DEVELOPMENT APPLICATION ACOUSTIC ASSESSMENT

EMIRATES LUXURY RESORT, WOLGAN VALLEY, NSW

REPORT FOR:
Emirates Resorts and Hotels
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Level 18, Citigroup Centre
2 Park Street
SYDNEY NSW 2000
REPORT NO: SA0416-MH-a1
DATE: 6th October, 2005

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DOCUMENT CONTROL SHEET

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		Original Date of Issue:	18th August, 2005
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Document Description:	Development Application Acoustic Assessment

REVISION/VERIFICATION HISTORY

REVISION NUMBER	DATE	CHECKED BY		ISSUED BY	
0 - Draft	18th August, 2005	KF		MH	
1 - Preliminary	24th August, 2005	MH		MH	
2 – Final	6th October, 2005	MH		MH	

DISTRIBUTION

DESTINATION	NUMBER OF COPIES									
Revision Number	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
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1 INTRODUCTION

1.1 BACKGROUND

Bassett Acoustics was commissioned by Clifton Coney Group on behalf of Emirates Resorts and Hotels to provide a Development Application acoustical assessment of the proposed Emirates Luxury Resort in the Wolgan Valley, NSW.

The proposed exclusive resort is set within a 1457 Hectare property that will be managed as a dedicated wildlife conservation area. The resort, which is modelled on the environmentally sensitive Emirates Al Maha Resort in Dubai, will be designed to blend in with the natural landscape and bush setting. It will provide:

- A 1400 m^2 conference facility
- 40 luxurious suites set individually in a bush setting including private pool
- Main restaurant and bar
- Spa, gymnasium and leisure centre
- Staff service and maintenance facilities
- On and off site guest facilities
- Associated infrastructure including access roads, storm and waste water management facilities, helicopter landing pad and pedestrian paths

This report will:

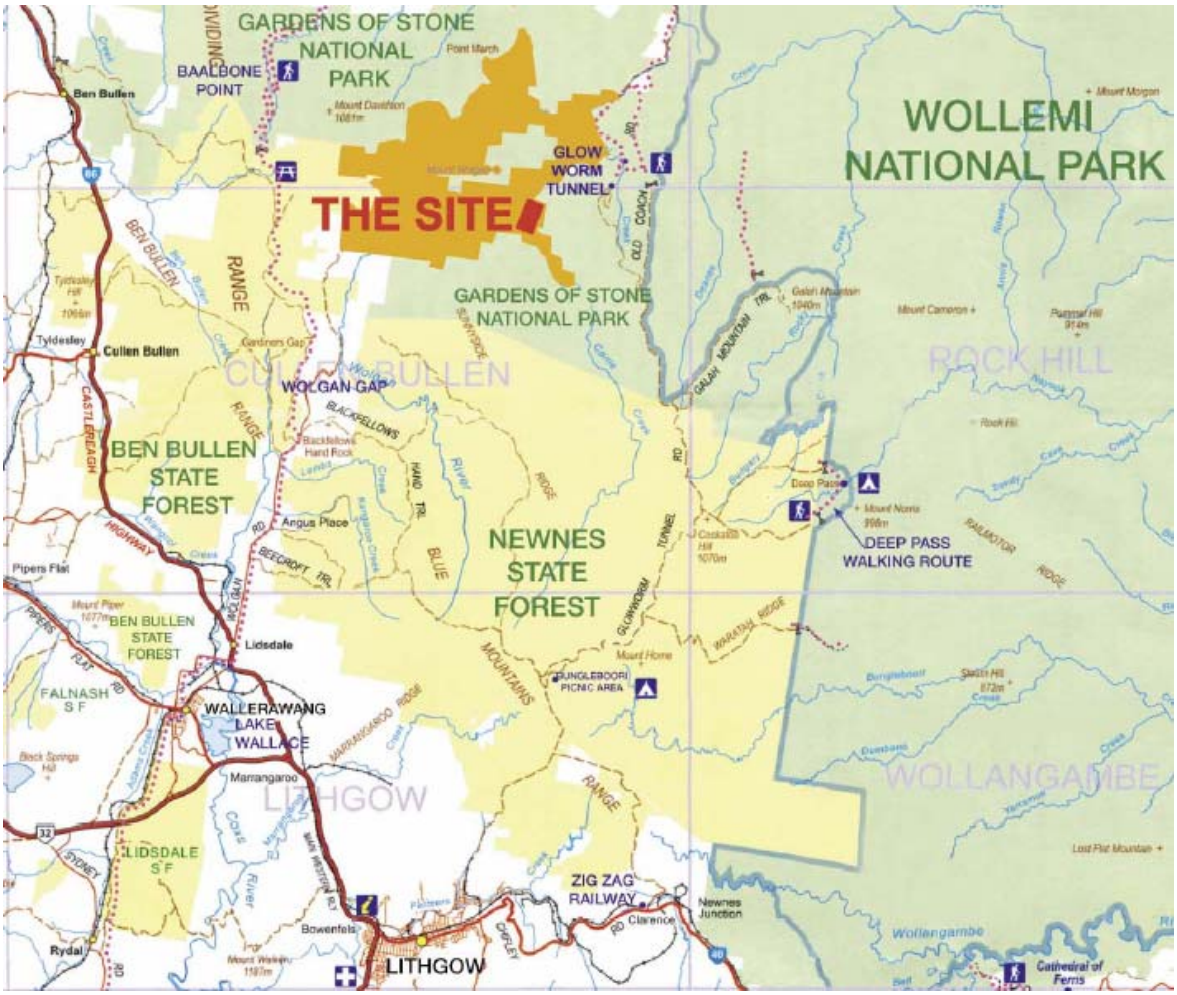
- Recommend maximum internal noise criteria for the different areas of the development
- Provide the results of background noise monitoring performed at the nearest residential properties to the site
- Recommend maximum environmental criteria for noise emissions from the mechanical plant, such as the waste water treatment plant and mechanical services associated with the development, particularly from the staff accommodation and maintenance facility
- Assess road traffic noise generation associated with the development
- Comment on the use of helicopters to access the site

