Tony Owen & Partners

Twin Creeks Golf Club and Hotel

Acoustic DA Assessment

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Table of Contents

Index of Figures

Index of Tables

1 Introduction

The following report has been prepared by Acouras Consultancy on behalf of Tony Owen & Partners to assess the potential for noise impact associated with the Twin Creeks Golf Club and Hotel. The residential development will include:

- Two levels of basement carpark.
- Hotel lobby, retail, gym, café, bar, outdoor pool and seating area on ground floor.
- Hotel suites on level 1 to level 9.

The proposed residential development is surrounded by existing residential buildings. The site location is shown in Figure 1.

Figure 1 – Site Location, Nearest Residents and Noise Logger Position

2 Noise Criteria

The following standards and guidelines are applicable to this project:

- Penrith City Council: Development Control Plan (2014) Part C12.
- NCC/BCA Part F5.
- NSW EPA "Industrial Noise Policy" (INP) and "Noise Guide for Local Government" (NGLG).
- NSW EPA "Interim Construction Noise Guideline" (ICNG).
- Australian Standard AS 2021-2000 "Acoustics – Aircraft Noise Intrusion – Building siting and construction"
- Australian standard AS/NZS 2107-2016: Acoustics – Recommended design sound levels and reverberation times for building interiors.
- Australian standard AS 1055.1-1997: Acoustics – Description and measurement of environmental noise - General procedures.

2.1 Internal Noise Levels

Council require an assessment of any development that complies with the provisions and standards for road traffic noise in accordance with the relevant State Government authorities or agencies, as well as relevant Australian Standards.

The development is not greatly impact by any road traffic noise and therefore the AS/NZS 2107–2016 outlines the acceptable internal noise levels such that a satisfactory acoustic environment within non-residential spaces in new and existing buildings can be achieved. Table 1 presents the recommended internal design noise levels.

Table 1— Recommended Internal Design Noise Levels (AS/NZS 2107)

Type of occupancy/activity	Design sound level ($L_{Aeq,t}$) range
Hotels near minor roads-	
Sleeping	30 to 35 (night time)
Foyer and recreation areas	45 to 50
Dining rooms	40 to 45
Ballroom/Function Room (with sound reinforcement)	35 to 45
Kitchen	< 55
Small Retail (General)	< 50
Enclosed Carparks	< 65

2.2 Aircraft Noise Intrusion

The Penrith DCP, Part C12 "Noise and Vibration" requires an assessment of the potential aircraft noise from the second Sydney airport. The assessment of the proposed site is to be determined by based on the ANEF contour map shown in Figure C12.1 in Part C12.

For in insulation of sound intrusion from external noise sources, the Australian Standard AS 2021-2015 "Acoustics – Aircraft Noise Intrusion – Building siting and construction" that requires the hotel development be designed to meet the following internal noise levels.

Table 2 – AS2021 Noise Intrusion Criteria

Space	AS2021 Maximum L_{Amax} dB
Relaxing, sleeping	55
Social activities	70
Service activities	75
Shops	75

Based on our visit to the development site, the dominate noise level are from aircraft flyovers near the site. Applying the procedure given in the Australian Standard to assess aircraft noise flyovers the following Table 3 provides the distance co-ordinates relative to the proposed second Sydney Airport runway.

Table 3 – Distance Co-ordinates from Proposed Second Sydney Airport

	Runway
DS (m)	100
DT (m)	11,700
DL (m)	N/A

Using the above co-ordinates, aircraft noise levels given in standard indicates that the highest L_{Amax} level at this site are from a take-off of a Boeing 747-400 on the at L_{max} 83dB(A) heading north.

2.3 Sound Insulation Requirement (Part F5 NCC/BCA)

For sound transmission and insulation between sole occupancy units (SOU) within the same development, walls and floors to be constructed in accordance with requirements of Part F5 of the Building Code of Australia (BCA). Sound insulation requirements are summarised in Table 4.

Table 4 - NCC Part F5 Requirements (Class 2 or 3)

Building Element	Minimum NCC Part F5 Requirements
Sound Insulation Rating of Walls (Class 2 or 3)	
Walls between separate sole occupancy units.	Rw + Ctr 50 (airborne)
Walls between wet areas (bathrooms, sanitary compartment, laundry or kitchen) and a habitable room (other than kitchen) in adjoining apartments.	Rw + Ctr 50 (airborne) & of discontinuous construction
Walls between sole occupancy unit and stairway, public corridors, public lobby or the like or parts of a different classification.	Rw 50 (airborne)
Walls between a plant room or lift shaft and a sole occupancy unit.	Rw 50 (airborne) & of discontinuous construction
Sound Insulation Rating of Floors (Class 2 or 3)	
Floors between sole occupancy units or between a sole occupancy unit and plant room, lift shaft, stairway, public corridor, public lobby or the like.	Rw + Ctr 50 (airborne) & Ln,w + CI < 62 (impact)
Apartment Entry Doors (Class 2 or 3)	
A door incorporated in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like.	Rw 30 (airborne)
Services (Class 2, 3 or 9c)	
If a storm water pipe, a duct, soil, waste or water supply pipe including a duct or pipe that is located in a wall or floor cavity serves or passes through more than one sole occupancy unit must be separated:	
if the adjacent room is a habitable room (other than a kitchen); or	Rw + Ctr 40
if the room is a kitchen or non-habitable room	Rw + Ctr 25

Construction Deemed to Satisfy

The forms of construction must be installed as follows:

(a) Masonry—Units must be laid with all joints filled solid, including those between the masonry and any adjoining construction.

(b) Concrete slabs—Joints between concrete slabs or panels and any adjoining construction must be filled solid.

(c) Sheeting materials—

(i) if one layer is required on both sides of a wall, it must be fastened to the studs with joints staggered on opposite sides; and

(ii) if two layers are required, the second layer must be fastened over the first layer so that the joints do not coincide with those of the first layer; and

(iii) joints between sheets or between sheets and any adjoining construction must be taped and filled solid.

