Attachment C – Revised Noise and Vibration Impact Assessment Report dated 20 September 2010

Port Kembla Port Corporation

20 September 2010

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Port Kembla Outer Harbour

Noise Impact Assessment

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Prepared for

Port Kembla Port Corporation

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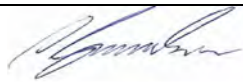
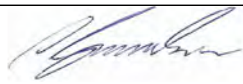
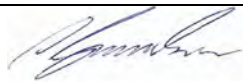
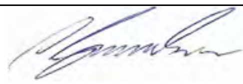
00	14-Dec-2009	For Client Comment	Peter Sanderson Senior Acoustic Engineer	
01	05-Jan-2010	For Client Comment	Peter Sanderson Senior Acoustic Engineer	
02	18-Mar-2010	For Public Exhibition	Peter Sanderson Senior Acoustic Engineer	
03	20-Sep-2010	Final Issue	Peter Sanderson Senior Acoustic Engineer	

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1.0 Introduction

An acoustic assessment of the likely construction and operational activities associated with the proposed development of Port Kembla Outer Harbour (PKOH) has been carried out.

This Noise Impact Assessment (NIA) has been updated following detailed discussions with the Department of Climate Change and Water (DECCW) and the Department of Planning (DoP). Various issues raised by DECCW and DoP following submission of the Environmental Assessment and subsequent public exhibition have been addressed.

1.1 Background

Port Kembla Port Corporation is seeking concurrent Concept Plan approval for the total development (Stages 1, 2 and 3) and Major Project approval for Stage 1 of the development. The Major Project sits within, and is part of, the overarching Concept Plan framework. A description of the Concept Plan and Major Project is provided below. Further discussion on the framework of the Concept Plan and Major Project is presented in Sections 5 and 6 of the Environmental Assessment report.

Concept Plan Description

The Outer Harbour development is to be constructed in three discrete stages over the next 30 years with an anticipated completion date of 2037. Concept Plan approval is being sought for the total development. Construction of the Concept Plan would be staged to meet the needs of prospective customers, to cater for growing port needs and regional development, and to increase the potential to address the needs of new industry for 30 plus years into the future.

The Concept Plan provides a framework for the progressive completion of the Outer Harbour development and comprises creation of land dedicated to port activity. The reclaimed land would be divided into two main areas, one devoted to the import and export of dry bulk, break bulk and bulk liquid cargoes (multi-purpose terminals) and one devoted to container trade (container terminals).

Once the Concept Plan is completed, the reclamation footprint of the development would extend from the existing Port Kembla Gateway jetty in the north to Foreshore Road in the south, the boat harbour to the east and existing rail sidings to the west.

PKPC is seeking Concept Plan Approval for the total development of the Outer Harbour with the understanding that separate Major Project applications would be made for approval to construct and operate facilities on the site. PKPC would construct the reclamation, road and rail infrastructure and basic services for the site as a whole. Development of specific facilities may be undertaken by PKPC or third party operators who would lease part of the site from PKPC for a specific purpose. It is initially intended that the first stage of the multi-purpose terminals, including utilities and amenities, would be developed, operated and maintained by PKPC as a common user facility.

Stage 1 would be constructed between 2010 and 2018, Stage 2 between 2014 and 2025 and Stage 3 between 2026 and 2037.

Major Project Description

Major Project Approval is being sought to construct and operate Stage 1 of the Concept Plan. Construction of the Major Project would be divided into three sub-stages, identified as Stage 1a, Stage 1b and Stage 1c.

Construction elements of Stage 1 comprise demolition of No.3 and No.4 Jetties, and reclamation and dredging for the footprint of the total development, with the following exceptions:

- An area in the vicinity of the Port Kembla Gateway.
- Expansion of the current swing basin area (ship turning circle).

At the completion of Stage 1 the central portion of the multi-purpose terminals would be operational. Road and rail infrastructure to support the first multi-purpose berth would also be constructed, and would comprise:

- Upgrade of rail infrastructure in the South Yard.
- A new road link from Christy Drive to the central portion of the multi-purpose terminals.

- A temporary road to facilitate construction of the container terminals.

The Major Project application sits within, and is part of, the overarching Concept Plan. Stage 1 is proposed to be constructed between 2010 and 2018. Major Project Approval would allow PKPC to commence reclamation and dredging for the multi-purpose and container terminals and construct and commence operations for the first multi-purpose berth. Stages 2 and 3 of the Concept Plan would be subject to separate applications for Project Approval made at a later date.

1.2 Scope of Acoustic Assessment

This assessment considers likely construction and operational scenarios associated with the Concept Plan and the Major Project. A detailed construction and operational NIA for the Major Project has been carried out. At this stage of the development detailed construction and operational methodology for the overall Concept Plan is not available. This assessment has therefore been carried out based on likely site activities that have been confirmed with Port Kembla Port Corporation (PKPC)

The construction scenario that has been modelled is considered to be representative of the likely worst case impacts associated with the Concept Plan and Major Project. Specific construction activities for each stage of the Concept Plan and Major Project have not been assessed but rather the assessment has focused on the representative activities of both stages at the shortest distance between source and receivers.

Following comment from DECCW and discussion with PKPC the possibility of overlapping construction activities between Stage 1 and Stage 2 have been assessed.

Construction of a new rail siding associated with the Major Project and located at the South Yard has been assessed. At this stage the construction impact resulting from the Major Project only has been assessed because the layout of rail infrastructure in Port Kembla is likely to change as a result of a review of rail infrastructure that is currently planned for 2010 (refer to Section 5.2.2). It is likely that construction activity associated with the Concept Plan would utilise similar plant.

It is understood that the construction phase is to include 24 hour dredging operations and that underwater blasting will take place to facilitate this procedure. Blasting locations have not yet been decided so a generic blasting assessment has been carried out to quantify the potential impact on nearby noise and vibration sensitive receivers.

AECOM has been advised that the construction works are to take place during standard working hours (Monday to Friday 0700 – 1800 and Saturday 0800 – 1200), with the exception of dredging pumps, which will be operational 24 hours a day.

Operational activities associated with the Concept Plan and the Major Project are understood to take place 24 hours a day, seven days a week. The predicted noise impact resulting from operation of the Major Project alone and the Concept Plan, incorporating the Major Project, has been assessed.

Rail activities in the South Yard associated with the Major Project and the Concept Plan have been assessed.

The potential for sleep disturbance as a result of operational activities associated with the Concept Plan and the operation of the South Yard during Major Project have also been assessed.

2.0 Existing Noise Environment

2.1 Noise Logging

Three loggers were used to continuously measure background noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The loggers were located at 7 Wentworth Road, 14 O'Donnell Street and 2 Reservoir Street, Port Kembla. These locations are considered to be representative of the sensitive receivers in the area. The data from the logger located at 2 Reservoir Street was not used as the logger experienced technical difficulties and only gathered reliable data for the period Thursday 18th Sept 2008 to 21st September 2008 (DECCW guidelines require a minimum of 7 consecutive days of logging). An additional logger was used to continuously measure road traffic noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The logger was located at 43-57 Five Islands Road, adjacent to the carriageway. The loggers and receiver locations are shown on Figure 1.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level.

The Assessment Background Level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or Rating Background Level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration.

The NSW Department of Environment, Climate Change and Water (DECCW) Industrial Noise Policy (INP) application notes recommend that when higher background noise levels (RBL) occur in the night time or evening assessment periods, the criteria are generally set to the lower evening or daytime criteria in accordance with community expectations.

Measured ambient noise levels are shown in Table 1. Graphical representation of the logging results is shown in Appendix B.

