HEGGIES
AUSTRALIA

REPORT 30-1202-R2
Revision 3

Proposed Regional Distribution Centre
Rooty Hill
Noise Impact Assessment

PREPARED FOR

Readymix Holdings Pty Limited
c/- National Environmental Consulting Services
PO Box 271
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Proposed Regional Distribution Centre

Rooty Hill

Noise Impact Assessment

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EXECUTIVE SUMMARY

Heggies Australia Pty Ltd (Heggies) has been commissioned by National Environmental Consulting Services, on behalf of Readymix Holdings Pty Limited, to conduct a noise impact assessment for a proposed Regional Distribution Centre (RDC) to be located off Kellogg Road, Rooty Hill. This report presents the results and findings of the noise assessment including consideration of construction, road and rail traffic and operational noise from the proposed development.

An ambient noise monitoring program was conducted by Heggies. Ambient noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers. The objective of this survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the proposed development.

OPERATIONAL NOISE PREDICTIONS

A computer model was used to predict noise emissions from the proposed RDC. The Environmental Noise Model (ENM) used has been produced in conjunction with the DEC. Noise levels were predicted for the general operational scenario summarised in **Section 7.1.3** with the inclusion of the noise mitigation and management procedures detailed in **Section 7.1.2**.

Operational noise levels are predicted to meet the project specific noise criteria at all residential locations under calm and prevailing weather conditions. In addition, noise levels at the Colebee function centre and the Blacktown Olympic Venue are predicted to meet the acceptable project specific noise criteria and predicted noise levels in all areas of the Reserve are below the recommended maximum amenity level during all periods.

Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the proposed distribution centre are likely to be less than those predicted. Hence, the predicted noise levels provided in this report can be achieved.

Due to the nature of sound, noise level values do not add together the same way as ordinary numbers. If an existing noise level is 10 dBA (or more) above the noise level produced by a new source then the new source will not increase the existing noise level. Existing noise levels, during the night-time period, have been measured at Station Street and Crawford Road with typical average noise levels (L_{Aeq}) of 55 dBA and 49 dBA, respectively. Operational noise predictions show that noise levels from the RDC during a typical night-time operational scenario will be no greater than 39 dBA at either of these locations. Hence, average night-time noise levels are not expected to increase at these residential areas as a result of operation of the RDC.

SLEEP DISTURBANCE ASSESSMENT

In the interests of minimising sleep disturbance impacts the following mitigation measures will be implemented during the morning shoulder and night-time periods:

- Storage bins will not be loaded from an empty state.
- Front end loader reversing alarms will not be used; reversing warnings will be visual only.
- All conveyor start-up warnings will be visual, not audible.
- All those provided in **Section 7.1.2**.

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The highest L_{Amax} noise level at any residential area is predicted to occur when trains are maneuvering at the extremities of the rail siding in the presence of a temperature inversion. External noise levels up to L_{Amax} 47 dBA may occur at some Station Street residences in this situation, up to 52 dBA at residences in Mavis Street and up to L_{Amax} 50 dBA at Crawford Road residences. Hence, predicted noise levels meet the recommended sleep disturbance noise goal of 53 dBA.

RAIL TRAFFIC NOISE ASSESSMENT

The increase in rail traffic generated by the RDC of an average of four trains per day (an average increase of eight rail movements per day on any particular section of the line utilised by RDC rail traffic) is predicted to increase the existing $L_{Aeq(24hour)}$ rail noise level by less than 0.5 dBA. This is considered to be a negligible increase in noise levels and such an increase would not be discernible. It is predicted that the existing L_{Amax} noise levels due to rail traffic movements will not increase.

ROAD TRAFFIC NOISE ASSESSMENT

The results of traffic noise predictions indicate that the inclusion of heavy vehicle traffic on the M7 main carriageway from the proposed development will increase 'existing' road traffic noise levels by less than 1 dBA. This increase is unlikely to be perceptible to residential receivers along the M7 route. Hence, the inclusion of RDC vehicle movements on the M7 main carriageway is predicted to meet the requirements of the Environmental Criteria for Road Traffic Noise (ECRTN). RDC vehicle movements on the on/off ramps at Woodstock Avenue and Power Street are also predicted to meet the relevant noise goals at nearby residential areas.

CONSTRUCTION NOISE ASSESSMENT

Construction noise levels are predicted to be below the relevant noise goals at each of the residential areas considered, once the relevant noise barriers are established, for the majority of the construction program. Small sections of the Nurragingy Reserve are likely to experience noise levels greater than the relevant noise goal when heavy construction equipment is operating on the Readymix/Nurragingy boundary. The noise impact in the Reserve will obviously decrease as works move away from these respective boundaries. Notwithstanding this, recommendations have been presented in **Section 7.5.2** with the aim of minimising construction noise impact at the Nurragingy Reserve and at the nearest residential locations.

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1 INTRODUCTION

Heggies Australia Pty Ltd (Heggies) has been commissioned by National Environmental Consulting Services, on behalf of Readymix Holdings Pty Limited, to conduct a noise impact assessment for a proposed Regional Distribution Centre (RDC) to be located off Kellogg Road, Rooty Hill.

Broadly, the objective of the noise assessment was to identify the potential impacts of noise from the proposed development, including construction and operation of the facility and associated rail and road traffic movements, and to provide advice with regard to effective mitigation strategies where necessary.

The noise assessment has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the Department of Environment and Conservation's (DEC, formerly the EPA) NSW Industrial Noise Policy (INP). Reference has also been made to the NSW Environmental Criteria for Road Traffic Noise (ECRTN). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, rail traffic noise and construction noise goals, reference has been made to the NSW Environmental Noise Control Manual (ENCM).

2 PROJECT DESCRIPTION

2.1 Regional Distribution Centre (RDC)

Readymix proposes to construct and operate a Regional Distribution Centre (RDC) at Kellogg Road, Rooty Hill. The RDC will be a key component of the Readymix rail based strategy. The site is strategically located at the intersection of the Main Western Rail Line and M7 Motorway in an established and growing Industrial Zone.

Construction materials will be transported by rail to Rooty Hill from quarries outside of the Sydney Basin. The proposed RDC would be capable of handling up to 4 million tonnes of product each year. It would commence operation handling approximately 2 Mtpa to 2.5 Mtpa, increasing to a projected full capacity of around 4 Mtpa over time. The products to be received and distributed are typically single size crushed aggregate, blended crushed aggregates, and natural and manufactured sand. The individual product sizes that would typically be stored are 20 mm, 14 mm, 10 mm, 7 mm, 5 mm and natural and manufactured sand (less than 5mm) or blends of these. At times the need may arise to receive and distribute product sizes other than these, as required by the market.

These materials would be blended, as required to suit customer specifications, by equipment in the RDC and distributed by road to the Sydney market. The materials are typically used for manufacture of concrete and asphalt however, they also have a variety of other uses in the civil and construction industries.

The RDC will include:

- A regional office building which incorporates a quarry materials and concrete testing laboratory.
- A rail siding with aggregate unloading facility.
- Storage bin area and load out facilities.
- Ground storage and reclaim facilities.
- Blending plant.
- A conveyor system linking the unloading station to the storage and truck load out facilities.
- Workshop, stores, and amenities facilities, truck wash-down facilities, truck refuelling, weighbridges, truck and car parking.
- Concrete batching plant.
- Bridges at two locations over Angus Creek.
- Realignment of North Parade.

The rail siding would be approximately 1,500 m in length and able to accommodate trains up to 800 m long. It would comprise three rail tracks, a “shunt neck” and two small spur lines. A single unloading station comprising of two dump bins with capacity to hold a minimum of two wagons each would be built to span below both the unloading tracks, one bin per track. The unloading station would be enclosed on three sides and is designed to operate at 2,500 tonnes per hour, unloading a train in approximately two to three hours depending on the number of different products on a given train. Trains would comprise of three to four locomotives and 42 to 50 wagons, carrying between 3,150 tonnes and 3,750 tonnes of product. It is expected on average four trains per day will be required to deliver approximately 4 million tonnes of product per year to the site (depending on the train size and consist).