(d) Timber or steel-framed construction—perimeter framing members must be securely fixed to the adjoining structure and—

(i) bedded in resilient compound; or

(ii) the joints must be caulked so that there are no voids between the framing members and the adjoining structure.

(e) Services—

(i) Services must not be chased into concrete or masonry elements.

(ii) A door or panel required to have a certain Rw + Ctr that provides access to a duct, pipe or other service must—

(A) not open into any habitable room (other than a kitchen); and

(B) be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10 mm, be fitted with a sealing gasket along all edges and be constructed of—

(aa) wood, particleboard or blockboard not less than 33 mm thick; or

(bb) compressed fibre reinforced cement sheeting not less than 9Â mm thick; or

(cc) other suitable material with a mass per unit area not less than 24.4 kg/m^2

(iii) A water supply pipe must—

(A) only be installed in the cavity of discontinuous construction; and

(B) in the case of a pipe that serves only one sole-occupancy unit, not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10 mm to the other wall leaf.

(iv) Electrical outlets must be offset from each other—

(A) in masonry walling, not less than 100 mm; and

(B) in timber or steel framed walling, not less than 300 mm.

2.4 Construction Noise Criteria

The NSW EPA "Interim Construction Noise Guideline" (ICNG) provides guidance on noise limits from construction sites. Table 5 is an extract from the EPA guideline.

When assessing short-term construction works, best management practices should be implemented to reduce any impact as far as practically possible.

Table 5 – Noise at Residences Using Quantitative Assessment

Time of Day	Management Level $L_{Aeq\ (15min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

2.5 Noise Survey and Project Specific Limits

An unattended noise survey was carried out at the site to measure the background and ambient noise levels. Noise monitoring was conducted between Thursday 14th to Thursday 21st July 2016.

The monitor was positioned, as shown in Figure 1 to assess the existing traffic noise levels along Twin Creeks Drive and establish the representative background noise level of the surrounding area.

Measurements were conducted using the following equipment:

- SVAN 977 Type 1 Real time Analyser/Noise Logger. Serial No. 34892.
- SVAN SV30A Type 1 Sound Level Calibrator. Serial No. 31830.

Noise monitoring was conducted in general accordance with Australian standard AS 1055.1-1997: Acoustics-Description and measurement of environmental noise-General procedures. T

he noise analyser was calibrated immediately before and after measurements were taken with no discernible differences between these two recorded levels. The sound analyser is Type 1 and complies with Australian standard AS1259.2: 1990.

During the monitoring period any adverse weather condition have been excluded. The noise logger results are presented in Appendix C.

2.5.1 Traffic Noise Level

The existing local roads surrounding the development have minimal traffic flow. Table 6 presents a summary of the measured ambient noise level in the surrounding environment.

Table 6 – Measured Ambient Noise and Levels, dBA

Location	Period	Average L_{eq}	Highest L_{eq} 1hr
Twin Creeks Resort	Day (07:00-22:00)	49	54
	Night (22:00-07:00)	42	49

2.5.2 NSW Industrial Noise Policy

The DCP does not recommended an objective method to assess noise from the development, therefore the procedures as set out in the NSW Industrial Noise Policy have been applied. Table 7 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project. The amenity criteria is based on a suburban receiver.

Table 7—Noise Survey Summary and Project Limits, dBA

Time Period	Existing Noise Levels		NSW Industrial Noise Policy	
	$L_{eq\ (period)}$	RBL	Amenity Criteria Recommended Noise Level (acceptable), L_{eq}	Project Specific Limit L_{eq}
Day (07:00-18:00)	49	36	55	41
Evening (18:00-22:00)	46	36	45	37
Night (22:07:00)	42	33	40	32

During detailed design stage, the design and selection of the mechanical equipment required to service the proposed development will be required to achieve the EPA noise limits as presented in the table above.

2.5.3 Noise Criteria for Licenced Premises

To assess the impact of noise emanating from the operation of the licenced bar to the adjacent residents, the NSW Governments Office of Liquor, Gaming and Racing (OLGR) provides the following noise guidelines:

> *The LA10* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*
>
> *The LA10* noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) between 12:00 midnight and 07:00 am at the boundary of any affected residence.*
>
> *Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 am.*
>
> ** LA10 is the average maximum deflection of the noise emission from the licensed premises.*

The noise impact of the proposed function room is to be assessed based on the existing background noise level, determining by the lowest repeatable L_{90} dB(A) during the respective periods. The background levels recorded at the location and the OLGR noise limit are shown in the following Table 8.

Table 8 — OLGR Noise Limit

7.00am to midnight	Octave Band, Hz Lin									Overall dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Lowest Repeatable L_{90}	32	39	35	28	24	25	23	26	29	33
Noise Criteria Before Midnight, L_{10}	37	44	40	33	29	30	28	31	34	38

2.6 Traffic Noise Generation

The development of the new development has the potential to generate increased traffic noise along Twin Creeks Drive will be assessed in accordance with the NSW EPA Road Noise Policy (RNP). Table 9 sets out the assessment criteria for residences to be applied to particular types of project, road category and land use.

Table 9— Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/land use	Assessment Criteria - dBA	
		Day (7am-10pm)	Night (10pm-7am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

3 Assessment and Recommendations

3.1 Façade Glazing Requirements

Acoustic glazing for the apartments are given in Table 10 are required to reduce noise impact on the internal occupants and should result in noise levels within such units in accordance with the Department of Planning Noise Guidelines and AS/NZS 2107:2000.

