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Kosciuszko Thredbo Pty Ltd

Thredbo Golf Course Subdivision

Noise Impact Assessment

20E-24-0031-TRP-59068-4

28 October 2025

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Report Title:	Noise Assessment Report
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Rev. #	*Comments / Details of change(s) made*	*Date*	*Revised by:*
Rev. 00	Original issue	9 June 2025	
Rev. 01	Client Comments	24 Jul 2025	CL
Rev. 02	Updated Lot Plan	09 Oct 2025	CL
Rev. 03	Client Comment	14 Oct 2025	CL
Rev. 04		28 Oct 2025	CL

Executive Summary

Vipac Engineers & Scientists Ltd. (Vipac) has been commissioned by Kosciuszko Thredbo Pty Ltd to conduct a noise impact assessment for the construction and operation of a proposed development located at Lot 876 Thredbo Golf Course, Thredbo NSW, 2625. The proposed development will comprise of eighteen (18) separate residential lodging, and a road that will provide access via Crackenback Drive.

The following documents were used as reference for this noise impact assessment:

- NSW Environment Protection Authority's Noise Policy for Industry 2017 (NPfI);
- NSW Road Noise Policy;
- Alpine SEPP 'Chapter 4 of State Environmental Planning Policy (Precinct-Regional)' 2021;
- Architectural drawings listed in Table 2-1.

During the site visit a noise logger was setup to capture ambient noise levels for 7 days. Fourteen (14) noise receivers are identified which are mostly existing residential lodging. Details of the nearest noise sensitive receivers are provided in Table 3-1 and marked on Figure 3.2.

Noise monitoring data was used to determine the project noise level limits for both construction and operational noise scenarios for daytime, evening, and night. Noise monitoring was also used to calibrate the SoundPLAN 3D noise modelling software for noise predictions.

Based on the predicted construction noise levels, exceedances of the project noise level limits are expected. A Construction Noise and Vibration Management Plan (CNVMP) has been developed and included in this report, detailing the proposed mitigation, monitoring, and management measures to be implemented prior to and during construction.

For operational noise of the development, three main sources of noise were identified, including bus shuttle, private vehicle drive by, and public car parking vehicle movements. Based on the predicted operational noise levels, noise levels are predicted to comply with the project noise level limits during day, evening, and night.

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1 Introduction

Vipac Engineers & Scientists Ltd. (Vipac) has been commissioned by Kosciuszko Thredbo Pty Ltd to conduct a noise assessment of the proposed subdivision, located at Lot 876 Thredbo Golf Course, Thredbo, New South Wales, 2625.

The report covers the following:

- Description of development;
- Determination of appropriate noise criteria for the development;
- Predicted noise emissions from the site during construction;

This assessment is based on measurements and calculations carried out by Vipac, operational parameters for the site, as advised by Kosciuszko Thredbo Pty Ltd, using references listed in section 2.

2 References

The following documents were referenced for this noise assessment:

- NSW Environment Protection Authority's Noise Policy for Industry 2017 (NPfI);
- NSW Road Noise Policy;
- Alpine SEPP 'Chapter 4 of State Environmental Planning Policy' 2021;
- Architectural drawings listed in Table 2-1.

Table 2-1: Architectural Drawings List

Drawing Ref	Drawing Description	Revision	Prepared By	Dated
A1.000	Site Plan A	D	Djrd Architects	01/09/2025
A1.001	Site Plan B	L	Djrd Architects	21/08/2025
A1.002	Lots	G	Djrd Architects	21/09/2025
A1.003	Staging Area	G	Djrd Architects	10/02/2025
A1.004	Parking	H	Djrd Architects	09/05/2025
U-183	Drawing List, and Locality Plan (Sheets 1-45)	K	Djrd Architects	08/09/2025

3 Development Description

3.1 Site Description

The site is located at the Thredbo Golf Course, Thredbo, New South Wales 2625, within the Head Lease Area, Lot 876/DP1243112. The Development sits largely on the existing first, third and fourth fairways though encroaches into the adjacent eucalypt forest. These forest areas are largely slashed and managed as part of the golf course. The site will be accessed via a new road off Crackenback Drive and provides for 18 separate building lots.

The subdivision proposal necessitates a re-design of the golf course. The preferred re-design retains a nine-hole course, albeit shortened in distance with all bar one hole being par three holes. The Development will include provision of municipal infrastructure, including new road access, water, sewer, power, gas, and telecommunication/data infrastructure.

A concept design for the proposed development is presented in Figure 3.1.

