

Intermodal Logistics Centre at Enfield Environmental Assessment

CHAPTER 11

NOISE AND VIBRATION ASSESSMENT

■ October 2005

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11. Noise and Vibration Assessment

This chapter provides a summary of the potential noise and vibration impacts resulting from the construction and operation of the proposed Intermodal Logistics Centre (ILC) at Enfield. A full copy of the Noise and Vibration Assessment, detailing the study undertaken by Renzo Tonin and Associates, can be found at Appendix E – Noise and Vibration Impact Assessment.

It addresses the requirements of the Director-General in assessing noise and vibration impacts on affected residences and sensitive receptors. The study was undertaken in accordance with the requirements of the Environment Protection Authority's Industrial Noise Policy (2000). Specifically, the chapter quantifies the potential noise generated by the construction of the ILC, as well as road traffic and site operations involved with the freight handling activities, and the subsequent impacts of these on the neighbouring premises to the site. The study included a program of noise monitoring at potentially affected receivers and the modelling of likely noise emissions at these locations. Results of this modelling were assessed against the relevant criteria set by the NSW Department of Environment and Conservation¹ (DEC). The chapter identifies appropriate noise mitigation measures for the construction and operation of the ILC.

11.1. Introduction

11.1.1. Scope of Noise and Vibration Assessment

This chapter provides the assessment on the noise and vibration impacts resulting from the loading / unloading operations and associated activities at the proposed Intermodal Logistics Centre at Enfield. The sections following provide the noise and vibration assessment of the construction and operation of the ILC site and impacts associated with traffic generated by that development.

Although it was acknowledged as outside the scope of the subject proposal, the Director-General made a specific request to discuss the noise assessment for the proposed upgrade of the freight line between the Botany Yards (at Port Botany) and Cooks River. No other reference was made to any specific assessment of the effects of noise and vibration impacts resulting from the operation of the freight rail network between Port Botany and Enfield, although the rail traffic noise at the proposed Intermodal Terminal was required to be considered as a source during the operation of the ILC site. The issue of noise emissions from freight trains on the freight line was raised, however, by a number of Government agencies in their correspondence and by the community during consultation.

Chapter 8 – Rail Traffic and Transport has outlined that, if the NSW Government policy that 40% of containers to and from Port Botany are to be carried by rail by 2011, the number of freight trains using the dedicated line from Port Botany would increase significantly beyond current levels, regardless of whether the ILC at Enfield is developed or not. The proposed ILC would not be generating more freight trains along the line. Rather, it would provide a loading / unloading point for some freight

¹ The NSW Environment Protection Authority (EPA) now falls under the umbrella of the Department of Environment and Conservation (DEC). Where relevant, the terms EPA and DEC are used, but apply to the same organisation.

trains that are expected on and must use that line. The management and regulation of noise and vibration issues on the freight line is a matter for RailCorp (the current Environment Protection Licence (EPL) holder), the likely future EPL holder (ARTC) and the regulator of the licence (Department of Environment and Conservation (DEC)).

The operation of the rail transport of freight to and from Enfield falls within the existing operating licences for the freight line, and no further assessment is required. Nevertheless, to satisfy the requirement of the Director-General regarding discussion on the proposed upgrade to the freight line, the potential noise impacts on the dedicated freight line are discussed in Section 11-5.

11.2. Existing Noise Environment

11.2.1. Study Area

The proposed ILC site is bound by industrial land to the east and west and mixed industrial/residential to the north and south. Existing noise levels in the study area are dominated by traffic noise along the main arterial routes in addition to industrial uses, including the existing railway infrastructure of the new Enfield Marshalling Yards.

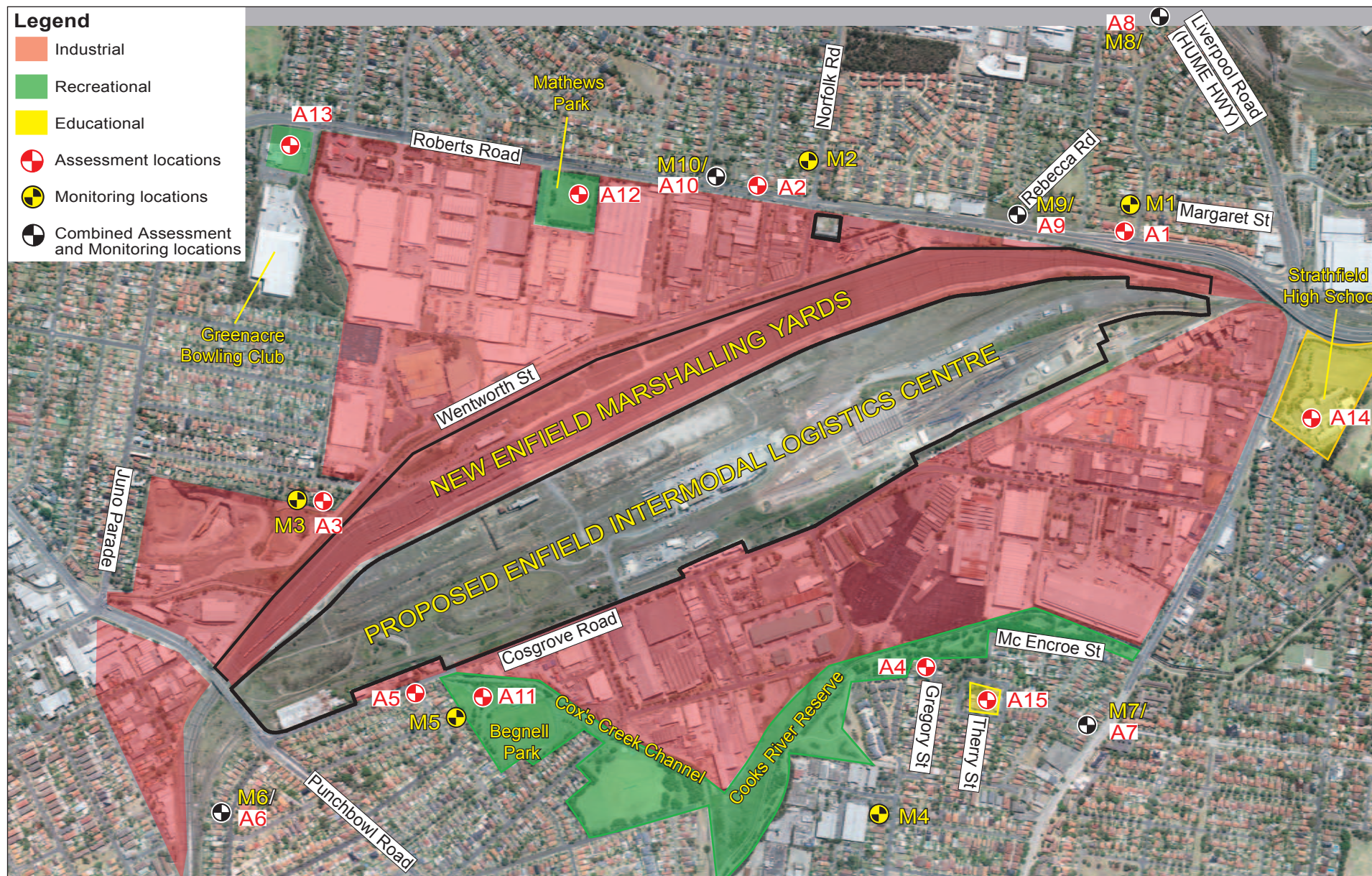
The nearest potentially affected residential locations identified within the study were:

- Residences on Cosgrove Road, south of Coxs Creek Channel;
- Residences on Punchbowl Road, adjacent to the rail line and opposite the site;
- Residences on Wentworth Street (south), adjacent to the rail line at the southern end of site;
- Residences on Norfolk Road and Roberts Road;
- Residences on Rebecca Road and Roberts Road;
- Residences on Margaret Street, backing onto Roberts Road; and
- Residences in Gregory Street, Therry Street and McEncroe Street, Strathfield South (adjacent to Cooks River Reserve).