The Concrete Batching Plant (CBP) would have the capacity to produce up to 200,000 m^3 annually. The CBP is described as a dual alley dry batch concrete plant where mixing of the materials occurs within the truck agitators. The plant is a semi-enclosed metal clad structure with four silos. The upper level of the batch house comprises weigh bins and storage bins for holding the specific batch quantities of each product. The lower level provides access for the truck agitators to receive batches of concrete. The CBP weighs and delivers specified volumes of cement, aggregate, admixtures, additives and water to the truck agitators. Admixtures are contained in storage tanks connected to flow meters, which dose the concrete batch water with the correct amount of admixture prior to being discharged to the truck agitator.

2.2 Acoustically Significant Plant and Equipment

Acoustically significant plant and equipment to be used on site, and the associated sound power levels, are provided in **Table 1**. These levels were obtained from a Heggies database of similar equipment.

Table 1 RDC Plant and Equipment Sound Power Levels

Plant and Equipment	**$L_{Aeq(15minute)}$ Sound Power Level***
Trucks being loaded with product	100 dBA
Trucks driving off	91 dBA
Blending plant	106 dBA
Product being loaded into lined storage bins	100 dBA
RDC front end loader	110 dBA
Truck unloading into reclaim hopper	95 dBA
Radial stacker	104 dBA
Conveyor drive	105 dBA
Conveyors	102 dBA/100m
Skid steer loader	104 dBA
Street sweeper/Water cart	110 dBA
Forklift	98 dBA
Dust control units (enclosed)	93 dBA
Maintenance activities (eg grinding, welding, etc)	Up to 104 dBA
Air compressor	90 dBA
Rail noise: unloading from train locomotives** wagon bunching	109 dBA 100 dBA 95 dBA
Agitator loading	110 dBA
Agitator slumping	110 dBA
Cement tanker	111 dBA
Raw materials delivery truck	102 dBA
CBP front end loader	107 dBA

* Assuming continuous operation

** The locomotive sound power level utilised in Heggies noise model was determined from measurements conducted by a Heggies operator during shunting activities. Using this measurement, a sound power level of 100 dBA was determined for one (1) locomotive. The sound power level has been adjusted upward to account for the fact there will be 3-4 locomotives in operation at Rooty Hill RDC and also adjusted downward to account for the duty cycle of the train.

2.3 Hours of Operation

The proposal is for the RDC to operate 24 hours a day, 7 days per week. The timing of rail deliveries cannot be accurately predicted and will vary depending on rail network availability. Therefore rail unloading operations will also need to be able to occur on a 24 hour a day, 7 days per week basis.

2.4 Transportation

All traffic to the RDC would access the site via Kellogg Road apart from a small proportion of vehicles accessing the laboratory facilities via the existing Humes entry on Woodstock Avenue. Access to and from Kellogg Road for all heavy vehicles from the south would be via Woodstock Avenue, direct from the proposed M7 Motorway. Heavy vehicles to and from the north would use Woodstock Avenue, Glendenning Road and Power Street, direct to the M7. Concrete delivery trucks will use local roads in the general area depending on the location of the end customer.

It is anticipated approximately 40% of loads leaving the site would travel north with the remainder travelling south.

Deliveries from the site would be despatched 24 hours per day, 7 days per week. Most loads would be despatched during the period 6.00 am to 6.00 pm Monday to Saturday. A lower number of despatches would occur outside these hours to meet customer requirements. Estimates of heavy vehicle traffic movements to and from the subject site have been provided by Irwinconsult.

The nearest residential locations that will potentially be affected by an increase in road traffic noise are as follows:

- Lambert Avenue, Glenndenning, adjacent to the ramp onto the M7 from Power Street (the point where northbound RDC heavy vehicle traffic will enter/leave the M7) and;
- The northern end of Station Street, Rooty Hill, adjacent to the ramp onto the M7 from Woodstock Avenue (the point where southbound RDC heavy vehicle traffic will enter/leave the M7).

3 SITE DETAILS

The site for the proposed development is located off Kellogg Road, Rooty Hill. It lies within the City of Blacktown, Parish of Rooty Hill and the County of Cumberland. The site is situated within a developed industrial area in Western Sydney approximately 35 km west of the Sydney Central Business District (CBD).

The development site is located adjacent to existing industrial properties to the west and north. The nearest potentially affected areas are residences to the west of the site on Station Street, Rooty Hill and to the east of the site off Knox Road, Doonside (see Location Map **Appendix A**). The Nurragingy Reserve is also a potentially affected area since it is located immediately east of the proposed site. The Colebee Centre, a function centre, located in the Nurragingy Reserve east of the subject site and the Blacktown Olympic Venue, located to the south across the Main Western Railway corridor, have also been considered as potentially noise-sensitive areas.

Residences south of the rail line, near Rooty Hill station, on Mavis Street have also been included in the sleep disturbance assessment due to their close proximity to the rail line.

Residential areas adjacent to the heavy vehicle traffic route to and from the site (M7) have also been considered as part of this assessment.

4 IMPACT ASSESSMENT PROCEDURES

4.1 General Objectives

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the Department of the Environment and Conservation (DEC). The Industrial Noise Policy (INP) was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the DEC to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

4.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

4.3 Assessing Amenity

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For high-traffic areas there is a separate amenity criterion.

An extract from the INP that relates to the amenity criteria is given in **Table 2** and **Table 3**.

Table 2 Amenity Criteria - Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards	All	Noisiest 1 hour period		
- internal			35	40
- external			50	55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am, On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 3 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 2**

The DEC has acknowledged that *"where early morning (5 am - 7 am) operations are proposed, it may be unduly stringent to expect such operations to be assessed against the night-time criteria - especially if existing background noise levels are steadily rising in these early morning hours".* For this reason, the morning shoulder period (6.00 am - 7.00 am) has been considered separately as part of this assessment.

4.3.1 Assessment in Areas of High Traffic Noise

The NSW INP states that, in some areas, the level of road traffic noise may be high enough to make noise from an industrial source effectively inaudible, even though the L_{Aeq} noise level from that industrial noise source may exceed the recommended acceptable amenity noise level shown in **Table 2**. In such cases, the amenity criterion for noise from the industrial application becomes the $L_{Aeq(Period),\ traffic}$ minus 10 dBA and replaces the amenity criteria provided in **Table 2** and **Table 3**.

This criterion may be applied only if all of the following apply:

- Traffic noise is identified as the dominant noise source at this site.
- The existing traffic noise level is 10 dB or more above the acceptable noise level for the area.
- It is highly unlikely the road traffic noise levels would decrease in the future.

4.4 Assessing Sleep Disturbance

The DEC has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance has not been identified under the INP and hence, sleep arousal has been assessed using the guidelines set out in the ENCM Chapter 19-3.

To avoid the likelihood of sleep disturbance the ENCM recommends that the $L_{A1(1minute)}$ noise level of the source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

4.5 Assessing Rail Noise

Rail traffic noise goals are outlined in Chapter 163 of the Environmental Noise Control Manual (ENCM). This guideline refers to State-owned rail lines only and so applies to the Main Western Rail line, which provides access to the subject site.

4.6 Road Traffic Noise

The Environment Protection Authority released the "*Environmental Criteria for Road Traffic Noise*" in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts.

4.7 Construction Noise

The ENCM, Chapter 171, sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. Based upon this document the project specific construction noise goals outlined in **Table 4** will apply to the construction period of the proposed RDC and associated rail siding at the nearest potentially affected residential locations.

Table 4 Construction Noise Goals

Construction Period	**Acceptable L_{A10} Noise Level***
4 weeks and under	Background L_{A90} plus 20 dBA
4 weeks to 26 weeks	Background L_{A90} plus 10 dBA
Greater than 26 weeks	Background L_{A90} plus 5 dBA

* Applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No construction work is to take place on Sundays or Public Holidays.

In the absence of specific construction noise goals for a passive recreation area (Nurragingy Reserve) the recommended maximum amenity criteria defined in the INP has been adopted for the purpose of this assessment.

5 EXISTING ACOUSTICAL AND METEOROLOGICAL ENVIRONMENT

5.1 General Methodology

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "Sound Level Meters" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

5.2 Unattended Continuous Noise Monitoring

Background noise levels were monitored by Heggies. The objective of the background noise survey was to measure $L_{A90(period)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residential locations during the day, evening and night-time periods to enable the determination of the intrusiveness and amenity criteria for the proposed development.

