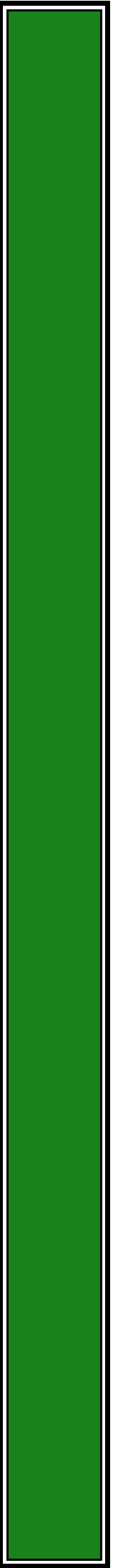


Appendix 6

Acoustic Impact Assessment



FRAZER PARK RECYCLING FACILITY

OPERATIONAL NOISE ASSESSMENT

REPORT NO. 13273
VERSION A

AUGUST 2015

PREPARED FOR

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DOCUMENT CONTROL

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Note

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We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.



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This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.



Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.



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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

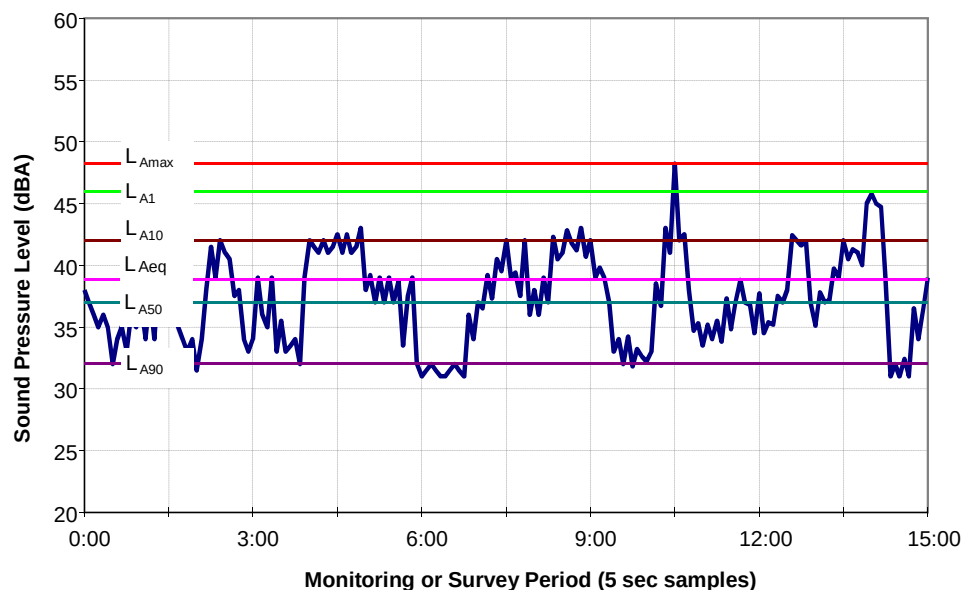
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Wilkinson Murray Pty Limited has been engaged by Hodgson Quarry Products Pty Ltd to provide a noise impact assessment of the proposed modification of operations at their existing quarry site located adjacent to the Pacific Highway at Moonee (Figure 1-1).

A new development application is sought to include a building materials recycling facility to operate in conjunction with the existing approved quarry operation. This noise assessment evaluates potentially noisy activities from fixed and mobile plant and on site associated with extraction of material, crushing and screening plus the handling and recycling of imported materials in accordance with the EPA NSW *Industrial Noise Policy (INP)*.

The report considers existing residences within Catherine Hill Bay as well as a recently approved residential subdivision (Catherine Hill Bay South – shaded red) which is closer to the quarry boundary, and details the assessment of the potential impacts upon the acoustic amenity of the residential development and outlines in-principle noise mitigation strategies where required.

The assessment also considers the potential impact associated with additional trucks along the Pacific Highway in accordance with the EPA NSW *Road Noise Policy (RNP)*.

Figure 1-1 Locality Map (showing Existing Residences and Monitoring Location)



2 SITE DESCRIPTION

2.1 Existing and Proposed Site Operations

The Frazer Park site is located adjacent to the Pacific Highway at Moonee on the outskirts of the Munmorah State Conservation Area (See Figure 1-1). There are no existing residential receivers within 1km radius of the site.

