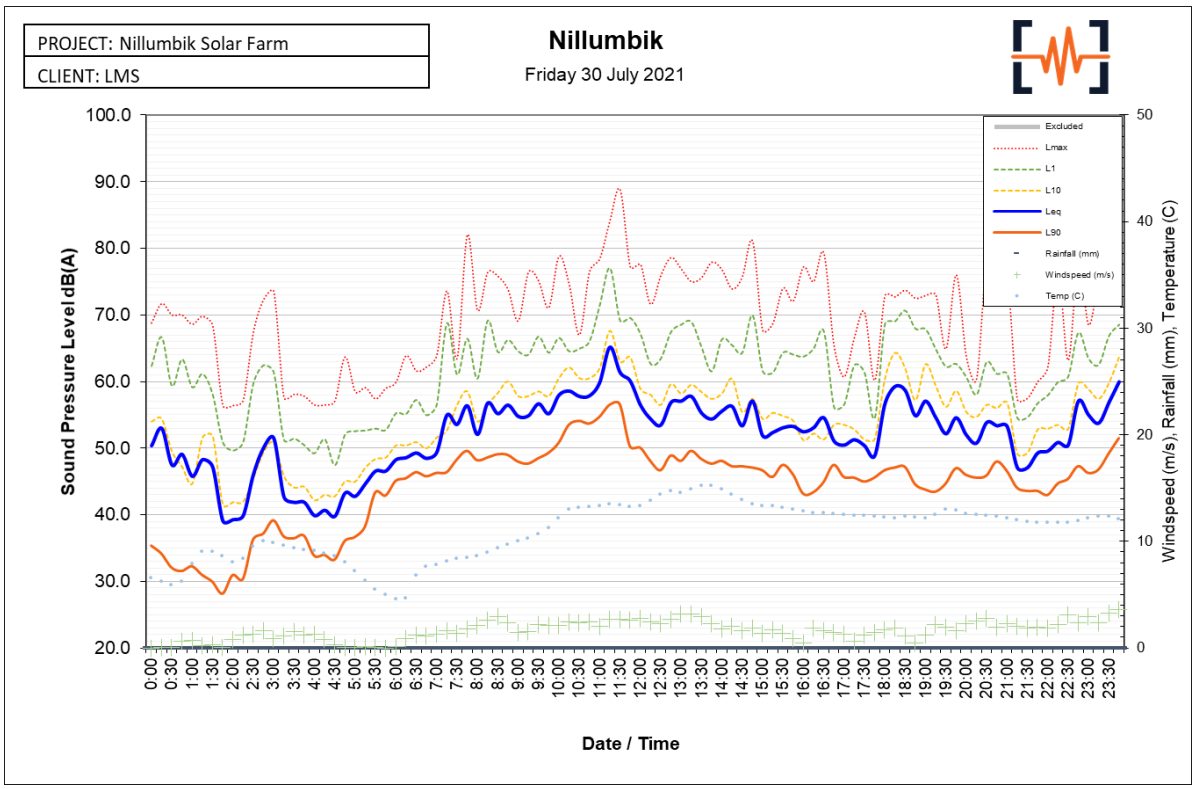
APPENDIX A - NOISE GRAPHS

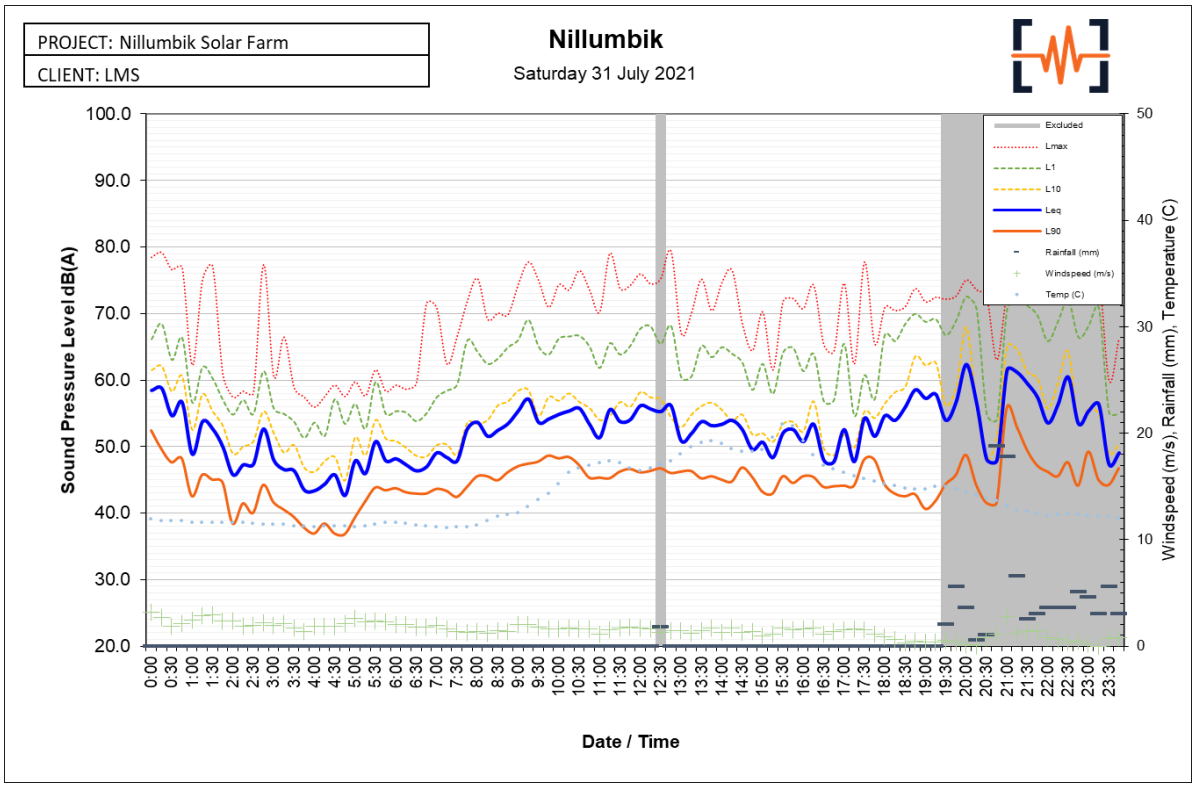


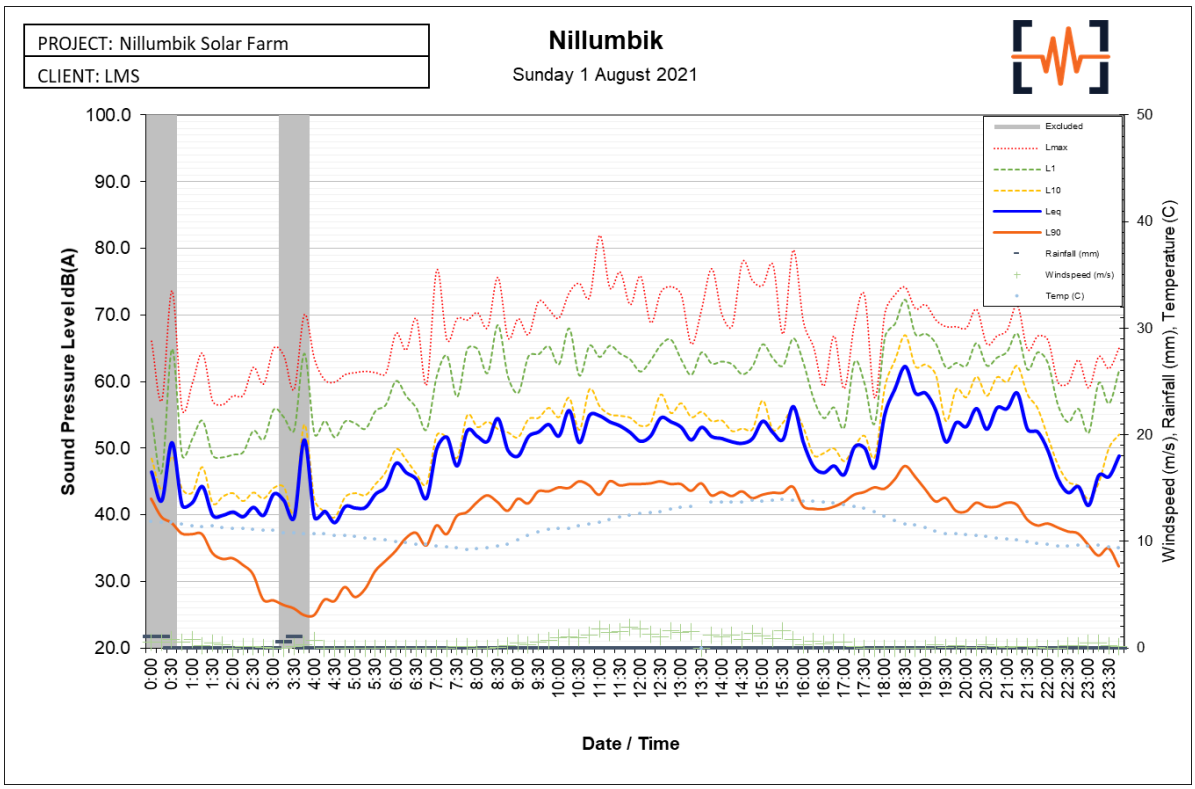


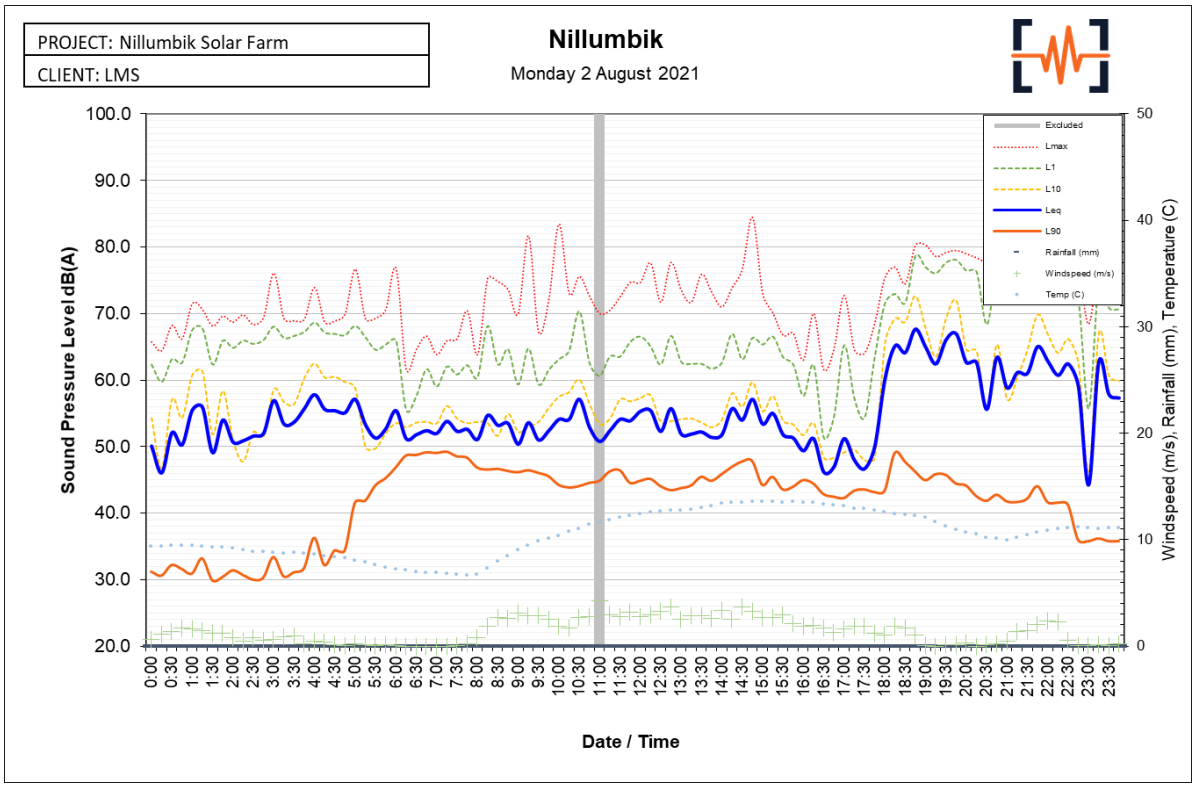


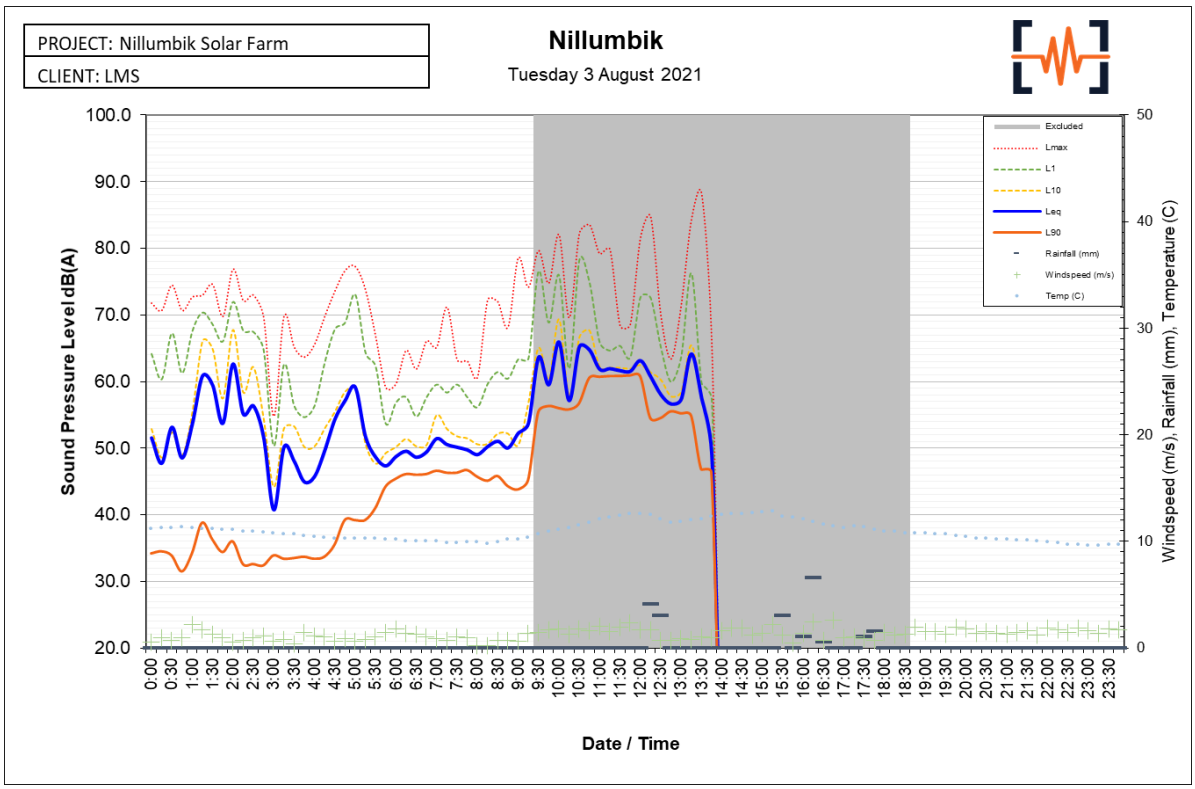












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Brendale, Qld, 4500

MEMO

Date:	1/3/2022
To:	LMS Energy Pty Ltd
Attention:	Fiona Lambert
Author:	Asbjorn Hansen
Document Reference:	ME20210022A - Memo for Nillumbik Solar Farm

NOISE IMPACTS PERTAINING A REDUCTION OF SOLAR OUTPUT

In January 2022 Matrix Acoustics prepared the noise impact assessment for the proposed 2.8 MW Solar PV Facility at the Nillumbik landfill site at 290 Yan Yean Road, Plenty.

The noise impact assessment found that the noise levels experienced at the receptors surrounding the proposed facility would be in compliance with the noise limit during normal operation of the site.

The design has since January 2022 changed with the proposed change being to reduce the output from 2.8MW to 1.2MW. This will result in a reduction in the number of panels at the site, and also a reduction in the number of inverters.

A summary of the project changes are as follows:

- Reduction in the size of the system from 2.8MW to 1.2MW (AC).
- Reduction in the number of solar panels.
- Reduction in the footprint on the site.
- Reduction in the number of inverters from 28 to 12 in the electrical compound.
- Removal of the reactor from the electrical compound.
- Reduction in the number of transformers from two to one.
- Removal of the transformer from the electrical compound. The transformer will be owned by Ausnet and location is yet to be advised by AusNet.
- Removal of Ring Main Unit from electrical compound.
- Reduction in the size of the electrical compound to accommodate less equipment.
- Addition of a switchboard to the electrical compound.

