Report

23 October 2024

To	Andrew Sheed (Akasha Energy) Prabha Subramanian (Akaysha Energy)	**Contact No.**	+ 61 2 9239 7205
Copy to	Jordon Doss (Akaysha Energy)	**Email**	Evan.Milton@ghd.com
From	Evan Milton (GHD) Rosy Browell (GHD) Matthijs Oosterlaken (GHD)	**Project No.**	12619020
Project Name	Waratah Super Battery - Noise Modelling		
Subject	Out of hours work – noise monitoring and model validation		

1. Introduction

1.1 Purpose of this report

Akaysha Energy obtained approval (reference SSI-48492458-PA-33) from the Department of Planning, Housing & Infrastructure (DPHI) to carry out construction activities outside of standard construction hours on Saturdays from 7 am to 8 am and from 1 pm to 5 pm, and on Sundays from 7 am to 5 pm. One of the requirements of this approval is to undertake attended noise monitoring in order to validate the noise model.

GHD has conducted short-term attended noise monitoring at sensitive receiver locations and unattended measurements at an intermediate location to quantify noise levels from the construction site at receivers.

The purpose of this report is to describe the findings of the noise monitoring surveys undertaken to date and present the validated noise modelling results.

1.2 Scope of work

The following works were undertaken:

– At-receiver attended noise monitoring to check compliance the noise management levels
– Unattended on-site noise measurements to facilitate calculation of site contribution at receivers
– Validated the noise modelling using the noise monitoring survey results.

1.3 Limitations

This report: has been prepared by GHD for Akaysha Energy and may only be used and relied on by Akaysha Energy for the purpose agreed between GHD and Akaysha Energy as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Akaysha Energy arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

2. Construction noise and vibration criteria

2.1 Construction noise management levels

The report *Waratah Super Battery – Munmorah, Appendix G - Noise and Vibration Assessment* (GHD, 2022) has established construction NMLs at sensitive receivers, based on the established Rating Background noise Levels (RBL). The established NMLs have been reproduced in Table 2.1 below. The receiver locations are presented in Figure 2.1.

Predicted noise levels from the validated noise model have been assessed against the daytime NMLs for construction works outside standard hours at the receivers identified in Figure 2.1.

Table 2.1 Project specific construction noise management levels

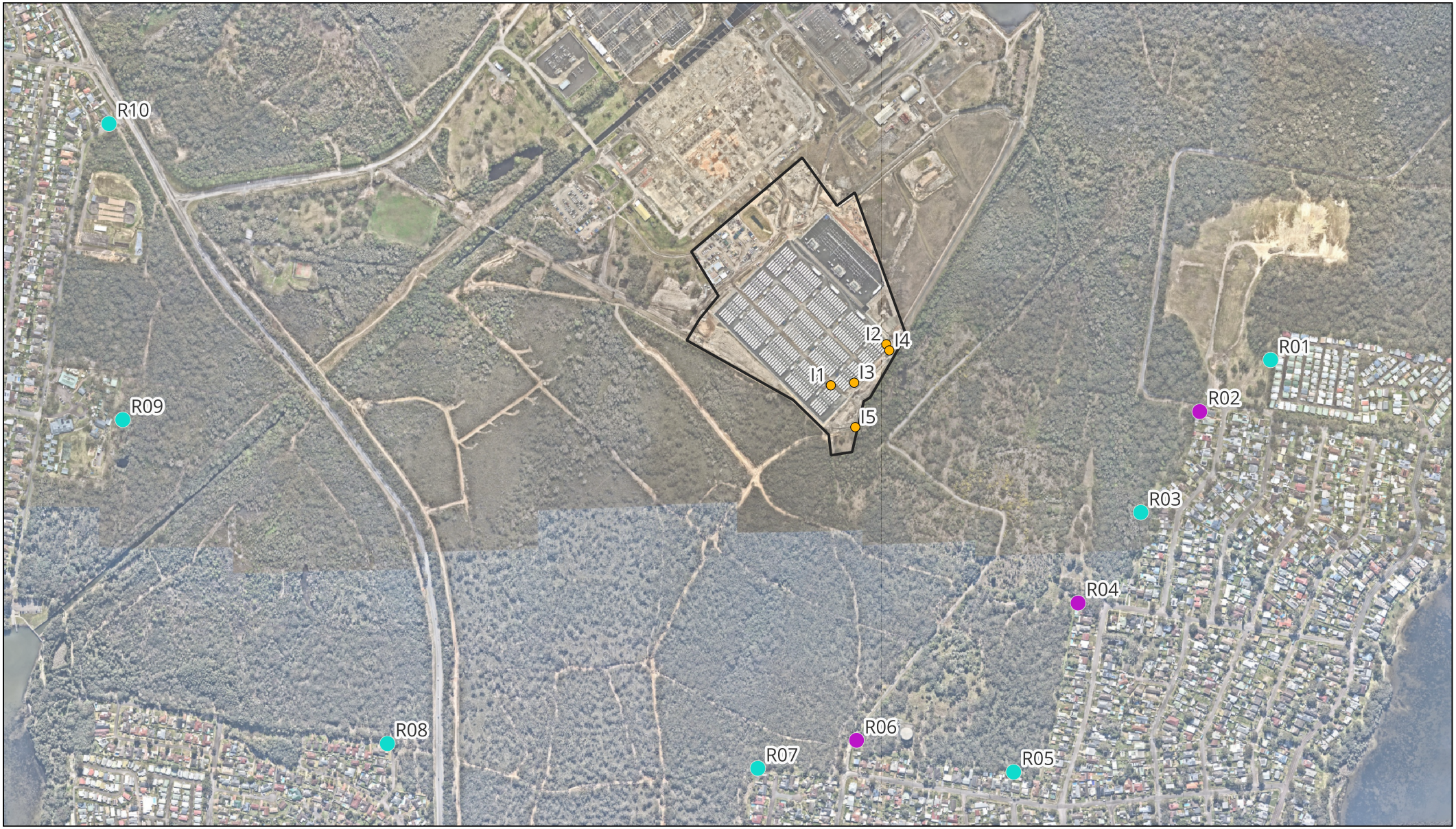
Sensitive receiver type	Standard construction hours		Outside standard construction hours		
	Noise affected (dBA)	Highly noise affected (dBA)	Day (dBA)	Evening (dBA)	Night (dBA)
Residential receivers R1 to R7 and R9 (NCA1)	45	75	40	40	35
Residential receivers R8 and R10 (NCA2)	58	75	53	47	35