The quarry is currently approved to extract 50,000 to 100,000 tonnes of raw material and process 30,000 to 100,000 tonnes of material per annum and operates between 7.00am and 6.00pm, Monday to Saturday. The present operation, which involves extraction of material, stockpiling and also crushing and screening that, makes the rock suitable for use as construction material, operates a screen, a crusher, a power grid, a dump truck, an excavator, two front end loaders and a dozer.

No change is sought to the approved extraction rate of up to 100,000 tonnes of hard rock (conglomerate), but in parallel the proposed site operations may also process up to 200,000 tonnes of recycled products and cement products.

No change in the number of on-site fixed or mobile plant is required, although all the plant would now be utilised more frequently each day. However, additional truck movements to and from the site are proposed.

The layout of the proposed site is shown in Figure 2-1 with an additional stockpile area and new site office.

2.2 Surrounding Areas

The local terrain consists of undulating hills covered with vegetation comprising dense bushland with trees up to 10m high.

The land surrounding the quarry site is rural. The nearest existing residential area is the Catherine Hill Bay Cultural Precinct located approximately 1.5km north-east from the site, north of Montefiore Street. There is also an isolated residence situated approximately 1km south-west from the site adjacent to the Pacific Highway. The potentially most affected residential area would be the approved Catherine Hill Bay (South) Residential Development shaded in red, which will be built over the coal mining lands as shown in Figure 1-1, approximately 800m from the site.

Figure 2-1 Proposed Site Layout following modifications and Monitoring Locations



3 EXISTING NOISE ENVIRONMENT

To assess noise generated from the site, the *INP* requires ambient noise levels to be measured in order to set criteria.

Since the closest future residences are not yet built and the land is currently bush, existing measurements may not be representative of future background levels once the land is developed. In addition, since the quarry is operational, long-term unattended monitoring at this location may also be affected by existing quarry noise.

For this reason, background noise levels were established based on previous background noise monitoring in the area not affected by the existing site (but at a similar set back from the highway and the ocean) and short-term unattended measurements during our site visit when we were able to stop operations to measure background levels.

3.1 Short-Term Unattended Noise Monitoring

To provide further perspective on the noise levels at various locations around the facility for the daytime period, attended / unattended noise measurements were conducted on Monday, 4 November 2013 at the three locations (M1-M3) shown in Figures 1-1 and 2-1.

The noise monitoring equipment used for this measurement consisted of two ARL NGARA environmental noise loggers (Location M1 and M2) set to A-weighted, fast response, continuously monitoring in 0.1 second intervals for later detailed analysis of required descriptors and one ARL environmental noise logger set to A-weighted, fast response, continuously monitoring in 15 minute intervals at Location M3. The equipment calibration was checked before and after the survey and no significant drift was noted.

The noise survey indicated that the ambient noise level at Location 2 and 3 was heavily influenced by rustling foliage. At Location M3 (shown in Figure 1-1) at the future residential boundary, the noise from the existing quarrying operations site was inaudible at the time of the noise survey.

The purpose of the measurements was to measure noise emissions from the existing operation to be used to validate the noise model.

Based on the measurements using the NGARA noise monitors (records WAV files and 100ms noise levels), the plant noise contribution has been calculated. Table 3-2 presents these noise levels.

Table 3-1 Noise Measurement Results of Site Noise – dBA

Site Operations	Time	Measured Contribution from Site $L_{Aeq,15min}$	
		Loc #1	Loc #2
Loading material onto truck at northern stockpile (Front end loader + dump truck)	8.15 – 8.30	55	<46
Crushing and screening + loading material onto truck at northern stockpile (Front end loader + dump truck)	10.00 – 10.15	59	<49
Dozer ripping in recycled products pit + loading material onto truck at northern stockpile (Front end loader + dump truck)	11.00 – 11.15	61	<50
Excavator on top of the recycled products area + loading material onto truck at northern stockpile (Front end loader + dump truck)	11.30 – 11.45	58	<48

A measurement of background noise levels between 12.45pm – 1.15pm using a B&K2260 in the existing Catherine Hill Bay Precinct was 44dBA at daytime.

3.2 Long-Term Unattended Noise Monitoring

Unattended long-term noise monitoring was conducted by Renzo Tonin & Associates in July 2007 along Flowers Drive on the outskirts of the northern end of the Catherine Hill Bay Cultural Precinct as shown in Figure 1-1. The measured Rating Background Levels (RBLs) are presented in Table 3-2.