A review of the changes and revised layout of the site confirms that the findings of the initial report dated 13 January 2022 are still relevant, and that the decreased size of the development will still meet the relevant standards/provisions previously assessed against.

Yours sincerely,

Asbjorn Hansen (RPEQ: 21838)

Asbjorn Hansen

End of Memo

Nillumbik Solar Farm

Location:	Nillumbik
Client:	LMS Energy
Date:	September 2021

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APPROVAL / SIGN OFF

ISSUE				
	Name	Position	Signature	Date
Prepared by:	Asbjorn Hansen (RPEQ: 21838)	Senior Engineer	Asbjorn Hansen	13/09/2021
Reviewed by:	Ben Hall	Principal Consultant		14/09/2021
Approved by:	Asbjorn Hansen (RPEQ: 21838)	Senior Engineer	Asbjorn Hansen	14/09/2021
Comments:				

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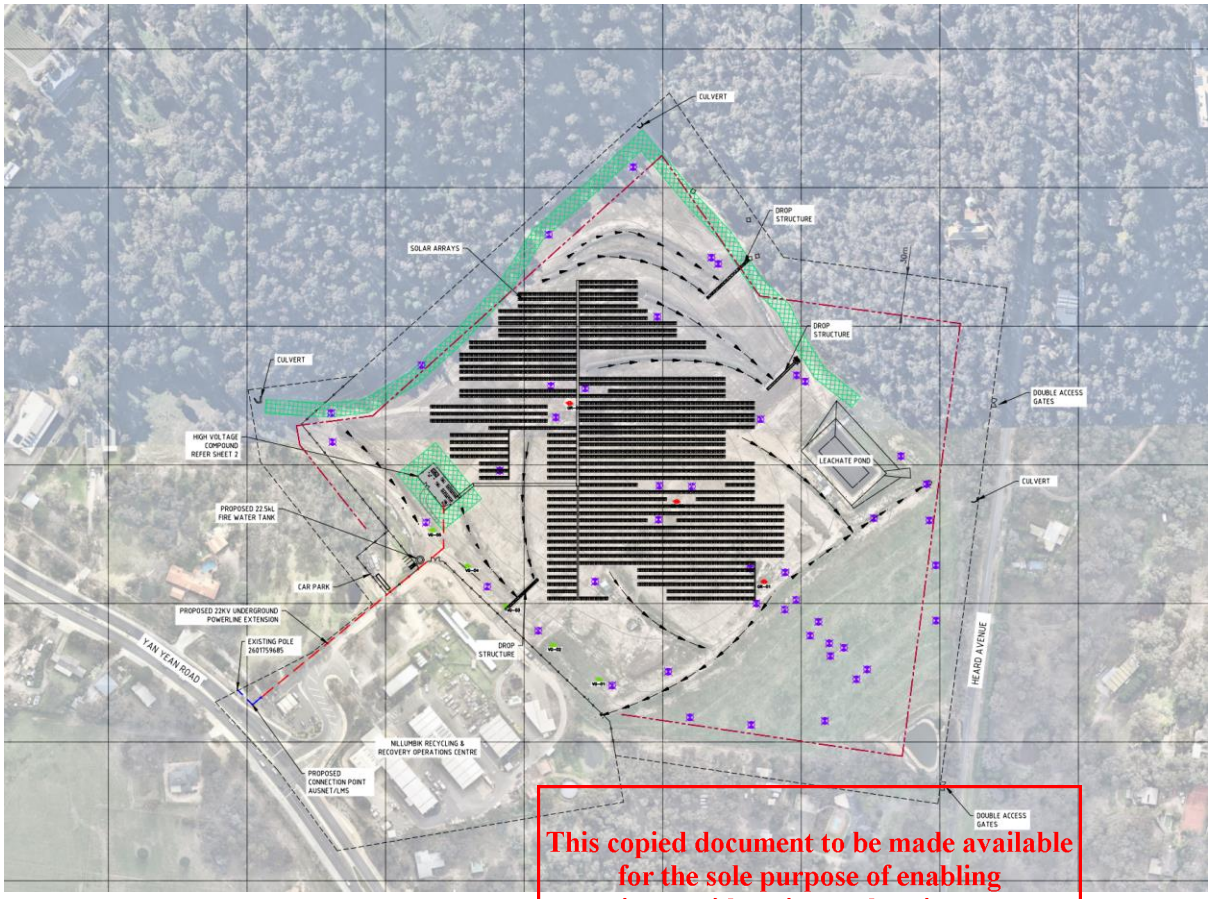
The site will be an unmanned facility. The number of vehicles and personnel accessing the site will therefore be limited to occasional maintenance staff, there are as such no set operational hours for staff. It should however be noted that the inverters only will be operating, and hence generating noise, during daylight hours. The proposed site layout is shown in Figure 1-1 below.

Figure 1-1 Proposed site layout



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The distance between the site and the receptors are approximately 150 to 300 m.

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The noise monitoring location was approximately 150 m northeast of Yan Yean Road and represents the ambient noise levels for the noise sensitive receptors situated within 150 m of Yan Yean Road.

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- Pulsar Model 105 acoustic calibrator, serial number: 93095

Noise from Yan Yean Road is continuous at this location as well as occasional noise from Nillumbik Recycling Centre.