The criteria for noise emission from the services associated with the site are taken from the recommendations of the NSW Department of Environment and Conservation (formerly the EPA). As the current design of the facility is very preliminary, noise emmission from particular items of plant have not as yet been assessed since the precise location of the equipment and sound power levels of the sources are unknown.

1.2 SITE DESCRIPTION

The proposed development site is located in the Wolgan Valley, approximately 190 km north-west of Sydney on the edge of the Blue Mountains adjacent to both the Wollemi and Gardens of Stone National Parks. It is approximately 35 km north of the town of Lithgow and about 8 km south of the former settlement of Newnes. The location of the site is shown in Figure 1-1 below.

Figure 1-1 - Site Location Plan



1.3 SITE ACCESS

Access to the site is via Wolgan Road. This road is sealed from Lidsdale until just after the steep and winding descent through Wolgan Gap. From Wolgan Gap to Newnes, the road is of generally well maintained unsealed construction.

Wolgan Road is generally used only by the 16 permanent residents of the Valley during the week. Anecdotally, the Wolgan Road can become (relatively) busy on weekends and public holidays when day-trippers and campers use the road to visit the popular camp site, picnic area and historical ruins at Newnes.

1.4 DEVELOPMENT DESCRIPTION

1.4.1 Site Description

The development will consist of a number of separate areas spread over the property to accommodate the various needs of the resort. These can be summarised into three distinct areas as follows:

- Main resort area including the conference centre and main building (surrounded by Villas),
- Spa and homestead precinct (surrounded by Villas)
- Staff and Managers accommodation and maintenance facilities (including helicopter pad)

These areas can be seen in Figure 2 below.

Figure 2 – Development Site Layout

1.5 RESORT OCCUPANCY AND TRAFFIC GENERATION

The resort will cater for up to approximately 90 guests and will be manned by approximately 120 staff with about 60 of the staff being housed in the staff accommodation area. It is expected that 60 staff members would access the site on a daily basis. The day staff will access the site by resort vehicle. This is likely to be in the form of a 15 seater minibus. Four minibus trips will be required to pickup and drop off staff each morning and evening. On every third or fourth day up to 2 minibuses will bring staff to the site and take staff from the site.

The resort is likely to have an 80-90% occupancy rate and the average stay is likely to be of four days duration.

Access to the site by the guests will only be via resort vehicles. It is envisaged that the guests will be picked up either from Sydney's Kingsford Smith Airport or a location within Lithgow, and be transported by luxury four wheel drive vehicle to the resort. Some guest will travel directly from Kingsford Smith Airport to the site by helicopter. There will only be a maximum of 4 helicopter flights a week to the resort. These flight paths will follow the main access roads from Penrith to the site and will not cross over the National Parks. There will not be any joy flights from the resort and helicopter use will be strictly for transportation purposes only.

It is expected that up to four vehicle trips will be required to bring guests to the site each morning and four vehicles will transport guests from the resort to either Lithgow or Kingsford Smith Airport. Another three will bring guests to the resort at around noon and depart with guests leaving the resort.

One delivery truck will bring perishables to the resort each day.

The traffic engineer engaged for the development has estimated that the resort will generate 28 Daily Vehicle Trips and up to 7 peak hour vehicle trips on the Worst Case Peak Day.

2 NOISE MEASUREMENTS

2.1 ROAD TRAFFIC NOISE MEASUREMENTS

A 01dB noise logger was used to continuously measure noise levels at the nearest residence to the proposed development site. This logger was located along the driveway to "Penrose", a residence located almost opposite the main site access point off Wolgan Road.

The logger was set for a sample period of 15 minutes and continuously logged for a period of eight days from Wednesday evening 10th August until Friday morning 19th August, 2005. The noise logger provides a measurement of the existing background noise levels close to the development site. The dominant source of ambient noise near the site is wind moving the vegetation, insects, grazing cattle and the occasional passing road vehicle or high level aircraft passing overhead.

The logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events such as the pass by of a vehicle. The L_{A90} is taken as the background noise level. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The results give the $L_{Aeq,1hr}$ noise level for both the day and night time periods. This represents the highest tenth percentile hourly A-weighted L_{eq} noise level during the period 7 am to 10 pm and 10 pm to 7 am over the entire monitoring period. The average L_{max} noise levels measured during the night between the 11th and 17th August by the noise logger is also listed in Table 2-1 below. Although these are the indices that are used to quantify traffic noise, in reality, because the existing traffic volumes are so low, the noise measured probably relates more to breezes moving vegetation and animal noise. Graphical representations of the logged noise levels are included in Appendix B.