Background noise levels were monitored at two separate locations, considered to be representative of the nearest potentially affected receivers, from Tuesday 31 August to Wednesday 8 September 2004, inclusive. Details of monitoring locations are provided in **Table 5**.

Table 5 Noise Monitoring Locations

Location	Details	Description
1	54 Station Street, Rooty Hill	Front yard of residence
2	11 Crawford Road, Doonside	South side of residence (no direct line of sight to rail line)

ARL Type EL316 noise loggers were used to monitor the ambient noise levels at each location. The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including L_{Amax}, L_{A1}, L_{A50}, L_{A90}, L_{A99}, L_{Amin} and L_{Aeq}. Precautions were taken to minimise influences from extraneous noise sources and reflections from adjacent buildings.

Weather data for the survey period was obtained from the nearest Bureau of Meteorology station located at Horsley Park. Noise data corresponding to periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) were discarded in accordance with INP data exclusion methodology. A summary of the results of the background surveys is given in **Table 6**. Results are displayed graphically in **Appendix B** for details.

Table 6 Summary of Existing Ambient Noise Levels

Location	Period	Background L_{A90} Noise Level	Measured $L_{Aeq(Period)}$	Estimated Existing Industrial Contribution L_{Aeq}
		Rating Background Level		
54 Station Street, Rooty Hill	Morning Shoulder	42 dBA*	61 dBA	44 dBA
	Day	47 dBA	60 dBA	< 54 dBA
	Evening	43 dBA	57 dBA	48 dBA
	Night	38 dBA	55 dBA	44 dBA
11 Crawford Road, Doonside	Morning Shoulder	39 dBA*	54 dBA	< 39 dBA
	Day	40 dBA	57 dBA	< 54 dBA
	Evening	40 dBA	60 dBA	< 44 dBA
	Night	38 dBA	49 dBA	< 39 dBA

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
Morning Shoulder 6.00 am to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am
The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period
The RBL for the morning shoulder period has been determined as the midpoint between the RBL's measured for the two assessment periods either side of the morning shoulder, ie day and night time periods. The measured background level for the morning shoulder for each location is 51 dBA at Station St and and 48 dBA at Crawford Rd.

5.3 Operator Attended Noise Monitoring

Operator attended noise measurements were conducted during the daytime period at each monitoring location and at the Nurragingy Reserve. Each measurement was conducted over a 15 minute period using a Rion NA27 one third octave band integrating sound level meter. The results of the operator attended noise measurements are given in **Table 7**. Ambient noise levels given in the table include all noise sources such as road and rail traffic, insects, birds, as well as any other industrial operations.

Table 7 Operator Attended Noise Survey Results

Location	Date/ Start time/ Weather	Primary Noise Descriptor (dBA re 20 μPa)					Description of Noise Emission, Typical Maximum Levels L_{Amax} (dBA) and Estimated Existing L_{Aeq} Contribution
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
54 Station Street, Rooty Hill	31/8/2004 1240 Day W=1 m/s E Temp=23°C	77	70	60	45	58	Rumble of trucks on Parkway Ave to 62 Local traffic to 77 WM7 construction works*, reversing alarm to 60 Local voice to 53 Helicopter to 66 Some birds, mainly traffic
11 Crawford Road, Doonside	31/8/2004 1140 Day W=0.5 m/s E Temp=19°C	65	54	51	44	48	Local traffic to 58 Rooster to 50 Birds to 65 TV next door audible No industry noise discernible
Nurragingy Reserve picnic area adjacent to Main Western Rail line (~100 m from rail line)	17/3/2005 1213 Day W=1 m/s SW Temp=22°C	76	70	55	48	57	Impact (rock) hammering from SW up to 59 Coal train pass-by to 76 Car pass-by on local road to 63 Birds to 58

* Although M7 construction works were being conducted during the monitoring period these activities did not significantly increase the measured daytime ambient background noise levels. Current measured ambient noise levels at the Station St location were compared to previously measured data, obtained in 2002 at the same location, and it was found that the daytime RBL had increased by only 1 dBA.

Results of the operator attended noise surveys indicate that traffic is the main contributor to ambient noise levels at each residential location. Results also indicate that noise from existing rail operations and local traffic contribute significantly to ambient noise in the Nurragingy Reserve.

5.4 Effects of Meteorology on Noise Levels

5.4.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Weather data was obtained, for a period of 12 months, from a DEC weather station located adjacent to Mamre Road, St Mary's. This location is approximately 8 km west of the subject site. This data was analysed to determine the frequency of occurrence of winds up to speeds of 3 m/s for daytime, evening and night in each season. Details of the weather data analysis are provided as **Appendix C**. A summary of the most frequently occurring winds is contained within **Table 8**, **Table 9** and **Table 10**. The percentage occurrence figures provided in magenta are those approaching the 30% threshold and those shown in red exceed the 30% threshold.

Table 8 Seasonal Frequency of Occurrence of Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	3.8%	NNE±45°	18.3%	8.6%	27.0%
Autumn	11.9%	S±45°	15.1%	10.0%	25.1%
Winter	20.9%	NNW±45°	20.9%	3.8%	24.7%
Spring	5.1%	NNE±45°	15.6%	5.1%	20.7%

Table 9 Seasonal Frequency of Occurrence of Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	7.8%	E±45°	27.3%	14.9%	42.2%
Autumn	26.1%	S±45°	31.5%	9.0%	40.5%
		SW±45°	28.9%	7.3%	36.3%
Winter	35.9%	SSW±45°	29.0%	2.2%	31.2%
Spring	17.1%	SSW±45°	22.7%	5.0%	27.6%

Table 10 Seasonal Frequency of Occurrence of Wind Speed Intervals - Night

Period	Calm	Wind Direction	0.5 - 2 m/s	2 - 3 m/s	0.5 - 3 m/s
Summer	28.9%	SSW±45°	48.0%	4.6%	52.6%
Autumn	37.2%	SSW±45°	40.7%	6.6%	47.3%
Winter	53.7%	SSW±45°	21.1%	1.6%	22.7%
Spring	31.2%	SSW±45°	40.5%	4.5%	45.0%

Seasonal wind records indicate that certain winds are a feature of the area. The frequency of winds below 3 m/s (predominantly up to 2 m/s) is above the 30% threshold during several seasons and periods. Modelling under prevailing wind was therefore conducted as part of this investigation.

This data was compared to 6 months of meteorological data obtained from the One Steel site (adjacent to the proposed development). Both data sets showed the same trends with regard to wind speeds and direction thereby confirming the validity of the St Mary's data.

5.4.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

Meteorological data, obtained from the DEC weather station at St Mary's, indicates that temperature inversions are a feature of the area. The proposal is for operations to be undertaken 24 hours a day, seven days a week. Hence, the occurrence of temperature inversion during the night-time period has been considered as part of this noise assessment.

6 PROJECT SPECIFIC NOISE CRITERIA

6.1 Operational Noise Design Criteria

The noise emission design criteria for the proposed development at Rooty Hill have been established with reference to the INP outlined in **Section 4** of this report.

The existing L_{Aeq} noise levels in the vicinity of the subject site are dominated by traffic and include some noise from existing industrial operations. The amenity criteria have been established using the results of ambient noise measurements and with reference to assessment in areas of high traffic noise in accordance with the INP. Where it was found that existing industrial noise contributed to ambient noise levels at potentially affected areas in the vicinity of the subject site appropriate adjustments have been made to the amenity criteria for these locations.

The acoustical environment at Location 1 (Station Street) was observed to be dominated by road traffic noise, particularly during the night-time period. A 55 dBA L_{Aeq} was recorded during this period, which is 10 dBA higher than the acceptable amenity criterion provided in the INP. Due to the construction of the M7, immediately adjacent to Location 1, it is also highly unlikely that traffic noise levels at this location will decrease in the future. Therefore, for the night-time period, Location 1 has been assessed as an area of high traffic noise.

The acoustical environment typifies an urban environment, with heavy and continuous traffic flows, and residences near both commercial and industrial districts. Therefore, the residences in the general area have been assessed as "urban" receiver types.