Figure 3-1 Location of the noise monitor

Image 3-1 Noise monitor at the site

Noise monitoring was conducted for 8 days commencing Monday 26 July and concluding Tuesday 3 August 2021. The noise monitor recorded the following parameters, L_{max}, L_{min}, L_{eq}, L_{01}, L_{10}, L_{90} for each 15 minute interval with a 'Fast' time weighting. The noise monitor was calibrated pre and post the measurement period with no variations greater than 0.1 dB observed. Some inclement weather (rainfall was above 3 mm/hr, or wind above 5 m/s) was observed during the monitoring period and these have been excluded from the background assessment. Elevated noise levels as a result of activity at the Recycling Centre were also excluded during the analysis of the noise data.

The arithmetic average noise levels in each period were determined for the duration of the monitoring.

Table 3-1 presents a summary of the day, evening, night-time, Saturday and Sunday average background noise levels. Noise logging graphs are presented in Appendix A.

Table 3-1 Summary of recorded noise levels

Period	Ave L_{A01} dBA	Ave L_{A10} dBA	Ave L_{Aeq} dBA	Median L_{90} dBA
Day	61	54	52	45
Evening	67	60	57	43
Saturday (1300 – 1800)	61	53	51	42
Sunday (0700 – 1800)	62	54	52	41
Night	59	51	49	33

The noise levels measured are typical of noise levels in a semi-rural setting in close vicinity to a significant transportation corridor.

3.2 LAND USE ZONINGS

SEPP N1 requires the classification of land use zonings in the determination of the project noise criteria. Image 3-2 the zones surrounding the monitoring location.

Image 3-2 Zones surrounding Location B

4 NOISE LIMITS

4.1 CONSTRUCTION AND DECOMMISSIONING NOISE LIMITS

Construction noise levels are governed by Victorian EPA Publication 1834, November 2020 *Civil construction, building and demolition guide* which specifies limits for construction and demolition noise. The guideline does not specify noise limits for normal working hours which are 7am – 6pm Monday to Friday and 7am – 1pm Saturday. The Saturday working hours applies to this project as this project is considered a major industrial project.

Though the guideline does not specify a noise limit for normal working hours it does state that: *"You are expected to minimise noise and vibration at all times"*. For the sake of this assessment, the target construction noise level during normal construction hours is taken to be 55 dBA, measured as an equivalent noise level (L_{Aeq}) outside of a dwelling. 55 dBA is based on a noise level where conversations easily can be held without having to raise the voice. Figure 4-1 shows the decibel scale including examples of how loud various noise sources are.

Figure 4-1 Decibel scale

Decibels	Example
0	Silence
10	Breathing, ticking watch
20	Rustling leaves, mosquitos
30	Whispering
40	Light rain, computer hum
50	Quiet office, refrigerator
60	Normal conversation, air conditioner
70	Shower, toilet flush, dishwasher
80	City traffic, vacuum cleaner
90	Music in headphones, lawn mower
100	Motorcycle, hand drill
110	Rock concert, chain saw
120	Thunderclap
130	Maximum stadium crowd noise
140	Aeroplane taking off
150	Fighter jet take off
160	Shot gun
170	Fireworks
180	Rocket launch

Construction works is not planned outside normal construction hours.

4.2 OPERATIONAL NOISE LIMIT

As the site is situated in the metropolitan Melbourne the noise limits applicable for the site are prescribed by the SEPP N-1. The SEPP N-1 stipulates how the noise limits are determined based on the existing ambient background noise levels. The noise limits were derived as outlined in the SEPP N-1 and are shown in Table 4-1.

Table 4-1 Operational noise limits

Period	Zoning Levels, dBA	Background Level, dBA	Noise Limit, dBA
Day	57	45 (neutral)	57
Evening	51	43 (neutral)	51
Saturday (1300 – 1800)	51	42 (neutral)	51
Sunday (0700 – 1800)	51	41 (low)	49 » (51+41)/2+3
Night	46	33 (low)	43 » (46+33)/2+3

5 ASSESSMENT

The proposed site is a newly capped landfill site. A requirement for the development of this site is that no works is undertaken to the capping which includes drilling holes in the capping. It therefore follows that drilling for mounting of the solar panel frames is not possible. The solar panel frames for this project will be fabricated offsite. The frames consist of a concrete footed metal structure that is placed on the capping which of the time of construction will be planted with grass. Once the solar frames are placed in the correct locations the solar panels are mounted on the frames using hand tools. It should be noted that the solar panel frames are static frames, hence solar tracking will not occur.

The construction of the solar PV facility is likely to occur over a few months, however for much of the time the construction works is likely to generate relative low noise levels as the works predominantly will consist of mounting of solar panels to the solar panel frames as well as clip and fastening of power cables to the solar panel frames. The noisiest activities are therefore likely to be the construction of the high voltage compound and the directional drilling machine for the connection of the facility to the grid.

The noise sources used during the construction will include delivery trucks, a directional drilling machine, a telehandler, a crane and hand tools. Construction activities are anticipated to only occur during normal construction hours of 7am to 6pm Monday to Friday and Saturday 7am to 1pm.

The proposed facility will only generate noise during daylight hours as all the electronic components turn off once the sun stops shining on the solar panels. At the proposed location of the site the sun rises between the hours of 5:50am and 7:36am depending on the time of the year and the sun sets between the hours 5:07pm and 8:45pm. It therefore follows that the facility is likely to generate noise both during the day, evening and the night-time period during the operational stage of the facility.

It should however be noted that the facility is not likely to operate at full capacity in the early morning and just before sunset due to the shading provided by parallel rows of solar panels and low intensity light in these periods. The cooling fans are as such not likely to operate at full speed, as the system is not operating at full capacity. It therefore follows that the system is likely to generate less noise in the early morning and in the evening periods.