Table 2-1 Measured Traffic Noise Levels

Date	Noise Level dB(A)		
	Day $L_{Aeq,1hr}$	**Night $L_{Aeq,1hr}$**	**L_{Amax}***
Thursday 11th – 17th August, 2005	46 dB(A)	41 dB(A)	58

Note * The L_{Amax} noise level has been obtained by determining the average of the 3rd highest L_{Amax} noise levels measured during each night time period (10pm to 7 am) for the one week monitoring period. Any obviously abnormal measurement results that could be the result of some interference with the measurement equipment were ignored. This is in accordance with the DEC guidelines presented in 'Environmental Criteria for Road Traffic Noise' (ECRTN).

2.2 AMBIENT NOISE LEVEL MEASUREMENTS

The background noise level is defined by the Department of Environment and Conservation (DEC) as "the underlying level of noise present in ambient noise when all unusual extraneous noise is removed". It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is represented by the $L_{A90,15\ min}$ descriptor. The noise levels measured at the nearest neighbour's residential boundary were analysed to determine a single assessment background level (ABL) for each day, evening and night period, in accordance with the DEC's NSW Industrial Noise Policy and the Noise Guide for Local Government.

The ABL is established by determining the lowest tenth percentile level of the L_{A90} noise data acquired over each period of interest. Table 2-2 below presents the individual ABLs for each day's assessment periods at the logger location.

The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period Table 2-2 also presents the existing L_{Aeq} ambient noise levels, selected for each day, evening and night periods, in accordance with the INP. An overall representative L_{Aeq} noise level is determined by logarithmically averaging each assessment period for the entire monitoring period.

Table 2-2 Existing Background (L_{A90}) and Ambient (L_{Aeq}) Noise Levels

Date	L_{A90} Background Noise Levels			L_{Aeq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
Thursday 11th August, 2005	31	26	25	42	38	38
Friday 12th August, 2005	26	25	25	39	31	31
Saturday 13th August, 2005	25	25	25	39	31	32
Sunday 14th August, 2005	26	26	26	52	33	38
Monday 15th August, 2005	35	29	26	46	42	38
Tuesday 16th August, 2005	25	25	24	40	34	36
Wednesday 17th August, 2005	24	25	24	36	37	34
RBL / Log Average	**26**	**25**	**25**	**46**	**37**	**36**

Notes:
1. Day is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Where the existing background noise level is less than 30 dB(A), as it is here for all three time periods, then the INP recommends that the Rating Background Noise Level be set to 30 dB(A).

3 NOISE CRITERIA

This section will establish criteria in order to address the following acoustical issues:

- Internal mechanical services noise levels within habitable spaces.
- External environmental noise emission from the site including mechanical services and operational noise from the development

3.1 INTERNAL NOISE CRITERIA

Internal noise levels in the resort spaces will be affected by the air-conditioning system servicing the space and to a minor extent by the natural environment in which the development is set.

Mechanical services noise within the development will be controlled to very low levels so as to make as little impact as is possible. Ideally the services will be designed to inaudible levels so that the guests will not be aware that the environment has been conditioned for thermal comfort.

3.1.1 Recommended Ambient Mechanical Services Internal Noise Levels

Internal noise levels due to air conditioning and mechanical ventilation plant should not exceed the satisfactory acceptable levels recommended in Australia/New Zealand Standard AS/NZS 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*. This Standard recommends satisfactory and maximum internal noise levels for building interiors based on room designation and location of the development relative to external noise sources.

Table 3-1 lists the relevant internal noise levels recommended in AS/NZS 2107:2000. In order to achieve the appropriate internal noise level, the lower of the of the internal noise level range will be adopted as a maximum limit for the internal noise criteria for mechanical plant noise.

Table 3-1 AS/NZS 2107:2000 Internal Noise Criteria

Type of Occupancy	Recommended Design Sound Level, L_{Aeq}, dB(A)		Recommended Reverberation Times (s)
	Satisfactory	Maximum	
Hotels and motels -			
Bars and lounges	45	50	-
Conference areas -			
Without sound reinforcement -			
- Up to 50 people	35	40	Curve 1 *
- From 50 to 250 persons	30	35	Curve 1 *
With sound reinforcement	35	45	Curve 1 *
Dining rooms	40	45	<1.0
Enclosed car parks	55	65	-
Foyers and recreational areas	45	50	See Note
Kitchen, laundry and maintenance areas	45	55	
Sleeping areas -			
Hotel and motels near minor roads	30	35	-
Hotels and motels near major roads	35	40	-
Washrooms and toilets	45	55	-

Note: AS/NZS 2107:2000 recommends that reverberation times in these spaces should be minimised as far as possible for noise control.

Curve 1 of the Standard gives mid-frequency reverberation times for different areas based upon room volume.

3.1.2 Traffic Noise Criteria

The proposed development is covered by State Environmental Planning Policy (State Significant Development) 2005. In accordance with the DEC's requirements for the Statement of Environmental Effects, the DEC's document *Environmental Criteria for Road Traffic Noise* will be used for the assessment and control of road traffic noise generated by the proposed development.