The Colebee Centre has been assessed as a passive recreation area and the Blacktown Olympic Venue has been assessed as an active recreation area, as defined in the INP. It has been assumed that each of these venues may be used during the night-time period.

The Nurragingy Reserve has also been assessed as a passive recreation area (family picnics, etc) however, it is assumed that this will not be in use during the night-time period.

The resulting operational project specific noise criteria for the proposed distribution centre are shown in **Table 11**. Intrusiveness criterion for the morning shoulder period has been based on Rating Background Levels (RBL's) calculated as the midpoint between the RBL's measured for the two assessment periods either side of the morning shoulder, ie day and night-time. Amenity criterion has been selected as the midpoint value of the amenity criteria for the two assessment periods either side of the morning shoulder.

Table 11 Proposed RDC Project Specific Noise Criteria

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria
Location 1 (Station Street)	Morning Shoulder	47 dBA	52 dBA	47 dBA
	Day	52 dBA	60 dBA	52 dBA
	Evening	48 dBA	46 dBA	46 dBA
	Night	43 dBA	45 dBA*	43 dBA
Location 2 (Crawford Road)	Morning Shoulder	44 dBA	52 dBA	44 dBA
	Day	45 dBA	60 dBA	45 dBA
	Evening	45 dBA	50 dBA	45 dBA
	Night	43 dBA	45 dBA	43 dBA
Nurragingy Reserve	When in use - day and evening periods only	N/A	Acceptable 50 dBA Recommend Max. 55 dBA	50 dBA 55 dBA max.
Colebee Centre	When in use	N/A	Acceptable 50 dBA Recommend Max. 55 dBA	50 dBA 55 dBA max.
Blacktown Olympic Venue	When in use	N/A	Acceptable 55 dBA Recommend Max. 60 dBA	55 dBA 60 dBA max.

* This criterion has been determined as per the INP for assessment in areas of high traffic noise.
Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night 10.00 pm to 7.00 am; Morning Shoulder 6.00 am to 7.00 am
On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am

The INP states that these criteria have been selected to protect at least 90% of the population, living in the vicinity of industrial noise sources, from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

6.2 Sleep Disturbance Noise Goals

The relevant sleep disturbance noise goals for each residential area are provided in **Table 12**.

Table 12 Sleep Disturbance Noise Goals

Location	Period	Measured Background Noise Level (L_{A90})	Sleep Disturbance Noise Goal
Station Street*	Morning Shoulder	40 dBA**	55 dBA
	Night	38 dBA	53 dBA
Crawford Road	Morning Shoulder	48 dBA	58 dBA
	Night	43 dBA**	53 dBA

*Sleep disturbance noise goals for Station Street have been adopted at Mavis Street residences.
** These background noise levels are the *lowest* LA90 recorded for the morning shoulder period during the noise monitoring survey.

6.3 Rail Traffic Noise Goals

External rail noise level goals for residential receivers are specified as an $L_{Aeq(24hour)}$ noise level and as a maximum pass-by level. Recommended planning and maximum noise levels provided in the ENCM are presented in **Table 13**.

Table 13 Rail Traffic Noise Goals

	Planning Levels	Maximum Levels
LAeq(24hour)	55 dBA	60 dBA
LAmax	80 dBA	85 dBA

6.4 Road Traffic Noise Design Criteria

Road traffic noise criteria are set out in the ECRTN. The criteria recommended in the policy document are based on the functional categories of the subject roads, as applied by the RTA. All raw material deliveries and aggregate product despatches will utilise the M7. This road is classified as an arterial road which, by definition, carries predominantly through-traffic from one region to another, forming a principal avenue of communication for urban traffic movements. Concrete agitators will utilise roads in the general area depending on the location of the end customer.

The relevant road traffic noise criteria for the subject development are provided in **Table 14**.

Table 14 Road Traffic Noise Criteria

Type of Development	Criteria		
	Day 7 am - 10 pm	Night 10 pm - 7 am	Where Criteria are Already Exceeded
Land use developments with potential to create additional traffic on existing freeways/ arterials	LAeq(15hour) 60 dBA	LAeq(9hour) 55 dBA	Where feasible, 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.

The ECRTN also draws the following conclusions with regard to maximum noise levels and the likelihood of sleep disturbance:

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

6.5 Construction Noise Goals

The daytime background noise level (L_{A90}) has been determined at two potentially affected residential locations. A daytime L_{A90} of 47 dBA was measured at Location 1 (Station Street) and 40 dBA at Location 2 (Crawford Road). This infers the project specific construction noise goals presented in **Table 15** for the nearest potentially affected residential locations.

Table 15 Construction Noise Goals - Residential Areas

Construction Period	Construction Noise Goal (L_{A10})[1]	
	Location 1 (Station Street)*	**Location 2 (Crawford Road)**
4 weeks and under	67 dBA	60 dBA
4 weeks to 26 weeks	57 dBA	50 dBA
Greater than 26 weeks	52 dBA	45 dBA

1. Applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No construction work is to take place on Sundays or Public Holidays.

* These criteria have also been adopted at Mavis Street residences.

The relevant construction noise goal for the Nurragingy Reserve is $L_{Aeq(Period)}$ 55 dBA, based on the recommended maximum amenity criterion for a passive recreation area as per the INP.

7 ASSESSMENT OF NOISE IMPACTS

7.1 Operational Noise Modelling

7.1.1 Operational Noise Modelling Parameters

A computer model was used to predict noise emissions from the proposed RDC. The Environmental Noise Model (ENM) used has been produced in conjunction with the DEC. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

Topographic contours and drawings of the proposed site were supplied by Readymix and utilised for the purpose of modelling noise from the proposed development.

Due to the large size of the Nurragingy Reserve noise impact has been assessed at the point most likely to be utilised as a passive recreation area nearest to the proposed development. This location, and others where noise was assessed, is shown on the Location Map in **Appendix A**.

Prediction of noise under calm and prevailing atmospheric conditions (temperature inversion and prevailing winds) was conducted. Atmospheric parameters under which noise predictions were made are given in **Table 16**.

Table 16 Meteorological Parameters for Noise Predictions

	Temperature	**Humidity**	**Wind Speed**	**Wind Direction** (degrees from north)	**Temperature Gradient**
Calm (All periods)	20°C	65%	N/A	N/A	N/A
Temperature Inversion (Night)	10°C	90%	N/A	N/A	3°C/100 m
Easterly Wind (Evening)	20°C	65%	2 m/s	90°	N/A
SSW Wind (Evening and Night)	20°C	65%	2 m/s	202.5°	N/A

The INP states that "Where there is 30% or more occurrence of wind speeds below 3 m/s then use the highest wind speed (below 3 m/s) instead of the default[1]". A wind speed of 2 m/s has been used in the noise model since the analysis of existing weather data has showed that, where prevailing winds were present, the significant majority of them (91% or more) were 2 m/s or below.

Other assumptions made in modelling the proposed development include the following:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources, such as delivery and product despatch trucks, were modelled at typical locations and assumed to operate in repetitive cycles.
- All mitigation measures described in **Section 7.1.2** are implemented.

[1] The default wind speed, as described in the INP, is 3m/s

- The radial stacker will only be used in the situation of an unforeseen malfunction with the main storage bins. Noise predictions have been made with and without the radial stacker. It has been assumed that the main storage bins will not be loaded when the stacker is in operation.
- The main storage bins will only be loaded from an empty state immediately after the RDC opens or when the bins are required to be emptied for maintenance (or other) purposes. This activity is anticipated to occur rarely and will be minimised by the fact that each bin will generally store only one type of material. Hence, this activity has not been considered as part of the normal operating scenario.