Other sensitive land uses also identified in the study area were Strathfield High School, Begnell and Matthews Park and the Greenacre Bowling Club. Strathfield High School is located approximately 200m from the northern end of the site and in addition up to six other schools are located within 1km of the ILC site. These are shown in **Figure 11-1**.

Legend

- Industrial
- Recreational
- Educational
- Assessment locations
- Monitoring locations
- Combined Assessment and Monitoring locations



11.2.2. Noise Monitoring and Assessment Locations

To quantify the existing ambient noise environment, noise monitoring was conducted at selected receiver locations over ten days during February 2005. Noise measurements were taken at the nearest or potentially most affected residential locations. In some assessment locations, the existing noise environment was characterised based on noise levels measured at the nearest representative monitoring locations. For example, noise monitoring undertaken at 6 Jean Street was considered representative of noise levels at the identified nearest and potentially worst affected location on the corner of Jean Street and Roberts Road. In summary, the monitoring locations reflect the noise environment experienced in the vicinity of the selected assessment locations surrounding the site. This methodology is considered reasonable and satisfactorily meets DEC's noise policy requirements. The noise monitoring and equivalent assessment locations are summarised in **Table 11-1** below.

■ **Table 11-1: Summary of Assessment Locations and their Related Noise Monitoring Locations**

Assessment Location		Related Noise Monitoring Location		Assessment Type
Residential Locations				
A1	Eastern end of Jean Street, Strathfield South	M1	6 Jean Street, Strathfield South	Construction/ Industrial
A2	Eastern end of Ivy Street, Strathfield South	M2	42 Norfolk Road, Strathfield South	Construction/ Industrial
A3	2 Wentworth St (south), Greenacre	M3	14 Wentworth St (south), Greenacre	Construction/ Industrial
A4	Eastern end of Gregory Street, Strathfield South	M4	124B Dean Street, Strathfield South	Construction/ Industrial
A5	Western end of Blanche Street, Strathfield South	M5	43 Blanche Street, Strathfield South	Construction/ Industrial
A6	40 Bazentin Street, Belfield	M6	40 Bazentin Street, Belfield	Construction/ Industrial
A7	554 Liverpool Road (Hume Highway), Strathfield	M7	554 Liverpool Road (Hume Highway), Strathfield	Road Traffic
A8	1 Hume Highway, Strathfield	M8	1 Hume Highway, Strathfield	Road Traffic
A9	20 Rebecca Road, Strathfield South	M9	20 Rebecca Road, Strathfield South	Road Traffic
A10	118 Roberts Road, Strathfield South	M10	118 Roberts Road, Strathfield South	Road Traffic
Sensitive Land Use Locations				
A11	Begnell Park, Cosgrove Rd, Strathfield South	M5	43 Blanche Street, Strathfield South	Industrial
A12	Matthew Park, Roberts Rd, Greenacre	M10	118 Roberts Road, Strathfield South	Industrial/Road Traffic
A13	Greenacre Bowling Club, Roberts Rd	M10	118 Roberts Road, Strathfield South	Industrial/Road Traffic
A14	Strathfield South High, Corner Roberts Rd and Liverpool Rd	M7	554 Liverpool Road (Hume Highway), Strathfield	Industrial/Road Traffic
A15	St Anne's School, St Anne's Square, Strathfield South	M4	124B Dean Street, Strathfield South	Industrial

The type of assessment carried out at each assessment location is also identified in the table, which was determined from the site inspection and from aerial photographs depicting land use surrounding the site.

Figure 11-1 shows the assessment locations marked as 'A1' to 'A15'.

Table 11-2 presents the existing L_{eq} ambient noise level, calculated for each day, evening and night period, in accordance with the NSW DEC's Industrial Noise Policy (INP). An overall representative L_{eq} noise level is determined by logarithmic averaging each assessment period for the entire monitoring period. It is noted that ambient noise levels measured during this period included existing industry noise from the new Enfield Marshalling Yards and other surrounding industry.

Table 11-2: Measured Existing Ambient² (L_{eq})³ & Background⁴ (L_{90})⁵ Noise Levels dB(A)

Noise Monitoring Location	L_{90} Background Noise Levels			L_{eq} Ambient Noise Levels		
	Day	Evening	Night	Day	Evening	Night
	7am - 6pm	6pm - 10pm	10pm - 7am	7am - 6pm	6pm - 10pm	10pm - 7am
M1 6 Jean Street	49	49	43	59	59	52
M2 42 Norfolk Road	48	47	42	61	61	55
M3 14 Wentworth St (south)	44	42	37	61	63	48
M4 124B Dean Street	44	42	40	60	56	53
M5 43 Blanche Street	41	41	38	55	60	46
M6 40 Bazentin Street	41	40	36	56	64	49

Notes: Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.

Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.

Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays.

At Locations M1 to M6, the noise monitor was positioned outdoors in the open, away from building facades, in accordance with general environmental noise measurement requirements.

Traffic noise levels were measured at residential locations potentially affected by road traffic noise from the proposal. Traffic noise levels for day ($L_{Aeq(15hr)}$) and night ($L_{Aeq(9hr)}$) periods in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN) are presented in **Table 11-3**.

² The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

³ The L_{eq} "equivalent noise level" represents the average noise energy level during the measurement period.

⁴ Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).

⁵ The L_{90} noise level is the noise level in dB(A) exceeded for 90% of a specified time period. For a 1 hour period the level would be exceeded for 54 minutes but would be less for the remaining 6 minutes.