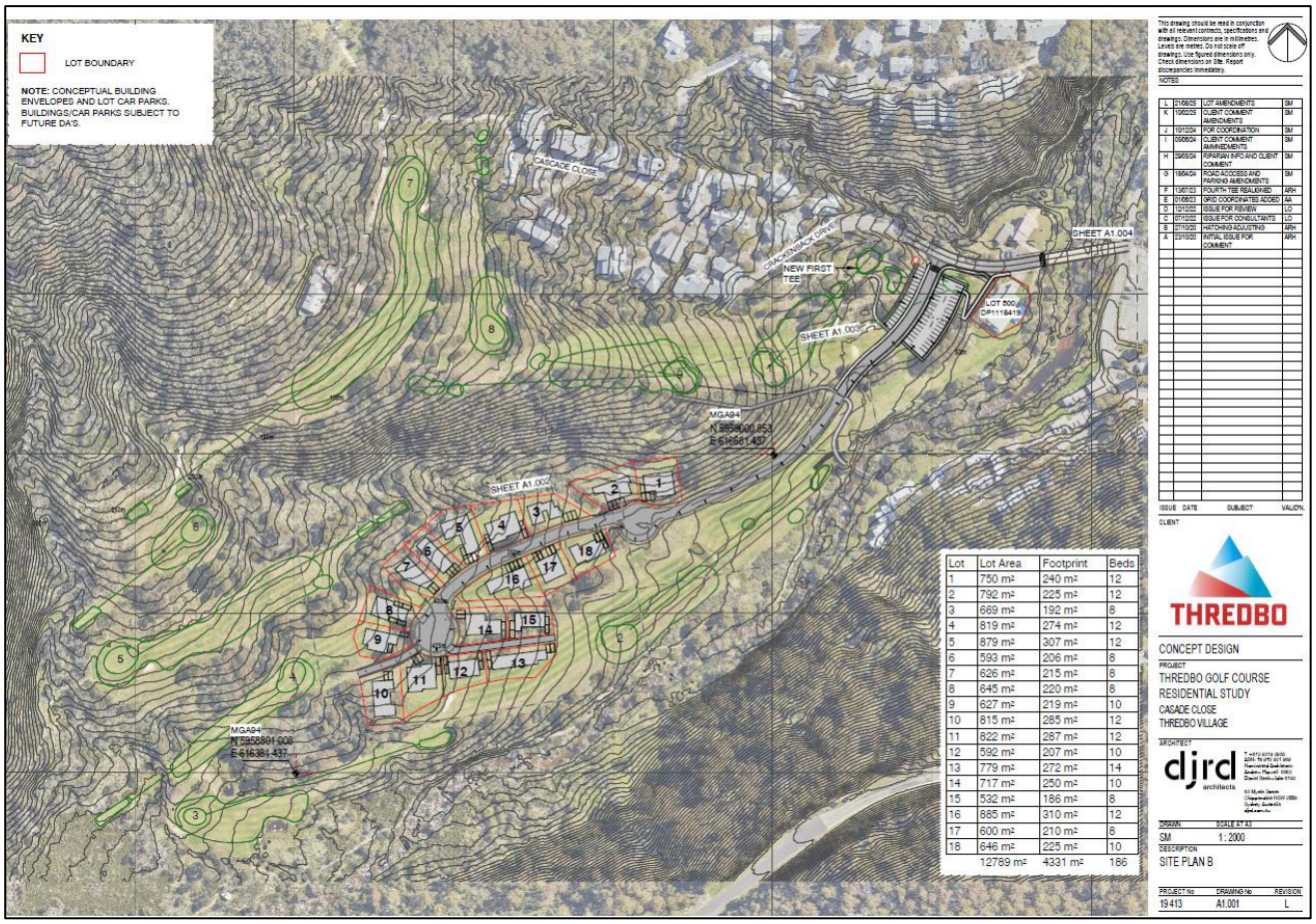

Figure 3.1 – Conceptual Design – Site Plan B

3.2 Relevant Noise Receivers

Details of the nearest noise sensitive receivers are provided in Table 3-1 and marked on Figure 3.2.

Table 3-1: Relevant Noise Sensitive Receivers

Receiver	Location	Type	Description
R1	1 Diggings Terrace	Residential	Cabins
R2	1 Diggings Terrace	Residential	Cabins
R3	1 Diggings Terrace	Residential/Commercial	Cabins/Restaurant
R4	4 Crackenback Dr	Commercial	Community Centre/Childcare Building
R5	2 Crackenback Dr	Commercial	Chapel
R6	Unit 2/4 Crackenback Dr	Residential	Cabins/Town Houses
R7	Unit 3/6B Crackenback Dr	Residential	Cabins/Town Houses
R8	Unit 4/6B Crackenback Dr	Residential	Cabins/Town Houses
R9	8 Crackenback Dr	Residential	Cabins/Town Houses
R10	5 Crackenback Dr	Residential	Cabins/Town Houses
R11	7A Crackenback Dr	Residential	Cabins/Town Houses
R12	7B Crackenback Dr	Residential	Cabins/Town Houses
R13	7C Crackenback Dr	Residential	Cabins/Town Houses
R14	1 Cascades Cl	Residential	Cabins/Town Houses

Noise monitoring locations are also showed on Figure 3.2.

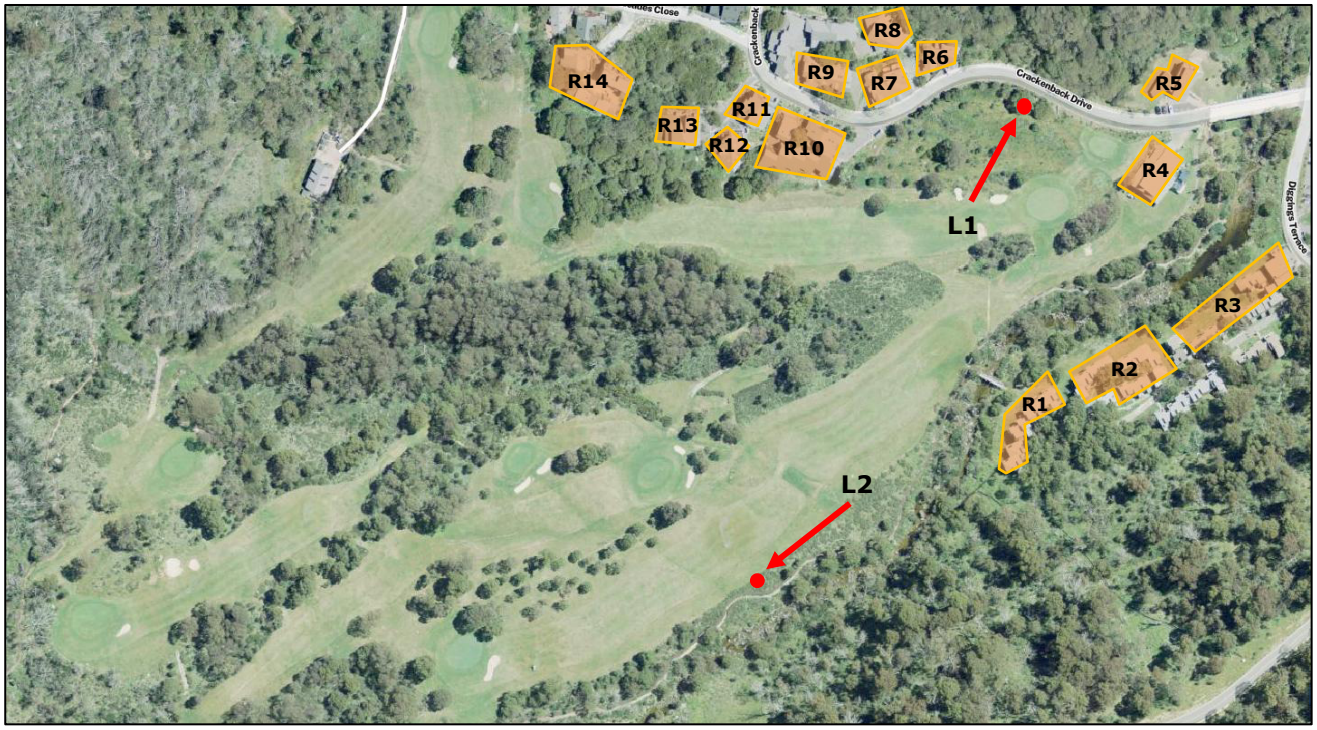

Figure 3.2 – Aerial Photo of Subject Site, Noise Sensitive Receivers (R1 to R14) and Noise Logger Locations (L1 and L2)

4 Environmental Noise Survey

Unattended noise monitoring was conducted over a representative period of seven days from the 6th of March to the 13th of March 2024 to determine the background noise levels. Data impacted by weather was filtered according to the procedures set out in the NSW Noise Policy for Industry (NPI). The noise logger was configured to measure instantaneous noise levels with a "Fast" time "A" frequency weighting. The noise logger was checked for calibration before and after the logging period with no drift.

Instrument details and location coordinates used during noise monitoring is provided in Table 4-1.