Table 1 – Summary of ambient noise levels dB(A)

Logger Location	Day		Evening		Night	
7 Wentworth Road	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008			48	52	45	52
Fri 19th September 2008	50	56	47	56	49	53
Sat 20th September 2008	47	55	39	54	37	50
Sun 21st September 2008	43	67*	45	53	46	53
Mon 22nd September 2008	49	56	48	52	44	51
Tues 23rd September 2008	43	53	40	48	43	51
Wed 24th September 2008	47	54	46	51	48	53
RBL	**47**		**46**		**45**	
Log Average L_{Aeq}		**61**		**53**		**52**
14 O'Donnell Street	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008	-	-	40	44	37	44
Fri 19th September 2008	43	51	43	48	41	47
Sat 20th September 2008	39	50	38	43	26	45
Sun 21st September 2008	37	49	40	44	40	47
Mon 22nd September 2008	41	50	42	46	35	47
Tues 23rd September 2008	39	48	32	43	31	44
Wed 24th September 2008	38	54	38	45	41	48
RBL	**39**		**40**		**37**	
Amended RBL	**39**		**39**		**37**	
Log Average, L_{Aeq}		**51**		**45**		**46**

* Result of noisy afternoon activity

The road traffic noise levels from Five Islands Road are summarised in Table 2.

Table 2 – Summary of road traffic noise levels at 7m from Five Islands Road

Day Time - ECRTN Timebase			
15 hr Leq, (7am to 10pm)	70.9	1 hr Leq	72.8
Night Time - ECRTN Timebase			
9hr Leq, (10pm to 7am)	67.5	1 hr Leq	70.6

2.2 Noise Sensitive Receivers

The logger located at 7 Wentworth Road was affected by road traffic noise from the nearby Five Islands Road. This location has been assumed to be representative of residential properties adjacent to or in close proximity to the more heavily used roads in the area. This has been designated Sensitive Catchment Area 1 (SCA1).

The logger located at 14 O'Donnell Road is considered to be representative of residential properties located further away from the more heavily used roads in the area. This has been designated Sensitive Catchment Area 2 (SCA2).

Figure 1 shows the ambient noise logging locations and defines SCA1 and SCA 2. Figure 2 shows the traffic noise logger location and noise sensitive receivers adjacent to Five Islands Road, Cringila. Figure 3 shows noise sensitive receivers at Masters Road.

Figure 1 – Sensitive receivers (SCA1 and SCA2) and noise logging locations

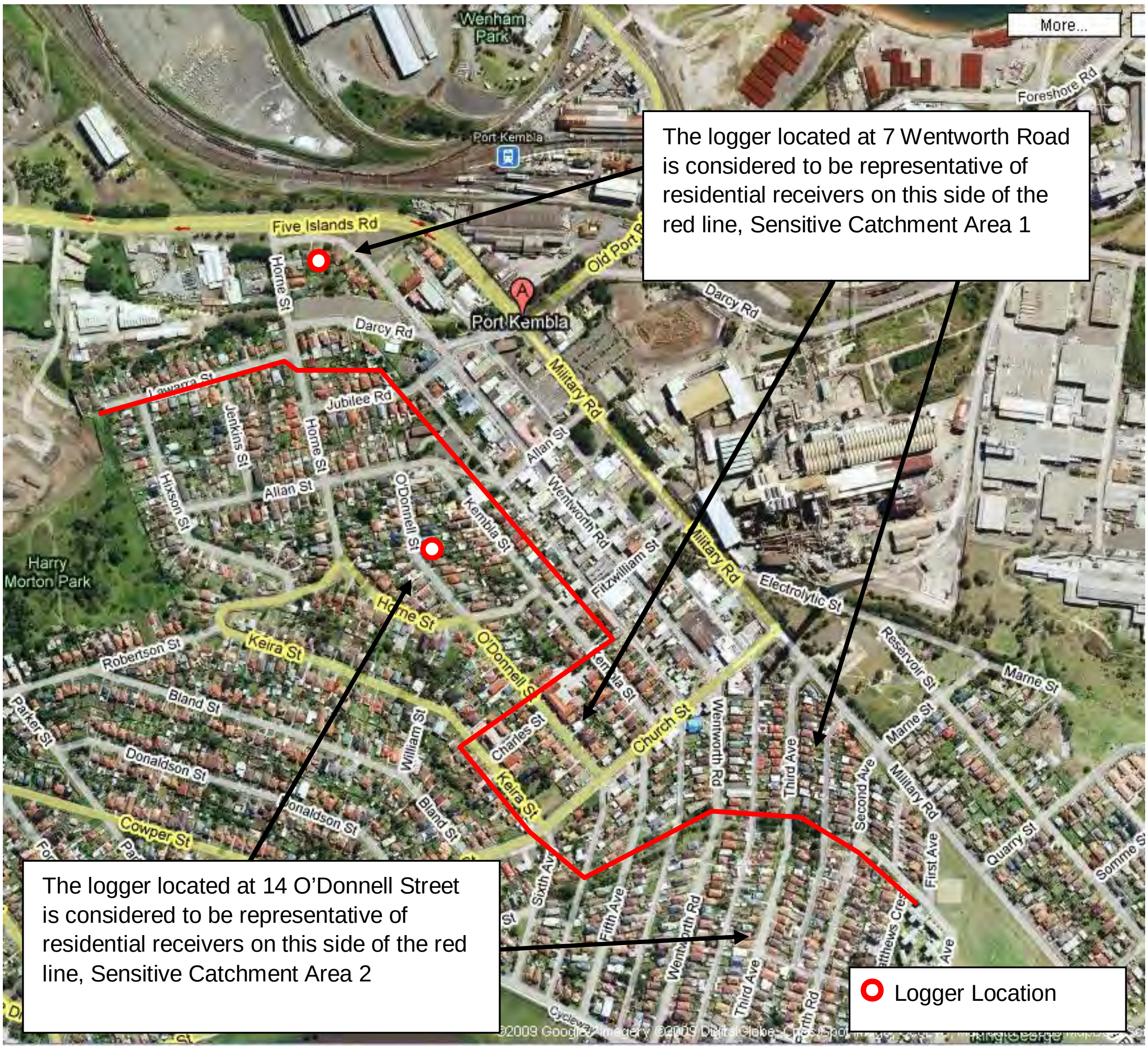


Figure 2 Five Islands Road, Cringilla noise logging location and most affected traffic noise receivers

Figure 3 Masters Road traffic noise receivers

3.0 Noise and vibration criteria

3.1 Construction noise criteria

The DECCWs '*Interim Construction Noise Guidelines (ICNG)'* has been used to assess the construction noise impact associated with the planned development at Port Kembla Outer Harbour. This document supersedes their previous publication the *Environmental Noise Control Manual (ENCM)* and is used as the basis for establishing construction noise criteria.

Under the DECCW guidelines a Construction Noise and Vibration Management Plan (CNVMP) is required to be compiled by the Contractor, prior to construction commencing.

Noise level objectives must be set for the daytime and evening periods, and must be complied with where reasonably practicable. Work that is proposed outside of standard working hours, as defined in the *ICNG*, generally requires strong justification.

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

The *ICNG* defines what is considered to be feasible and reasonable as follows:

> *Feasible*
>
> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*
>
> *Reasonable*
>
> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

The *ICNG* recommends that a quantitative assessment is carried out for all *'major construction projects that are typically subject to the EIA process'*. A quantitative assessment, based on a likely 'worst case' construction scenario associated with both the Concept Plan and Major Project, has been carried out using typical construction equipment likely to be used for both the Concept Plan and Major Project. Should the equipment used during construction differ greatly from that assumed for modelling purposes then it is likely the assessment will change.