3.1.2.1 L_{eq} Levels

The proposed development will be assessed for road traffic noise generated by the development by addressing the Department of Environment and Conservation's document *Environmental Criteria for Road Traffic Noise* (*ECRTN*).

Table 3-2 below presents the DEC's road traffic noise criteria for land use developments with the potential to create additional traffic on local roads. The external noise criteria are applied at 1 metre from the affected external façade of the residences located along Wolgan Road.

Table 3-2 Road Traffic Noise Criteria for land use developments with potential to create additional traffic on surrounding roads.

Type of Development	Criteria		
	Day (7am-10pm) dB(A)	Night (10pm-7am) dB(A)	Where criteria are already exceeded
13. Land use development with the potential to create additional traffic on local roads	$L_{Aeq(1hr)}$ 55	$L_{Aeq(1hr)}$ 50	Where feasible and reasonable, the existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.

3.1.2.2 Sleep Arousal

The DEC *ECRTN* recommends that an assessment of sleep arousal due to the pass-bys of heavy vehicles during the night period be conducted. Since there will not be traffic generated by the development during the night, sleep arousal will not need to assessed for this development.

3.2 NOISE EMISSION CRITERIA

The Emirate Resort development has the potential to contribute to the existing external noise environment, although its generally remote location greatly limits this risk. Noise will however be generated by the traffic movements on the site and mechanical plant servicing the development. In order to ensure nearby residential properties are not adversely affected by the noise emission from the site, environmental noise criteria are established and must be applied at the most affected residential boundary. For a rural property this boundary is generally considered to be the boundary to the house paddock or yard.

3.2.1 Mechanical Services Noise Emission Criteria

The DEC's INP for the assessment and control of industrial noise sets out guidelines for industrial noises. These guidelines will apply to all mechanical plant installed at the development and will also apply to vehicles using the roads on the property.

The assessment procedure for industrial noise sources has two components:

1. Controlling intrusive noise impacts in the short term for residences.
2. Maintaining noise level amenity for particular land uses for residences and other land uses.

3.2.1.1 Intrusive Noise Impacts

The *INP* states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

3.2.1.2 Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the "Background Creep" or Amenity criterion.

For a residential receiver in a rural area (as defined by the *INP*), the recommended amenity criteria are shown in Table 3-3.

Table 3-3 Recommended L_{Aeq} noise levels from Industrial Noise Sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45

When the existing noise level *from industrial sources* is close to the 'Acceptable Noise Level' (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with Table 2.2 of the *INP*. Since there are no existing industrial noises in the area, "creeping background" noise will not be relevant to this development.

3.2.2 Resultant Environmental Noise Criteria

A summary of the intrusive and amenity criteria is given in Table 3-4 below. These criteria must be applied at the most affected residential boundary.

Table 3-4 Summary of Environmental Noise Criteria, dB(A)

Period	RBL (L_{A90})	Intrusive Criterion (RBL + 5)	Existing L_{eq}	Amenity Criterion	Final Environmental Criteria
Day	30*	**35**	46	**50**	**35**
Evening	30*	**35**	37	**45**	**35**
Night	30*	**35**	36	**40**	**35**

* Note: Where the measured RBL is less than 30 dB(A) then the RBL is set to 30 dB(A).

These criteria apply to environmental noise emission from mechanical services outdoor plant, maintenance activities, vehicle activities on the site and car parking associated with the development.

3.3 CONSTRUCTION NOISE CRITERIA

The NSW Department of Environment and Conservation's Environmental Noise Control Manual (ENCM) has been largely superseded by the NSW Industrial Noise Policy (INP) and a new DEC publication, "Noise Guidelines for Local Council". Construction noise criteria were previously specified in the ENCM and have not been included in either of the aforementioned publications. The DEC have advised that they are currently developing new draft guidelines for managing construction noise which will adopt a "best practice" type approach that attempts to reduce construction noise to a level that is limited by what is feasible and reasonable.

The guidelines will require a construction noise management plan to be compiled by the developer. Noise level objectives must be set for the day time and evening periods, and must be complied with where reasonably practicable. The objective levels should be identical to those found in the ENCM. During the night time period, the noise limits detailed in the INP must be met and a strong case must be presented if residential properties are affected as to why construction will be undertaken during the night-time period.

The noise management plan should detail the best practice construction methods to be used, presenting a reasonable and feasible approach. The plan should identify the extent of the residential area affected and assess the impact on residents. The plan should detail any community relation programs which are planned eg. prior notification for particularly noisy activities, letter box drop regarding out of hours construction work to be undertaken, etc and a 24 hour contact phone number for residents to call should they have any complaints or questions.

The construction site noise section, Chapter 171 of the ENCM, is reproduced below.

> ***CONSTRUCTION SITE NOISE***
>
> *Where there is a likelihood of annoyance due to noise from construction sites, conditions such as the following may be specified in a development consent or building application. This applies particularly to non-scheduled premises such as commercial buildings where a long construction time is not likely. The criteria may not be applicable to long term constructions such as coal mines which may take several years. Variations should be made according to local conditions.*

Level Restrictions

(i) Construction period of 4 weeks and under

The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).