Table 4-1 Instruments Used for Noise Monitoring

Equipment	Serial Number	Next calibration date	Location Coordinates
01dB – Metravib Duo Noise Logger	10294	25/03/2027	36.50614°S 148.30010°E
01dB – Metravib Duo Noise Logger	10296	25/03/2027	36.50857°S 148.29788°E
Bruel & Kjaer 2270 Sound Level Meter	3029498	19/04/2026	N/A
Bruel & Kjaer Acoustical Calibrator	2445463	18/04/2026	N/A

4.1 Unattended Noise Measurements

Measurement results obtained from the noise logger have been analysed in accordance with the procedures set out in the NSW Policy for Industry (NPI) for determining background noise levels of the area and are presented in Table 4-2.

According to NPfI, background noise level is known as the Rating Background Level (RBL). The RBL is calculated for the Day, Evening and Night-time periods, as defined in the NPfI, where the time periods are defined as:

Day	0700 - 1800hrs
Evening	1800 - 2200hrs

Night	2200 - 0700hrs

Table 4-2 Measured Ambient Noise Levels Per Period - dB(A)

Period	Time Period	L1		L2	
		RBL L_{A90}	$L_{Aeq,\ period}$	RBL L_{A90}	$L_{Aeq,\ period}$
Day	0700-1800hrs	44	51	50	52
Evening	1800-2200hrs	44	47	51	51
Night	2200-0700hrs	41	42	51	51

5 Noise Criteria

Intrusiveness Criteria

The Intrusiveness Criteria is used to evaluate the extent to which a noise intrudes above the background, particularly where the receiver is a dwelling. The NPfI considers that the L_{Aeq}, 15-minute level associate with a broad-band industrial noise source may be up to 5 dB(A) above the rating background noise level (L_{A90}) at a receiver without being considered offensive.

The rating background noise level (RBL) is similar to the 10th percentile background L_{A90} however uses a different sampling technique to determine the value.

Where a noise source contains certain characteristics, such as tonality, intermittency, impulsiveness, irregularity or low-frequency dominance, correction factors may need to be applied to the noise annoyance criteria to determine the project specific criteria.

Amenity Criteria

The NSW NPfI also considers that there is a community expectation for a certain level of environmental noise amenity, depending on the type of area in which the noise sensitive receiver is located. The Industrial Noise Policy provides a table of recommended L_{Aeq} noise levels that, subject to the type of area and time of day, are considered desirable.

Depending on the level of existing industrial or commercial noise, these desirable levels are adjusted so as to require progressively more stringent amenity compliance levels. The objective of this approach is to prevent the background noise level from continually increasing as a result of each progressive new development. For a holiday accommodation amenity area, the NPfI proposes the L_{Aeq} noise level should not exceed the following acceptable noise emission levels shown in Table 5-1.

Table 5-1: Amenity Noise Levels (ANL) – Holiday Accommodation NSW NPfI

Receiver Type	Period	Time	Levels dB(A)
Hotels, motels, caretakers' quarters, holiday accomodation, permanent resident caravan parks.	Daytime	0700 – 1800 hrs	55
	Evening	1800 – 2200 hrs	50
	Night-time	2200 – 0700 hrs	45

This policy sets out two separate noise criteria designed to ensure developments meet environmental noise objectives. The first criterion accounts for intrusive noise and the second criterion applies to protection of amenity of particular land uses. Applying both the amenity and intrusiveness criteria to the situation and adopting the more stringent of the two is used to assess the new development. This becomes the project specific noise levels. Applying the most stringent requirement as the project specific noise levels ensures that both intrusive noise is limited, and the amenity is protected.

The noise criterion for commercial receivers during all time periods for urban areas is 65 dB(A).

5.1 Project Specific Noise Levels - NPfI

Table 5-2 presents the project trigger noise level (PTNL) for the nearest affected receiver. The PTNL per period is obtained using the lower value of the measurements from noise loggers at L1 and L2.

Table 5-2: Project Trigger Noise Levels, dB(A)

Receiver Type	Time of Day	RBL L_{A90}	Existing L_{Aeq} (period)	ANL (Holiday Accommodation) $L_{Aeq\ (15\ min)}$	Intrusive $L_{Aeq\ (15\ min)}$	Amenity $L_{Aeq\ (15\ min)}$	PTNL
Residential (external)	Day	44	51	55	49	52	**49**
	Evening	44	47	50	49	48	**48**
	Night	41	42	45	46	43	**43**
Commercial (when in use)	When in use	-	-	65	-	-	**65**

5.2 NSW Road Noise Policy

The Road Noise Policy (RNP) addresses the issue of traffic noise from new and existing roads, and developments that generate traffic noise; and aims to reduce the road noise impact on the residents. The Policy provides noise guidelines/criteria for road related projects and methodologies to undertake a traffic noise assessment. The potential traffic noise generated from the use of the proposed development is assessed in accordance with the RNP.

Table 6-3 summarises the applicable road categories to establish the noise assessment criteria based on the type of road and the proposed land use developments.

Table 5-3: Road Noise Policy

Road Category	Type of Project / Land Use	Assessment Criteria/ Target Noise Level, dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Local Road	5. Existing residences affected by noise from redevelopment of existing local roads	L_{Aeq}, (1hour) 55 (external)	L_{Aeq}, (1 hour) 50 (external)

As stated in Section 3.4 of the Road Noise Policy, with regards to existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use development, any increase in total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

5.2.1 Road Noise Policy Levels

The Road Noise Policy (RNP) addresses the issue of traffic noise from new and existing roads, and developments that generate traffic noise; and aims to reduce the road noise impact on the residents. The Policy provides noise guidelines/criteria for road related projects and methodologies to undertake a traffic noise assessment. The potential traffic noise generated from the use of the proposed development is assessed in accordance with the RNP.

Traffic noise values obtained from noise monitoring are presented in Table 5-4.

Table 5-4: Traffic Noise Measurement dB(A).

Location	Day		Night	
	$L_{Aeq\ -\ 15hr}$	$L_{Aeq\ -\ Noisiest\ 1Hr}$	$L_{Aeq\ -\ 9hr}$	$L_{Aeq\ -\ Noisiest\ 1Hr}$
Logger L1	50	52	42	46
Logger L2	50	53	51	52

5.3 Sleep Disturbance

Activities occurring on-site during the night period have the potential to cause sleep disturbance for the nearby residents. These include activities associated with the Development between 2200 through to 0700hrs.

The Noise Policy for Industry states that a detailed maximum noise level assessment should be undertaken where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or;
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.

The Policy does not currently provide details on how to assess sleep disturbance but makes reference to the RNP. The RNP suggests that potential sleep arousal from traffic should be assessed. The RNP has compared a number of sleep disturbance criteria and concluded the following:

- Maximum internal noise levels below 50-55 dB L_{Amax} are unlikely to cause awakening reactions,
- One or two noise events per night, with maximum internal noise levels of 65-70 dB L_{Amax} are not likely to affect health and wellbeing significantly.