Predicted noise levels at nearby noise sensitive receivers (residential, commercial and industrial premises) are compared to the levels provided in Section 4 of the *ICNG*. Where an exceedance of the criteria is predicted the *ICNG* advises that the proponent should apply all feasible and reasonable work practises to minimise the noise impact.

Criteria for residential receivers are set using the information in Table 3.

Table 3 – Construction noise at residences using quantitative assessment

Time of Day	Management Level L_{Aeq} (15min)*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 (ICNG).

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

3.1.1 Construction noise management levels

It is assumed that the construction activities will take place during recommended standard working hours (07.00 am – 6.00 pm Monday to Friday and 8.00 am – 1.00 pm Saturday). However it is likely that dredging pumps/plant will be operational 24 hours a day.

Construction noise management levels for the most affected residential receivers are shown in Table 4.

Table 4 – Construction noise management levels – Residential receivers

Receivers	Background Noise Level, L_{A90} Day dB(A)	Daytime Noise Management Levels L_{Aeq} dB(A)	Background Noise Level, L_{A90} Night dB(A)	Night time Noise Management Limit L_{Aeq} dB(A)
Sensitive Catchment Area 1	47	57	45	50
Sensitive Catchment Area 2	39	49	37	42

Criteria for other sensitive land uses, such as schools, hospitals or places of worship are shown in Table 5.

Table 5 – Construction noise management levels – Sensitive land uses other than residential

Land Use	Management Level, L_{Aeq} (15 min) (applies when properties are in use)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas(characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses.

Criteria for industrial and commercial premises are shown below:

- Industrial premises: external $L_{Aeq\ (15min)}$ 75 dB(A)
- Offices, retail outlets: external $L_{Aeq\ (15min)}$ 70 dB(A)

3.2 Operational noise and vibration criteria

3.2.1 L_{Aeq} criteria

Any noise generated within the PKOH development site boundary, including noise from plant, truck movements, rail movements (including Stabling Yard activities), loading/unloading activities, and mechanical services or associated with site buildings must be assessed in accordance with the INP.

The assessment procedure for industrial noise sources has two components, which are:

- controlling intrusive noise impacts in the short term for residences; and
- maintaining noise level amenity for particular land uses for residences and other land uses.

Intrusive noise impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the *Intrusiveness Criterion*. The *Rating Background Level* (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1* of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is termed the *Amenity criterion*.

For a residential receiver in an urban area, the amenity criteria are shown in Table 6.

Table 6 Recommended L_{Aeq} noise levels from industrial noise sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Where there are high levels of existing industrial or transportation noise then noise from the new source must be controlled to preserve the amenity of the area. Table 2.2 in the INP provides modification factors for areas with existing high levels of industrial or transportation noise.

There is a significant contribution from existing industrial and traffic sources at all of the logging locations adjacent to the PKOH development site.

Due to this contribution from existing industrial noise sources the amenity criteria has been modified as per the recommendations in Table 2.2 of the INP.

Cumulative impact

Environmental noise criteria must consider the cumulative impact from all operational activities associated with the Major Project and the overall Concept Plan.

As the Major Project will be operating independently of the Concept Plan for a period of time, the operational activities associated with this phase have been assessed on both a standalone basis and as part of the Concept Plan.

The criteria for assessment of the Major Project and Concept Plan are consistent.

Final environmental noise criteria

A summary of the environmental noise criteria and the resultant project specific noise goals are given in Table 7.

Table 7 Environmental noise criteria and project Specific Noise Goals

Receiver	Period	RBL (L_{A90})	Intrusive Criterion RBL + 5	Ambient (L_{Aeq})	Amenity Criterion	Project Specific Noise GoalsdB(A)
Sensitive Catchment Area 1	Day	47	52	61	52	52
	Evening	46	51	53	43	43
	Night	45	50	52	42	42
Sensitive	Day	39	44	51	60	44

Receiver	Period	RBL (L_{A90})	Intrusive Criterion RBL + 5	Ambient (L_{Aeq})	Amenity Criterion	Project Specific Noise GoalsdB(A)
Catchment Area 2	Evening	39	44	45	48	44
	Night	37	42	46	37	37

As the noise emissions from the Outer Harbour development would be dominated by relatively constant activities during the assessment periods, the $L_{Aeq,\ period}$ has been assumed to be equal to the assessed $L_{Aeq,\ 15\ min}$ for the worst case operational scenario. This ensures compliance with both criteria at sensitive residential receivers and represents a conservative assumption.

The project specific noise goals in Table 7 are applicable for all the operational noise sources\ associated with the Major Project and the Concept Plan at the residential receivers most likely to be affected.

Meteorological Effects

Certain meteorological effects, such as source to receiver wind speeds of less than 3 m/s and thermal inversions, can increase the impact at noise sensitive receivers.

The INP states that temperature inversions are considered to be a feature of the area when they occur for more than 30% of the time during the winter months and between the hours of 6pm and 7am. Adverse wind conditions are considered to be a feature of the area when source to receiver wind speeds are below 3 m/s for more than 30% of the time during any assessment period.

Meteorological data sourced from the DECCW Wollongong monitoring station between July 2006 and June 2007, and summarised in the Air Quality report submitted as part of this EA, have been reviewed.

This data set indicates that f class temperature inversions occur for approximately 34% of the time, principally during the winter months. A screening test indicates that the occurrence of f-class temperature inversions has the potential to increase the noise impact at sensitive receivers by more than 3 dB(A). f-class temperature inversions have therefore been included in all night time modelling scenarios.

The data set indicates that source to receiver (i.e. north easterly) wind speeds of less than 3m/s occur for approximately 17% of the time. This is below the 30% requirement specified by the INP to indicate that adverse wind conditions are a feature of the area, however, in order to produce a worst case assessment adverse wind conditions have been included in the daytime modelling.

The meteorological parameters included in the modelling are summarised in Table 8.

Table 8 Noise modelling meteorological parameters

Time period	Source to receiver wind speed	Stability class
Daytime	3 m/s	d-class
Night time	0 m/s	f-class (i.e. thermal inversion)

3.2.2 Sleep disturbance criteria

The DECCW's INP has been updated with application notes which discuss sleep disturbance. The INP application notes consider it appropriate that **$L_{Amax} \leq L_{A90} + 15$** be used as a screening criterion to assess the likelihood of sleep disturbance.

If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

The sleep disturbance criteria for SCA 1 and SCA 2 are summarised in Table 9.

Table 9 Sleep disturbance criteria

Catchment Area	RBL Night (L_{A90})dB(A)	Sleep Disturbance Screening Criteria L_{Amax} dB(A)
SCA 1	45	60
SCA 2	37	52

3.3 Rail Noise Criteria

The noise and vibration emission from rail vehicles movements generated by but not actually within the proposed site should be considered against the advice given in the DECCW publication '*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects'* (IGANRIP). The rail movements generated by the proposed development would be assessed in accordance with the guidance for *'Redevelopment of existing rail lines'*.

The IGANRIP recommends that rail infrastructure projects with the potential for noise and vibration impacts should be compared against the airborne and ground borne noise trigger levels to decide whether assessments of impacts and feasible and reasonable mitigation measures are necessary. The airborne noise criteria for *Redevelopment of Existing Rail Line* near to residential receivers are given below in Table 10.

The airborne noise criteria for *Redevelopment of Existing Rail Line* near to receivers other than residential are given in Table 11.