(ii) Construction period greater than 4 weeks and not exceeding 26 weeks

The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

Although not specifically stated, it is understood that when the construction noise activities exceed 26 weeks, the L_{10} level should not exceed the background level by more than 5 dB(A).

Time Restrictions

Monday to Friday, 7am to 6pm

Saturday, 7am to 1pm if inaudible on residential premises, otherwise: 8am to 1pm.

No construction work to take place on Sundays or Public Holidays.

Silencing

All possible steps should be taken to silence construction site equipment. It is particularly important that silenced equipment should be used on road or rail works where 24 hr operation is necessary.

The construction period is likely to be over 26 weeks, therefore the L_{10} criterion will be 35 dB(A) during the day-time and evening at the nearest residential receivers located to the north of the site. If the construction of the maintenance facility and staff accommodation takes between 4 weeks and 26 weeks then the construction noise criteria could be increased to 40 dB(A).

4 NOISE ASSESSMENT & RECOMMENDATIONS

The assessment of noise generated by the proposed development is carried out in this section of the report with regard to the established criteria detailed in Section 3. Assessments include:

- Traffic noise generated by the development and internal traffic noise within habitable spaces.
- Environmental noise emission from the mechanical services associated with the development
- Assessment of construction noise and traffic generated by the construction of the development

4.1 NOISE ASSESSMENT OF TRAFFIC GENERATED BY THE DEVELOPMENT

The preliminary traffic report has identified that the proposed development will generate approximately 28 vehicle trips per day and up to 7 vehicle trips per hour.

The existing traffic volumes along Wolgan Road have recently been measured at 52 to 61 per day at the bottom of Wolgan Gap during on weekdays and 80 to 99 per day on weekends. It is noted that these measurements were made during the winter months and perhaps three times that amount could occur on weekends during summer when camping activity levels are high.

Just after the subject site access point, the number of daily vehicles has been measured at 22 to 24 during the week and 63 to 77 on weekends during winter. These levels could increase to 150-200 vehicles in periods of peak activity in summer. The maximum hourly traffic flow has been measured at 2-3 during the week and 11 to 13 on weekends. With the development contributing another 7 vehicles per hour, the maximum number of vehicles will increase to approximately 10 per hour during the week and 23 on weekends.

The residences located near to the site entrance are all set back from the road by at least 100m.

In the summer months when the road is more heavily utilised, the traffic consultant has estimates that in the busiest times, such as long weekends, 200-250 car per day could access the valley resulting in peak hourly trips of 30 to 40 vehicles per hour. At a distance of 100 m with a speed of approximately 50 km/hr, this traffic flow would result in a façade noise level of approximately 40 dB(A). With the additional 7 vehicles per hour, this noise level would increase by less than 1 dB(A). This level of increase in noise level is imperceptible, although the increase in number of vehicle pass-bys may be noticeable to a careful observer. Both the existing and the future maximum predicted traffic flows are comfortably below the traffic noise criteria of 55 dB(A) and 50 dB(A) given in Section 3.1.2.1.

It should be noted that these predictions assume that the road remains well maintained and free from corrugations and pot holes.

4.2 ENVIRONMENTAL NOISE EMISSION

The maintenance facility and staff accommodation are located approximately 1.8 km from the nearest residence and is partially shielded by the local topography.

To achieve the noise emission limit of 35 dB(A), noise emission from mechanical plant (including the sewer treatment plant), equipment used at the maintenance facility and the mechanical equipment servicing the staff accommodation area must be limited to a total maximum sound power level of approximately 110 dB(A). The use of standard mechanical building services will result in maximum sound power emissions well below this level. Some maintenance operations have the potential to approach this level however operational procedures will be in place to prevent the disturbance of guests and these same procedures will also guarantee that the environmental noise emission criteria is not exceeded.

At this stage the mechanical services have not been fully specified therefore detailed recommendations to reduce environmental noise emissions from these noise sources can not be provided. Detailed noise control recommendations will be specified during the detailed design stage of the project primarily to control noise to the resort guests. The controls required to limit noise exposure to the resort guests will ensure compliance with the recommended noise criteria contained in Section 3.2 of the report.

4.3 CONSTRUCTION NOISE ASSESSMENT

As most of the construction of the resort will be performed at remote locations quite a long way from the adjacent residents, we expect that the major effect of the resort construction will be limited to vehicles accessing the site to deliver materials and construction staff.

The traffic consultant has estimated the construction of the resort could generate a total of 80 to 90 vehicle trips per day for the duration of the construction program. A peak hourly traffic generation of approximately 22 vehicles per hour could be expected. Together with the existing traffic of up to 40 vehicles per hour during the summer months would increase the expected noise level to approximately 42 dB(A) at a residence located 100 m from the road. This is below the road traffic noise criteria nominated in Section 3.1.2.1.

It is recommended that a Construction Noise Management Plan be developed by the builder to ensure that the construction noise criteria nominated in Section 3.3 is complied with during the construction period.

5 CONSTRUCTION ACOUSTIC PERFORMANCE – BCA COMPLIANCE

Building Code of Australia (BCA) 2004 is the current issue of the BCA, having been issued on the 1 May 2004. The current BCA incorporates higher standards of acoustical construction than the previous version in response to increasing evidence that the previous BCA sound insulation requirements did not meet community expectations.