5.3.1 Project Sleep Disturbance Levels

Based on the night-time RBL of 41 dB(A) and L_{AFmax} 42 dB(A) the site-specific trigger levels for further assessment are specified in Table 5-5.

Table 5-5: Sleep Disturbance Specific Levels. dB(A)

Receiver Type	RBL disturbance	L_{AFmax} disturbance
Residential	46	57

6 Operational Noise Impact Assessment

Noise predictions were conducted using SoundPLAN 3D noise modelling software. The CONCAWE noise prediction method was implemented throughout all calculations within SoundPLAN. The use of the software and referenced modelling methodology is accepted for use in the state of NSW by NSW EPA for environmental noise modelling purposes. As a conservative approach, 2-3 m/s wind has been assumed for all calculations in this report.

6.1 Operational Noise

6.1.1 Bus Shuttle & Parking Lot

The two noise sources identified include bus shuttle operation and use of the public carpark, as shown in Figure 6.1 and Figure *6.2* for reference. Traffic data is not available at this stage; therefore, assumptions were made for operational noise scenarios.

The predicted operational noise levels are presented in Table 6-1. The range of predicted operational noise is derived from the assumed worst case operational conditions for Day/Evening and Night conditions, as follows:

> **Day / Evening:** Busiest 15 minutes: 1x bus drive by, 8x vehicles drive via Main Road, 5x car engine start up in the public parking space.
>
> **Night:** Busiest 15 minutes: No bus, 4x vehicles drive by via Main Road, 5x car engines start up in the public parking space.

The bus schedule and maximum number of vehicles passing by per hour were advised by the client. Vipac has assumed that 10% of cars in the public parking space start their engines during the busiest 15 minutes. If the above assumptions change, the report outcomes can be revised accordingly.

Table 6-1: PNL Operational Noise

Time of Day	Predicted Noise Levels (dB(A))													
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Day/ Evening	34	35	33	39	46	35	35	30	31	33	<20	29	30	27

Night	<20	30	30	36	35	30	29	26	27	24	<20	<20	<20	<20

Based on the operational noise levels presented in Table 6-2, compliance with the project noise level limits of 43 to 49 dB(A) during the day or evening, and 40 dB(A) at night, is predicted.

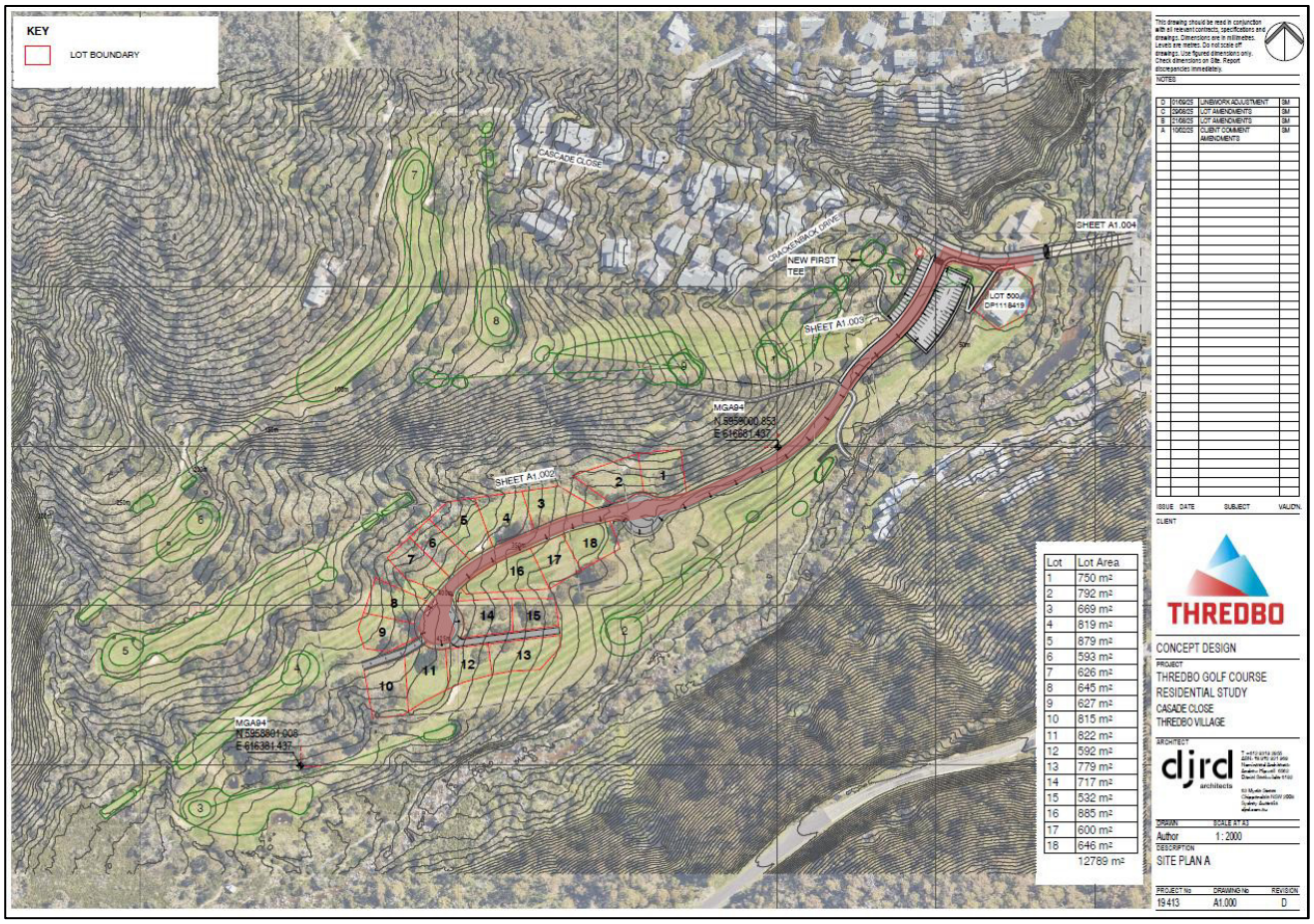

Figure 6.1 Bus Shuttle Route (red shaded area)