■ **Table 11-3: Measured Existing Road Traffic (L_{eq}) Noise Levels**

Noise Monitoring Location	Road Traffic Noise Source	Distance from Road (m)	L_{eq} Traffic Noise Levels, dB(A)	
			Day	Night
M7 554 Liverpool Road	Liverpool Road	15	$L_{Aeq,15hr} = 71$	$L_{Aeq,9hr} = 67$
M8 1 Hume Highway	Hume Highway	10	$L_{Aeq,15hr} = 70$	$L_{Aeq,9hr} = 67$
M9 20 Rebecca Road	Roberts Road	25	$L_{Aeq,15hr} = 72$	$L_{Aeq,9hr} = 69$
M10 118 Roberts Road	Roberts Road	10	$L_{Aeq,15hr} = 70$	$L_{Aeq,9hr} = 67$

Notes: Existing traffic noise levels measured at 1m from the residential facade

Day is defined as 7:00am to 10:00pm; Night is defined as 10pm to 7am

Noise monitoring was conducted only at residential receiver locations. Therefore, corrections (distance and angle of view to roads) were applied to the measured noise levels to establish existing traffic noise levels at other potentially noise sensitive locations affected by road traffic noise on Roberts Road and Hume Highway (Liverpool Road), as presented in **Table 11-4**.

■ **Table 11-4: Established Existing Road Traffic (L_{eq}) Noise Levels at Assessment Locations**

Assessment Locations	Noise levels measured at	Road Traffic Noise Source	Distance from Road (m)	L_{eq} Traffic Noise Levels, dB(A)	
				$L_{Aeq,15hr}$	$L_{Aeq,9hr}$
A12 Matthew Park, Roberts Rd, Greenacre	M10	Roberts Rd	35	67	64
A13 Greenacre Bowling Club, Roberts Rd	M10	Roberts Rd	10	74	70
A14 Strathfield South High, Corner Roberts Rd and Liverpool Rd	M7	Liverpool Rd / Hume Hwy	10	74	68

Note: Calculated existing traffic noise levels are corrected to represent ‘free field’ noise levels. The calculated traffic noise level at Strathfield South High School does not take into account noise barriers surrounding school grounds.

11.3. Industrial Noise Assessment

11.3.1. Operational Criteria

The assessment procedure for industrial noise sources as set out in the INP has two components:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for residences and other land uses.

The amenity criteria are relied upon for the control of the potential cumulative impact of a proposed industrial source in areas of existing industry, such as in the instance of the proposed ILC site. Generally, for urban areas the amenity criteria as defined in the INP would result in base noise objectives of 60, 50, and 45 dB(A) for day, evening and night respectively. These base noise criteria are then adjusted by up to 10dB depending on the extent of existing industrial noise impact upon the receiver, to ensure that the proposed new industry does not significantly increase industrial noise

levels in the area. If an area is already exposed to higher levels of industrial noise, the amenity criteria are stricter, thereby limiting future increases in industrial noise and preventing ‘background noise creep’. In this way, the cumulative impacts of existing and known future industrial noise sources are minimised.

In addition to the amenity criteria, the intrusiveness criteria were also addressed in the study, in accordance with the INP. Generally, the background noise levels plus 5 dB(A) determine the intrusiveness criteria.

In assessing the noise impact of industrial sources, both components are taken into account for residential receivers, but in most cases only one will become the limiting criterion and form the project-specific noise levels for the industrial source.

In this noise impact assessment, industrial noise from the site was assessed at eleven locations (ie, 6 residential and 5 non-residential sensitive receivers). **Table 11-5** lists the INP Industrial Noise Criteria for residential and non-residential receivers, based on the ambient noise monitoring carried out at the nearest affected residential locations. Further details on these criteria are provided in Appendix E.

Table 11-5: NSW INP Industrial Noise Criteria

Location		Intrusiveness Criteria L _{Aeq,15min} dB(A)			Amenity Criteria L _{Aeq,period} dB(A)		
		Day	Eve	Night	Day	Eve	Night
A1	Eastern end of Jean Street	54	54	48	54	49	42
A2	Eastern end of Ivy Street	53	52	47	52	51	45
A3	2 Wentworth Street (south)	49	47	42	52	53	38
A4	Eastern end of Gregory Street	49	47	45	52	46	43
A5	Western end of Blanche Street	46	46	43	58	50	37
A6	40 Bazentin Street	46	45	41	58	54	39
A11	Begnell Park	N/A			50		
A12	Matthew Park				50		
A13	Greenacre Bowling Club				55		
A14	Strathfield South High School				35(internal)		
A15	St Anne's School				35(internal)		

As shown above, in this project the night-time amenity criteria become the project-specific noise criteria as they are the most stringent.

11.3.2. Sleep Arousal Criteria

Noise emanating from the site operations after 10pm and before 7am, has the potential for creating sleep arousal. The NSW INP does not address the issue of sleep arousal. Therefore, it is common practice to use the Sleep Intrusiveness Criteria as provided by the NSW Environmental Noise Control Manual (ENCM). **Table 11-6** summarises the sleep intrusiveness criteria that may be applied to the nominated residential premises. It should be noted that it is recognised within the industry that ENCM

criteria for sleep arousal, as detailed in **Table 11-6**, is conservatively low. Recent research discussed in Appendix E – Noise and Vibration Assessment shows that if the emergence level is less than 53dB(A) internally within a bedroom (corresponding to approximately 65dB(A) externally), it has less capacity to disturb, despite it emerging more than 15dB(A) above the background noise level. Therefore, a suitable criterion which will ensure that 90% of the population (including the aged) are protected during sleep, is:

- An emergence level of “background plus 15dB(A)” outdoors; and
- Where the emergence level is less than 65dB(A), a value of 65dB(A) outdoors.

Notwithstanding the above, the sleep arousal criteria described in the ENCM is used here for the purpose of this noise impact assessment. This is a conservative approach.

Table 11-6: Sleep Intrusiveness Criteria L_1 ⁶ dB(A)

Location (Industrial Noise Assessment Locations)		L_1 Criteria, dB(A)
A1	Eastern end of Jean Street	$L_1 \leq 43 + 15 = 58$
A2	Eastern end of Ivy Street	$L_1 \leq 42 + 15 = 57$
A3	2 Wentworth St (south)	$L_1 \leq 37 + 15 = 52$
A4	Eastern end of Gregory Street	$L_1 \leq 40 + 15 = 55$
A5	Western end of Blanche Street	$L_1 \leq 38 + 15 = 53$
A6	40 Bazentin Street	$L_1 \leq 36 + 15 = 51$