Table 10 – Schedule of Window and Glazing (R_w)

Level	Space	Glazing Thickness	Minimum R_w (Glazing+Frame)
G	Gym, spa, store, lobby, ballroom/function	6.38mm laminated	30
All	Hotel suite	10.38mm laminated	32

All other non-habitable spaces, such as bathrooms and laundries require minimum 6mm monolithic glass (Rw 28).

All Windows/doors should be well sealed (air tight) when closed with good acoustic seals around the top and bottom sliders. Mohair seals are not considered to be acoustic seals.

3.2 Building Façade Construction

To provide sufficient acoustic attention of noise, the general external construction of the proposed building would need to be constructed as detailed in Table 11.

Table 11 – External Façade Construction (R_w)

Building Element	Proposed Construction	Minimum R_w
External Wall	Masonry or cavity brick	45
Roof and ceiling	Hotel: Concrete with a plasterboard cavity ceiling. Insulation in the cavity as per ESD requirements.	45
	Ballroom: Metal deck (Colorbond) with internal suspended plasterboard ceiling. Acoustic insulation in the cavity to be 50-75mm thick (nom. density of 12kg/m^3).	45

3.3 Mechanical Services

At the DA stage, the design and selection of mechanical equipment has not been finalised. Following the DA approval of the proposed development, during the Construction Certification Stage a detail assessment of all mechanical plant and equipment will be conducted to ensure compliance with the EPA and DCP noise criteria.

Typical acoustic measures may include the construction of acoustic barriers, enclosures, attenuators and/or acoustic louvres.

3.4 Ballroom

The proposed ballroom on ground floor of the development is used for private functions and is not generally open to the patrons of the hotel. The recommended external façade construction is given in Table 10 and Table 11.

As part of the management plan, we recommend that all openable windows and doors are to be closed after 10pm every night and all functions finish at midnight.

3.5 Café and External Seating Area

The proposed bar and café could potentially operate between 7am and 10pm each day to service the patrons of the hotel. Noise associated with the café, bar and surrounding the pool area would predominately be from patrons talking in the external seated areas.

Table 12 presents the typical speech noise levels used for assessing the impact at the nearest sensitive residential receivers to the south.

Table 12 — Typical Noise Level of Speech

Typical Speech at 1m[1]	Octave Band, Hz Lin									Overall dBA
	31.5	63	125	250	500	1k	2k	4k	8k	
Normal Voice	-	-	54	56	58	59	53	47	40	61
Raised Voice	-	-	49	59	63	65	59	53	47	67

[1]Harris "Handbook of Acoustical Measurements and Noise Control".

Taking into consideration the noise from the seated patrons in the external area (at full capacity), calculations have been conducted based on Concawe using CadnaA (version 4.5.149). We assume people would speak a raised voice level in the café and bar seating areas, and with a normal voice around the pool areas.

Based on this implementation of the above conditions, Table 13summaries the predicted noise level at the nearest receiver located at No.8 Crystal Downs (R1). Figure 2and Figure 3 presents the noise model predications.

To achieve the OLGR noise limits, we recommend a 2m high acoustic barrier at the location shown in Figure 3 . The acoustic barrier is to have a minimum sound rating of Rw30 and can be constructed of a solid material such as:

- 20mm lapped hardwood timber panelling.
- 75mm Hebel panel.
- 50mm thick masonry/concrete.
- Modular acoustic panels, such Modular Wall Systems “EnduroMax”.

Table 13 — Predicted Noise Level at Nearest Receivers (with mitigation)

Receiver Location	Predicted Overall Noise Level, L_{10} dBA		Overall Noise Limit L_{10} dBA	Complies (Y/N)
	No Barrier	With Barrier		
R1	41	36	38	Y

We predict the noise levels would be less than 36dBA at the nearest receiver (R1) and therefore comply with the OLGR noise limits.