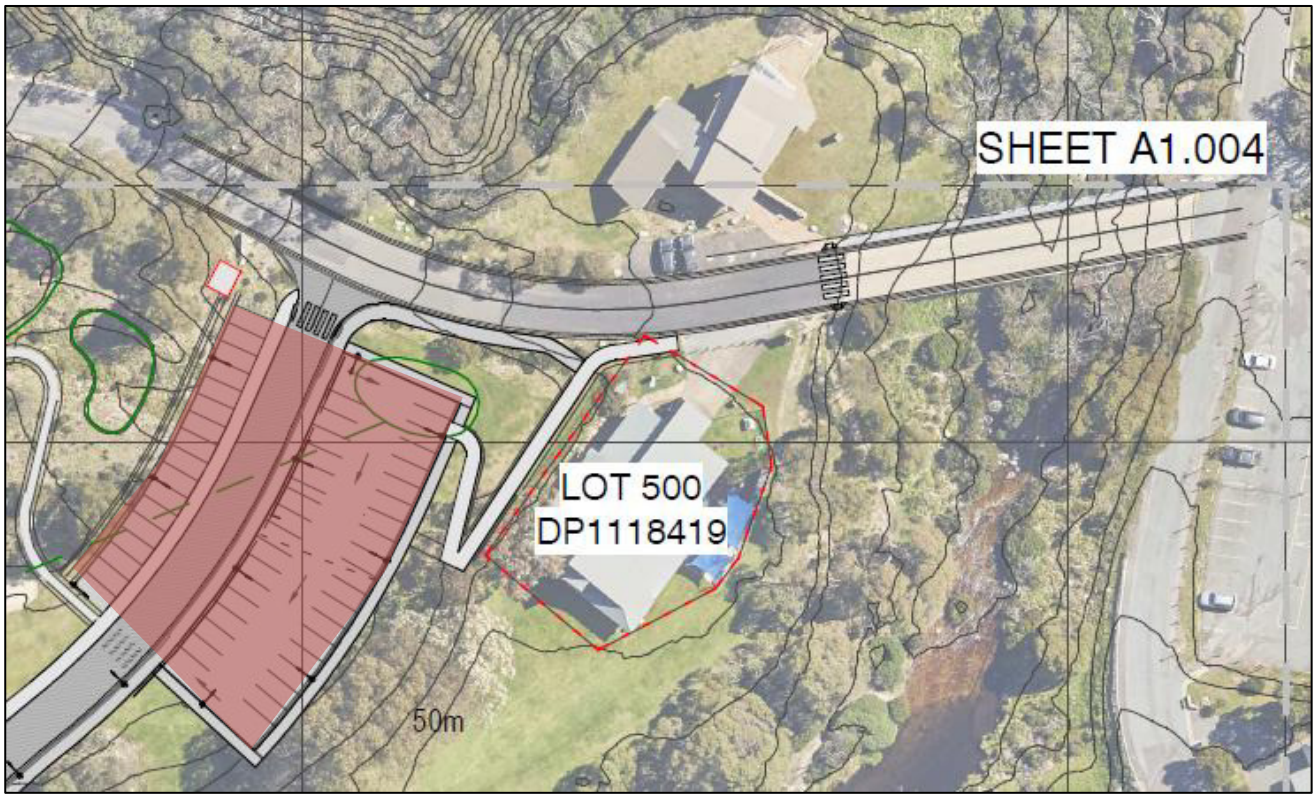

Figure 6.2 *Proposed Public Car Park (red shaded area)*

7 Construction Noise and Vibration

This section outlines the predicted noise and vibration impacts associated with the proposed construction activities and presents the recommended management and mitigation measures. The assessment considers typical equipment and construction practices, and is based on relevant guidelines including the EPA's Interim Construction Noise Guideline and Assessing Vibration: A Technical Guideline. The objective is to ensure that construction works are managed in a way that minimises adverse impacts on nearby sensitive receivers, particularly the Community Centre and surrounding residences.

7.1 Construction Noise

A preliminary construction noise assessment has been undertaken using the highest expected sound power levels for the plant and equipment typically used for excavation and construction. The proposed construction works are expected to be carried out during standard construction hours, in accordance with the EPA Interim Construction Noise Guideline, as follows:

- Monday to Friday 7:00 am to 6:00 pm
- Saturday 8:00 am to 1 pm
- No works on Sunday and public holidays

Any work outside of these hours must be approved separately, and a condition of consent is expected to account for this. The day noise management level $L_{Aeq,15min}$ of 49 dB(A) is determined for all sensitive receivers based on the day RBL of 44 dB(A), as per the interim Construction Noise Guideline. The construction noise at the receiver will depend on the location of the plant and equipment. For this assessment, the plant and equipment are assumed to be located at the centre of the main subject site and a secondary location in the proposed parking lot.

The client has provided a list of the construction equipment and mobile equipment that are expected to be used during the demolition, excavation, and construction, these include:

- Excavators
- Graders
- Rollers
- Ripping/Shearing equipment
- Air compressors
- Pavers/Road equipment

- Chippers
- Chainsaws
- Brush cutters
- Hand tools
- Jack hammer
- Rock breaking equipment
- Hand tools
- Trucks
- Utility vehicles
- Buggies
- Mobile Crane
- Forklift

The predicted construction noise levels are presented in Table 7-1, and represents noise levels from at the furthest and closest distances to each receiver.

Table 7-1: PNL Construction Equipment (red cells indicate exceedance predicted)

Noise Source	Predicted Noise Levels (dB(A))													
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Excavator	53-59	51-58	50-57	50-57	50-56	47-54	45-57	42-48	41-48	53-60	53-59	54-60	54-60	54-60
Grader	53-62	52-61	51-60	51-60	50-59	52-61	47-56	42-51	41-51	54-63	49-58	54-63	54-63	54-63
Roller	53-65	52-64	51-63	51-62	50-62	52-63	52-64	42-53	41-53	54-66	47-59	54-66	55-66	54-66
Woodchipper	43-66	40-63	38-61	40-62	37-60	40-62	41-63	25-48	26-48	43-66	30-52	44-66	44-66	44-66
Chainsaw	40-56	37-53	35-52	36-53	34-51	37-53	30-47	24-40	23-40	40-56	35-51	41-57	41-57	41-57
Brush Cutter	44-55	41-52	39-50	41-51	38-49	41-51	37-47	27-38	57-38	44-55	36-37	45-55	45-55	45-55
Hand Tools	41-49	39-58	38-47	38-46	37-46	39-47	39-48	28-37	28-37	41-50	33-42	41-50	42-50	41-50
Mobile Crane	53-59	52-58	50-57	50-57	50-56	51-58	52-58	41-47	41-47	53-60	47-53	54-60	54-60	54-60
Front Loaders	53-59	52-58	51-56	51-56	50-56	51-57	47-53	42-48	41-47	53-60	49-55	54-60	54-60	54-60
Jack Hammer	54-58	52-57	51-55	51-55	50-55	52-56	52-57	41-48	41-45	54-58	44-48	54-59	54-59	54-58
Forklift	30-33	27-30	21-24	25-28	24-27	26-29	27-30	<20	<20	29-32	18-21	30-33	30-33	29-32
Air Compressor	52-54	51-52	46-47	49-51	49-50	50-52	50-52	39-41	39-40	52-54	42-44	52-54	52-54	52-54
Paver	53-54	52-53	47-48	50-51	50-51	51-52	52-53	41-41	40-41	53-54	45-46	54-55	54-55	54-55
Mobile Equipment (Trucks, Buggies & 4WD)	26-27	26-27	23-24	27-28	38-39	26-27	26-27	20-21	21-22	24-25	<20	22-23	22-23	20-21

Based on the predicted construction noise levels presented in Table 6-1, noise levels are predicted to exceed the project noise level limit of 49 dB(A). A detailed Construction Noise Management Plan is outlined in Section 7.3.1.