7.1.2 Noise Management and Mitigation

Noise mitigation and management procedures that have been incorporated into the model with the aim of achieving project specific noise criteria include the construction of noise barriers, enclosures, other specific equipment treatment and management of equipment use during certain periods. A complete list of mitigation and noise management measures is as follows:

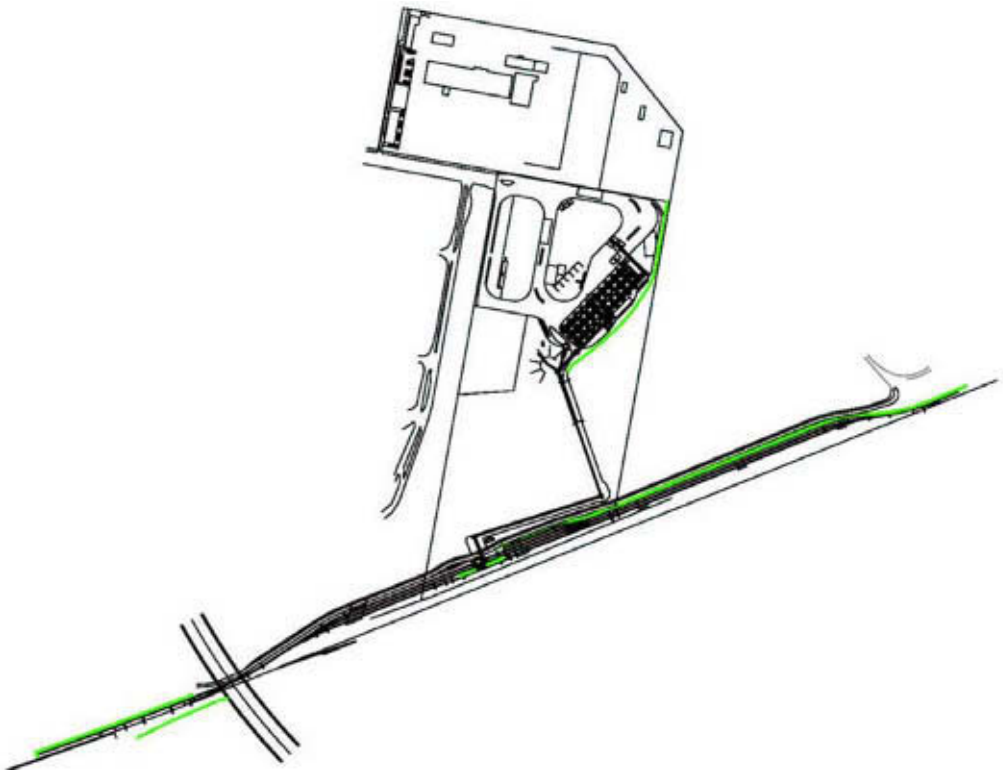
Noise Barriers and Enclosures

- All conveyor drives and transfer points will be enclosed.
- Conveyors proposed for use on site will be designed as follows:
  - Conveyor CV-01 will be designed to achieve a sound power level of 97 dBA/100m.
  - All other conveyors (excluding the radial stacker) will be designed to achieve a sound power level of 92 dBA/100m.

  Note: Reduction in the sound power level of conveyors can be readily achieved by enclosing (or partially enclosing) the conveyor, utilising specialised low-noise components or some combination of these two methods.
- Both dust collector units located south of Angus Creek and those located on top of the main storage bins and truck load-out bins will be enclosed. The following mitigation measures will be applied to the other two dust collector units (ie the unit which is located immediately north of the main storage bins and the unit which is located adjacent to the reclaim hopper):
  - The air pulse unit and clean air chamber will be enclosed.
  - The units will be located to obtain maximum shielding from other items on site.
- A wing-wall on the south-west corner of the CBP slump enclosure which will be at least the same height as the opening of the enclosure and extend a minimum of 3 m from the end of the enclosure.
- A wing-wall on each corner of the south side of the rail unloading station which will extend a minimum of 25 m from either end of the rail unloading enclosure and be the same height as the opening of the enclosure.
- A continuous noise wall, minimum of 4 m in height, along the eastern side of the subject site; from the north eastern corner to conveyor CV-02, running along the proposed truck route and continuing as near as possible to conveyor CV-02.
- A continuous noise wall will be constructed as near as possible to the eastern end of the rail siding that runs along the Nurragingy Reserve to a minimum height of 3 m above the rail level. This wall will begin at the dead-end buffer stop at Eastern Creek (wrap around the end or extend approximately 10 m east of the dead-end) and extend west to the rail unloading station on the northern side of the siding.
- A continuous noise wall will be constructed as near as possible on the northern side of the rail siding from the extremity at the western end (wrap around the dead-end buffer stop) and extend east to the M7 overpass at a minimum height of 3 m above rail level.

- A continuous noise wall will be constructed as near as possible on the southern side of the main rail line from the M7 overpass extending for approximately 150 m towards Rooty Hill station at a minimum height of 2 m above rail level.
- The noise walls adjacent to the rail siding should be constructed from timber or an aerated concrete product, sheet steel fencing product is not recommended due to its highly reflective properties.
- Where noise walls are specified, the same level of noise attenuation can be provided by an earth bund or the combination of a noise wall and earth bund provided the overall height remains at the recommended level. A schematic diagram is provided as **Figure 1** showing the locations of the noise walls.

Figure 1 Noise Wall Locations



Equipment Treatments

- The cone section of the rail unloading bins and the main storage bins will be lined to reduce impact noise. Only storage bins that receive aggregate will require to be lined, it is not necessary to line those receiving sand.

Plant Management

- The main storage bins will not be loaded from an empty state during the evening, night-time or morning shoulder period.
- The concrete plant will be limited to one agitator being loaded and one agitator slumping at any one time during the evening and night-time period. The concrete plant would not be limited to this scenario during the morning shoulder period. Operation of the front end loader and aggregate deliveries would still be permissible during all periods.
- The blending plant will not be in operation during the evening or night-time periods.

7.1.3 Operational Scenario - Noise Model Summary

The operational scenario modelled during each period is summarised in **Table 17**. A tick (✓) indicates that the equipment is in operation during the relevant period. A cross (×) indicates that the equipment is not in operation during the relevant period. Where there is a number in brackets following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. It should be noted that the operational scenario modelled is likely to represent an acoustically worst-case scenario.

Table 17 Operational Scenario Considered in Noise Model

Plant and Equipment	**Morning Shoulder**	**Day**	**Evening**	**Night**
Trucks being loaded with product (x4) (2 in load-out enclosures and 1 at ground bins, 1 at blending plant during morning shoulder and day only)	✓ (4)	✓ (4)	✓ (3)	✓ (3)
Trucks driving off (x4)	✓ (4)	✓ (4)	✓ (4)	✓ (4)
Blending plant	✓	✓	×	×
Product being loaded into storage bins (1 at a time)	✓	✓	✓	✓
RDC front end loader (operating near ground bins)	✓	✓	✓	✓
Truck unloading into reclaim hopper (in enclosure)	✓	✓	✓	✓
Radial stacker[1]	✓	✓	✓	✓
Conveyor drives (enclosed)	✓	✓	✓	✓
Conveyors	✓	✓	✓	✓
Skid steer loader	✓	✓	✓	✓
Street sweeper (or water cart)	✓	✓	✓	✓
Forklift	✓	✓	✓	✓
Dust control units[2]	✓	✓	✓	✓
Maintenance activities (eg grinding, welding, etc)	✓	✓	✓	✓
Rail noise (one train arriving while one is unloading):				
Unloading from train (in rail unloading enclosure)	✓	✓	✓	✓
Locomotives	✓	✓	✓	✓
Wagon bunching	✓	✓	✓	✓
Agitator loading (in loading enclosure, doors on south side of enclosure assumed closed)	✓ (2)	✓ (2)	✓ (1)	✓ (1)
Agitator slumping (in slump enclosure)	✓ (2)	✓ (2)	✓ (1)	✓ (1)
Cement tanker (Adjacent to blending plant)	✓	✓	✓	✓
Cement tanker (CBP)	✓	✓	✓	✓
Raw materials delivery truck (CBP)	✓	✓	✓	✓
CBP front end loader	✓	✓	✓	✓

1. Refer to **Section 7.1.1**
2. Refer to **Section 7.1.2**

7.1.4 Operational Noise Modelling Results and Discussion

Noise emission levels were predicted from the proposed development for the typical operational scenario described in **Table 17** including the noise mitigation and management procedures described in **Section 7.1.2**. Noise from all sources that contribute to the total noise from the site have been examined to identify characteristics that may cause greater annoyance (for example tonality, impulsiveness etc). The appropriate modifying factors, as outlined in the INP, have been applied where these characteristics are considered to be present. Noise levels predicted at the specific receiver locations (shown in **Appendix A**) are provided in **Table 18** and **Table 19** for operation with and without the radial stacker, respectively. Noise contour maps, provided as **Appendix D**, show predicted noise levels from operation of the proposed RDC at the project site and surrounding areas.