Table 3-2 Measured Rating Background Levels (RBLs) (Renzo Tonin) – dBA

Location	7am-6pm	6pm-10pm	10pm-7am
Flowers Drive	37	36	30

3.3 Background Noise Summary

The long-term unattended measured rating background levels are typical of a rural, low residential area. As such, the rating background level of 37dBA would not be representative of that in the Catherine Hill Bay (South) Residential Development once occupied. This is supported by the measured L_{A90} background noise level during the daytime period (12.45pm – 1.15pm) of 44dBA (measured in November 2013) at the centre of the existing Catherine Hill Bay Cultural Precinct, which is typical of a residential environment near the coast. It is expected the RBL will increase marginally during the daytime and evening, more so than the night time period, once the subdivisions has been built. This would be due to domestic noise such as occupants and mechanical plant. Therefore, a higher RBL more representative of residential subdivision would apply for assessment purposes.

Given the closest locations to the site are further from the ocean (often a source of background noise) than the existing residential precinct we consider a background noise level of 40dBA is reasonable to adopt as a conservative future RBL for this area.

3.4 Traffic Noise

As the proposed operation involve additional truck movements, it is necessary to understand the existing traffic noise level impinging on the façade of the potentially most affected receiver.

The most affected location is DP249281 located along the Pacific Highway at a façade setback distance of 49m from the centre of the road (See Figure 1-1). The measured $L_{Aeq,15min}$ between 12.26pm and 12.41pm at a free field position at the front gate (set back of 30m) was 68dBA for approximately 200 light vehicles and 15 heavy vehicles.

At the façade of the residence, allowing for increased setback, which would reduce levels by over 2dBA and a facade correction of +2.5dBA, the same rounded level of 68dBA is predicted. This is considered to be representative of the $L_{Aeq,15hr}$ noise level at daytime.

4 SITE OPERATIONAL NOISE CRITERIA

The EPA *Industrial Noise Policy (INP)* is the preferred method to assess potential noise impacts from extractive industries such as the subject site. The *INP* recommends two criteria, "intrusiveness" and "amenity", both of which are relevant for the assessment of noise from the site. In most situations, one of these is more stringent than the other and becomes the project specific noise criteria. The criteria are based on the L_{Aeq} descriptor, which is explained in the Glossary of Acoustic Terms.

For sources such as the fixed and mobile plant associated with the site, appropriate noise criteria are specified in the *INP*. The criterion depends on whether existing noise levels in an area are close to recommended amenity levels for different types of residential receiver areas (i.e. urban, rural, near existing roads).

In regions where existing noise levels are low, noise levels from the proposed operation are limited by the intrusiveness criterion. In general, the L_{Aeq} noise level from such sources should not exceed the RBL by more than 5dBA. This is assessed over a typical worst-case 15-minute period.

Where noise levels from industrial sources are close to or above the acceptable levels then the amenity criterion, which incorporates a sliding scale to set limits, would apply. The sliding scale prevents the overall noise level exceeding the acceptable level due to the addition of a new noise source. Amenity criterion also needs to consider noise level from all industrial sources in the region, which includes the site. The intention is that the sum of all local noise sources remains within the acceptable levels for each time period.

The amenity criteria are determined by which particular characterisation surrounding residences become classified as. The potentially affected residences near the site are in an area which would be classified as "rural" and the relevant recommended "acceptable" amenity criteria for $L_{Aeq,period}$ are 50, 45 and 40dBA for daytime, evening and night time periods respectively. "Maximum" recommended levels are also part of the criteria and are all 5dBA higher than the "acceptable" levels.

Note that since the existing quarrying operation at the site occurs between 7.00am and 6.00pm, only the daytime period is being assessed.

Table 4-1 shows the relevant noise industrial noise criteria for this project based on a rural area classification. The daytime noise criterion for the Catherine Hill Bay Residential Development is based on the background measurement at the Catherine Hill Bay Cultural Precinct as this measurement is considered to be representative of similar environment.

Table 4-1 Industrial Noise Intrusiveness & Amenity Criteria

Receiver Area	Time Period	RBL (dBA)	Intrusiveness Criterion L _{Aeq,15min} (dBA)	Amenity Criterion L _{Aeq,period} (dBA)
Existing	Daytime (7.00am–6.00pm)	37	42	50
Future	Daytime (7.00am–6.00pm)	40	45	50

For day period, the intrusive noise criterion is below the amenity criterion. Therefore, the project specific noise criterion for the day is L_{Aeq,15min} 42dBA at existing residences and 45dBA at future residences.