Table 10. Airborne rail traffic noise trigger levels for residential and educational receivers

Receiver	Noise trigger levels dB(A)		
	Day (7am -10 pm)	Night (10 pm – 7 am)	Comment
Residential	Development increases existing rail noise levels **and** resulting rail noise levels exceed:		These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project. An 'increase' in existing rail noise levels is taken to be an increase of 2 dB(A) or more in L_{Aeq} in any hour or an increase of 3 dB(A) or more in L_{Amax}.
	65 $L_{Aeq(15h)}$ 85 L_{Amax}	60 $L_{Aeq(9h)}$ 85 L_{Amax}	

Table 11 – Airborne rail traffic noise trigger levels for sensitive land uses other than residential

Sensitive Land Use	Noise Trigger Levels dB(A)
	Redevelopment of existing rail line
	Development increase the existing rail noise levels by 2 dB(A) or more in L_{Aeq} in any hour ***and*** resulting rail noise levels exceed:
Schools, educational institutions – internal	45 $L_{Aeq(1hr)}$
Places of worship – internal	45 $L_{Aeq(1hr)}$
Hospitals	60 $L_{Aeq(1hr)}$
Hospitals – internal	35 $L_{Aeq(1hr)}$
Passive recreation	L_{Aeq} as per residential noise level values in Table 1* (does not include maximum noise level component)
Active recreation (e.g. golf course)	65 $L_{Aeq(24hr)}$

* Refers to Table 1 in IGANRIP i.e.Table 10 in this report

3.4 Road Traffic Noise Criteria

The proposed facility will generate truck and light vehicle movements on Five Islands Road, Flinders Road and Old Port Road. The potential noise impact resulting from additional truck and light vehicle movement is greatest as a result of movements on these roads due to the close proximity of potentially noise sensitive receivers.

The impact of noise from the movements has been assessed using the Department of Environment, Climate Change and Water (DECCW) document 'Environmental Criteria for Road Traffic Noise' (ECRTN).

The two primary roads in the study area that the development may impact are Five Islands Road and Old Port Road. Roads are classified depending on how they function within the surrounding road network. In this case Five Islands Road would be classified as an arterial road and Old Port Road as a sub arterial road.

Road traffic noise criteria for arterial and collector roads are presented in Table 12.

Table 12 Road traffic noise criteria – Arterial and collector roads

Period	Parameter	Criterion
Day (7.00 am – 10.00pm)	$L_{Aeq,\ 15hr}$	60
Night (10.00 pm – 7.00am)	$L_{Aeq,\ 9hr}$	55

In cases where noise from an existing road already exceeds the above criteria, Table 1 of the ECRTN recommends that "*Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access road; 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 existing noise impact from traffic adjacent to Five Islands Road is shown in Table 13. Also shown in Table 13 is the maximum allowable noise impact following implementation of all feasible and reasonable mitigation measures (i.e existing + 2 dB(A)).

Table 13 – Daytime and Night time existing ECRTN noise levels

Day Time - ECRTN Timebase	
Existing $L_{Aeq\ (15hr)}$, (7am to 10pm)	71
Maximum allowable $L_{Aeq\ (15hr)}$, (7am to 10pm)*	73
Night Time – ECRTN Timebase	
Existing $L_{Aeq\ (9hr)}$, (10pm to 7am)	68
Maximum allowable $L_{Aeq\ (9hr)}$, (10pm to 7am)*	70

** Following application of all feasible and reasonable mitigation measures*

Feasible and reasonable road traffic noise mitigation options are discussed in Section 5.6

3.5 Vibration criteria

3.5.1 Construction blasting criteria

Construction blasting can result in two adverse environmental effects – airblast and ground vibration. The airblast and ground vibration produced may cause human discomfort and may have the potential to cause damage to structures, architectural elements and services.

Airblast will have no impact during the construction stage of the Major Project or Concept Plan as all blasting is to take place under a minimum water depth of 5 m. The acoustic impedance mismatch between air and water means that the vast majority of acoustic energy from an underwater blast will be reflected at the water surface. The minimal amount of energy that is not reflected is likely to be at a low sound pressure level at infrasound frequencies, and as such would not be perceptible by the nearest receivers.

The Australian and New Zealand Environment Conservation Council (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* has been adopted by the DECCW as comfort criteria. The guidelines are not intended to be structural damage criteria; however they do provide a conservative approach to assessing blasting impacts.

3.5.2 Ground vibration

- The ANZECC recommended maximum level for ground vibration is 5 mm/s (Peak Particle Velocity, PPV);
- The PPV of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time; and
- Experience has shown that for almost all sites a PPV of less than 1 mm/s is generally achieved. It is recognised that it is not practicable to achieve a PPV of this level at all sites and hence a recommended maximum level of 5 mm/s has been selected. However, it is recommended that a level of 2 mm/s (PPV) be considered as the long term regulatory goal for the control of ground vibration.

3.5.3 Times and frequency of blasting

- Blasting should generally only be permitted during the hours of 9.00 am – 3.00 pm Monday to Friday and 9.00 am – 12.00 pm on Saturday. Blasting should not take place on Sundays or Public Holidays;

- Blasting should generally take place no more than once per day. (This requirement would not apply to minor blasts such as for clearing crushers, feed chutes etc); and
- The restrictions on times and frequency of blasting do not apply to:
  - o Those premises where the effects of the blasting are not perceived at noise sensitive sites; and
  - o Major underground metalliferous mining operations.

The ANZECC guidelines criteria are summarised in Table 14.

Table 14 - ANZECC guideline blast criteria summary

	ANZECC Guidelines
Noise	≤ 115 dB(linear) peak for 95% of total number of blasts in 12 months ≤ 120 dB(linear) peak for any blast
Vibration	≤ 5 mm/sec PPV for 95% of total number of blasts in 12 months ≤ 10 mm/sec PPV for any blast

Australian Standard 2187.2 'Explosives – Storage and use Part 2: Use of explosives' notes that damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133 dB(lin peak).

3.5.4 Building exposure to vibration

DIN Standard 4150 - Part 3 - Structural Vibration in Buildings - Effects on Structures provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. The long term criteria, which produce the most conservative assessment, are shown in Table 15. It should also be noted that these levels are "safe limits", up to which no damage due to vibration effects has been observed for the particular class of building. "Damage" is defined by DIN 4150 to include even minor non-structural effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.

DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits will not necessarily result in damage, the limits are generally recognised as being conservative.

Table 15- DIN 4150: Structural damage safe limits for building vibration

Type of Structure	Guideline values for Peal Particle Velocity (PPV) in mm/s in horizontal plane of highest floor at all frequencies
Dwellings and buildings of similar design and/or occupancy	5
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings quantifies three different levels of damage to structures:

- **Cosmetic** – The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction;

- **Minor –** The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks; and
- **Major** – Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

BS 7385 provides guidance on assessing the possibility of vibration-induced damage in buildings due to a variety of sources and sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The standard states that there is a major difference between the sensitivity of people in feeling vibration and the onset of levels of vibration which may damage the structure. The levels of vibration at which people are likely to comment are below levels of vibration which damage buildings, except at lower frequencies.

The full assessment method presented takes into account the magnitude, frequency and duration of recorded vibration together with consideration of the type of building which is exposed.

Although the criteria contained within BS7385 are useful when appraising the relative severity of structural vibration, it is important to note that they are not intended to be adopted as acceptable or non-acceptable limits for vibration. The criteria in BS7385 are shown Table 16 below.

Table 16 – BS 7382-2: Transient vibration guide values for cosmetic damage.

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz Increasing to 50 mm/s at 40 Hz and above
NOTE 1 Values referred to are at the base of the building. NOTE 2 For unreinforced or light framed structures at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.		