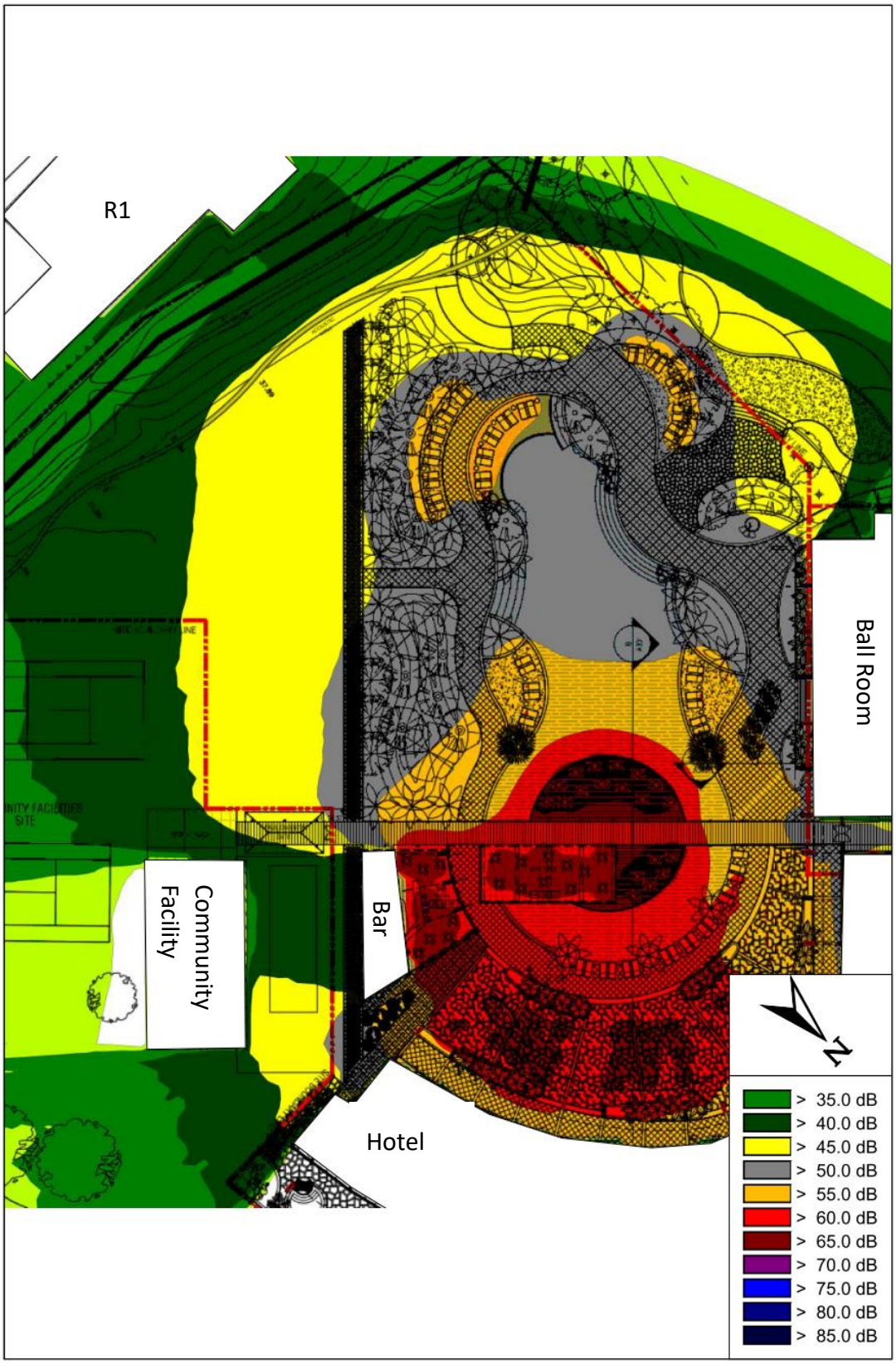


Figure 2 – Noise Model for Outdoor Noise (no mitigation)

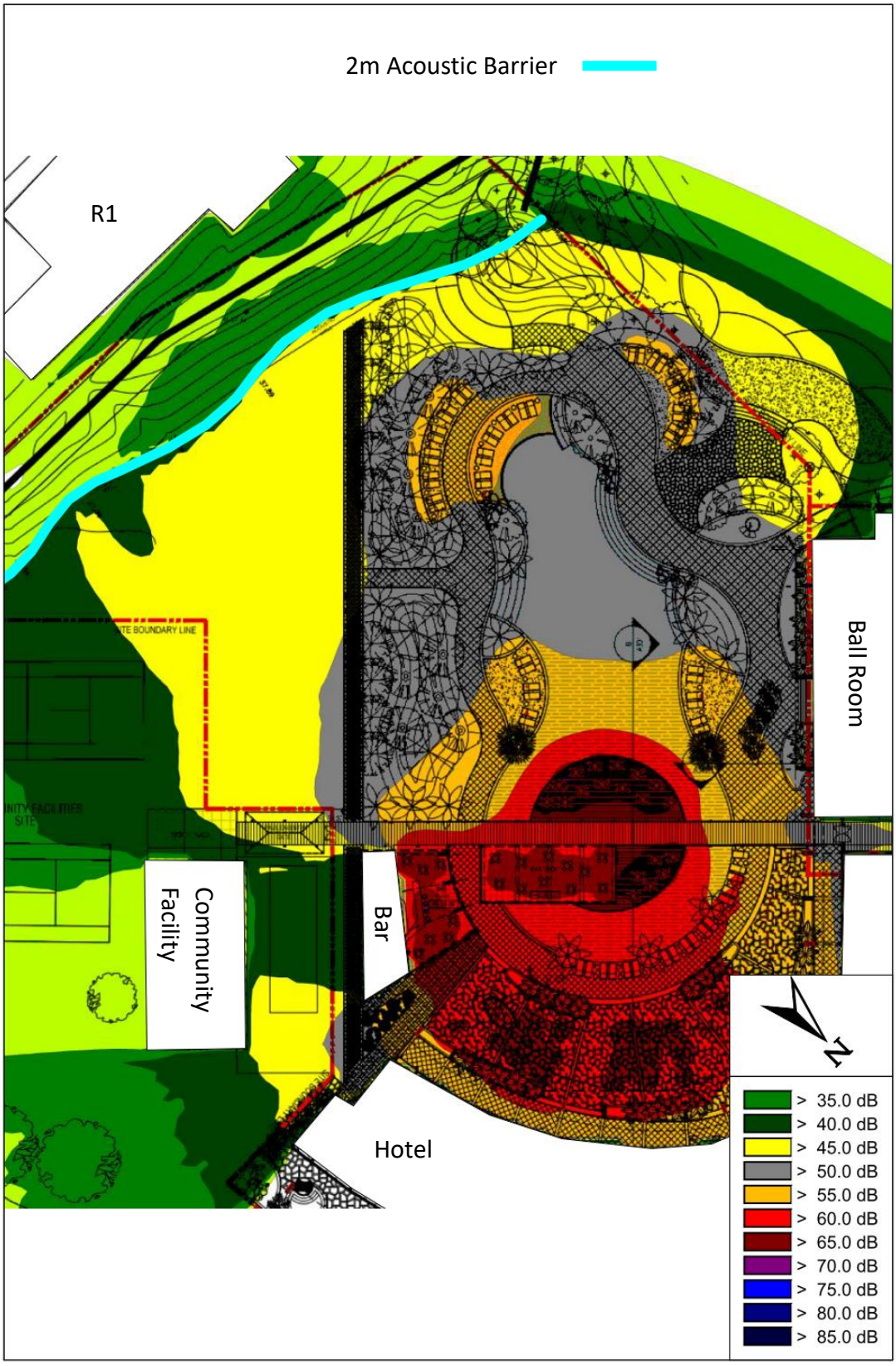


Figure 3 – Noise Model for Outdoor Noise (with mitigation)

3.6 Assessment of Traffic Noise Generation

This section details a review of the expected increase in traffic noise generation from this development. Based on the report prepared by TRAFFIX (ref: 16.103r01v05) dated the 20/7/2017.