7.2 Construction Vibration

The effects of vibration can be divided into concerns over structural damage and human annoyance. This section will outline the relevant vibration criteria for the two concerns.

The human annoyance vibration assessment should be undertaken using the OEH's publication *'Assessing Vibration: a technical Guideline',* based on the BS 6472 Standard. This Guideline covers the appropriate methods and criteria for the assessment of the intrusive vibration on living and working space. The guideline describes the following:

- The characteristics of vibration and associated effects that can cause community disturbance and concern to people, in particular the occupants of buildings.
- Criteria defining values of vibration to protect amenity.
- Procedures for the measurement and evaluation of vibration values and other associated emissions.

A summary of the VDV criteria for human comfort limits are adopted from the OEH's publication *'Assessing Vibration: a technical Guideline* and are presented in Table 7-2 and Table 7-3

Table 7-2: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime		Night Time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residents	0.20	0.40	0.13	0.26
Offices, Schools, Educational, institutions and place of worship	0.40	0.80	0.40	0.80

Table 7-3: Criteria for exposure to continuous and impulsive vibration

Place	Time	Assessment criteria: [1]rms acceleration (m/s^2) (& vib. accel. value) (dB re 10^{-6} m/s^2) Preferred	Maximum	[2]rms velocity (mm/s) (& vib. velocity value) (dB re 10^{-6} mm/s) Preferred	Maximum	[2]Peak velocity (mm/s) Preferred	Maximum
Continuous vibration							
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day- or night-time	0.0050 (74 dB)	0.010 (80 dB)	0.10 (100 dB)	0.20 (106 dB)	0.14	0.28
Residences	Daytime[3]	0.010 (80 dB)	0.020 (86 dB)	0.20 (106 dB)	0.40 (112 dB)	0.28	0.56
	Night-time	0.0070 (77 dB)	0.014 (83 dB)	0.14 (103 dB)	0.28 (109 dB)	0.20	0.40
Offices	Day- or night-time	0.020 (86 dB)	0.040 (92 dB)	0.40 (112 dB)	0.80 (118 dB)	0.56	1.1
Workshops	Day- or night-time	0.040 (92 dB)	0.080 (98 dB)	0.80 (118 dB)	1.6 (124 dB)	1.1	2.2
Impulsive vibration							
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day- or night-time	0.0050 (74 dB)	0.010 (80 dB)	0.10 (100 dB)	0.20 (106 dB)	0.14	0.28
Residences	Daytime[3]	0.30 (110 dB)	0.60 (113 dB)	6.0 (136 dB)	12.0 (142 dB)	8.6	17.0
	Night-time	0.10 (100 dB)	0.20 (106 dB)	2.0 (126 dB)	4.0 (132 dB)	2.8	5.6
Offices	Day- or night-time	0.64 (116 dB)	1.28 (122 dB)	13.0 (142 dB)	26.0 (148 dB)	18.0	36.0
Workshops	Day- or night-time	0.64 (116 dB)	1.28 (122 dB)	13.0 (142 dB)	26.0 (148 dB)	18.0	36.0

1 Values derived from z-axis critical frequency range 4–8 Hz. Where required, a more detailed analysis can be conducted as per BS 6472–1992.
2 Values given for the most critical frequency range >8 Hz assuming sinusoidal motion. Where required, a more detailed analysis can be conducted as per AS 2670.2–1990. Sufficient justification should accompany the use of a peak velocity approach if used in an assessment.
3 Specific values depend on social and cultural factors, psychological attitudes and expected degree of intrusion.

The German Standard DIN 4150-3 Structural Vibration Part 3: Effects of Vibration on Structures should be used to assess vibration levels that may cause structural damage. This Standard specifies methods of measuring and evaluating the effects of vibration on structures designed primarily for static loading.

Short term vibration is classified as vibrations which do not occur often enough to cause structural fatigue. Table 7-4 gives a guideline value for short term vibration velocity at the foundation and in the plane of the highest floor of various types of building.

Table 7-4: Structural Damage – Short Term Vibration (mm/s)

Type of Structure	At foundation frequency of			Plane of floor of uppermost storey
	Less than 10Hz	10-50Hz	50-100Hz	All frequencies

Buildings used for commercial purposes, industrial buildings, and building of similar design	20	20 to 40	40 to 50	4
Dwelling and buildings of similar design and/or occupancy	5	5 to15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3 to 8	8 to 10	8

7.3 Construction Noise and Vibration Management Plan

7.3.1 Construction Noise Control

The following feasible and reasonable work practices should be implemented where practicable to minimise noise impacts. Additional to the above work practices, best practice noise mitigation measures for construction and demolition noise has been sourced from AS2436:2010.

The following steps from 'Interim Construction Noise Guideline' should be followed when selecting work practices to minimise construction noise:

Step 1: Identify work practices likely to be major contributors of noise.

Step 2: Select feasible and reasonable work practices relevant to the project.

Step 3: Apply the applicable universal work practices as well as the selected feasible and reasonable work practices.

7.3.1.1 Feasible and Reasonable Work Practices

Use quieter equipment:

- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled excavators can be less noisy than steel tracked plant.
- When renting, select quieter items of plant and equipment where feasible and reasonable.
- When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.
- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences.

Operate construction plant in a quiet and efficient manner:

- Reduce throttle setting and turn off equipment when not being used.
- Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

Maintain plant equipment regularly:

- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers.
- Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified.
- For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals.
- Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair.
- Ensure air lines on pneumatic equipment do not leak.

Plant location:

- Place as much distance as possible between the plant or equipment and residences and other sensitive land uses.
- Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times.
- Locate site vehicle entrances away from residences and other sensitive land uses.
- Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site.

Alternatives to reversing alarms:

- Avoid use of reversing alarms by designing site layout to avoid reversing.
- Install where feasible and reasonable less annoying alternatives to the typical 'beeper' alarms, such as broadband quackers, that emit noise over a wide range of frequencies.

Enclosures, barriers and acoustic shielding:

- Reuse existing structures rather than demolish and reconstruct.
- Use temporary site buildings and material stockpiles as noise barriers where possible, for example by positioning the temporary site building to act as a noise barrier to the Community Centre.
- Schedule construction of permanent walls to be used as early as possible as noise barriers.
- Note large reflecting surfaces on and off site that might increase noise levels, and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.
- Installation and use of temporary acoustic hoardings around the site.