11.3.3. Predicted Industrial Noise Levels

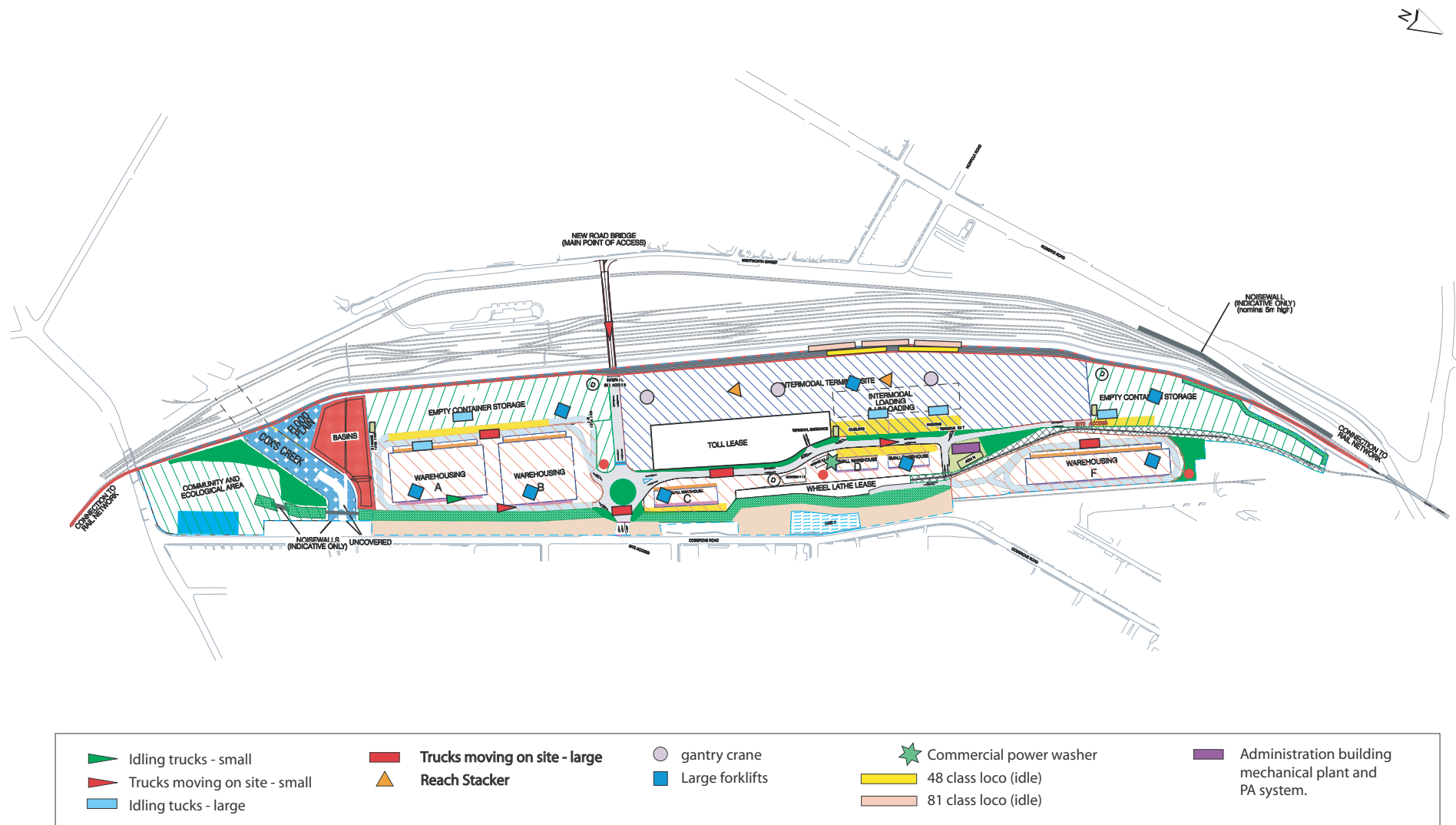
The major activities and the predicted noise levels likely during the site operation are identified in detail in Appendix E. They include vehicle movements on site, train movements on site, loading and unloading activities, vehicle weighing, washing and refuelling, the mechanical plant and public address systems. The noise assessment used these noise source predictions to model two scenarios for the major activities during operation. The two scenarios were based on a ‘worst-case’ scenario (worst case rail plus all plant operating) and a ‘normal-case’ (normal case rail plus all plant operating) scenario. Activities anticipated and the type and numbers of plant operating for both scenarios are depicted in **Figures 11-2** and **11-3**.

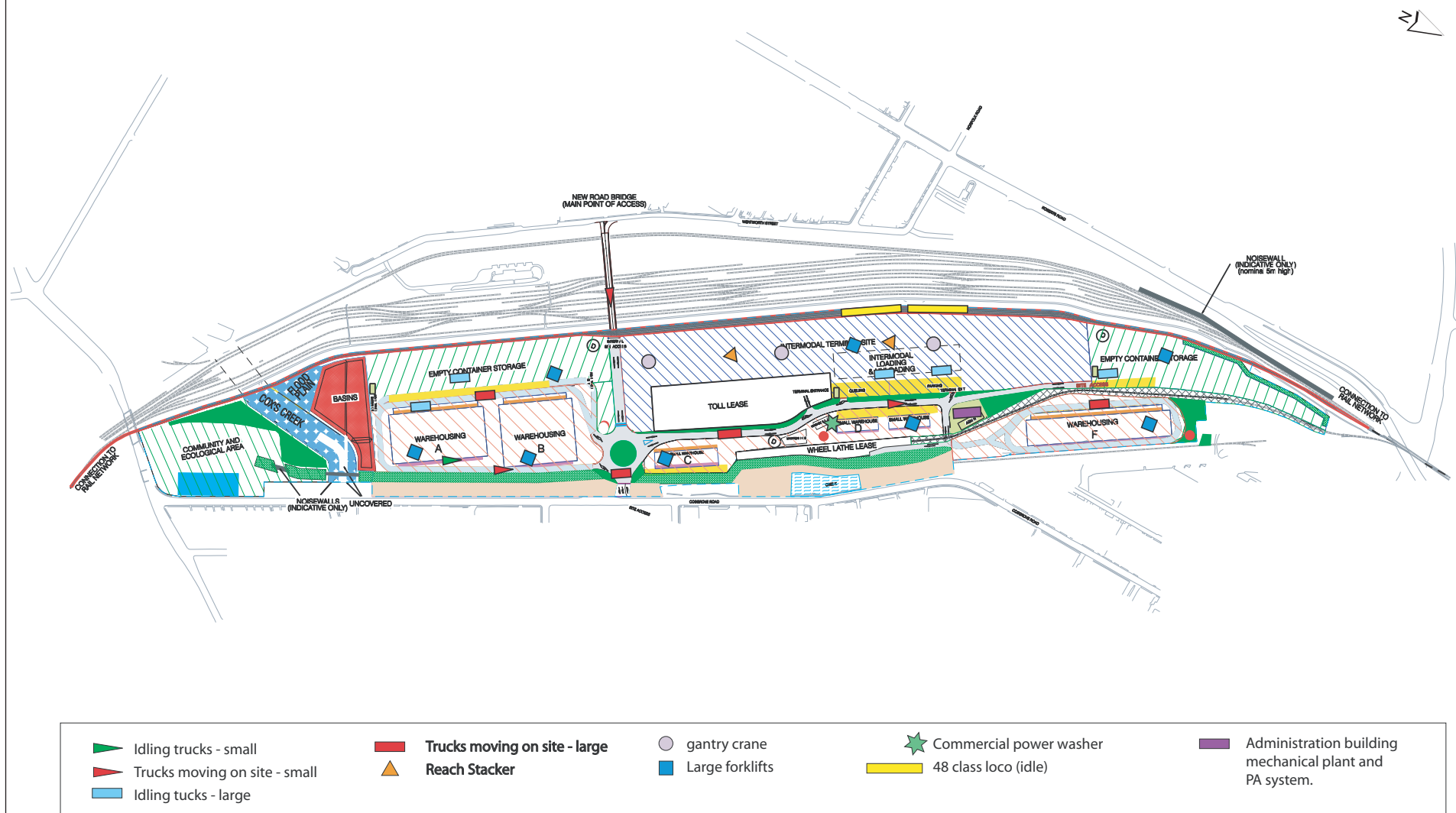
The models included noise predictions for each of the following two meteorological scenarios:

- Calm & isothermal⁷ conditions (acoustically neutral) – no wind and no temperature inversion; and
- Slight wind conditions (the INP default wind conditions).