The current traffic flow (including seasonal adjustment) for the existing facilities is:

- 31 veh/hr (4 in and 27 out).

The expected peak hour trip generation for the development is:

- 114 trips/hr (91 in, 23 out).

Based on the survey of the current traffic flows and future traffic flows given in Appendix D of the traffic report, the following Table 14 summaries the predicted change in traffic noise levels.

Table 14 – Predicted Change Traffic Noise Levels during Afternoon Peak Periods

Site	Time	Current Traffic Flow	Future Peak Traffic Flow	Change in Traffic Noise, dBA
Twin Creeks Drive and Portrush Crescent	PM Peak (Friday)	155	329	3.3
	Saturday Midday Peak	200	400	3.0
Twin Creeks Drive and Luddenham Road	PM Peak (Friday)	395	569	1.6
	Saturday Midday Peak	713	913	1.1

The predictions indicate that there is potentially an increase of up to 3.3dB along Twin Creek Road heading towards Luddenham Road during PM peak periods. Potentially, the only residential receiver that may be affected is the resident at No.2 Comargo Lane.

Following DA approval, the client in consultation with the affected residents along Twin Creeks Drive is identify feasible and reasonable options for acoustic mitigation measures, such as “at-property” treatments. The types of acoustic could include one or a combination of the following treatments:

- Upgrade acoustic insulation (50-75mm thick) in the cavity of extern wall and roof.
- Upgrade laminated glass to the external façade glazing.
- Provide fresh air ventilation and/or air-conditioning to allow windows to be closed during peak times.
- Provide landscape mound or a solid fence along Twin Creeks Drive. The fence can be constructed of lapped timber or metal/colobond with a minimum Rw 25.

3.7 Noise from Waste Collection Vehicles

For all privately operated waste collection vehicles entering the loading dock on ground level, Part 4.3.3 of EPA Noise Guide for Local Government it is recommends the following time restrictions:

- Before 8.00 am or after 8.00 pm on any Saturday, Sunday or public holiday.
- Before 8.00 am or after 8.00 pm on any Saturday, Sunday or public holiday.

This excludes motor vehicles (related to residents or patrons) entering of existing the premises.

Additional management controls of the rubbish collection vehicles to minimise noise impact to the units on ground floor could include:

- Using up-to-date equipment that uses 'quieter' technology such as low-noise bin lifters.
- Maintaining rubbish trucks and braking materials to minimise or eliminate noise such as squeaky brakes.
- Educating drivers and collectors to be careful and to implement quiet work practices.
- Setting more appropriate times for the rubbish collection.

The location of the loading dock on basement level will provided noise control of truck vehicle noise and loading activity within the building. This would provided aan improved acoustic amenity to the nearby residents.

3.8 Management of Construction Noise

Details of the construction schedule (timeframe), methodology and construction equipment to be used have not been finalised. Based on our noise survey of the existing background and ambient noise levels Table 15 presents a summary the noise management level for this project in accordance with EPA's ICNG.

Table 15 — EPA ICNG: Construction Noise Limits, dBA

Receiver	Time Period	Existing Noise Levels		Management Level
		$L_{eq\ (period)}$	RBL	$L_{Aeq\ (15min)}$*
Residential	Mon-Fri: 07.00-18.00	49	36	46
	Sat: 08.00-13.00	48	39	49

In order to manage the noise from the construction activities, Table 16 is an excerpt from Appendix E 'Noise Sources, remedies and their effectiveness' Australian Standard 2436:2010, presenting possible noise reductions from various control mechanisms.

Table 16 – Relative Effectiveness of Various forms of Noise Control

Control by	Noise Reduction Possible in Practice, dB(A)
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

Once the details of the construction phase have been finalised for the project, a further detailed assessment is to be conducted prior to commencement of excavation, demolition and construction of this development.

4 Conclusion

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of Penrith City Council DCP.

An environmental noise survey of the site has been conducted and the noise limiting criteria for mechanical plant/equipment noise emission has been determined based on the EPA INP. The limits are presented in Table 7.

Construction for glazing, external walls and the roof/ceiling systems have been provided to achieve the internal noise criteria and are detailed in Section 3.1 and Section 3.2 based on the impact of road and aircraft noise.

Noise associated with patron activity in the outdoor seating area of the café and bar as detailed in Section 3.5 . Patron activity noise has been assessed in accordance with the NSW OLGR noise limits (before midnight) and our predictions with the recommended acoustic treatment the patron activity noise from the use of the outdoor seating areas is predicted to comply with the OLGR noise limits.

The assessment of increased traffic generation in Section 3.6 has been assessed according to EPA RNP noise guidelines. Based on the expected traffic activity for the development, the increase in traffic from the operation of the development is expected to be approximately 3.3dB, which exceeds the EPA's 2dB recommendation. It is recommended that following DA approval, the client in consultation with the affected residents identify feasible and reasonable options for acoustic mitigation.

The noise limiting criteria for construction activity noise is presented in Table 15 and has been determined based on the on Council's construction noise code. Once details of construction staging are finalised a detailed assessment is to be conducted prior to commencement of demolition and construction. Table 16 provides typical acoustic measures that can be adopted to provide effective noise control.

Providing the recommendations in this report are implemented, the noise from the proposed development is predicted to comply with acoustic requirements of the DCP, NSW EPA, BCA Part F5 and relevant Australian Standards.

Appendix A – Acoustic Terminology

Decibel, dB: A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 micro Pascals.

A-WEIGHTING: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

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.

Ambient Noise/Sound: All noise level present in a given environment, usually being a composite of sounds from many sources far and near. Traffic, HVAC, masking sound or even low-level background music can contribute to ambient level of noise or sound.