5 METEOROLOGY

At distances from a source to receiver of several hundred metres or more, the resultant noise levels from a noise source will be influenced by wind and temperature gradients. At this site, winds from the south-west would have an influence over Catherine Hill Bay.

Winds and temperature gradients vary between hours of the day. Consequently, effects of these components need to be considered for day, evening and night time period.

When assessing potential noise impacts the *INP* requires that the effects of any weather conditions that are a feature of the area when the development operates need to be taken into consideration. The procedures described in the *INP* are directed toward finding a single set of meteorological conditions which represent general adverse conditions for noise propagation to be implemented in the noise assessment.

5.1 Wind

Wind can increase noise at a receiver when it blows from the direction of the noise source. An increase in wind strength also results in a corresponding increase in wind noise at the receiver which often masks noise from the source under investigation.

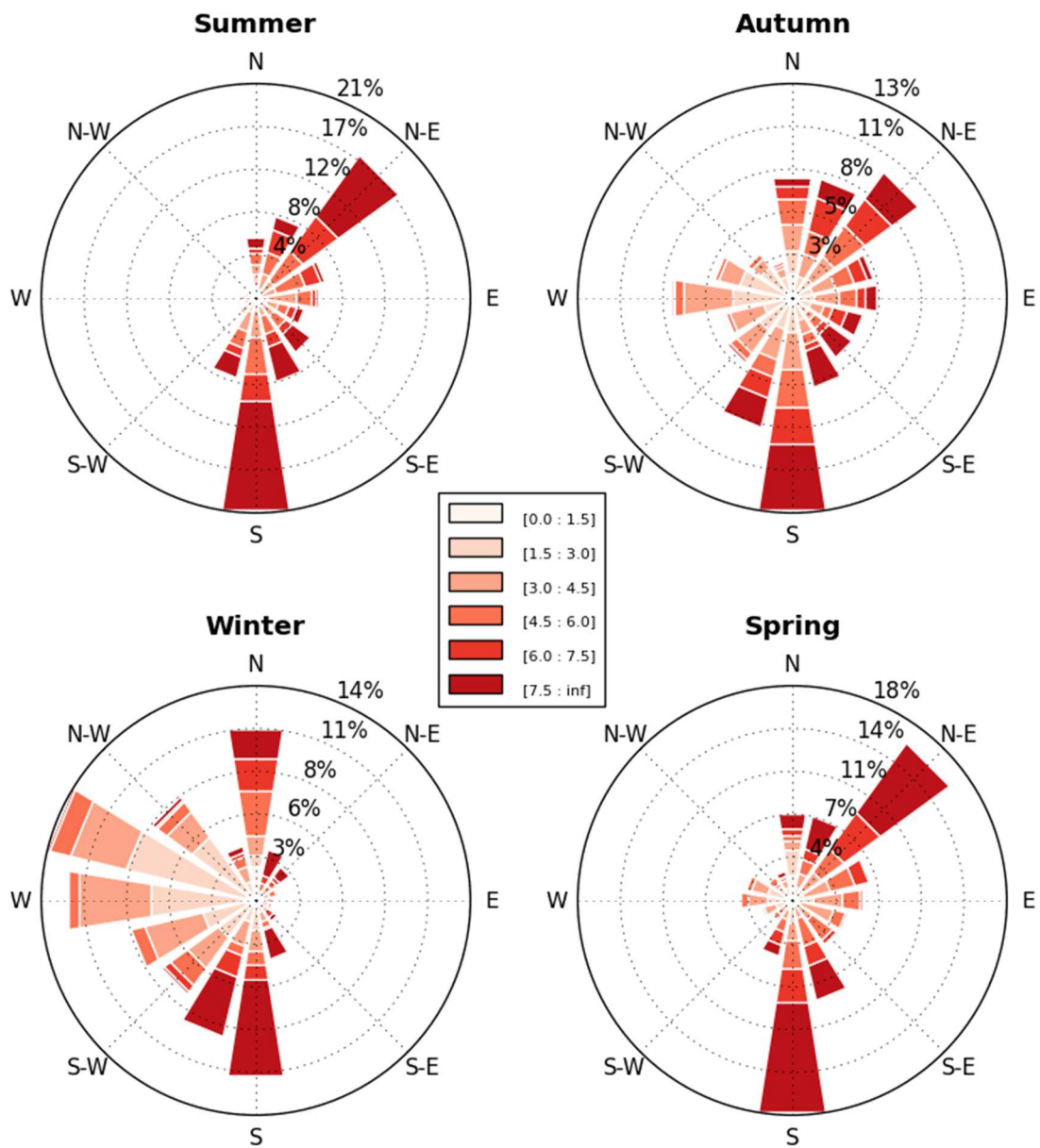
The affectation of noise due to wind should be considered when wind is a feature of the area under consideration. The *INP* defines this as where wind blows at speeds up to 3m/s for more than 30% of the time in any period of the day in and season.