⁶ This is the noise level in dB(A) exceeded for 1% of a specified time period. For a 1 hour period the level would be exceeded for 36 seconds but would be less for the remaining 59 minutes 24 seconds.

⁷ Isothermal –same temperature. That is, no temperature inversion present.





The model results are described in Appendix E. They showed that, without any mitigation, exceedances of the noise criteria outlined in **Table 11-5 and 11-6** above would be experienced under both of the scenarios modelled at the nearest receiver locations (residential receivers A1-A6 and non-residential receivers A11-A15). The largest noise contributors were found to be idling locomotives and loading / unloading operations at the container storage areas. The models also demonstrated that the sleep intrusiveness criteria might also be exceeded under certain weather conditions. It was determined that noise mitigation would be necessary to reduce noise emissions from the site, as discussed below.

11.3.4. Predicted Industrial Noise Levels with Mitigation Measures

The model was used to predict noise levels following the implementation of noise amelioration treatments. The detailed mitigation measures are provided in Appendix E, and included:

- Reducing noise at the source through managing locomotive idling positions, installation of engine treatment, such as high grade performance mufflers and engine air-intake treatment on all mobile plant and the management of reverse alarms and PA systems on the site; and
- Installation of noise barriers located along certain sections of the boundary of the ILC site, adjacent to Cosgrove Road in the south east of the site and to Roberts Road at the north west of the site. The location of these noise barriers is shown in **Figures 11-2 and 11-3**. They would be about 5m high.

The noise environment simulation was undertaken following implementation of a combination of 6dB(A) mufflers applied to all mobile plant and with the noise barriers in place, as described above, with two 48 Class locomotives idling at the southern end of the intermodal terminal, rather than the north. No further noise mitigation was imposed on the trains (other than location of the locomotives) as neither Sydney Ports nor the site operators are responsible for rail operations.

Table 11-7 summarises resulting noise impacts at night from the site operating at full capacity with noise mitigation measures in place.

Noise emission from the site, with noise mitigation measures applied, would comply with the amenity noise criteria under calm-isothermal conditions at all receivers, except for 1dB(A) exceedances at A1 and A4. A 1dB(A) exceedance is considered minor and insignificant, as a change in noise level of 1dB(A) is inaudible under field conditions. With noise mitigation measures applied, noise emission complies with the intrusiveness noise criteria under calm-isothermal conditions at all receivers.

In both the amenity and intrusiveness assessments, under the most adverse wind conditions (i.e. slight wind blowing from source to receiver), exceedances of the noise criteria still exist. Westerly winds cause exceedances at A4 to A6 (6 to 15dB(A)) and A15 (7dB(A)) and south easterly winds cause exceedances at A1 (up to 10dB(A)) and A2 (up to 6dB(A)).

The frequency of occurrence of westerly winds is 34% of the time during Autumn, Winter and Spring, and for the south easterly winds is 30% of the time during Summer. That is, the noise results predicted under the combined total frequency of adverse wind conditions will occur for approximately one third

(33%) of the year. Winds from other directions occur less frequently and were not considered in the model, in accordance with INP requirements.

Where a noise exceedance is caused by adverse weather conditions, increasing the height of noise barriers provides minimal to no acoustic benefit for surrounding residential areas. To reduce noise emission adequately during such adverse meteorological conditions would require the enclosing of site operations, which is not feasible due to the size of the site and the nature of the activities.

Table 11-7: Cumulative Noise Impact Assessment – Scenario 1 With Mitigation Measures, dB(A)

Location		'Intrusive' Noise Levels, $L_{Aeq}(15min)$				Amenity Noise Levels, $L_{Aeq}(night)$			
		Criteria	Calm & iso-thermal	Wind - W	Wind - SE	Criteria	Calm & iso-thermal	Wind - W	Wind - SE
A1	Eastern end of Jean St	48	43	39	52	42	43	40	52
A2	Eastern end of Ivy St	47	41	35	50	45	41	35	51
A3	2 Wentworth St (south)	42	34	38	28	38	34	37	27
A4	Eastern end of Gregory St	45	38	53	39	37	38	52	38
A5	Western end of Blanche St	43	42	49	37	43	41	48	36
A6	40 Bazentin St	41	38	48	32	39	37	47	31
A11	Begnell Park	-	-	-	-	50	41	48	36
A12	Matthew Park	-	-	-	-	50	35	29	43
A13	Greenacre Bowling Club	-	-	-	-	55	28	24	29
A14	Strathfield South High School	-	-	-	-	45 ³	37	40	48
A15	St Anne's School	-	-	-	-	45 ³	38	52	38

Note: 1. **Bold** font indicates exceedance with NSW EPA Industrial Noise Criteria, either the Intrusive, the Amenity or both criteria.
2. 'Worst-case' scenario - assuming all noise sources operate concurrently. This may not actually occur in practice.
3. Equivalent to internal criteria of 35dB(A).

The results shown in **Table 11-7** indicate a “worst-case” assessment. That is, with all vehicles and equipment at the ILC operating simultaneously and the facility operating at capacity in 2016, 10 years after commencement of operations. It is unlikely that all equipment would operate simultaneously, but this scenario was selected for modelling of noise impacts to present a conservative estimate.

The Environmental Noise Management Plan developed as part of the site operation would be used to specify the operational mitigation requirements as used in the noise assessment model (that is, locating locomotives as the southern end of the Intermodal Terminal, installing mufflers on all forklifts, reach stackers and gantry cranes) and to offer practical management measures to ensure noise impacts to residents and non-residential sensitive receivers are further minimised. The plan would include:

- Compliance with noise goals;
- Use of mufflers;
- Location of locomotives on site;
- Equipment maintenance and operation;
- Complaints handling procedures; and
- Community consultation.

11.3.5. Sleep Intrusiveness

Maximum noise level predictions (in terms of the L_1 descriptor, an approximation to the average maximum noise level) were made for the purposes of assessing potential sleep disturbance impacts. The dominant source of L_1 noise is likely to be the operation of container forklifts loading and unloading containers, producing L_1 noise levels up to 120 dB(A). Forklift and truck reverse alarms are also of concern, producing L_1 noise levels of approximately 107 dB(A). The results are summarised in **Table 11-8** below.

■ **Table 11-8 – Sleep Arousal Assessment – Industrial Noise Sources**

Location	Period	Sleep Arousal Criteria, L_1	Predicted Noise Levels, L_1		
			Calm & isothermal	Wind - W	Wind - SE
A1 Eastern end of Jean St	Night	58	60	56	69
A2 Eastern end of Ivy St	Night	57	42	36	51
A3 2 Wentworth St (south)	Night	52	39	43	33
A4 Eastern end of Gregory St	Night	55	50	65	51
A5 Western end of Blanche St	Night	53	61	68	56
A6 40 Bazentin St	Night	51	51	61	45

Note: 1. **Bold** font indicates exceedance with the NSW Sleep Arousal Criteria
2. 'Worst-case' scenario – assuming all noise sources operate concurrently. This may not actually occur in practice.