5.1 SOUND POWER LEVELS

The noise impacts associated with the construction phase have been modelled with the sound power levels presented in Table 5-1

Table 5-1 Construction equipment sound power levels

Equipment	Sound power level, dBA
Delivery truck	98
Concrete truck	100
Crane	101
Telehandler	99
Hand tools	92
Directional drilling machine	103

The only items generating noise during the operational phase will be the inverters as well as maintenance staff when present. The maintenance staff is likely to drive around the site to look for issues and use hand tools where issues are identified. The noise impacts associated with maintenance works are considered minimal. Maintenance works has as such not been assessed.

Table 5-2 and Table 5-3 lists the sound power levels used for the assessment of the two operational stages of the project.

Table 5-2 Sound power levels of the equipment at the facility for stage 1

Equipment	Sound power level, dBA	Number of items
100 kVA inverter	77	12

Table 5-3 Sound power levels of the equipment at the facility for stage 2

Equipment	Sound power level, dBA	Number of items
100 kVA inverter	77	28

It should be noted that the sound power level of the Sunny Highpower PEAK3 100kVA inverter is based on the assumption that the 69 dBA noise emission data level as provided in the data sheet is the noise level 1 m from the inverter when it is operating at full capacity. This assumption is based on information found in an earlier version of the data sheet for this inverter.

5.2 NOISE MODEL INFORMATION

Noise levels from the proposed construction and plant operations have been predicted with the proprietary software package SoundPLAN version 8.1 using the in-built ISO 9613-2:1996 *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* prediction method.

Elevation data for the site and the surrounding area was obtained from the Victoria State Governments Vicmap Elevation 10 m grid resolution raster model. The elevation contours have been used to construction a 3D terrain model for the area which was imported into SoundPLAN.

Noise predictions have been calculated conservatively with the ISO 9613 method which incorporates downwind propagation or equivalently propagation under a well-developed moderate ground-based temperature inversion.

Table 5-4 presents the meteorological conditions used in the noise model.

Table 5-4 Modelled meteorological conditions

Meteorological condition	Value
Air pressure	1013 mbar
Relative humidity	70%
Temperature	10°C

5.3 CONSTRUCTION AND DECOMMISSIONING

Three scenarios were modelled for the construction and decommissioning of the site:

- Scenario 1 includes a cement truck pouring the slab for the high voltage compound.
- Scenario 2 includes a crane lifting the large inverter into place, a delivery truck delivering solar panels, a telehandler unloading the solar panels and two groups of people installing panels using hand tools. It is expected that the decommissioning of the solar PV facility will include hand tools, a telehandler and trucks, hence noise levels for the decommissioning of the site is expected to be very similar to the noise levels generated during the construction of the site.
- Scenario 3 includes a directional drilling machine used for drilling an underground power line required to connect the solar PV facility to the grid.

Figure 5-1 shows the receptors surrounding the site and the expected noise levels from the cementing activities.

Figure 5-1 Pouring of concrete slab

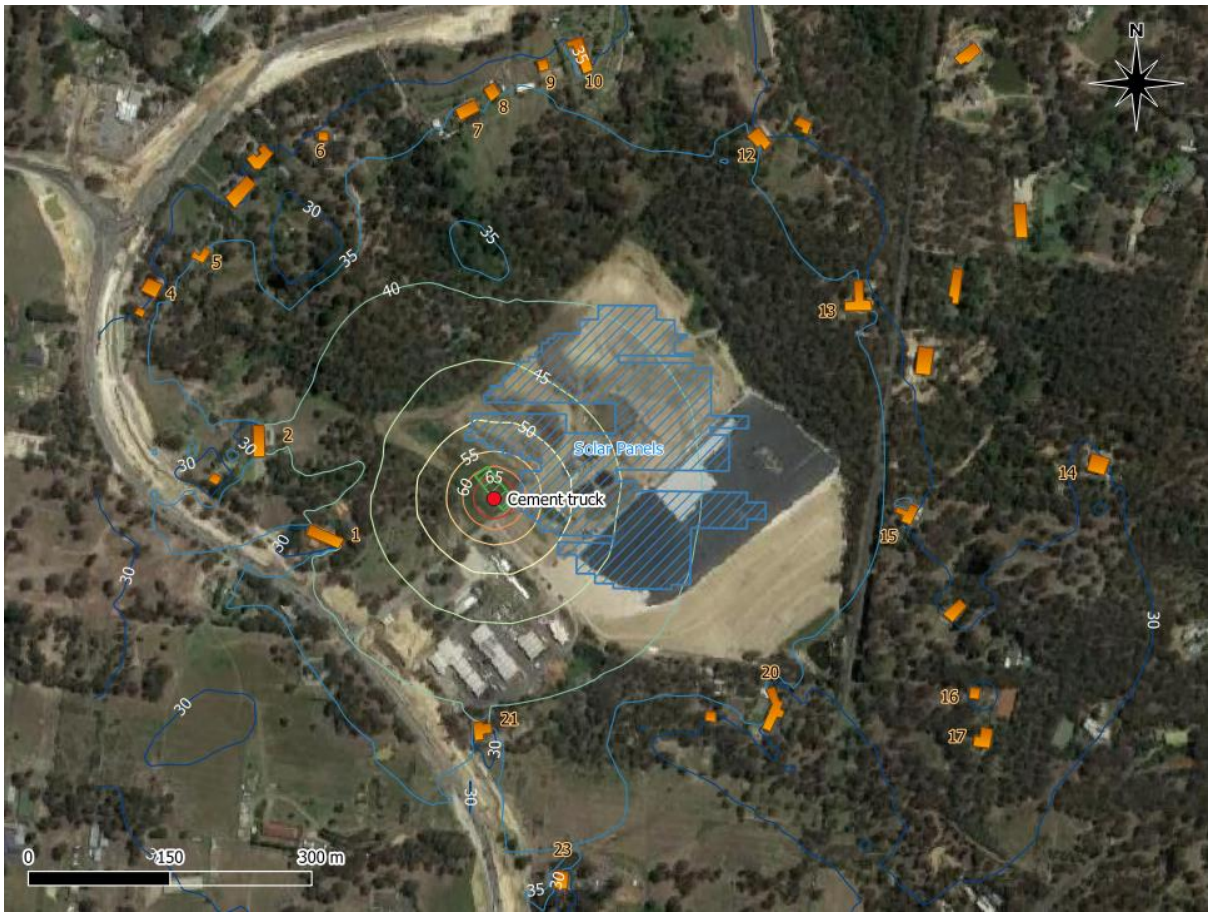

Figure 5-1 shows that none of the receptors are predicted to experience noise levels above 45 dBA.