Note where the dynamic loading caused by continuous vibration results in dynamic magnification due to resonance, the guide values in Table 16 may need to be reduced by up to 50%, especially at the lower frequencies where lower guide values apply.

BS 7385 asserts that minor damage is possible at vibration magnitudes that are greater than twice those given in Table 16 above, and that major damage to a building structure may occur at values greater than four times the stated values.

3.5.5 Human exposure to tactile vibration

Long term exposure to vibration in buildings may cause annoyance. The levels at which annoyance occurs are much lower than the structural damage criteria in buildings.

British Standard 6472-1992 Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) and NSW DECC publication 'Assessing Vibration – A Technical Guideline' provides guidance on human response to vibration are used to set guideline vibration levels for this project. BS 6472-1992 has recently been superseded by BS 6472-2008. Although a new version of BS 6472 has been published, the DECCW still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time and accordingly the 1992 version is referred to.

DECCW guideline is based on Vibration Dose Values (VDVs). The VDV is given by the fourth root of the integral with respect to time of the fourth power of the weighted acceleration. The VDV accumulates the vibration energy received over the daytime and night-time periods. This is expressed mathematically as:

$$VDV = \left(\int_0^T a_w^4(t)dt \right)^{0.25}$$

The VDV is much more strongly influenced by vibration magnitude than by duration. A doubling (or halving) in the vibration magnitude results in a sixteen fold decrease (or increase) in the exposure duration for a VDV with the same magnitude.

Where there are repeated vibration events of variable magnitude the total vibration dose for the relevant period may be obtained by summing the N individual vibration doses using following formula:

$$VDV = \sqrt[4]{\left(\sum_{i=1:N} VDV_i^4\right)},$$

where VDV_i is the individual vibration dose.

The VDV is a cumulative measure and increases as the exposure duration increases. It is not an averaging procedure. An X% increase in VDV can be directly related to an X% increase in vibration discomfort. The probability of adverse comment from occupants exposed to a particular level of vibration is given in Table 17.

Table 17 – DECCW: Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$) during construction activities

Location	Daytime		Night-time	
	Preferred	Maximum	Preferred	Maximum
Critical areas	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

The DECCW guideline states that '*there is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community*'.

3.5.6 Ground-borne Noise

Vibration generated by train movement enters buildings via the ground. This causes the floors, walls and ceilings to vibrate and to radiate noise. This noise is commonly referred to as structure- or ground-borne noise or regenerated noise. Regenerated noise is low frequency and if audible is perceived as a 'rumble'.

The ground-borne noise goals as outlined in the DECCW document "*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects*" (IGANRIP) are employed. The noise trigger levels for ground-borne noise are summarised in Table 18.

Table 18 – Recommended ground-borne noise goals for operational activities

Receiver	Time of day	Noise trigger levels dB(A)
		Development increases existing rail noise levels by 3 dB(A) or more and resulting rail noise levels exceed:
Residential	Day (7 am – 10 pm)	40 dB(A) $L_{Amax, slow}$
	Night (10 pm – 7 am)	35 dB(A) $L_{Amax, slow}$
Schools, educational institutions, places of worship	When in use	40-45 dB(A) $L_{Amax, slow}$

The closest residential receivers that may be impacted by ground borne noise are located approximately 100m form the South Yard, on Wentworth Road.

4.0 Noise and Vibration Assessment

4.1 Modelling

Construction and operational noise activities were modelled using SoundPLAN v7.0 modelling software. The environmental noise impact at the sensitive receivers was assessed using an implementation of the CONCAWE algorithms.

As stated in Section 3.2 and shown in Table 8, f-class temperature inversions have been included in all night time modelling scenarios and source to receiver wind speeds of less than 3 m/s have been included in all daytime and evening modelling scenarios.

Noise contours for the day and night time periods generated by the assessment of both the Major Project and Concept Plan are included in Appendix A.

4.2 Assumptions

In determining the noise impact assessment for construction and operational noise it has been assumed that the scenarios modelled accurately represent activities that will take place on site. Changes to the modelled scenarios may result in changes to the predicted noise impact levels.

4.3 Construction noise and vibration assessment

The construction scenario modelled for the construction noise impact assessment has been agreed in discussion with PKPC and AECOM maritime engineers. The assessment is considered to be conservative as it allows for concurrent construction activity at Stage 1 and Stage 2. It is considered unlikely that construction of Stage 1 and Stage 2 will overlap and if they do so then it is unlikely all plant for both stages will operate concurrently.

Following review of the NIA during the public exhibition period, DECCW raised some concerns regarding the plant included in the construction noise assessment and the sound power (L_w) used for some of the items of plant. As a result of this, changes have been made to the plant included in the construction noise impact assessment.

The plant included in the construction noise impact assessment has evolved over time as the understanding of the likely construction methodology has increased. The plant detailed in Table 19 is considered to be representative of plant that will be used in the berth construction works. The sound power levels shown in Table 19 are consistent with data published in the UK DEFRA document '*Update of noise database for prediction of noise on construction and open sites*'.

In order to ensure that any potential overlap in construction of Stage 1 and Stage 2 is accounted for, the construction noise impact assessment model assumes:

- Stage 1 and Stage 2 construction occurs simultaneously;
- The shortest distance between construction activities on site and the closest noise sensitive receivers;
- All plant is operational concurrently; and
- There is an adverse source to receiver wind speed of 3 m/s.

It is understood that fill material is to be sourced from dredging activities and imported to site from various external earthworks projects.

Fill material will be transported to site by road, rail and barge. A single train per day will transport fill material to the site during the Major Project (Stage 1) construction phase. The impact on nearby receivers of the road and rail movements associated with the delivery of fill material has been included in the assessment of construction noise, and found to comply with the construction noise management levels at the closest residential receivers.

AECOM has been advised that, with the exception of dredging activities, construction activities will not operate outside of standard daytime working hours. The assessment for the evening and night time periods therefore assumes that only the dredging ship is operational.

A detailed construction programme has not yet been confirmed and the predicted noise impact may change if the assumed construction scenario is altered.

Plant included in the assessment is shown in Table 19. The number of plant shown indicates the plant included for each Stage (i.e two lots of plant have been included in the modelling to ensure assessment of possible Stage 1 and Stage 2 concurrent construction activity).

Exceptions to this are as follows:

- Road and rail movements associated with delivery of fill material will not increase for concurrent construction activity, as this only occurs during Stage 1; and
- The dredging plant associated with the night time works has not been doubled as it is likely that two dredging barges is the worst case.

Table 19 – Assumed construction equipment for each Stage and indicative sound power levels

Activity	Plant	% On-time in typical 15 min period	Number of Plant Items/Movements for each Stage	L_w dB	L_w per metre dB
Reclamation and Berth Construction	Trucks – Delivering Fill Material	20	6	107	77
	Train – Delivering Fill Material	100	1	142	106
	Asphalt Paver	20	1 (2 movements)	110	83
	12T Vibratory Roller	100	1 (20 movements)	120	99
	Graders	100	2 (15 movements each)	111	92
	40T Excavator	100	1	115	-
	Front End Loaders	60	2 (3 movements each)	114	86
	D9 Bulldozers	100	2	121	-
	Sheet Piling	40 (impact time)	3	120	-
	110T Rotary Bore Piling Rig	100	2	121	-
	Grab Hopper Dredge Ship	100	2	120	-

The impact of construction noise at all nearby noise sensitive receivers is predicted to comply with the daytime and night time noise management levels as presented in Table 4 and Table 5. This does not include the impact of construction at the South Yard.

The layout of the modelling scenarios and tabulated results showing the predicted noise impact at a large number of representative receivers are included in Appendix C.