Operational noise levels are predicted to meet the project specific noise criteria at all residential locations under calm and prevailing weather conditions. In addition, noise levels at the Colebee function centre and the Blacktown Olympic Venue are predicted to meet the acceptable project specific noise criteria.

Due to the nature of sound, noise level values do not add together the same way as ordinary numbers[2]. If an existing noise level is 10 dBA (or more) above the noise level produced by a new source then the new source will not increase the existing noise level. Existing noise levels, during the night-time period, have been measured at Station Street and Crawford Road with typical average noise levels (L_{Aeq}) of 55 dBA and 49 dBA, respectively. Operational noise predictions show that noise levels from the RDC during a typical night-time operational scenario will be no greater than 39 dBA at either of these locations. Hence, average night-time noise levels are not expected to increase at these residential areas as a result of operation of the RDC.

Predicted noise levels in all areas of the Reserve are below the recommended maximum amenity level, provided in the INP, of 55 dBA. As can be seen from the noise contour diagrams there are some small areas of the Reserve, adjacent to the Readymix boundary, which may experience noise levels higher than the acceptable amenity level for a passive recreation area (50 dBA) with all equipment on site operating simultaneously.

The worst-case prevailing meteorological scenario, with regard to noise for the Reserve, is under the influence of a SSW wind which occurs during the evening or night-time period only. It is understood that the Nurragingy Reserve does not operate during the night-time period and typically closes at 5.30 pm (6.30 pm during October, November and March and 7.00 pm during summer). Since prevailing winds have not been identified during the evening period (6.00 pm to 10.00 pm) during October and November, this minor exceedance of the acceptable amenity criteria may occur for up to one hour a day for four months of the year.

It should be noted that ambient noise levels within the Reserve are already relatively high, particularly in close proximity to the rail line. A short-term $L_{Aeq(15minute)}$ of 57 dBA was measured during an operator attended survey at a distance of 100 m from the rail line. This measured existing noise level is higher than the recommended maximum amenity level of 55 dBA, as described in the INP, for a passive recreation area.

The noise barriers adjacent to the rail line, both at Nurragingy Reserve and near Rooty Hill station, will have the effect of minimising noise and visual impacts as a result of construction and operation of the RDC. These barriers will also have the additional benefit of reducing existing rail traffic noise. For example, during the operator attended noise measurement conducted in the Reserve, noise levels up to 76 dBA were recorded during a coal train pass-by. This noise level will be significantly reduced (by up to 13 dBA) with the inclusion of the barrier for the proposed RDC.

[2] Refer to **Appendix E** for a brief overview of general acoustic concepts.

Reflection of noise from barriers adjacent to the rail line, in particular those west of the M7 overpass and the M7 overpass itself, has been considered in the material selection of these barriers. Timber or aerated concrete have much higher noise absorptive properties than sheet metal. It is also anticipated that the location and orientation of these noise barriers will not increase the noise impact at any nearby residential location.

Table 18 Predicted RDC Noise Levels - Without Radial Stacker

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)				Project Specific Noise Criteria (L_{Aeq})
		Calm	Temperature Inversion	Easterly Wind	SSW Wind	
Location 1 (Station St)	Morn. Shoulder	35	39	n/a	34	52 dBA
	Day	35	n/a	n/a	n/a	52 dBA
	Evening	35	n/a	44	34	46 dBA
	Night	35	39	n/a	34	43 dBA
Location 2 (Crawford Rd)	Morn. Shoulder	34	38	n/a	39	52 dBA
	Day	34	n/a	n/a	n/a	45 dBA
	Evening	33	n/a	< 30	38	45 dBA
	Night	33	37	n/a	38	43 dBA
Mavis Street	Morn. Shoulder	30	34	n/a	< 30	52 dBA
	Day	30	n/a	n/a	n/a	52 dBA
	Evening	< 30	n/a	35	< 30	46 dBA
	Night	< 30	33	n/a	< 30	43 dBA
Nurragingy Reserve	When in use:					50 dBA
	Day	49	n/a	n/a	n/a	
	Evening	49	n/a	45	49	
Colebee Centre	When in use:					50 dBA
	Day	42	n/a	n/a	n/a	
	Evening/Night	41	47	36	49	
Blacktown Olympic Venue	When in use:					55 dBA
	Morn. Shoulder	51	52	n/a	48	
	Day	51	n/a	n/a	n/a	
	Evening/Night	50	52	49	47	

n/a: the meteorological condition is not relevant during this period

Table 19 Predicted RDC Noise Levels - With Radial Stacker*

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)				Project Specific Noise Criteria (L_{Aeq})
		Calm	Temperature Inversion	Easterly Wind	SSW Wind	
Location 1 (Station St)	Morn. Shoulder	35	39	n/a	34	52 dBA
	Day	35	n/a	n/a	n/a	52 dBA
	Evening	35	n/a	44	34	46 dBA
	Night	35	39	n/a	34	43 dBA
Location 2 (Crawford Rd)	Morn. Shoulder	34	38	n/a	40	52 dBA
	Day	34	n/a	n/a	n/a	45 dBA
	Evening	33	n/a	< 30	39	45 dBA
	Night	33	37	n/a	39	43 dBA
Mavis Street	Morn. Shoulder	30	34	n/a	< 30	52 dBA
	Day	30	n/a	n/a	n/a	52 dBA
	Evening	< 30	n/a	35	< 30	46 dBA
	Night	< 30	33	n/a	< 30	43 dBA
Nurragingy Reserve	When in use:					50 dBA
	Day	49	n/a	n/a	n/a	
	Evening	49	n/a	45	50	
Colebee Centre	When in use:					50 dBA
	Day	42	n/a	n/a	n/a	
	Evening/Night	41	47	36	49	
Blacktown Olympic Venue	When in use:					55 dBA
	Morn. Shoulder	51	53	n/a	48	
	Day	51	n/a	n/a	n/a	
	Evening/Night	51	53	50	48	

* Loading of main storage bins not occurring
n/a: the meteorological condition is not relevant during this period

Since the operational scenario modelled is likely to represent an acoustically worst-case scenario, actual operational noise levels from the proposed distribution centre are likely to be less than those predicted. Hence, the predicted noise levels provided here can be achieved.

With specific reference to rail operations, the scenario considered in Heggies' noise model considers locomotives, wagon bunching and rail unloading as three distinct noise sources. When the locomotives are at their highest output the rail unloading source will not exist (since the train would be in motion). Further, while a train is unloading, the locomotives would be at or near idle and therefore operating at a potentially lower sound power level than that utilised in the noise model. In addition to this, during unloading there would be no wagon bunching since the train would be stationary. Since all three sources have been modelled to occur simultaneously, it is Heggies' opinion that the modelled rail operations represent an acoustically worst case scenario.

7.1.5 Cumulative Noise Assessment

The proposed development site is situated within a developed industrial area in Western Sydney. Existing industrial properties are located to the west and south of the subject site.

Potential cumulative noise impacts from existing and successive developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise *amenity* levels for residences. Therefore, the cumulative impact of the proposed RDC with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas.

7.2 Sleep Disturbance Analysis

In the interests of minimising sleep disturbance impacts the following mitigation measures will be implemented during the morning shoulder and night-time periods:

- Storage bins will not be loaded from an empty state.
- Front end loader reversing alarms will not be used; reversing warnings will be visual only.
- All conveyor start-up warnings will be visual, not audible.
- All those provided **Section 7.1.2**.

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment to be used at the subject site (refer to **Table 20**) were used as input to the ENM acoustic model and predictions were made at the nearest residential areas in Station Street, Mavis Street[3] and Crawford Road under adverse weather conditions at night. Noise events considered include loading into an empty truck, truck reversing alarms, a front end loader scraping concrete and those associated with rail shunting. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}.