The objective of Part F of the BCA is to safeguard occupants from illness or loss of amenity as a result of undue sound being transmitted between adjoining sole-occupancy units, from common spaces to sole occupancy units and from parts of different classifications to sole-occupancy units. Since the residential section of the resort development would be classified as Class 3 building, the isolation requirement listed in Part F5 would apply.

Since the residential section of the development consists of individual villas, there are no common walls between dwellings, neither is there walls separating a residential component from an area of different classification. The sound insulation requirements of the BCA are therefore not relevant to this particular development.

6 CONCLUSION

This report presents the results of an acoustic study of the proposed Emirates Resort development in the Wolgan Valley. Environmental noise emission criteria to the nearest residence have been established and maximum sound power levels specified. Given that the distance of the nearest residence to the resort will be approximately 1.8km, the environmental noise emission from the operation of the development is expected to be well below the relevant noise emission criteria.

Traffic generated by the development has been assessed and found to comply with the relevant requirements of the DEC ECRTN.

A Construction Noise Management Plan, with a particular emphasis on construction traffic, should be developed by the successful contractor as part of a systematic approach to the management of the environmental impact of the construction process.

Helicopter access to the site will be limited to four flights a week and will follow the main road from Penrith to the site. Four flights a week is considered to be too infrequent to be a significant source of annoyance provided that flights are restricted to daytime only. There will not be any additional joy flights over the valley as a consequence of this development.

There are no acoustic site conditions that would preclude the proposed development from complying with the relevant noise criteria identified in this report. Environmental noise emission from the site will be controlled at all neighbouring residential premises, existing and proposed, by standard noise control techniques.

Appendix A - Glossary of Acoustic Terminology

The following is a brief description of the acoustic terminology used in this report.

Ambient Sound — The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.

Audible Range — The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.

Character, acoustic — The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.

Decibel [dB] — The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds;

0dB	The faintest sound we can hear
30dB	A quiet library or in a quiet location in the country
45dB	Typical office space. Ambience in the city at night
60dB	Martin Place at lunch time
70dB	The sound of a car passing on the street
80dB	Loud music played at home
90dB	The sound of a truck passing on the street
100dB	The sound of a rock band
115dB	Limit of sound permitted in industry
120dB	Deafening

dB(A) — *A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.

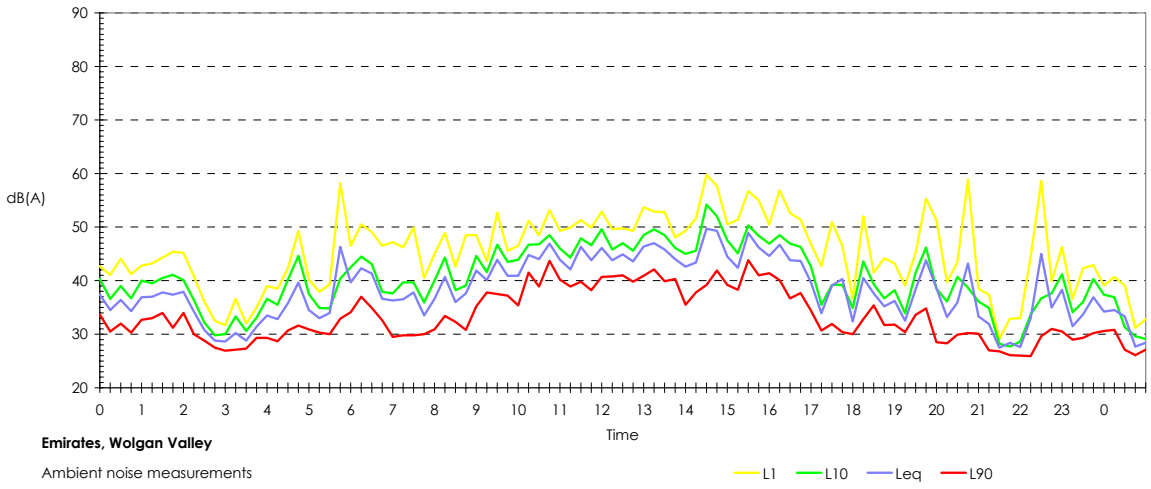
Frequency — Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.

Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

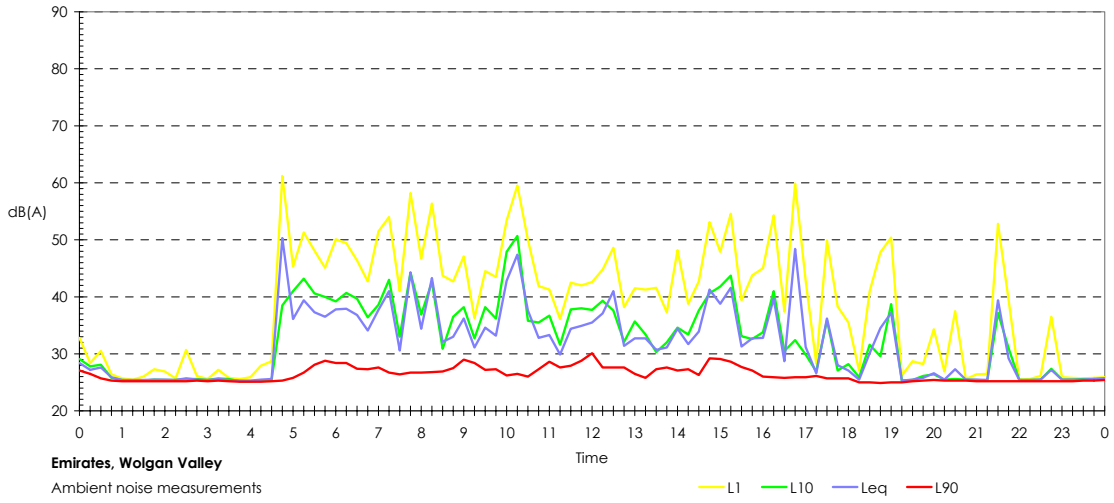
Appendix B – Graphical Logger Results

Logger Location – "Penrose"