4.3.1 South Yard Construction Works

The noise impact resulting from a typical construction scenario for the addition of one rail siding to an existing stabling yard has been assessed.

It has been assumed that construction activities will take place during the day time period only. The plant included in the construction assessment is shown in Table 20. The L_w of the plant included in the assessment has been updated in order to be consistent with data published in the UK DEFRA document '*Update of noise database for prediction of noise on construction and open sites*'.

It is expected that the construction works in the South Yard will take approximately 6 months. The noisiest activities associated with the works (demolition saws) are expected to persist for only a fraction of this period.

Table 20 Assumed construction equipment and indicative sound power levels

Activity	Plant	% On-time in typical 15 min period	Number of Plant Items/Movements	L_w dB
Siding Construction	30T Excavator	100	2	115
	25T Dump Truck	100	2	117
	D9 Dozer	100	1	121
	Rail Tamping Machine	100	1	100
	30T Mobile Crane	100	1	102
	Demolition Saw	100	1	121

The predicted noise impact at nearby noise sensitive receivers resulting from construction activities at the South Yard is shown in Table 21. This assumes no noise mitigation at the construction site.

Table 21 Predicted Stabling Yard Construction Noise Levels

Receivers	Daytime Construction Noise Management Levels dB(A)	Conditions	Predicted Noise Levels L_{Aeq} dB(A)	Predicted Noise Levels with Saw Mitigation L_{Aeq} dB(A)
Wentworth Road	57	Neutral	**68 (11)**	**63 (6)**
		Wind 3 m/s	**70 (13)**	**65 (8)**
Military Road	57	Neutral	**63 (6)**	**57**
		Wind 3 m/s	**65 (8)**	**60 (3)**
Jubilee Road	49	Neutral	**50 (1)**	**48**
		Wind 3 m/s	**52 (3)**	**51 (2)**

At the South Yard, the daytime construction noise management level is predicted to be exceeded by up to 13 dB(A) at the closest residential receivers (Wentworth Road) under adverse weather conditions, and by up to 11 dB(A) under neutral conditions. This is a worst case assessment i.e. the shortest distance between source and receivers and the noisiest activities occurring concurrently.

Given the large predicted exceedance of the construction noise criteria, noise mitigation options have been investigated.

4.3.2 South Yard Construction Noise Mitigation

The principal contributor to the exceedance of the construction noise criteria is the use of demolition saws and mobile plant, such as dump trucks and bulldozers.

It is likely that demolition saws will be used for only a fraction of the construction period. Furthermore, construction of a suitable temporary noise barrier around the site where saws are in use would reduce the predicted noise impact by up to 5 dB(A), reducing the worst predicted exceedance under adverse weather conditions to 8 dB(A) (6 dB(A) in neutral conditions).

Furthermore, the construction work in the South Yard for Major Project is likely to be of limited duration, approximately six months, and saws will be used for a fraction of this time.

PKPC are happy to commit to using appropriately constructed temporary noise barriers wherever feasible and reasonable to mitigate the construction noise from the South Yard works.

Noise from dump trucks and bulldozers is harder to mitigate due to their mobile nature.

It is recommended that feasible and reasonable mitigation measures are reviewed and incorporated into the construction noise and vibration management plan.

4.3.3 Cumulative Construction Noise Impact

The cumulative construction noise impact at the worst affected noise sensitive receivers, assuming that Stage 1 and Stage 2 berth construction works occur concurrently with the Stage 1 South Yard construction works, has been assessed.

The predicted noise impact as a result of the concurrent construction activities is the same as with the South Yard construction operating independently. The construction activities at the South Yard are the dominant source of construction noise.

4.3.4 Construction Road Traffic Noise Assessment

It is understood that the road traffic associated with the construction phase will add an additional 23 heavy vehicles per hour during the peak flow period (Appendix I of EIA). This is representative of the worst case construction traffic movements during Stage 1 of the construction. For later construction stages the number of truck movements associated with fill delivery will drop as the fill material will be transported by rail or barge. All of this additional traffic will pass the worst affected receivers near Lake Avenue (adjacent to Five Island Road) and along Gladstone Avenue (adjacent to Masters Road). The predicted increase in noise level at the worst affected receivers resulting from construction traffic is shown in Table 22.

Table 22 Construction Traffic - predicted increase in noise levels

Major Project		
2016 'Do Nothing' Heavy Vehicle Traffic Flow (peak hour)	Maximum Peak Hourly Construction Traffic Flow	Predicted Increase in Noise Levels dB(A)
AM		
258	23	0.4
PM		
228	23	0.4

The increase in noise levels resulting from construction traffic is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate at the worst affected receivers (i.e not more than existing level +2 dB(A)). Road traffic noise mitigation measures are discussed in Section 5.6.

4.3.5 Construction Vibration Assessment

Construction activities that can generate high levels of vibration include:

1. General earthworks;
2. Ground compaction (e.g. vibratory rollers);
3. Re-sleepering;
4. Rail tamping and dynamic track stabilization; and
5. Spoil removal via road.

This construction vibration assessment focuses on ground compaction, rail tamping or dynamic track stabilization as these activities are significantly more vibration intensive than earthworks and spoil removal.

Structural damage

Table 23 lists the estimated setbacks for these activities which are likely to be required to ensure that a peak particle velocity of 5 mm/s (residential) and 10mm/s (commercial) is not exceeded.

Table 23 – Required setbacks to limit PPVs to within 5 mm/s

Activity	Required setback to limit PPV to less 5 mm/s (Residential)	Required setback to limit PPV to less 5 mm/s (Commercial)
2-tonne vibratory roller	5 m	3 m
10-tonne vibratory roller	20 m	12 m
Rail tamping	5 m	3 m
Dynamic track stabilization	10 m	6 m

The effects of blasting and controlling PPVs by limiting the maximum instantaneous charges (MICs) are discussed in the blasting assessment (Section 4.7).

The required minimum setbacks indicate that cosmetic damage to residential receivers due to the proposed works is unlikely.

It is recommended that attended vibration monitoring is undertaken in situations where a plant is predicted to exceed the applicable vibration criteria (i.e. the separation of the plant to critical receivers is less than the required setbacks in Table 23). Attended measurements will allow for establishing site rules and for determining safe working distances.

The estimated setbacks must be considered as preliminary since they depend on geological and other factors. This preliminary study should be refined following early works once site-rules and buffer distances are established.

Human comfort – Tactile vibration

In general the human response to vibration is found to be a complex phenomenon. There are wide variations in vibration tolerance of humans and accordingly acceptance goals for human comfort are hard to define and quantify. Acceptable values of human exposure to vibration are primarily dependent on the activity taking place in the occupied space (e.g. workshop, office, or residence) and the character of vibration (e.g. continuous or intermittent). In addition, specific values are dependent upon social and cultural factors, psychological attitudes, expected interference with privacy, and ultimately the individual's perceptibility.

As the closest residential receivers are located approximately 100m from the South Yard, it is deemed very unlikely that residential receivers will be adversely affected by construction activities. Receivers located closer to the works may require careful management.

The mitigation methods are likely to include but not restricted to:

1. Source controls
    a. Use of less noise and vibration intensive equipment;
    b. Respite periods;
2. Management methods
    a. Community consultation;
    b. Complaint response;
    c. Site layout;
    d. Avoiding work during sensitive time periods (e.g. night work);
    e. Noise and vibration logging and attended measurements;
    f. Training;
3. Path controls
    a. Noise enclosures;
    b. Avoid vibration intensive works in a concentrated area and try to work over a large area in order to reduce maximum vibration dose values.