2.2 Conditions of Approval

Approval was granted by the Planning Secretary, subject to the following noise monitoring requirements as in the letter of approval (SSI-48492458-PA-33). This report outlines how these requirements have been met to maintain the acoustic amenity of the area.

1. *For all noise monitoring completed under the existing approval and this approval. reports are to be consistent with the requirements of Section 8.2 of the ICNG and include:*
    a. *Details on each monitoring location, including receptor number, address and a figure showing the locations;*
    b. *The date and start time of each noise monitoring event;*
    c. *Confirmation that each attended noise monitoring event was 15 minutes in duration;*
    d. *The parameters of the results. including total L_{Aeq} and L_{A90} levels for each monitoring event;*
    e. *The estimated site-only noise contribution for each monitoring event reported as an $L_{Aeq(15minute)}$; If construction noise is not audible during monitoring, this should be stated; and*
    f. *Weather conditions including wind speed and wind direction during monitoring.*
2. *Prior to 31 October 2024, or other timeframe agreed by the Planning Secretary, update and validate the noise model using the results of attended noise monitoring and provide to the Planning Secretary upon request;*
3. *Monthly attended monitoring during out of hours work to be undertaken to validate model predictions, with records to be consistent with the requirements in (1) above;*

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Legend

- Project Site
- Intermediate monitoring locations

Receivers

- Monitoring locations
- Non-monitoring recievers

Paper Size ISO A4

0 200 400 m

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Akaysha Energy
Waratah Super Battery
Outside standard hours construction

Project site, sensitive receivers and noise monitoring locations

Project No. **12619020**
Revision No. **1**
Date. **28/05/2024**

FIGURE 2.1

Document Path: \\ghdnet\ghd\AU\Sydney\Projects\21\12619020\Tech\03_GIS\WSB.qgz

Print Date: 17/10/2023

Data Source: Nearmap imagery

Created By: moosterlaken

3. Noise monitoring

3.1 Methodology

Noise monitoring has been conducted during the out of hours period on Saturdays as required by the conditions outlined in the Planning Secretary's letter of approval (SSI-48492458-PA-33). Details of the noise monitoring program and equipment are outlined in Table 3.1. The noise monitoring methodology to quantify existing construction noise levels included:

– Monthly noise monitoring for compliance of construction plant and equipment associated with the construction activities during the out of hours work on Saturdays.
– Noise monitoring was undertaken using two SVAN 977 sound level meters (SLM). Each SLM was programmed to accumulate L_{A90}, L_{A10}, and L_{Aeq} noise descriptors. The SLMs were used to measure noise levels at the following locations:
    - At one intermediate location to quantify the L_{Aeq} sound pressure level in close proximity to the construction activities for the purpose of determining the contribution of the site at the sensitive receivers.
    - At up to three sensitive receiver locations for a 15-minute period to quantify the L_{Aeq} sound pressure level at the receiver to observe if the construction activities were audible at the receiver.
– A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 1 dBA
– Noise monitoring was conducted by a competent Acoustic Engineer, who is a member employee of GHD, a member firm of the Association of Australasian Acoustical Consultants (AAAC).