Twelve month weather data for the year 2012 was obtained from the Bureau of Meteorological weather (See Figure 5-1). This data shows wind direction and wind speed ranges and was analysed to determine the frequency of occurrence of seasonal winds up to speeds of 3m/s for the daytime period and adopting an adverse wind condition is not applicable at this site for the assessment of daytime noise.

5.2 Temperature Inversion

Temperature inversions can increase noise levels at surrounding receivers by the reflection of sound waves from warmer upper layers of air. Temperature inversions occur predominantly at night, and therefore are not required to be considered further for a daytime only operation.

Figure 5-1 Yearly 2012-2013 wind roses (Norah Head) – wind speed range in m/s



6 OPERATIONAL NOISE ASSESSMENT

Noise modelling was conducted for both the operations occurring during our site visit to validate the noise model and also a typical future scenario including all the available equipment operating to represent a typical worst case 15 minute period.

Site related noise emissions were predominantly modeled using the ISO-9613 algorithm implemented in the "CadnaA" acoustic noise prediction software. Factors that are addressed in the modeling are:

- equipment sound level emissions and location;
- screening effects from buildings, stockpiles, topography;
- receiver locations;
- noise attenuation due to geometric spreading;
- directivity (where appropriate);
- ground effects; and.
- atmospheric absorption.

6.1 Operational Noise Sources

Noise levels associated with the existing quarry operations were measured during a site visit on 4 November 2013. The Sound Pressure Level (SPL) measurements of mobile plant such as front end loader, excavator and dozer were measured during typical operational movements at fixed distances. The SPL measurements of fixed plant such as the crushing and screening plant were also measured during its typical operation. These were converted to the Sound Power Level for each item of plant.

A summary of the Sound Power Levels of the plant at the existing site are presented in Table 6-1.

Table 6-1 Sound Power Levels of Existing Site Plant

Item	Activity	Sound Power Level L _{Aeq,15min} – dBA
Volvo L180c Front End Loader	Loading	108
Dump Truck	Idle	95
Komatsu D375A Dozer	Ripping	119
Volvo EC390 Excavator	Loading	114
Crusher and Screening Plant + Power Grid	Normal Operation	118

6.2 Model Validation

As short-term noise levels surrounding the site have been monitored during our site visit the estimated noise level contribution from existing quarrying noise was compared with the predicted noise levels for the existing operations in order to validate the noise model. During the day time measurement, there was a moderate southerly wind which has been included in the model.

Table 6-2 presents the comparison of measured noise levels with predicted noise levels.

Table 6-2 Comparison between Measured Results & Noise Model Predictions

Time	Operations	Measurement Location	Measured Contribution from Site – dBA	Predicted Noise Level – dBA
8.15 – 8.30	Loading material onto truck at northern stockpile (Front end loader + dump truck)	1	55	55
		2	<46	49
10.00 – 10.15	Crushing and screening + loading material onto truck at northern stockpile (Front end loader + dump truck)	1	59	60
		2	<49	53
11.00 – 11.15	Dozer ripping in recycled products pit + loading material onto truck at northern stockpile (Front end loader + dump truck)	1	61	62
		2	<50	52
11.30 – 11.45	Excavator on top of the recycled products area + loading material onto truck at northern stockpile (Front end loader + dump truck)	1	58	58
		2	<48	51

As presented in Table 6-2, there is good correlation between the measured and predicted noise levels from the site, with a tendency for the model to predict slightly higher levels than we measured.