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.

Background Noise (L 90): The sum total of all unwanted residual noise generated from all direct and reflected sound sources in a space that can represent an interface to, or interfere with good listening and speech intelligibility.

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.

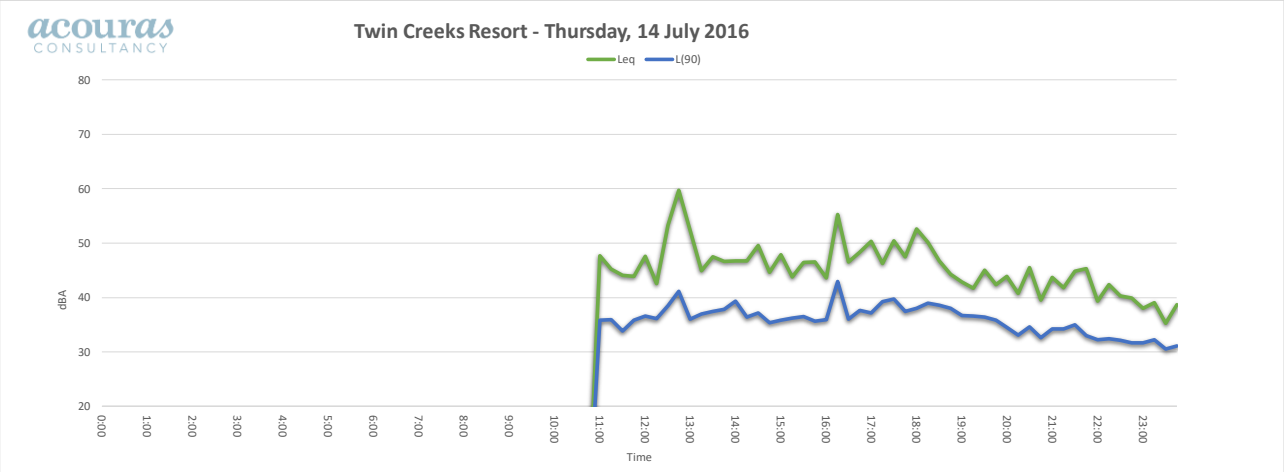
L AEQ,T : Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

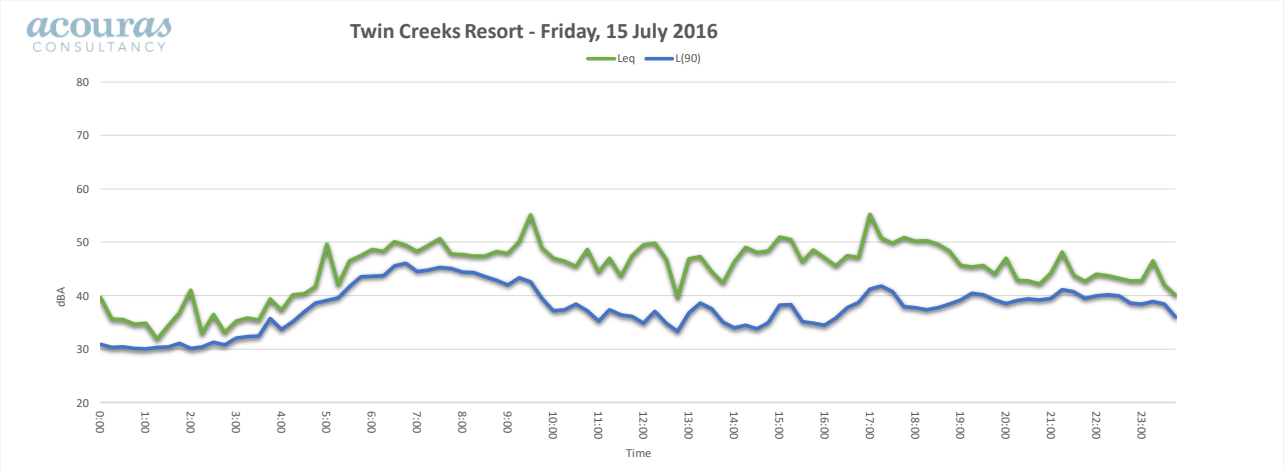
Appendix B – Architectural Drawings

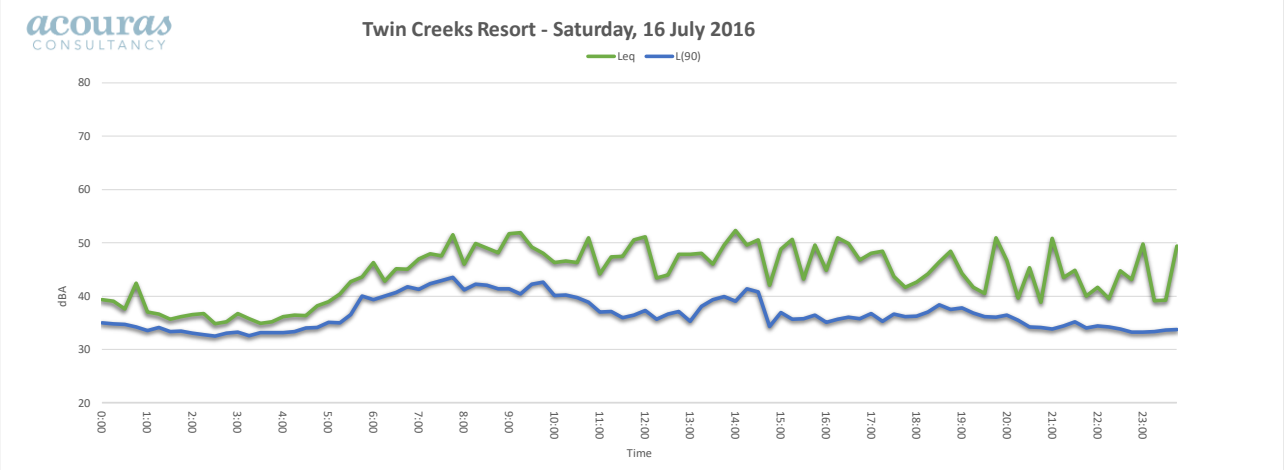
This assessment was based on the following architectural drawings provided by Tony Owen Partners.