Schedule activities to minimise noise impacts:

- Organise work to be undertaken during the recommended standard hours where possible.
- Schedule noisy work during periods when people are least affected. Provide respite periods while performing these works.
- Consult with affected neighbours about scheduling activities to minimise noise impacts.

Organise deliveries and access:

- The following indicative comments are made for deliveries and access:
    - Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening.
    - Amalgamated loads can lead to less noise and congestion in nearby streets.
    - Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
    - Designate access routes to the site, through consultation with potentially noise-affected residences and other sensitive land uses, and make drivers aware of nominated vehicle routes.
    - Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive land uses. Truck waiting areas may require bundling or walls to minimise noise.

Schedule deliveries to nominated hours only.

7.3.1.2 Universal Work Practices

Work practices at any time of day:

- Use toolbox talks to discuss ways to minimise noise.
- Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied.
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise.
- Avoid the use of radios or stereos outdoors where neighbours can be affected.
- Avoid shouting, and minimise talking loudly and slamming vehicle doors.
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
- Develop simple signage and display in clearly visible locations around the site that relate to relevant work practices and noise control.

It is also important to interact with the community to ensure a good working relationship between the proponent and the community, receive feedback on the project's environmental performance, and work cooperatively towards the outcomes to benefit the project.

Table 7-5 gives a guideline approach to community consultation, notification and complaint handling. This guide is adopted from the Interim Construction Noise Guideline, and it also provides measures such as letter box drops, project specific respite offer, phone calls and specific notification.

Table 7-5 Consultation and Notification Guideline Adopted from the ICNG.

Notification before and during construction
• Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside

Notification before and during construction
standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement. • Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information. • Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include afterhours emergency contact details. • Maintain good communication between the community and project staff. • Appoint a community liaison officer where required. • For larger projects consider a regular newsletter with site news, significant project events and timing of different activities. • Provide a toll-free contact phone number for enquiries during the works. • Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise.
Complaints handling
• Provide a readily accessible contact point, for example, through a 24 hour toll-free information and complaints line. • Give complaints a fair hearing. • Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow. • Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance. • Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information. • Implement all feasible and reasonable measures to address the source of complaint. • Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

7.3.1.3 Site Induction

All site personnel should undergo site induction training that includes raising awareness of noise and vibration issues, including but not limited to:

- Standard Construction Hours, including the respite period of all high intensive noise activities.
- Ensure machinery on site to be regularly serviced and maintained; this minimises additional noise generated from machines.
- Adhere to complaint handling instructions, as shown in Table 7-5.
- Ensure site personnel are aware of recent noise and vibration complaints, and provide advice on additional noise control measures that can be implemented.

Site personnel need to be made aware of the noise control measures found in Section 5 of this report

7.3.1.4 Noise Monitoring Program

A 15-minute attended noise measurement should be conducted monthly at each of the identified noise-sensitive areas during the excavation phase of works. This should include one location among R1–R3, monitoring at R4, and one location among R6–R10. A monthly noise monitoring report should also be provided and include the following:

- The noise monitoring locations and description of the noise monitoring methodology.
- The noise results represented in L_{Aeq} and a summary of the noise sources during the measurement at each location.
- If noise monitoring results indicate noise exceedance of the predicted noise values, as outlined in Section 4, then further noise control recommendations should be provided to the client.

Additional attended noise monitoring should be conducted when noise complaints arise from nearby receivers. This should either be done during the monthly noise monitoring assessment or on an individual complaint basis.

7.3.1.5 AS 2436:2010 Noise Reductions of Mitigation Methods

Table 5-2 has been sourced directly from AS 2436:2010 (Table C3) and details the potential noise reduction of standard mitigation measures typically utilised on construction and demolition sites.

Table 7-6 Relative Effectiveness of Various Forms of Noise Control

Control By	Nominal Noise Reduction Possible, in total A-weighted sound pressure level, dB
Distance	Approximately 6 for each doubling of distance
Screening	Normally 5 to 10, maximum 15
Enclosure	Normally 15 to 25, maximum 50
Silencing	Normally 5 to 10, maximum 20

7.3.2 Vibration Mitigation Control

The following practices should be implemented to reduce any potential vibrations affecting the surrounding structures:

- Place as much distance as possible between the construction/excavation work and the surrounding properties. Distance is one of the most effective mitigation measures against vibration.
- Organise earthmoving and ground impacting operations so as to not occur in the same time period.
- Conduct lower impact methods wherever possible, including the following:
    - Maintain rock hammer oriented towards the face and enlarge the excavation by breaking small wedges off face.
    - Operate jack hammer in short bursts only, to reduce amplification of vibrations and the rise of noise.

Should complaints from nearby sensitive receivers be received, the following steps are recommended:

- Vibration monitoring should be undertaken if rock breaking/hammering works are within 20 metres of a receiver. The vibration monitor will need to be installed at the nearest affected receivers and should have an alert system set at a trigger level of 4.5 mm/s. It is prudent to ensure monitoring is conducted permanently to ensure levels are recorded full time. This can be used to compare and assess against criteria, complaints, and extraneous events.
- In addition to the aforementioned, and specifically addressing the sensitive receiver (Community Centre), the following mitigation measures are recommended (subject to agreement with the tenancy):
    a. Install at least one vibration monitoring device (with trigger alert system) within the community centre which will monitor vibration levels during the entire construction program.
    b. Commence vibration monitoring prior to construction works at the proposed development, through a series of trial activities to understand background levels and vibration transmission.
    c. Maintain communication with the Community Centre regarding construction activities and estimated timelines.
    d. Endeavour to further mitigate any potential noise and vibration disturbance with occupants and co-ordinate timing where possible with the medical tenancy.

8 Conclusion

Vipac Engineers & Scientists Ltd has conducted a noise impact assessment for the proposed residential development on the Thredbo Golf Course, located on Lot 876 Thredbo Golf Course, Thredbo NSW 2625. The development will consist of 18 residential lodgings and a road that will provide access via Crackenback Drive.

Key findings indicate that construction noise is predicted to exceed the project noise limit of 49 dB(A), requiring the need for a Construction Noise and Vibration Management Plan (CNVMP). A detailed CNVMP has been provided in this report to outline the recommended mitigation and monitoring measures to manage potential impacts prior to and during the construction phase.

For operational noise, identified sources include bus shuttles, residential vehicle pass-by, and use of public car parking. Operational noise levels are predicted to comply with project noise limits during the day, evening and night. Final mechanical plant designs, though not yet known, must comply with the EPA NPfI noise criteria, potentially requiring screening and/or attenuators to achieve project-specific noise limits. This should be reviewed at detailed design or CC stage.

Appendix A Glossary of Terminology

Decibel, dB:

Unit of acoustic measurement. Measurements of power, pressure and intensity. Expressed in dB relative to standard reference levels.

dB (A):

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Sound Pressure Level, L_p (dB), of a sound:

20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter and varies with distance from the source and the environment.