Table 3.1 Noise monitoring details

Date	Equipment details		Wind conditions
	Intermediate location	At resident	
June (29/06/2024)	Svan 977 SN45733	Svan 977 SN45744	Northerly winds approximately 1-2m/s
July (20/07/2024)	Svan 977 SN99442	Svan 977 SN97592	North westerly winds approximately 5-6 m/s
August (24/08/2024)	Svan 977 SN36871	Svan 977 SN97592	North westerly winds approximately 1-2m/s
September (14/09/2024)	Svan 977 SN97592	Svan 977 SN36871	Northerly winds approximately 1-2m/s
October (19/09/2024)	Svan 977 SN97528	Svan 977 SN45746	South easterly winds approximately 1-2m/s

3.2 Noise monitoring at receivers

Short-term attended noise monitoring was undertaken at three receiver locations (R02, R04 and R06), which are located closest to the construction site.

The construction activities were not audible during any of the attended measurements subsequent to the monitoring conducted on 29 June 2024 when there were short periods where the construction noise was barely audible above the background noise level. During the site visits on 20 July 2024 monitoring was conducted at R04 however the measured wind speed was above 5m/s and as such monitoring was no conducted at other residential locations.

An overview of the measured noise levels and detailed observations are provided in Table 3.2.

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Table 3.2 Summary of attended noise monitoring at receivers

Date	Start time	Location	Measured noise levels (dBA)			Observation notes
			L_{A90}	$L_{Aeq,15min}$	L_{A10}	
June						
29/06/2024	13:00	R02	37	52	57	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, insects, trees) – occasional car passbys – occasional light planes
29/06/2024	13:25	R04	30	42	44	The construction activities were barely audible. The noise environment consisted of: – intermittent use of power tools at a resident – music at resident – environmental noises (birds, trees) – occasional car passbys – occasional light planes
29/06/2024	1:46	R06	41	46	47	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees) – occasional car passbys
July						
20/07/2024	14:26	R04	41	54	56	The construction activities were not audible Wind noise dominated the noise environment at this location, and wind speeds were measured above 5m/s
August						
24/08/2024	14:14	R04	39	51	52	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees) – occasional car passbys
24/08/2024	14:23	R06	38	43	45	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees) – occasional car passbys – occasional light planes
September						
14/09/2024	13:50	R02	37	49	47	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees) – occasional car passbys – occasional light planes
14/09/2024	14:09	R04	40	53	53	The construction activities were not audible. The noise environment consisted of: – intermittent construction work at a resident – environmental noises (birds, trees) – occasional car passbys
14/09/2024	14:28	R06	41	48	48	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees)

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Date	Start time	Location	Measured noise levels (dBA)			Observation notes
			L_{A90}	$L_{Aeq,15min}$	L_{A10}	
						– occasional car passbys – occasional light planes
October						
19/09/2024	14:34	R04	36	43	45	The construction activities were not audible. The noise environment consisted of: – motorbikes being ridden close to the monitoring location – environmental noises (birds, trees) – occasional car passbys
19/09/2024	14:07	R06	38	49	47	The construction activities were not audible. The noise environment consisted of: – environmental noises (birds, trees) – occasional car passbys

3.3 Intermediate location

Noise monitoring was undertaken at several intermediate location between the construction activities and the sensitive receivers, during the time attended measurements were being conducted at sensitive receiver locations.

These measurements were conducted for the purpose of establishing representative noise levels from the construction site to verify whether the noise model is representative for the construction works, as the site was inaudible at the receiver locations. The noise monitoring locations are presented in Figure 2.1. A summary of the monitoring results at this intermediate location is presented in Table 3.3.