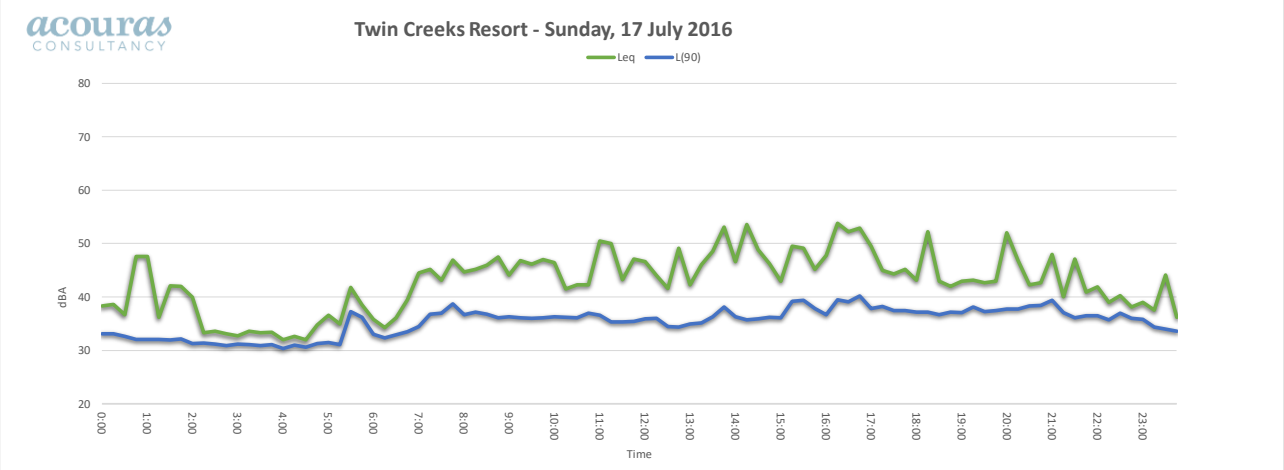
Drawing	Issue	Date	Description
A010	D	25 May 2017	Site Plan
A080	D	25 May 2017	Basement 2 Plan
A090	D	25 May 2017	Basement 1 Plan
A100	B	08 Feb 2018	Ground Floor
A101	D	25 May 2017	Level 1
A102	D	25 May 2017	Level 2
A103	D	25 May 2017	Level 3
A104	D	25 May 2017	Level 4
A105	D	25 May 2017	Level 5
A106	D	25 May 2017	Level 6
A107	D	25 May 2017	Level 7
A108	D	25 May 2017	Level 8
A109	D	25 May 2017	Level 9
A130	D	25 May 2017	Roof Level
A200	D	25 May 2017	South West Elevation & North West Elevation
A201	D	25 May 2017	South East Elevation & North East Elevation
A202	D	25 May 2017	South West Elevation & North West Elevation