Sound Power Level, L_W (dB), of a source:

10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone. Sound power level does not change with distance. The sound power level of a machine may vary depending on the actual operating load.

Ambient Sound:

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.

Background noise:

The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed.

Percentile Level - L_{90}, L_{10}, etc:

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L_{90} is the level which is exceeded for 90% of a measurement period. L_{90} is commonly referred to as the "background" sound level.

$L_{AEQ,T}$:

Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

Rating Background Level – RBL:

Method for determining the existing background noise level which involves calculating the tenth percentile from the L_{A90} measurements. This value gives the Assessment Background Noise Level (ABL). Rating Background Level is the median of the overall ABL.

Appendix B Unattended Noise Level Histogram

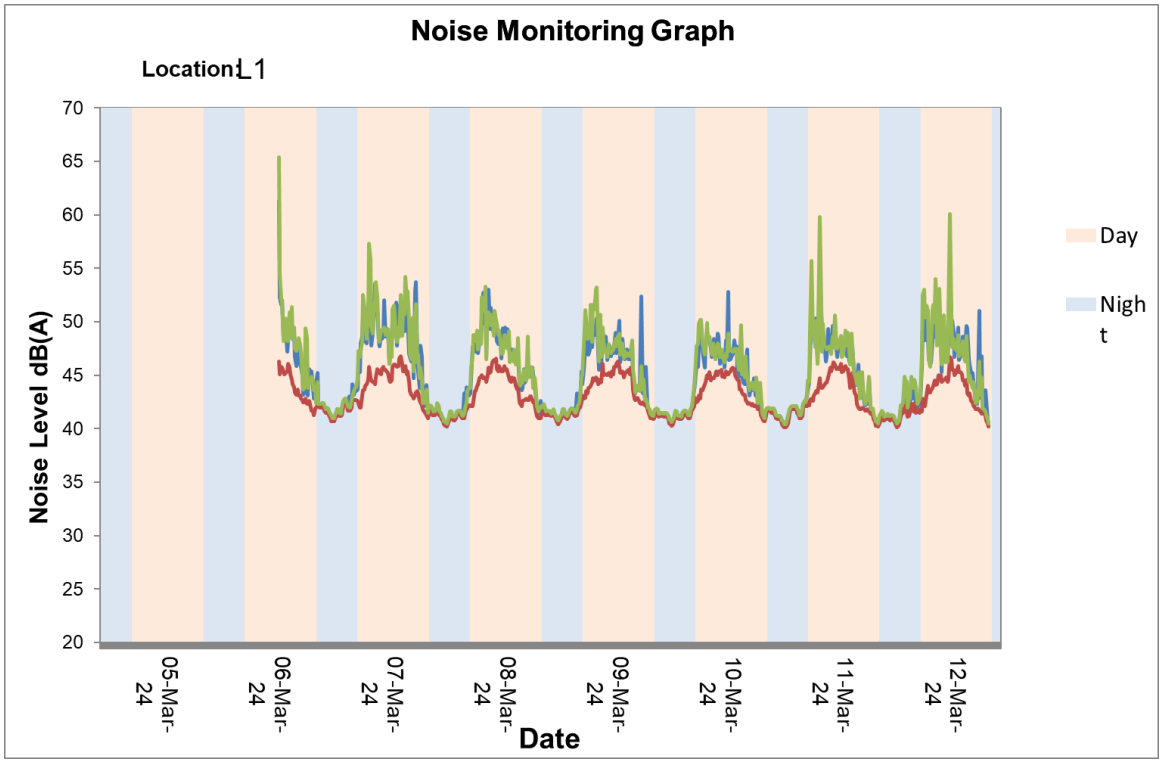

Figure 8.1 Noise Monitoring Graph at L1 during the 7-day period, showing correlation of noise level & time.

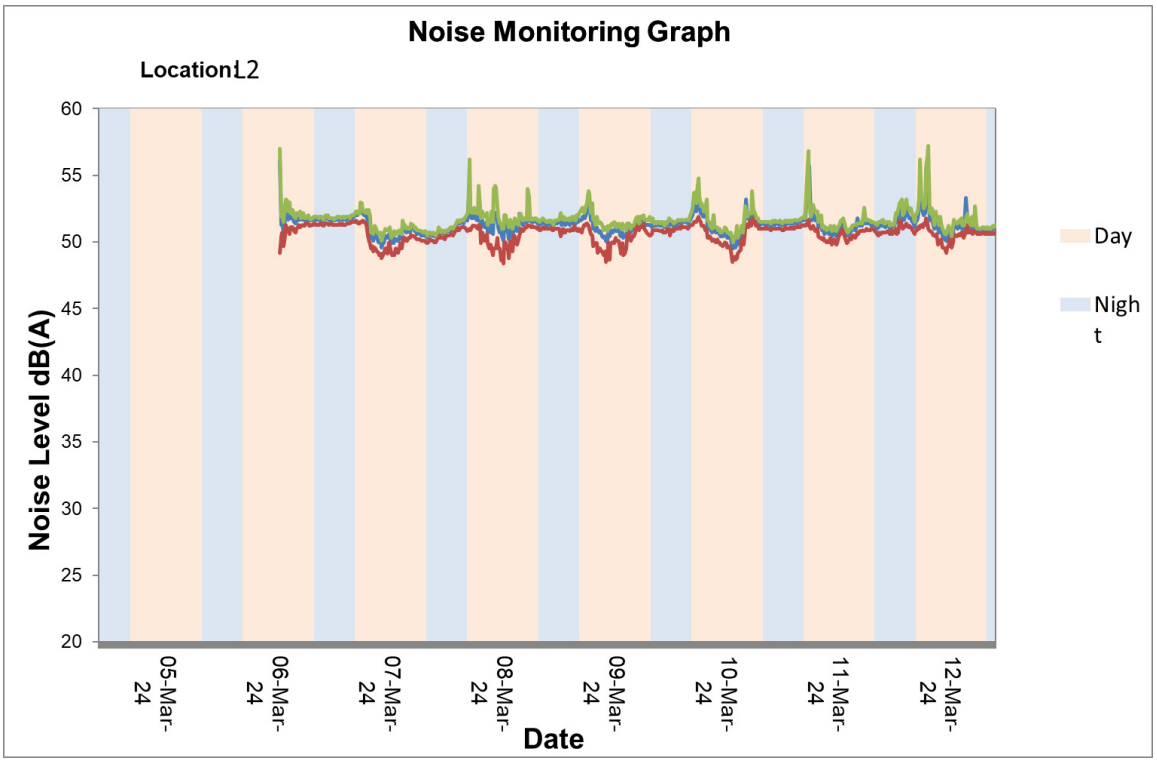

Figure 8.2 Noise Monitoring Graph at L2 during the 7-day period, showing correlation of noise level & time.