Table 3.3 Summary of attended noise monitoring at the intermediate locations

Date	Location	Start time - end time	Measured noise levels (dBA)		
			$L_{A90,15min}$	$L_{A10,15min}$	$L_{Aeq,15min}$
June (29/06/2024)	I1	12:45 – 13:00	53	59	57
		13:00 – 13:15	53	55	54
		13:15 – 13:30	52	61	59
		13:30 – 13:45	52	63	62
		13:45 – 14:00	53	60	58
		14:00 – 14:15	52	61	59
July (20/07/2024)	I2	14:26 – 14:41	41	56	54
August (24/08/2024)	I3	13:54 – 14:09	36	43	43
		14:09 – 14:24	37	44	41
		14:24 – 14:39	39	47	45
		14:39 – 14:54	37	47	51
		14:54 – 15:09	40	48	45
September (14/09/2024)	I4	13:30 – 13:45	50	58	56
		13:45 – 14:00	50	63	60
		14:00 – 14:15	47	63	60
		14:15 – 14:30	48	64	64

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Date	Location	Start time - end time	Measured noise levels (dBA)		
			$L_{A90,15min}$	$L_{A10,15min}$	$L_{Aeq,15min}$
		14:30 – 14:45	51	72	68
October (19/09/2024)	I5	12:54 – 13:09	34	41	38
		13:09 – 13:24	32	44	46
		13:24 – 13:39	32	49	48
		13:39 – 13:54	31	42	44

4. Noise model predictions

4.1 Modelling methodology

Noise modelling was undertaken using CadnaA (version 2023 MR 2) to predict noise levels at the sensitive receivers surrounding the project site using the noise prediction algorithm ISO9613-2, which is in line with the report *Waratah Super Battery – Noise Modelling - Construction works outside of standard hours* (GHD, 2023). An overview of the noise modelling parameters is included in Table 4.1.

The validated noise model as described in *Construction works outside of standard construction hours – daytime noise model validation* (GHD, 2024) was used to predict noise levels at the intermediate locations to compare against the monthly measured noise levels.

Table 4.1 Noise modelling parameters

Parameter	Description
Calculation method	ISO 9613-2:1996
Meteorology	Well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation Temperature: 20°C Humidity: 70%.
Topography	Sourced from ELVIS GIS Australia – 5 metres elevation intervals
Receiver heights	1.5 metres above building ground level for ground floor and 4.5 metres for first floor
Receiver locations	Adopted from *Waratah Super Battery – Munmorah, Appendix G – Noise and Vibration Assessment* (GHD, 2022)
Ground absorption	1 for all areas (0 is non-porous ground and 1 is porous ground such as that found in a rural setting comprising of mainly grass and vegetation)
Foliage	5 metres high foliage in the bushland areas between the project site and sensitive receivers has been included in the noise model.

4.2 Predicted noise levels

The predicted noise levels at the intermediate locations are shown in Table 4.2 and are compared to the average measured $L_{Aeq,15min}$ noise levels at those locations. The comparison shows that the predicted noise levels are significantly greater than the measured noise levels, which indicates that the predictions are conservative.

Table 4.3 shows the predicted noise levels at the sensitive receivers based on the validated noise model. At receiver R2, the noise levels are predicted to be 37 dBA at most and the NMLs are achieved at all sensitive receivers. Given the predictions are considered conservative, actual construction noise levels are expected to be lower. This is supported by the observations made during the attended noise monitoring at the receiver locations, where construction noise was inaudible during most noise monitoring surveys.

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Table 4.2 Predicted construction noise levels at intermediate locations

Intermediate location	Predicted noise level $L_{Aeq,15min}$ dBA	Average measured noise level $L_{Aeq,15min}$ dBA
I1 (June)	66	59
I2 (July)	66	54
I3 (August)	69	47
I4 (September)	65	63
I5 (October)	56	46

Table 4.3 Predicted construction noise levels at residential receivers

	Predicted noise levels at sensitive receiver (dBA)									
	R01	R02	R03	R04	R05	R06	R07	R08	R09	R10
Noise management level (Outside standard hours, day)	40	40	40	40	40	40	40	53	40	53
Ground floor	32	36	31	30	24	30	31	22	18	22
First floor	34	37	33	32	26	35	33	24	19	24

5. Conclusion

GHD has undertaken noise monitoring surveys during the construction works outside of standard construction hours for the purpose of validating the noise model and predictions, as required by the approval granted by the Planning Secretary.

Noise monitoring was undertaken at up to three sensitive receivers and at intermediate locations between receivers and the construction works. The previously validated noise model was used to predict noise levels at the intermediate locations and compared to the measured noise levels, which showed that the predicted noise levels are conservative.

At the receiver locations construction noise was inaudible during majority of monitoring periods. Additionally, the predicted noise levels using the validated model achieve the NMLs at all sensitive receivers.

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S3	A	R Browell	M. Oosterlaken	On file	E Milton	On file	23/10/24

GHD Pty Ltd | ABN 39 008 488 373
Contact: Rosy Browell, Engineer | GHD
133 Castlereagh Street, Level 15
Sydney, New South Wales 2000, Australia
T +61 2 9239 7100 | **F** +61 2 9239 7199 | **E** sydmail@ghd.com | **ghd.com**

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