The standard noise modelling procedure in NSW ignores the presence of dense bushland and consequently, in areas of dense bush it can over predict noise levels. The site and the measurement locations are separated by dense eucalypts and this would explain the differences measured.

However, as a conservative prediction tool, the noise model has been validated and is suitable for further modelling purposes.

6.3 Noise Modelling

6.3.1 Operation Description

The current extraction process includes the use of a dozer to rip or push material and an excavator for material handling. The extraction can occur either in the northern or southern section of the site. The extracted material then gets transported using a dump truck and / or a front end loader to the stockpile area or to the crusher where it gets crushed. The processed material is then stockpiled and loaded by a second front end loader onto haul trucks for off-site hauling.

In relation to hauling between 7.00am and 6.00pm, it is considered that the “worst-case” operating scenario would be when 4 truck movements overlap in the same 15-minute period. This assumption incorporates 2 haul trucks arriving one after another and subsequently leaving the site in a similar mode along with two dump trucks transporting material on site. The selection of 4 trucks is based on operational constraints as this is the maximum that can be loaded simultaneously.

6.3.2 Noise Modelling Results

The noise level for the scenario described in Section 6.3.1 has been calculated using the Cadna Modelling software.

For extraction in the northern area, closest to the residences, the noise level at the nearest existing residence (58 Flowers Drive) within the Catherine Hill Bay Cultural Precinct is predicted to be 34dBA. The predicted noise level complies with the $L_{Aeq,15min}$ intrusiveness criterion of 42dBA.

The assumed worst-case operational noise contour map in relation to extraction in the northern area closest to residences is shown in Figure 6-1. The noise level at the worst affected location along the western boundary of the Catherine Hill Bay Residential Development is calculated to be 41dBA, which meets the intrusiveness criteria of 45dBA (based on the assumed RBL of 40dBA). On this basis, we consider the site generated noise would have minimal impact at the future Catherine Hill Bay Residential Development, although it would be audible at times.

The standard noise modelling procedure in NSW ignores the presence of dense bushland and consequently, it can over predict noise levels. The site and the residential development are separated by dense eucalypts, therefore, the actual noise levels at the residential development are highly likely to be lower than the predicted noise levels.

Figure 6-1 Typical Worst-Case Operational Noise Contour – $L_{Aeq,15min}$ (dBA)



7 TRAFFIC NOISE ASSESSMENT

This section of the report assesses the potential noise impact associated with truck movements to and from the site along the Pacific Highway in accordance with the EPA NSW *Road Noise Policy (RNP)*.

There is one residence which fronts the Highway approximately 1km south of the site.

7.1 Road Noise Policy

For existing residences affected by additional traffic on existing freeways / arterial roads, such as the Pacific Highway, generated by land use developments, the appropriate noise assessment criteria are set in the *RNP*. The appropriate daytime base criterion is $L_{Aeq,15hr}$ 60dBA at 1m from the façade.

Although the existing traffic noise levels ($L_{Aeq,15hr}$ of 68dBA) are above the noise assessment criteria, the *RNP* deems an increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

7.2 Assessment of Traffic Noise

The existing site has approval for 28 trucks per day, based on the approved tonnage and assumptions about number of operating days and average loads. It is expected that truck numbers on any particular day can vary depending on demand.

It is assumed that as a worst-case scenario all trucks would arrive / depart to / from the south.

It is proposed that average truck numbers would increase to 56 movement per day; i.e. an increase less than 2 per hour averaged over the day.

Traffic volumes on the Pacific Highway are currently 12-13,000 vehicles in the 15-hour daytime period from 7.00am – 10.00pm with a conservative estimate of 5% heavy vehicles. The additional 28 truck movements on Pacific Highway would increase noise levels by less than 0.1dBA. The predicted increase is not noticeable and negligible impact is expected.

8 SUMMARY & CONCLUSION

Operational noise impacts associated with the use of the Frazer Park site for the recycling of building materials have been assessed in accordance with criteria recommended by the NSW *INP* for operational noise and the *RNP* for traffic noise. We understand that no additional plant is required on site, but existing plant would be used at a higher utilisation. There will also be increased truck movements to and from the site.

In relation to operational noise, compliance with the established criteria is achieved at existing residences and also at the most affected boundary of the future Catherine Hill Bay (South) residential development which will be closer to the site.

For traffic noise generated by the development, the increase is less than 0.1dB; therefore, negligible noise impact is predicted at residences located along the Pacific Highway trucking route.