Table 20 L_{Amax} Sound Power Levels

Source	Maximum Sound Power Level
Loading into an empty truck	113 dBA
Truck reversing alarms	104 dBA
Front end loader scraping concrete	117 dBA
Rail shunting	114 dBA

The highest L_{Amax} noise level at any residential area is predicted to occur when trains are maneuvering at the extremities of the rail siding in the presence of a temperature inversion. External noise levels up to L_{Amax} 47 dBA may occur at some Station Street residences in this situation, up to 52 dBA at residences in Mavis Street and up to L_{Amax} 50 dBA at Crawford Road residences. Hence, predicted noise levels meet the recommended sleep disturbance noise goal of 53 dBA.

[3] Sleep disturbance criteria determined for Station Street residences has been adopted at Mavis Street.

The ECRTN provides further guidance with regard to sleep disturbance and calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The DEC policy document acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the ECRTN provides that maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing. Maximum noise predictions have shown that external noise levels up to 52 dBA may occur at some residences during the night-time period as a result of RDC operation. This correlates to noise levels significantly below 50 dBA inside dwellings. Based on the preceding, maximum noise levels produced by operation of the RDC are not likely to cause sleep disturbance at the nearest residential areas to the subject site.

7.3 Rail Noise

All rail deliveries to and from the site will utilise the Main Western Railway Line. There will be an average of four (4) trains per day delivering aggregate products to the site at the maximum capacity of 4 million tonnes per annum. Estimated existing rail traffic movements for this section of the Main Western line were provided by RailCorp and are provided in **Table 21**.

Table 21 Estimated Existing Rail Traffic Movements

Period	Passenger		Freight and other trains*	
	To city	From City	To City	From City
Day (7am - 6pm)	61	62	5	5
Evening (6pm - 10pm)	17	24	2	2
Night (10pm - 7am)	26	16	5	5
Totals	**104**	**102**	**12**	**12**

* The current freight timetable is yet to be finalised; these estimated freight train movements are approximate only. It has also been assumed that freight trains are timed evenly throughout a 24-hour period.

Rail traffic noise levels have been predicted, at an offset distance of 50 metres, based on these existing rail traffic movements and the proposed RDC rail traffic movements. Rail traffic noise predictions are provided in **Table 22**.

Table 22 Rail Traffic Noise Predictions

Noise Descriptor	Rail Traffic Noise Prediction	
	Existing Rail Traffic	Total Rail Traffic Including 4 RDC Rail Traffic Movements
$L_{Aeq(24hour)}$	63.2 dBA	63.5 dBA
L_{Amax}	84.6 dBA	84.6 dBA

The increase in rail traffic generated by the RDC of an average of four trains per day (an average increase of eight rail movements per day on any particular section of the line utilised by RDC rail traffic) is predicted to increase the existing $L_{Aeq(24hour)}$ rail noise level by less than 0.5 dBA. This is considered to be a negligible increase in noise levels and such an increase would not be discernible. This increase has been predicted based on an offset distance of 50 metres from the rail line however, the increase in the predicted $L_{Aeq(24hour)}$ would be the same at all offset distances. It is predicted that the existing L_{Amax} noise levels due to rail traffic movements will not increase.

It should be noted that an easement currently exists on the small section of land immediately adjacent to the south of the Main Western Railway Line (between the residences on Mavis Street and the rail line) for noise, vibration and electrolysis.

7.4 Road Traffic Noise Assessment

7.4.1 Road Traffic Noise Modelling Parameters

M7 Main Carriageway

Calculation of road traffic noise levels has been conducted using the United States Federal Highways road traffic noise model (USFH). The USFH method for prediction of $L_{Aeq(period)}$ road traffic noise levels is an internationally accepted theoretical traffic noise prediction model which takes into account the L_{Amax} noise levels of vehicles, receiver offset distance, passby duration, vehicle speed, ground absorption (based on the ratio of soft ground and average height of propagation), number of vehicle movements, receiver height, truck exhaust height and the height and location of any intervening barriers.

The noise from road traffic was predicted at a distance of 30 m, which relates to the distance of the nearest residential dwellings from the M7, at a receiver height of 1.5 m above the ground.

For noise assessment purposes it has been assumed that 40% of RDC heavy vehicle traffic would travel north and 60% would travel south. Since north and south bound vehicles do not travel the same section of the M7, only the southbound scenario has been considered since it provides the maximum increase in traffic movements and hence a worst-case increase in noise levels.

Table 23 provides RDC heavy vehicle movements used for traffic noise predictions. Figures provided in the table are based on information provided by Irwinconsult.

Table 23 RDC Heavy Vehicle Traffic Movements

Type of Delivery/Vehicle	Average Daily Movements	Peak Hourly Movements
Light vehicles	470	75
Aggregate deliveries	800	160
Concrete deliveries	266	60
Cement, flyash and other tankers	30	4

Since the M7 is still in the construction stage it was not possible to obtain existing road traffic numbers via a traffic count. Predicted 'existing' traffic numbers for the M7 were obtained from the EIS for the M7 project and are provided in **Table 24**. The M7 traffic numbers provided in the table are hourly averages. Day and night-time traffic noise predictions have been based on predicted *peak* hourly traffic movements to/from the RDC. This is considered to be a conservative prediction since peak heavy vehicle movements from the plant is likely to occur when M7 traffic numbers are also at their maximum.

On/off Ramps

The impact of RDC traffic utilising the on/off ramps has been assessed separately. 'Existing' traffic numbers for the on/off ramps were obtained from Figures 10 to 13 of the Final Draft Traffic Impact Study for the RDC development prepared by Irwinconsult (dated 6th May 2005). Noise levels were predicted at the nearest residential locations to the ramps. Information was also obtained with regard to noise barriers incorporated in the M7 design adjacent to these residential locations.

7.4.2 Road Traffic Noise Modelling Results

Main Carriageway

Table 24 provides the predicted 'existing' traffic numbers for the M7 and predicted traffic noise increase with the inclusion of the proposed RDC vehicle movements on the M7 main carriageway. The traffic numbers provided in the table are hourly averages.

Table 24 Road Traffic Noise Assessment Details

	'Existing' M7 Traffic (from EIS)		Including 60% RDC Vehicle Movements		Predicted Increase in Road Traffic Noise (dBA)
	Light	Heavy	Light	Heavy	
Day	3240	67	3285	202	0.4
Night	1112	193	1157	328	0.8

The results of traffic noise predictions indicate that the inclusion of heavy vehicle traffic on the M7 main carriageway from the proposed development will increase 'existing' road traffic noise levels by less than 1 dBA. This increase is unlikely to be perceptible to residential receivers along the M7 route. Hence, the inclusion of RDC vehicle movements on the M7 is predicted to meet the requirements of the ECRTN.

On/off Ramps

Design drawings of the M7 indicate the following with regard to noise mitigation at the relevant on/off ramps:

- A 4 m noise wall is proposed adjacent to the on ramp from Power Street that shields residences in Lambert Avenue, Glendenning, which are approximately 28 m from the ramp.
- A 4.5 m noise wall is proposed adjacent to the off ramp to Woodstock Avenue that shields residences on Station Street, Rooty Hill, which are approximately 30 m from the ramp.

The $L_{Aeq(1hour)}$ noise level predicted at the two nearest residential areas to the on/off ramps, including RDC vehicle movements, is provided in **Table 25**. These predictions are based on the AM peak period (7.30 am to 8.30 am) and so provide a worst-case noise level. Traffic numbers used in the noise predictions include peak hour on/off ramp traffic and average hourly traffic on the M7 carriageway. The proposed M7 noise barriers have also been considered in these predictions.

Table 25 Road Traffic Noise Predictions - On/off Ramps

On/off Ramp/ Residential Location	Predicted Road Traffic Noise Including RDC Traffic* $L_{Aeq(1hour)}$
Power Street Off Ramp/Lambert Avenue	55 dBA
Woodstock Avenue On Ramp/Station Street	57 dBA

*Based on the AM peak period (7.30 am to 8.30 am)

The predicted worst-case $L_{Aeq(1hour)}$ road traffic noise level including RDC traffic will be less than the $L_{Aeq(15hour)}$ since the peak hourly vehicle movements will not occur for every hour of the daytime period. Therefore, the road traffic noise level is predicted to be below the relevant noise goal ($L_{Aeq(15hour)}$ 60 dBA) specified in the ECRTN.