The mitigation measures will be further developed in a "*Construction Noise and Vibration Management Plan*" (CNVMP) framework that takes into account relevant documents including DECCW's "*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects*", "*Interim Construction Noise Guideline*" and TIDC's "*Construction Noise Strategy (Rail Projects)*" and the Director General's Requirements as specified by the Department of Planning.

4.3.5.1 Human comfort – Ground-borne noise

Vibration generated by compacting enters buildings via the ground. This causes the floors, walls and ceilings to vibrate and to radiate noise. This noise is commonly referred to as structure- or ground-borne noise or regenerated noise. Ground-borne noise is low frequency and if audible is perceived as a 'rumble'.

In general, ground-borne noise level values are relevant only where they are higher than the airborne noise from the construction activities. Regenerated noise levels will be masked by air-borne noise associated with the construction activities.

The mitigation measures will be further developed in a CNVMP framework that takes into account relevant documents including DECCW's "*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects*", "*Interim Construction Noise Guideline*" and TIDC's "*Construction Noise Strategy (Rail Projects)*" and the Director General's Requirements as specified by the Department of Planning.

4.4 Operational noise and vibration assessment

An assessment of operational noise impact from the Major Project and the Concept Plan has been carried out. Both assessments are based on likely operational scenarios that were arrived at following discussion with AECOM maritime engineers, PKPC and DECCW.

The impact assessed in each case is based on the 'worst case' scenario i.e. the shortest likely distance between source and receivers. AECOM has been advised that the facility is to operate 24 hours a day, but that operations will be less extensive during the night-time period. For assessment purposes daytime, evening and night time operations have been assumed to be the same. This ensures that the worst case 15-minute will be assessed for each time period.

Where modelling has predicted exceedance of the relevant project specific noise goal, noise mitigation options have been investigated. At this stage a detailed mitigation solution has not been designed as this will form a part of the overall detailed design phase. The effect of mitigation has been demonstrated in principal to indicate that appropriate mitigation can reduce the predicted noise impact to an acceptable level.

On Site Rail Noise

The impact at noise sensitive receivers resulting from Major Project and Concept Plan operations at the proposed South Yard has been included in the operational assessment for both Major Project and Concept Plan.

The assessment has conservatively assumed that the maximum capacity operating scenario may occur at any point during the day, evening or night time.

The maximum capacity operating scenario for the Major Project is as follows:

- One train in entry holding siding for multi-purpose berth (one locomotive - South Yard);
- One train unloading at the multi-purpose berth (one locomotive moving).

The maximum capacity operating scenario for the Concept Plan assumes the Major Project operational scenario with the following additions:

- One train in entry holding siding for container berth (two locomotives stationary - South Yard);
- One train in exit holding siding for container berth (two locomotives moving - South Yard);
- One train unloading at container berth (two stationary locomotives at south end of container terminal).

It is understood that for the Major Project up to four trains per day will use the South Stabling Yard. The four trains will likely be split so that three operate during the day time and evening and one operates during the night time period.

For the Concept Plan operations an additional seventeen trains per day will be added to the Major Project operations. The seventeen trains will likely be split so that 12 operate during the day and 5 during the night time period.

Exact details of future rail infrastructure design and layout is not known at this stage. The local rail infrastructure is being reviewed in 2010 and changes in site layout may increase or decrease the predicted noise impact at noise sensitive receivers.

At this stage the proposed operations at the South Yard are indicative only and have been assessed based on a likely operational scenario. It is important to consider that the proposed Stabling Yard site is currently operational. The South Yard comprises eleven sidings and is currently operated by Pacific National on a 24/7 basis.

The predicted noise impact resulting from rail activities associated with the Major Project and Concept Plan has been assessed as part of the overall operational scenario.

4.4.1 Major Project

The noise impact at noise sensitive receivers resulting from operations associated with the Major Project has been assessed. Should operational activities vary from those used for modelling purposes it is likely that the assessment will change.

Operational activity associated with the Major Project relates to the operation of one berth at the multi-purpose terminal and can be broadly split into two categories:

Materials Exporting -

- Export material will arrive by train and be unloaded directly to a mobile conveyor system that feeds stockpiles.
- Material from the stockpiles is transferred by wheeled loader onto another mobile conveyor system which feeds directly to the ships hold.

Materials Importing -

- Material is unloaded by ship cranes/occasional quayside crane and loaded directly into either:
  - o Hoppers which feed directly into trucks (up to 21 two way peak hour movements)
  - o A mobile hopper connected to a conveyor system taking materials directly to the cement production facility.
- Finished product from the cement plant has been assumed to leave site via truck.

Operational activities within the cement production facility building envelope have not been assessed. This facility will be subject to a separate planning approval process which will include an acoustic assessment.

It has been advised that the moored ships, operating using only auxiliary power units, will not be a significant source of noise. Ventilation systems associated with the engine rooms and crew quarters will result in some noise but this is considered to be insignificant when considered alongside other port activities and is unlikely to run at night.

Sound power levels (L_W) for the plant included in the Major Project operational noise model are shown in Table 24.

Table 24 Major Project - Plant sound power levels (L_w), dB

Plant/Operation	Octave Band Sound Power Levels (L_w)						
	63 Hz	*125Hz*	*250Hz*	*500Hz*	*1kHz*	*2kHz*	*4kHz*
Truck moving	80	90	96	101	101	101	97
Trucks filling (gravel)	84	86	93	90	89	88	85
Conveyor belt	90	88	81	93	87	84	75
Train Idling	107	104	101	98	93	89	88
Train Moving	126	113	99	91	86	83	80
Stockpile Feeder	111	104	97	96	93	89	87
Quayside Crane	98	97	91	92	91	91	82
Ship Crane	100	95	98	94	84	84	74

Moving and linear noise sources have been modelled as line sources, with the sound power expressed as power per metre. This has been derived from the sound power of the plant and adjusted to account for:

- The number of plant items traversing the line source path in the assessment period;
- The proportion of the assessment period that the source is operational/moving; and
- The length of the line source.

The adjustment has been applied using the following equation:

$$SWL_{metre} = SWL_{truck} + (10 \log_{10} (t_{event}/t_{assessment}) + (10 \log_{10} n_{sources}) – (10 \log_{10} l_{line}))$$

Where:

- SWL = Sound Power in dB (or dB(A))
- tevent = duration of the event in seconds (s)
- tassessment = duration of the assessment period in seconds (s)
- nsources = number of sources
- lline = length of the line source in metres (m)

The purpose of the adjustment is to capture all the noise energy from all the noise events during the assessment period (including any breaks in activity if appropriate) and spread the energy equally over the length of the line source/vehicle route.

The noise data used in the assessment are from the AECOM in-house noise database and the UK DEFRA document '*Update of noise database for prediction of noise on construction and open sites*'.

Plant details as used in the SoundPLAN model are summarised in Table 25.

Table 25 – Major Project - Operational plant data used for modelling purposes

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
Major Project	Trucks on site access road	Line	3.6	10	5	77 per metre
	Trucks accessing/leaving Major Project area	Line	3.6	20	4	76 per metre
	Trucks direct filling from ship hoppers	Point	4.6	100	2	97
	Trucks accessing/leaving cement plant	Line	3.6	10	3	84 per metre
	Cement plant conveyor system	Line	3.5	100	1	75 per metre
	Train Idling	Point	4.5	100	1	103
	Train Unloading	Line	4.5	100	1	106 per metre
	Stockpile Conveyor 1	Line	Varies – 0-5m	100	1	74 per metre
	Stockpile Conveyor 2	Line	Varies - 3.5 – 22m	100	1	80 per metre
	Stockpile Conveyor 3	Line	3.5	100	1	77 per metre
	Stockpile Conveyor 4	Line	Varies 3.5 – 23.5	100	1	80 per metre

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
	Stockpiler Feeders	Point	3.5	100	2	112
	Mobile Quayside Crane	Point	3.5	100	1	102
	Ship Crane	Point	25	100	3	104

The predicted noise levels at sensitive receivers in Sensitive Catchment Areas 1 and 2, as a result of operations associated with the Major Project have been assessed.