Figure 5-2 shows the predicted noise levels as a result of the installation of the solar panels and the inverters.

Figure 5-2 Installation of solar panels and inverters

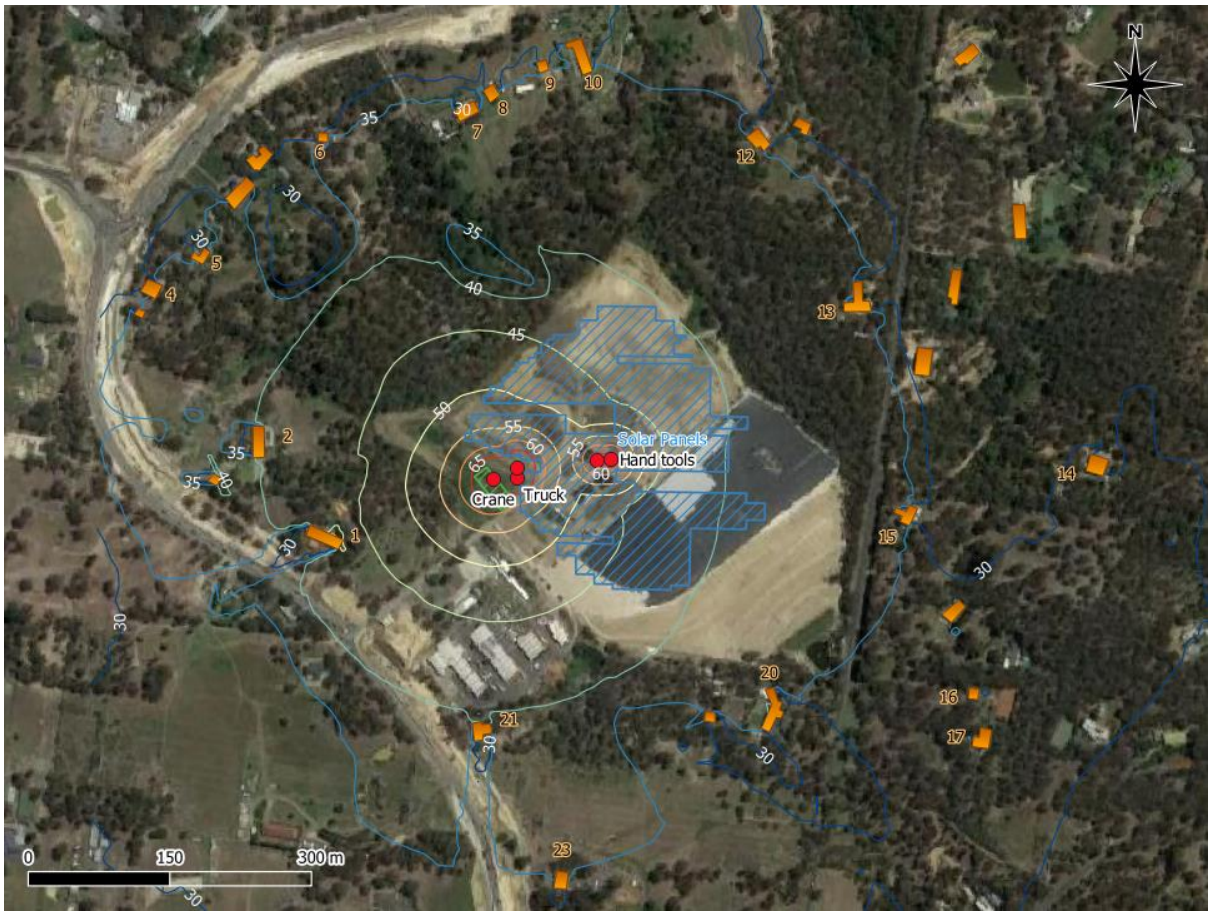

Figure 5-2 shows that none of the receptors are predicted to experience noise levels above 45 dBA.

Figure 5-3 shows the predicted noise levels for the directional drilling works.