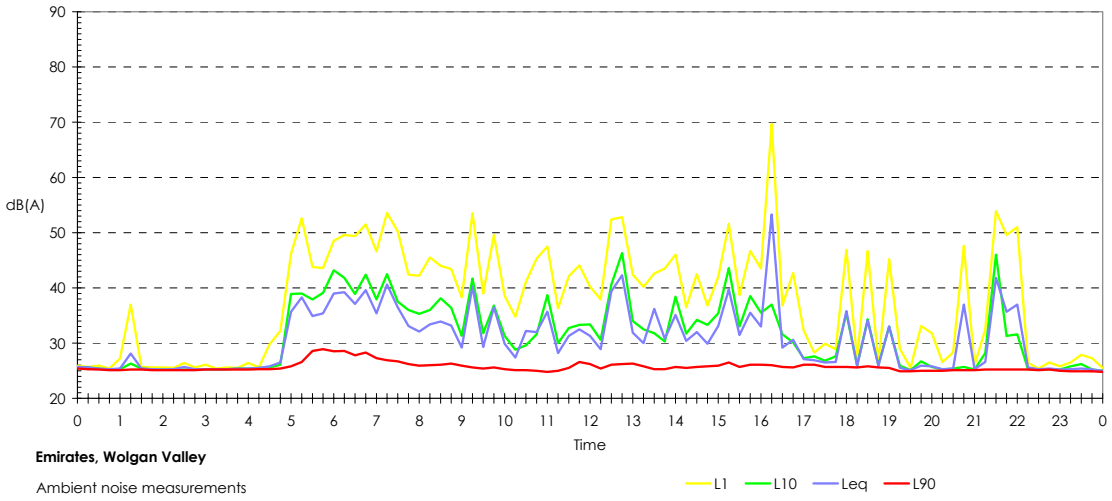
Thursday 11 August, 2005



Friday 12 August, 2005



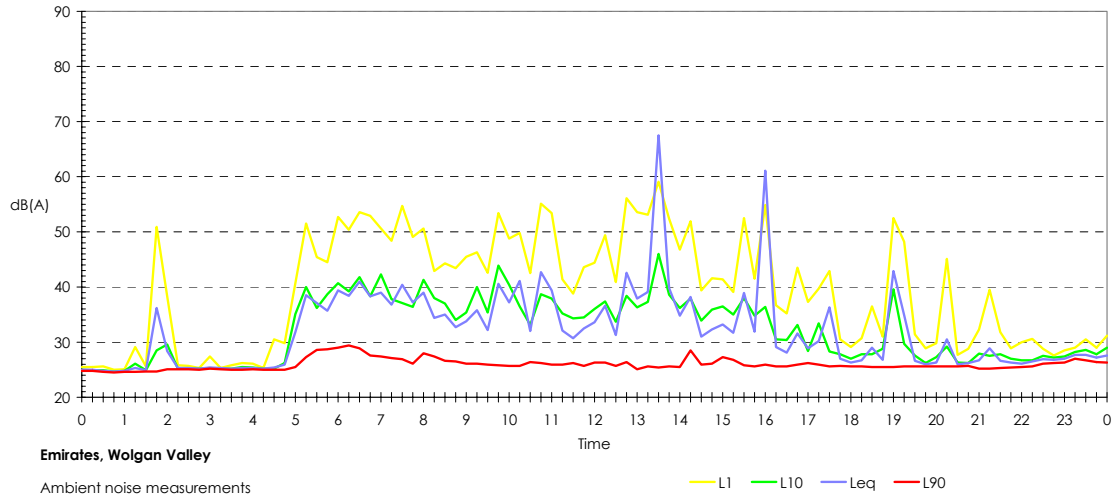
Saturday 13 August, 2005



Emirates, Wolgan Valley

Ambient noise measurements

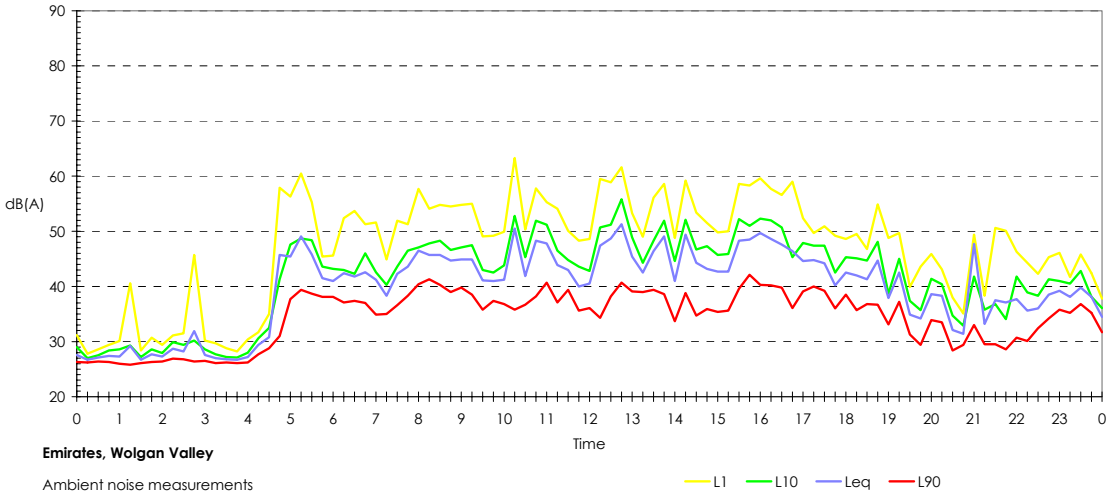
Sunday 14 August, 2005



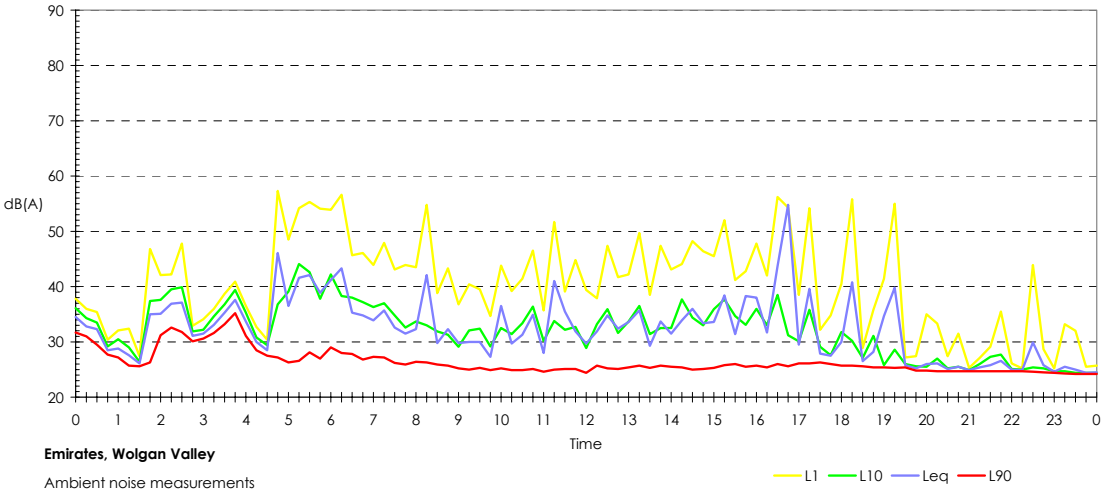
Emirates, Wolgan Valley

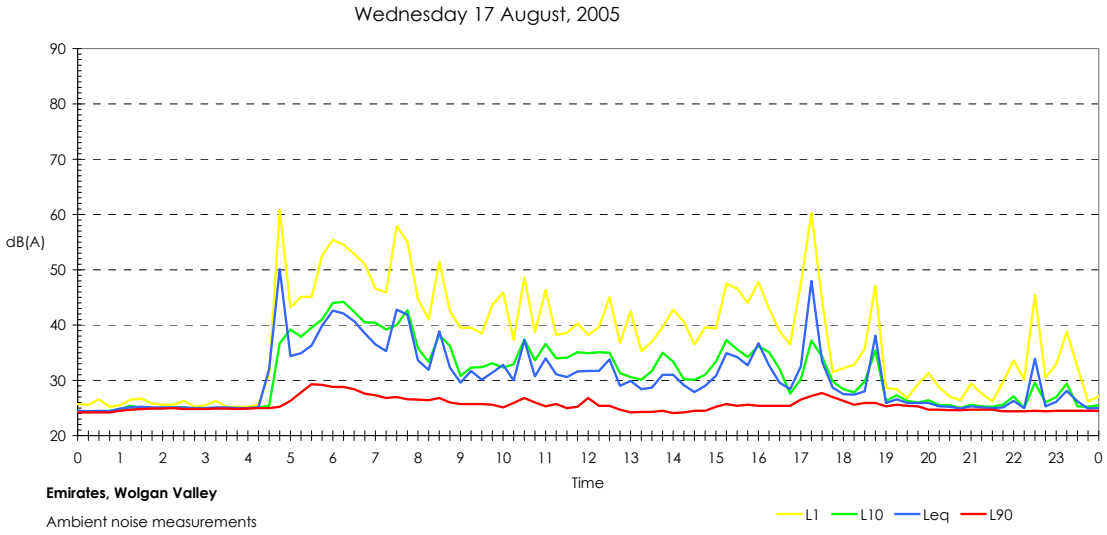
Ambient noise measurements

Monday 15 August, 2005



Tuesday 16 August, 2005





Emirates, Wolgan Valley
Ambient noise measurements