Maximum noise levels from road traffic are not expected to increase at the nearest residences to the on/off ramps as a result of RDC traffic. Most loads to/from the RDC would be despatched during the period 6.00 am to 6.00 pm Monday to Saturday so the volume of traffic to/from the RDC would be lower during the night time period.

7.5 Construction Noise Assessment

7.5.1 Construction Noise Modelling Parameters

Plant and equipment considered in assessing noise from construction of the proposed development are provided, with the associated sound power levels, in **Table 26**. Sound power levels of construction equipment were obtained from a Heggies database.

Proposed construction equipment was modelled at potential worst case locations on the subject site; the eastern, western and southern boundaries of the site and at either extremity of the rail siding.

Construction noise levels have been predicted assuming all barriers adjacent to the rail siding and along the eastern boundary of the site are in place.

Table 26 Construction Plant and Equipment

Plant and Equipment	Sound Power Level (L_{A10})
Scraper	111 dBA
Dozer	110 dBA
30 tonne Excavator	111 dBA
Articulated Dump Truck	111 dBA
Vibrating Roller	111 dBA
Mobile Cranes (up to 150t)	105 dBA
Grader	111 dBA
Water Cart	112 dBA
Asphalt Paving and Spray Seal Machines	112 dBA
Pile Boring Machine	107 dBA
Power Cable Feeding and Tensioning Truck	107 dBA
Concrete Boom Pump	107 dBA
Concrete Truck	103 dBA
Front End Loader	113 dBA
'Ditch Witch'	104 dBA
Rail Mounted Ballast Regulator	117 dBA
Rail Mounted Tamping Machine	117 dBA

7.5.2 Construction Noise Modelling Results and Discussion

The results of construction noise predictions are provided in **Table 27** for the nearest residential areas. These noise levels were predicted assuming all barriers adjacent to the rail siding and along the eastern boundary of the site are in place.

Table 27 Construction Noise Predictions - Residential Areas

Construction Plant and Equipment Location	Highest L_{A10} Noise Level Expected at Nearest Residential Area
Eastern boundary of Readymix site	40 dBA at Crawford Road
Western boundary of Readymix site	30 dBA at Station Street
Southern boundary of Readymix site	39 dBA at Station Street
Eastern end of rail siding	40 dBA at Crawford Road
Western end of rail siding	51 dBA at Mavis Street

It is anticipated that construction of the RDC would take approximately two years to complete. Hence, predicted construction noise levels have been compared to the "greater than 26 weeks" criteria, provided in **Table 15**, for the residential areas.

Construction noise levels are predicted to be below the relevant noise goals at each of the residential areas considered once the relevant noise barriers are in place. There may be short periods of time, while noise barriers are being constructed or when multiple pieces of construction equipment are in use, where construction noise levels exceed the relevant noise goals at residential areas.

Sections of the Nurragingy Reserve are likely to experience noise levels greater than the relevant noise goal when heavy construction equipment is operating on the eastern boundary of the Readymix site. Under this scenario, noise levels of approximately 61 dBA L_{Aeq} may be experienced in the Reserve adjacent to this boundary, even with the noise wall along this boundary in place, when, for example, a front-end loader is operating in this location. Similar noise levels can be expected in sections of the Reserve adjacent to the proposed siding when works are being conducted for the construction of the siding. The noise impact in the Reserve will obviously decrease as works move away from the Readymix/Nurragingy boundary or the eastern end of the proposed rail siding.

Most of the major earthworks to be conducted on the site will be completed within the first six months of the 24 month program. Construction of the Readymix rail siding and associated track works are expected to be completed within a 12 month period from commencement of these works and will not occur concurrently with major earthworks on the site. During these times, earthworks will not be occurring continuously on the respective boundaries adjacent to the Reserve.

For approximately the first six months of the construction period trucks will utilise the road network within part of the Reserve to gain access to North Parade from Knox Road. It is estimated that a *maximum* of 10 trucks each way (20 truck movements) will utilise the Reserve road network during the morning peak hour. The Environmental Criteria for Road Traffic Noise (ECRTN) provides a criteria for road traffic noise levels in a passive recreation area of 55 dBA $L_{Aeq(1hour)}$. Based on this maximum volume, the predicted $L_{Aeq(1hour)}$ due to construction traffic in the Reserve is 54 dBA. Hence, construction traffic noise levels are predicted to be below the relevant criteria.

As previously mentioned (see **Section 7.1.4**) existing ambient noise levels in some sections of the Reserve are already higher than the recommended maximum amenity level. In addition, given the temporary nature of construction activities, community expectations with regard to construction noise levels are often not as high as those for operational or ongoing noise levels. Not withstanding this, the following recommendations are made with the aim of minimising construction noise impact at the Nurragingy Reserve and at the nearest residential locations:

- The noise wall proposed along the eastern boundary of the Readymix site and those adjacent to the rail siding should be constructed as early as possible in the construction period.
- Site noisy equipment behind structures that act as barriers or at the greatest distance from the noise-sensitive area or orient the equipment so that noise emissions are directed away from any sensitive areas.
- Keep equipment well maintained.
- Employ "quiet" practices when operating equipment (eg positioning and unloading of trucks in appropriate areas).
- A Construction Noise Management Plan should be prepared and implemented prior to commencement of construction works at the site. This should include the following:
  - Construction noise and vibration goals.
  - Recommendations regarding specific physical and managerial measures for controlling noise, noise and vibration monitoring programs and reporting procedures.
  - Measures for dealing with exceedances and mechanisms to provide ongoing community liaison.

With regard to potentially offensive noise events associated with construction activities AS 2436-1981 "*Guide to noise control on construction, maintenance and demolition sites"* provides the following:

> *If noisy operations must be carried out, then a responsible person should maintain liaison between the neighbouring community and the contractor. This person should inform the public at what time to expect noisy operations and also inform the contractor of any special needs of the public.*
>
> *Consultation and cooperation between the contractor and his neighbours and the removal of uncertainty and rumour can help to reduce the adverse reaction to noise.*

7.5.3 Construction Vibration

The major vibration generating activities will occur during the earthworks in preparing the site; activities such as excavation and the use of vibratory rollers. The nearest residential premises to such construction activity is approximately 125 m (proximity of Mavis Street residence to rail siding). Due to the large separation distance to this and other residences, the level of vibration caused by construction activities at the Rooty Hill site is extremely unlikely to be perceptible at any of the nearest residential premises.

The nearest industrial building to potential vibration generating activities is that which is located adjacent to the Main Western Railway at the Blacktown Olympic Venue. This building is situated approximately 70 m from such potential construction activities. This magnitude of separation is expected to ensure that construction activities at the Rooty Hill site will have no impact on neighbouring industrial buildings.

8 CONCLUSION

Heggies has conducted a noise and vibration impact assessment for a proposed Regional Distribution Centre (RDC) to be located off Kellogg Road, Rooty Hill including consideration of construction, road and rail traffic and operational noise from the proposed development.

Operational noise levels are predicted meet the project specific noise criteria at all residential locations under calm and prevailing weather conditions. In addition, predicted operational noise levels from the subject site do not exceed the acceptable noise levels at the Colebee function centre and the Blacktown Olympic Venue and do not exceed the recommended maximum noise amenity level in any areas of the Nurragingy Reserve.

Predicted maximum noise levels from operation of the proposed RDC during the night-time period are also predicted to meet the recommended sleep disturbance noise goal.

The increase in rail traffic generated by the RDC is predicted to result in a negligible increase in rail traffic noise along the Main Western Railway corridor. Road traffic noise levels are predicted to satisfy the requirements of the ECRTN.

Construction noise levels are predicted to meet the relevant noise goals at the nearest potentially affected residential receivers. Various noise management techniques have been presented in this report to reduce the noise impact on the Nurragingy Reserve during the construction phase of the proposed development. Vibration levels generated by construction activities on the subject site are predicted to have a negligible impact on neighbouring residential and industrial locations.