Figure 5-3 Directional drilling works

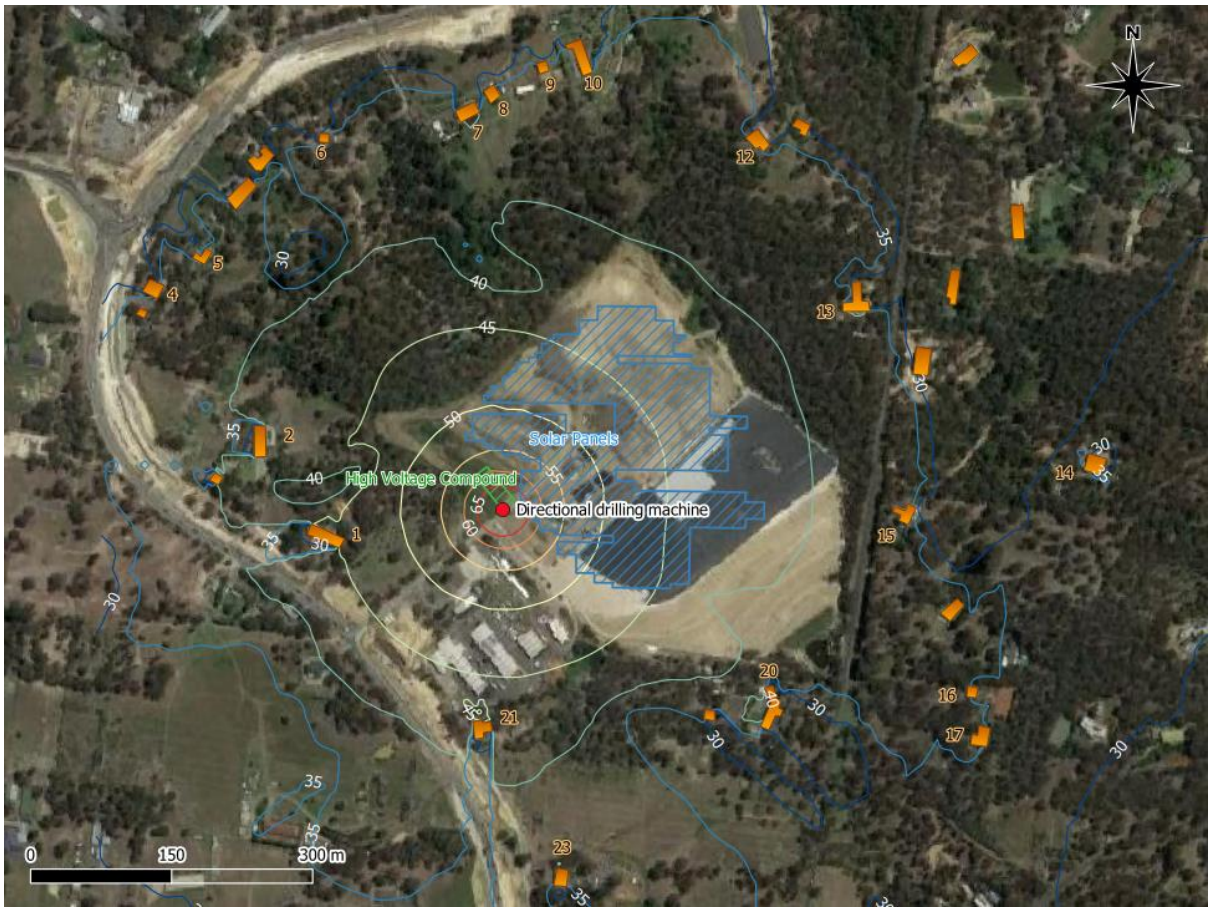

Figure 5-1 to Figure 5-3 shows that none of the receptors are predicted to experience noise levels in exceedance of the 55 dBA noise limit for the construction or the decommissioning of the solar PV facility.

5.4 OPERATIONAL PHASE

The noise model was used to determine the noise impacts for the situation where all inverters are generating maximum noise levels.

5.4.1 Stage 1

Figure 5-4 shows the predicted noise levels during periods where the 12 times 100 kVA inverters generate the highest noise levels.

Figure 5-4 Maximum predicted noise emission for Stage 1

Figure 5-4 shows that the most restrictive noise criteria (the night-time noise limit of 43 dBA) is not predicted to be exceeded at any of the noise sensitive receptors.

5.4.2 Stage 2

Figure 5-5 shows the predicted noise levels during periods where the 28 times 100 kVA inverters generate the highest noise levels.

Figure 5-5 Maximum predicted noise emission for Stage 2

Table 5-5 presents the predicted noise levels during periods where the 28 inverters generate the highest noise levels. The table also show whether the predicted noise levels are in compliance with the most restrictive noise limit, hence the 43 dBA night-time noise limit.

Table 5-5 Noise levels during maximum noise emission

Receiver	Predicted level during maximum noise emission, dBA	Complies with the 43 dBA noise limit?
1	33.9	Yes
2	30.8	Yes
4	25.6	Yes
5	25.9	Yes
6	25.0	Yes
7	26.3	Yes
8	25.7	Yes
9	26.4	Yes
10	24.9	Yes
12	25.4	Yes
13	26.5	Yes
14	19.8	Yes
15	25.9	Yes
16	23.2	Yes
17	22.7	Yes
20	26.9	Yes
21	30.1	Yes
23	25.7	Yes

Table 5-5 shows that the noise generated by the inverters when every single one of them generate the highest noise levels are predicted to comply with the noise limit for the night-time period and hence also for the day, the evening period as well as the Saturday and Sunday periods.

It is noted that noise emitted from the facility possibly would be lower in the early morning hours and in the evening hours as the facility is not expected to operate at full capacity as a result of lower sun irradiation in these time periods. The margin of compliance with the night-time noise limit of 3 dBA is therefore expected to be higher in the early morning hours, where the night-time noise limit is applicable.

6 CONCLUSION

The noise assessment found that the noise levels experienced at the receptors surrounding the proposed facility would be in compliance with the noise limit for the construction period.

The noise emitted from the site during normal Stage 1 operations showed compliance with the noise limits for the day, evening and night-time period.

The noise emitted from the site during normal Stage 2 operations also showed compliance with the noise limits for the day, evening and night-time period.

The assessment noted that noise emitted from the facility possibly would be lower in the early morning hours and in the evening hours as the facility is not expected to operate at full capacity as a result of lower sun irradiation in these time periods. The margin of compliance with the noise limit is therefore expected to be better than indicated in this report.

APPENDIX A - NOISE GRAPHS