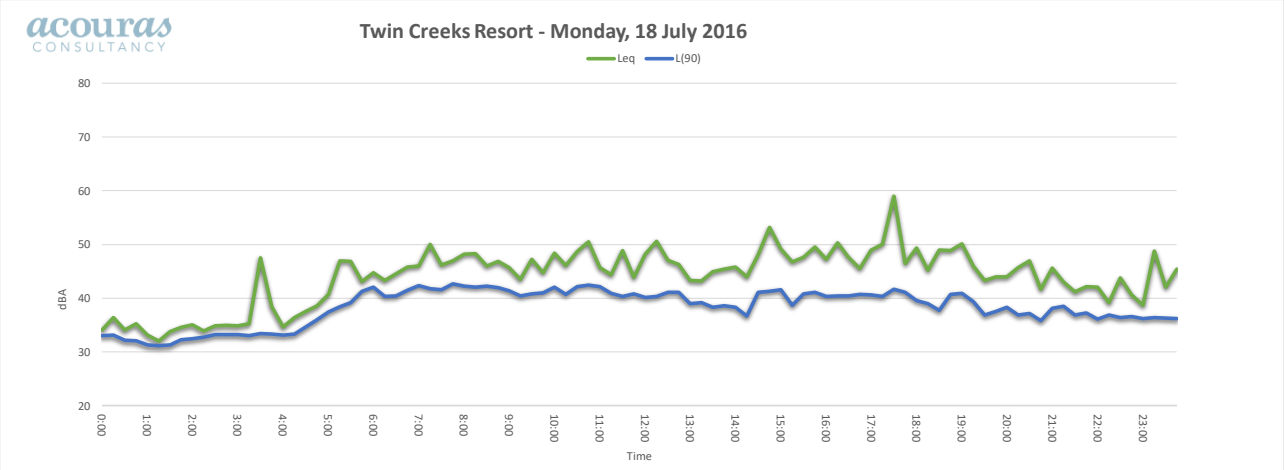
Appendix C – Noise Logger Results

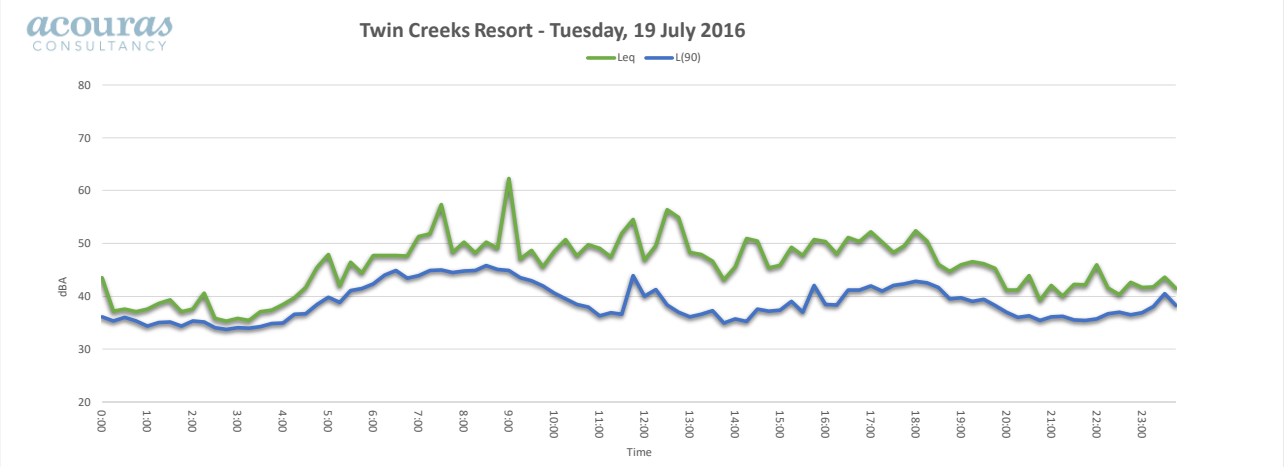


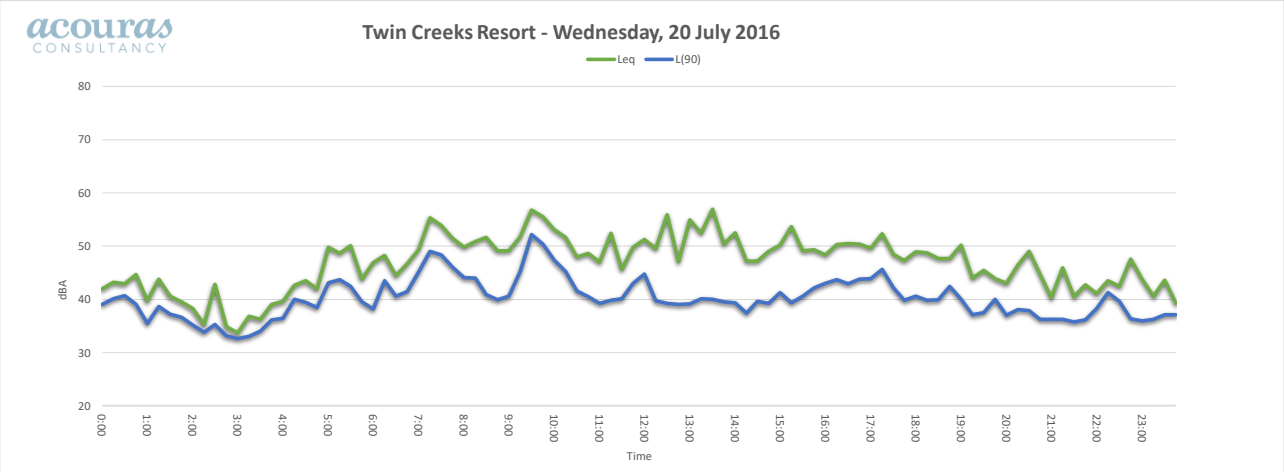


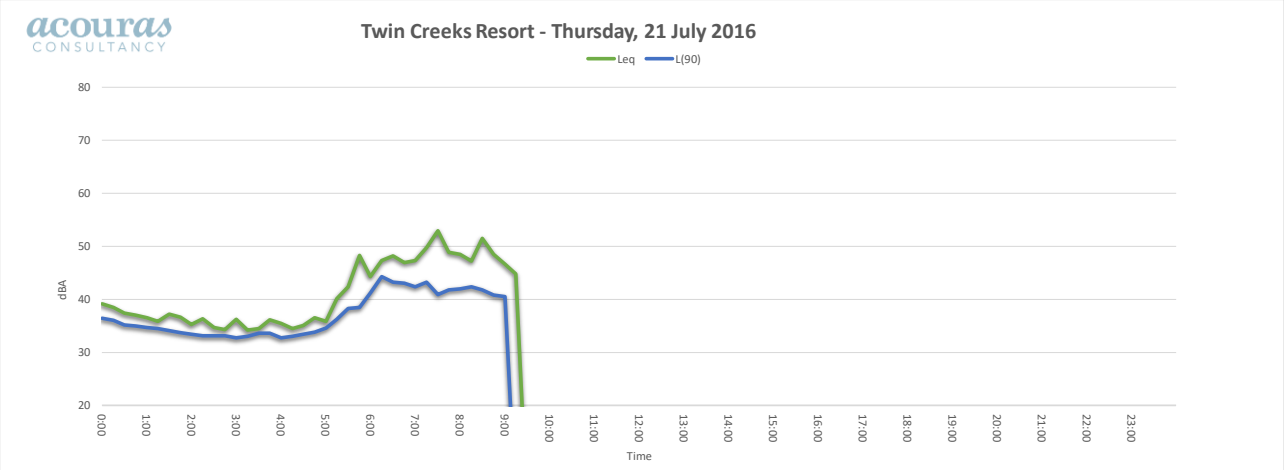



Twin Creeks Resort - Sunday, 17 July 2016
Leq
L(90)
dBA
Time


Twin Creeks Resort - Monday, 18 July 2016
Leq
L(90)
dBA
Time


Twin Creeks Resort - Tuesday, 19 July 2016
Leq
L(90)
dBA
Time


Twin Creeks Resort - Wednesday, 20 July 2016
Leq
L(90)
dBA
Time


Twin Creeks Resort - Thursday, 21 July 2016
Leq
L(90)
dBA
Time