The assessment compared the results with the criteria outlined in **Table 11-6**. The results showed that instantaneous noise generated by industrial noise sources on site may exceed the sleep arousal criteria at residences under calm conditions (A1 and A5) and under wind conditions (A1 and A4 to A6). Under calm and isothermal conditions the levels remain below 65 dB(A) which is considered to be the level that could cause sleep arousal. That is, predicted noise levels are below that which cause awakening in 90% of the population. Although the predicted levels may exceed the EPA limits, they are not considered loud enough to cause an impact on the surrounding residents. Nevertheless, the recommendations for appropriate noise mitigation measures, especially in terms of the actions described above, would assist in reducing the likelihood of sleep disturbance occurring.

11.4. Road Traffic Noise Assessment

11.4.1. Road Traffic Noise Criteria

The road traffic noise impact was assessed in accordance with the DEC's Environmental Criteria for Road Traffic Noise (ECRTN). The proposal involves the development of land with the potential to create additional traffic on existing arterial roads, namely Roberts Road and the Hume Highway. The relevant criteria from the ECRTN for this development type are reproduced in **Table 11-9** and **Table 11-10**.

Table 11-9: NSW DEC Road Traffic Noise Criteria

Type of Development	Criteria, dB(A)		Where Criteria are Already Exceeded
	Day	Night	
Land use developments with potential to create additional traffic on existing freeways / arterials (Hume Hwy & Roberts Road)	$L_{Aeq}(15hr)60$	$L_{Aeq}(9hr)55$	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria.

The ECRTN also sets guidelines for the assessment of traffic noise on sensitive land uses. These criteria are applicable to Strathfield High School, Matthews Park and Greenacre Bowling Club.

Table 11-10: NSW DEC Road Traffic Noise Criteria for Sensitive Land Uses

Type of Land Use	Criteria, dB(A)		Where Criteria are Already Exceeded
	Day	Night	
Existing school classroom	$L_{eq}(1hr) 45$ (internal)	-	Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the criteria cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 2dB(A).
Active recreation (eg golf courses)	$L_{eq}(15hr) 60$ (external)	-	
Passive recreation and school playgrounds	$L_{eq}(15hr) 55$ (external)	-	

Part (x) of the technical notes for Table 2 of the ECRTN states the following: *"In cases where existing schools are affected by noise from proposed roads, the daytime criterion is $L_{Aeq}(1hr) 45dB(A)$ (internal)."*

The $L_{eq}(1hr)$ criterion stated above are relevant between 8.30am and 3.30pm with the assessment point being inside the classroom with the windows open. To meet a level of 45dB(A) internally, the external noise level should not exceed 55dB(A), assuming a 10dB(A) noise reduction through an open window (ECRTN, p14). Where current ambient noise levels inside existing classrooms already exceed 45dB(A), then the permitted increase in ambient noise level is 2dB(A).

11.4.2. Road Traffic Noise Sources

It is estimated that approximately 103 truck movements⁸ would occur in the peak hour of operation when the maximum throughput capacity of the ILC is reached around 2016. As the primary market area is located to the west of the ILC site, the traffic studies have estimated that the majority of truck movements would be via Wentworth Street and Roberts Road. The secondary truck route would be via Cosgrove Road and Liverpool Road (Hume Highway).

Future traffic noise levels, based on traffic counts undertaken in 2005 and when the ILC at Enfield is anticipated to reach maximum throughput capacity in 2016, have been predicted using the Calculation of Road Traffic Noise (CoRTN) traffic noise model.

Traffic movements (volumes) are shown in **Table 11-11**.

Table 11-11: Traffic Movements per Year With and Without the ILC

Road	Assessment Period	2005 Without ILC		2016 With ILC	
		Measured Volume	% Heavy Vehicles	Projected Volume	% Heavy Vehicles
Liverpool Road (Hume Highway)	Day (15hr) ¹	39,125	6	58,206	6
	Night (9hr) ²	6,300	6	9,645	7
	Peak 1 Hour ³	3,868	6	5,657	6
Roberts Road	Day (15hr) ¹	55,252	11	54,928	11
	Night (9hr) ²	10,600	13	10,408	12
	Peak 1 Hour ³	4,665	10	4,599	6

Notes:
 Day is defined as 7am to 10pm
 Night is defined as 10pm to 7am
 Peak hour traffic movements over 1hour period
 Heavy vehicles include trucks and buses

11.4.3. Predicted Road Traffic Noise

The following predicted increases in road traffic noise levels have been determined for the primary and secondary truck routes as stated above. For most of the assessment locations, existing traffic noise levels already exceed the ECRTN daytime or night time criteria. Where noise levels are already exceeded and mitigation measures have been considered, the ECRTN provides for a 2dB(A) allowance over existing traffic noise levels. **Table 11-12** presents the existing traffic noise levels at each assessment location, and then the 'allowable traffic noise level' based on an increase of 2dB(A) above existing traffic noise levels. Total traffic noise levels are predicted, including additional traffic from the site, at each assessment location and compared to the 'Allowable Traffic Noise Level'.

⁸ trucks include articulated vehicles (heavy trucks) and rigid vehicles (light trucks). Movements are one way.

The results in **Table 11-12** show that where the facility is operating at capacity, traffic noise generated by the proposed development would not increase by more than 2dB(A). Therefore, traffic noise generated by the proposal complies with the ECRTN.

Table 11-12: Predicted Traffic Noise Levels at Worst Affected Residences and Sensitive Locations on Roberts Road and Liverpool Road, $L_{Aeq(period)}$ dB(A)

Assessment Location		Period	Existing Traffic Noise Level	Allowable Traffic Noise Level	Predicted Traffic Noise (with proposal)	Noise Exceedance
A7	554 Liverpool Road*	Day (15hrs)	71	73	72	Nil
		Night (9hrs)	67	69	69	Nil
A8	1 Hume Highway*	Day (15hrs)	70	72	71	Nil
		Night (9hrs)	67	69	66	Nil
A9	20 Rebecca Road*	Day (15hrs)	72	74	72	Nil
		Night (9hrs)	69	71	69	Nil
A10	118 Roberts Road*	Day (15hrs)	70	72	70	Nil
		Night (9hrs)	67	69	67	Nil
A12	Matthews Park #	Day (1hr peak)	69	71	69	Nil
A13	Greenacre Bowling Club #	Day (1hr peak)	76	77	76	Nil

* Residential location; # Recreational location

11.4.4. Maximum Noise Level

The NSW ECRTN does not specify a night-time L_{max} noise limit or noise goal. This is primarily because research conducted to date in this field has not been definitive and the relationship between maximum noise levels, sleep disturbance and subsequent health effects is not currently well defined. According to the policy the likely maximum or peak noise levels are to be broadly assessed and reported for the night-time period, which is considered by DEC as being 10pm to 7am.

Noise monitoring at the assessment locations indicated that existing night-time L_{max} traffic noise levels along Liverpool Road and Roberts Road reached maximum levels, as shown in **Table 11-13**. Night-time heavy vehicle movements are predicted to increase along Liverpool Road between Stacey Street and Coronation Parade and decrease slightly along Roberts Road, due to the operation of the proposed ILC. As outlined in **Table 11-13**, the additional traffic movements caused by the site operations are not expected to change the existing night time maximum noise level environment. As such, no mitigation measures for road traffic noise levels would be required.

Table 11-13: Maximum Night Time Noise Levels – Road Traffic Noise, dB(A)

Nearest Affected Residences		Noise Levels at Receiver Location	
		Current Maximum Levels	Predicted Maximum Levels
A7	554 Liverpool Road	75-83	75-83
A8	1 Hume Highway	80-85	80-85
A9	20 Rebecca Road	75-85	75-85
A10	118 Roberts Road	80-85	80-85

11.5. Noise on the Dedicated Freight Line

Rail noise has a number of contributory factors including rolling stock, engine noise and wheel condition, as well as track alignment and condition, grade and sleeper material/condition. Locality issues such as proximity to sensitive receivers are also important.

Rail noise from the dedicated freight line between Port Botany and Enfield was addressed in the Port Botany Expansion EIS (Sydney Ports Corporation, 2004). The EIS adopted RailCorp's previous assessments of predicted rail noise along the section of the line from Botany Yard to Marrickville, based on 35 trains per day, and then assessed any additional impacts that the proposed Port Botany expansion (operating at capacity with 54 trains per day) may have had over and above the impacts identified in the RailCorp assessments. An assessment of impacts along the line from Marrickville to beyond Enfield is also included in the Port Botany Expansion EIS.

The Port Botany Expansion EIS adopted the criteria used by RailCorp in its assessments for the duplication works between Marrickville and Cooks River on the dedicated freight line (now completed) which were developed in consultation with DEC. The EIS concluded that:

- Maximum noise levels would not be altered, although the frequency of the occurrence of maximum noise levels is likely to be increased. The increase in average noise levels associated with use of the freight line by the proposed new Port Botany terminal between Cooks River and Botany Yard, above the increases predicted in the assessment previously undertaken by RailCorp, was calculated as approximately 2 dBA;
- Compliance with the LAeq 24hr criteria is generally achieved between Cooks River and Marrickville, although the maximum criterion (LAm_{ax}) is exceeded in some locations. With noise barriers proposed by RailCorp, the number of residences affected would be approximately 20. The Port Botany Expansion EIS concluded that the proposed expansion at the port would not change results of the assessment undertaken by RailCorp;
- Between Marrickville and Enfield (where the freight line shares the same corridor as the passenger network) the additional number of trains due to the new Port Botany terminal would not create a perceptible increase in existing noise levels - the change in noise level was calculated to be up to 1dB. This is due to the small number of trains from the new terminal compared with total freight and passenger trains;
- Beyond Enfield, the impact of the trains from the new terminal would be sufficiently diluted within the system that the effects would be imperceptible.

The assessment did not take into account any potential reduction in noise levels due to improved technology in the future, which is likely to occur in the long term.

Given the conclusions of the Port Botany Expansion EIS and that any assessment of the movement of 5-10 trains (10-20 movements) per day to and from the proposed ILC at Enfield fits within that assessment, a similar conclusion is reached.

11.6. Construction Noise Assessment

11.6.1. Construction Criteria

The NSW DEC Environmental Noise Control Manual (ENCM) (1993), Chapter 171, sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. As the expected duration for the majority of works is 27 months, sites where the construction noise criteria applies would therefore be subjected to Background $L_{90} + 5$ dB(A).

A summary of the criteria applicable to the nearest affected locations is provided in **Table 11-14**. The background noise levels used to determine the criteria are presented in **Table 11-2**.

■ **Table 11-14: Summary of Construction Noise Criteria, dB(A)**

Location		Length of Construction Period Greater than 26 weeks Background $L_{90} + 5$ dB(A).
A1	Eastern end of Jean Street, Strathfield South	54
A2	Eastern end of Ivy Street, Strathfield South	53
A3	2 Wentworth Street (south), Greenacre	49
A4	Eastern end of Gregory Street, Strathfield South	49
A5	Western end of Blanche Street, Strathfield South	46
A6	40 Bazentin Street, Belfield	46

11.6.2. Predicted Construction Noise

An assessment of construction noise impacts was completed at the following assessment locations A1 – A6, selected to represent the residential receivers potentially affected by construction activities. The construction noise assessment made assumptions of construction plant and equipment to be used during the four main stages of construction.

The assumed construction program and equipment likely to be used are summarised in Chapter 4 – Project Description. Associated sound power levels are shown in **Table 11-15**. The cumulative sound power levels obtained from plant operating concurrently on the site were then used to calculate the predicted noise levels to the nearest affected residents.

■ **Table 11-15: Typical Construction Equipment & Sound Power Levels**

Plant Item	Plant Description	Sound Power Levels, dB(A) re: 10 ⁻¹² Watts	
		Range	Typical (Mid-Point), L _{A10}
1	Piling Drilling Rig	112-124	114
2	Mobile Crane	110-115	113
3	Scraper	110-115	113
4	Compactor	110-115	113
5	Pavement Laying Machine	110-114	112
6	Concrete Kerb Machines	110-114	112
7	Bulldozer	105-118	112
8	Tracked Excavator	105-115	110
9	Grader	105-115	110
10	Concrete Truck	108-110	109
11	Water Cart	106-108	107
12	Rollers	100-113	107
13	Asphalt Truck	106	106
14	Truck (>20tonne)	103-108	106
15	Concrete Pump	100-109	105
16	Backhoe	100-108	104

Note: The sound power data within the column marked "Typical (Mid-Point)" has been used in this study to calculate typical construction noise levels at the nominated assessment locations.

Noise levels at any receivers resulting from construction would depend on the location of the receiver with respect to the area of construction, shielding from intervening topography and structures, and the type and duration of operation being undertaken. Furthermore, noise levels at receivers would vary significantly over the total construction program due to the transient nature and large range of plant and equipment that could be used.

It should be noted that this assessment assumed that all plant would be operating at once, in accordance with a conservative assessment. The predicted noise levels at the six assessment locations are presented in **Table 11-16**.

■ **Table 11-16: Predicted Noise Levels from Untreated Construction Plant, dB(A)**

Construction Activity	(Typical) Proposed Equipment	L ₁₀ Construction Noise at Nearest Affected Residences, dB(A)					
		A1	A2	A3	A4	A5	A6
Criteria	<i>Greater than 26 weeks – L₉₀ + 5dB(A)</i>	54	53	49	49	46	46
Stage 1 – Site preparation	Sealed haul roads	67	53	59	53	72	66
	Stormwater detention ponds	44	48	60	48	66	57
	Removal / landfarming contaminated material	70	56	62	56	75	69
	Removal of unsuitable material from stockpiles, landscaping mounds / acoustic barriers, prepare light industrial / commercial area	74	60	66	61	79	73
Stage 2 – Earthworks & drainage	Earthworks	76	62	68	62	81	75
	Stormwater trunk drainage system	70	56	63	57	75	69
	Relocation of services	65	51	57	52	70	64
	Retaining walls / embankments	68	54	60	55	73	67
Stage 3 – Road & rail infra-structure	Off-site access works	66	56	62	59	70	61
	Reinforced earth wall for road embankment	72	59	65	59	78	72
	Northern bridge	50	55	59	52	57	53
	Install services and relocate rail line	54	51	49	47	49	45
	Railway line and sidings	58	55	53	51	53	49
	Container pavement works	73	59	65	60	78	72
	Internal road pavement works	65	54	60	57	69	57
Stage 4– Warehousing & final works	Warehousing and administration areas	67	55	62	59	71	59
	Warehouse pavement works	63	52	59	56	67	56
	Final landscaping	60	46	52	47	65	59

Note: **Bold** typeface indicates exceedance of the noise criteria.

Dependent on the construction stage and activity, construction noise exceeds the criteria at all of the assessment locations. The worst exceedances are predicted at receiver location A5, which is representative of the nearest residences on Cosgrove Road and to the south east of the site. Mitigation measures for treatment of construction noise are provided in Section 11.8.

11.7. Vibration Issues

Activities undertaken on the site during both the construction and operation stage of the project would cause ground vibration. However, depending on the type of activities undertaken, ground vibration is only potentially significant within approximately 25m of the activity.

The types of activities carried out on site during the construction and operation stage are unlikely to cause significant ground vibration beyond 25m from the source.

The nearest potentially affected residential premises to the proposed ILC are approximately 50m away. Therefore, it is unlikely that ground vibration will be an issue on this site and is not further considered further in this assessment.

11.8. Noise Management and Mitigation Measures

In order to reduce the potential noise impacts generated during the construction and the operation phases, the following mitigation measures would be implemented.

11.8.1. Construction

An Environmental Noise Management Plan (ENMP) would be prepared prior to the commencement of works and would form the noise management section of the Construction Environmental Management Plan (CEMP). This plan would require the application of a high level of management practice, including physical noise controls to construction equipment, equipment maintenance and utilising best practical technology and careful operation to achieve low levels of construction noise. The ENMP would also consider (where practical and feasible) the following issues:

- Noise compliance monitoring of equipment;
- Project planning and erection of noise attenuation as an early part of construction program where possible;
- The planning of noisy activities for parts of the day when they would have the least impact;
- A complaints handling procedure; and
- Communication between the community and the Sydney Ports construction management. This would be provided at the start of the works and maintained during the works.

An assessment of possible noise reduction levels was undertaken in the noise and vibration assessment (described in Appendix E). Screening, that is the use of temporary or permanent barriers can reduce noise impacts at affected residences by up to 15 dB(A), enclosing plant by up to 30 dB(A) and using residential class mufflers by up to 20 dB(A). The use of practical measures such as this, as well as appropriate timing of works and liaison with potentially affected community members, would have a significant reduction in the impacts associated with construction works.

It should be noted that the construction of permanent noise barriers, in particular the mounded areas in the south east of the site, as early as possible in Stage 2 of the construction schedule, will reduce the level of construction noise experienced by residences during the later stages of construction.

It is important that acoustic engineers work closely with construction contractors to identify the most appropriate mitigation measures and that the contractors work closely with the community to manage any impacts during construction.

11.8.2. Operation

The ENMP would include noise management for the operation stage of the facility and would form the noise management section of the Operational Environmental Management Plan (OEMP). The ENMP would detail methods available to mitigate noise during the operation of the proposal. In particular the

Plan would consider the reduction of noise at its source and the use of noise barriers, as detailed below:

Source Noise Reduction

- Time spent by locomotives idling at the northern end of the site would be reduced as much as possible by moving them to the southern end of the intermodal terminal;
- Mobile plant used on-site would be fitted with engine noise-reduction kits and variable reverse alarms or flashing lights;
- General maintenance of plant and equipment; and
- The use and management of public address systems would give consideration to noise impacts.

Noise Barriers

Results from the noise impact assessment suggest noise barriers would be required at the following two locations:

- At the south eastern boundary of the site within the vicinity of Cosgrove Road; and
- At the north western boundary of the site within the vicinity of Roberts Road.

The locations are detailed further in Chapter 4 – Project Description, and are shown in **Figures 11-3** and **11-4**. The height and length of either barrier would be dependent on topographical features at the site and the effectiveness of noise treatment at its source. Typically the barriers would be about 5m high.

Communication with the community is also an important process in managing operational noise impacts. Appropriate complaints procedures and means of responding to complaints will be established.

11.9. Cumulative Assessment

The DEC's Industrial Noise Policy takes cumulative impact into account with its Amenity Criteria, which considers all existing industrial noise sources at each noise assessment location and sets noise criteria that avoid the cumulative build-up or 'creep' of industrial noise over time in an area. Therefore, by following the policy guidelines, noise impact from each noise source is minimised to acceptable levels, thus minimising cumulative noise impacts upon receivers.

Currently, there are no known development proposals in the area in addition to the ILC which could contribute to the area's acoustic environment. Therefore, there are expected to be no cumulative effects from this proposal.

11.10. Conclusions

Conclusions resulting from the investigations undertaken as part of the Noise Impact Assessment were as follows:

- Operational noise emissions from the site may exceed the NSW DEC noise criteria without appropriate mitigative measures. Dominant noise sources were found to be the idling of trains, and plant operating in the northern end of the site. Noise emission from the site, with noise mitigation measures applied, would comply with the amenity noise criteria under calm-isothermal conditions at all receivers, except for 1dB(A) exceedances at A1 and A4. A 1dB(A) exceedance is considered minor and insignificant, as a change in noise level of 1dB(A) is inaudible under field conditions. With noise mitigation measures applied, noise emission complies with the intrusiveness noise criteria under calm, isothermal conditions at all receivers. In both the amenity and intrusiveness assessments, under the most adverse wind conditions (i.e. wind blowing from source to receiver), exceedances of the noise criteria still exist;
- Noise generated by construction activities may potentially exceed the NSW DEC's criteria for construction noise, depending on the duration of construction activities. Where noise exceedances are likely, suitable noise mitigation measures would be considered to reduce construction noise emission to compliant levels;
- Noise management measures detailed in this chapter would be considered to minimise adverse noise impacts where they may occur, to achieve compliance with criteria where reasonable and feasible;
- Future road traffic noise levels would comply with the NSW ECRTN criteria at all assessment locations; and
- Rail noise along the dedicated freight line between Port Botany and Enfield, assessed as part of the Port Botany Expansion EIS, would not have a significant impact beyond that which is currently occurring. That is, given the conclusions of the Port Botany Expansion EIS and that any assessment of the movement of 5 to 10 trains (10 to 20 movements) per day to and from the proposed ILC at Enfield fits within that assessment, a similar conclusion is reached.