No Mitigation

There are predicted 1 dB(A) exceedances of the daytime project specific noise goals at the three receivers in SCA1 situated closest to the South Yard. During the evening and night time periods there are predicted 4 - 11 dB(A) exceedances at the receivers on Wentworth Road in SCA1, which is situated directly opposite the South Yard. These exceedances are entirely due to an idling locomotive at the southern end of the South Yard.

There is no predicted exceedance of the daytime or evening project specific noise goals in SCA2 as a result of Major Project operations.

There is a predicted 4 dB(A) exceedance of the night time project specific noise goal at No 1 Jubilee Road and a predicted 1 dB(A) exceedance of the night time project specific noise goal at No 4 Jubilee Road in SCA2. As with predicted exceedances in SCA1, the predicted exceedances in SCA2 are entirely due to an idling locomotive at the southern end of the South Yard.

6 m High Acoustic Barrier

The SoundPLAN model was rerun with a 6m high acoustic barrier between the locomotive at the southern end of the South Yard and the noise sensitive receivers. With the barrier in place the predicted noise levels at noise sensitive receivers in both SCA1 and SCA2 complied with the project specific noise goals for all time periods.

There is no predicted exceedance of the noise management criteria for commercial and industrial premises as a result of Major Project operations.

It is likely that appropriately constructed mitigation in the South Yard will result in compliance with the project specific noise goals at noise sensitive receivers for all time periods.

Tabulated results (Table 40 - Table 43) showing the predicted noise impact at a wide range of representative receivers in SCA1 and SCA2, both with and without mitigation, are included in Appendix D. Predicted noise levels are shown graphically on noise contour plots in Appendix A.

4.4.2 Concept Plan

The impact at noise sensitive receivers resulting from operations associated with the overall Concept Plan has been assessed.

In addition to the operation of one berth for the multi-purpose terminal associated with the Major Project, the operations associated with the Concept Plan include the balance of the multi-purpose terminal (two additional berths relocated from Port Kembla Gateway) and the container terminal (4 berths). This gives a total of seven berths for Concept Plan operations.

Operations at the multi-purpose terminal will comprise offloading using ship and occasional quayside cranes, transportation of offloaded goods to internal or external storage areas by forklift and then transportation of goods off site by truck.

Operational activity associated with the Container Terminal can be broadly summarised as follows:

Goods Importing:

- Full containers arriving on ship are unloaded by quayside rail mounted quayside cranes. Containers are then transferred across the terminal by shuttle carriers and placed in stacks by rail mounted gantry cranes (RMGs).
- The stacks are transferred onto waiting trains by RMGs.

Goods exporting:

- Trains arriving on site with full/empty containers are unloaded by the RMGs. Containers are then transferred either directly to be loaded onto ship or to a 'buffer' stack area by shuttle carrier.
- Containers transferred to the buffer zone are stacked/unstacked by RMG.

It is understood that approximately 90% of containers will be moved by rail and 10% by road.

Sound power levels (L_W) for the plant included in the Concept Plan operational noise model are shown in Table 26. These activities are in addition to the activities specified in Table 25, which were also included in the modelling assessment.

Table 26 Concept Plan - Plant sound power levels (L_w), dB

Plant/Operation	Octave Band Sound Power Levels (Lw)						
	63 Hz	*125Hz*	*250Hz*	*500Hz*	*1kHz*	*2kHz*	*4kHz*
Multi-purpose Terminal							
Truck Moving	80	90	96	101	101	101	97
Forklift moving/loading	101	98	98	111	93	90	86
Quayside Crane	98	97	91	92	91	91	82
Ship mounted cranes	100	95	98	94	84	84	74
Container Terminal							
Rail Mounted Gantry Cranes	110	107	103	105	101	97	96
Train Moving – Class 81 Locomotive	127	114	101	92	88	85	82
Train Idling – Class 81 locomotive	104	107	98	98	98	91	79
Mobile Stackers	110	107	103	105	101	97	96
Quayside Crane	98	97	91	92	91	91	82
Truck Moving	80	90	96	101	101	101	97
Forklift moving/loading	101	98	98	111	93	90	86

The linear noise source adjustment outlined in Section 4.4.1 has also been applied to linear noise sources included as a part of the Concept Plan assessment.

The noise data used in the assessment are from the AECOM in-house noise database and the UK DEFRA document '*Update of noise database for prediction of noise on construction and open sites*'.

Plant details as used in the SoundPLAN model are summarised in Table 27.

Table 27 – Concept Plan - Operational plant data used for modelling purposes

Project Phase	Plant	Source Type	Source Height (mAOD)	% On-time in typical 15 min period	Number of plant	L_W dB(A)
Multi-purpose Terminal	Truck on site access road	Line	3.6	10	5 per 15 mins	107 per metre
	Trucks accessing warehousing	Line	3.6	10	3 per 15 mins	107 per metre
	Trucks accessing outside storage areas	Point	3.6	10	2 per 15 mins	107 per metre
	Forklift moving offloaded goods	Line	2	10-20	5 (each with 3 movements in 15 mins)	82 per metre
	Forklift loading goods	Line	2	5	2 (each with 3 movements in 15 mins)	82 per metre
	Quayside Crane	Point	3.5	100	1	102
	Ship mounted cranes	Point	25	100	4	104
	Train Moving	Line	4.5	25	1	93per metre
Container Terminal	Rail Mounted Gantry Cranes	Point	2	100	10	115
	Quayside Cranes (rail Mounted)	Point	2	100	8	115
	Mobile Stackers	Line	3	5	20	84 per metre
	Train Moving	Line	4.5	25	2	93 per metre
	Train Idling	Point	4.5	100	4	103
	Trucks Accessing Site	Line	3.6	10	5	76 per metre
	Forklift Loading Goods	Line	2	10	2 (each with 3 movements per 15 min)	82 per metre

The predicted noise levels at sensitive receivers in Sensitive Catchment Areas 1 and 2, as a result of operations associated with the Concept Plan have been assessed.

No Mitigation

With no mitigation in place, the noise impact at receivers in SCA1 arising from Concept Plan operations is predicted to exceed the project specific noise goals at some noise sensitive receivers during all time periods. There are predicted exceedances of the daytime project specific noise goal of up to 5 dB(A) at the worst affected receivers. There are predicted exceedances of the evening and night time project specific noise goals of up to 15 dB(A).

With no mitigation in place, the noise impact at receivers in SCA2 arising from Concept Plan operations is predicted to exceed the project specific noise goals at some noise sensitive receivers during the daytime and night time periods. There is a predicted exceedance of the daytime project specific noise goal of 2 dB(A) at one receiver. There are predicted exceedances of the night time project specific noise goals by up to 8 dB(A).

The dominant source of noise at receivers in both SCA1 and SCA2 is locomotives idling in the South Yard and moving from the South Yard to the container terminal.

6m Noise Barrier

The model was re-run with a 6m high noise barrier between noise sources in the South Yard and the noise sensitive receivers. This resulted in compliance with the project specific noise goals for daytime in SCA1 and for daytime and evening in SCA2.

With a 6m high barrier in the South Yard there were predicted exceedances of the evening and night time project specific noise goals by up to 7 dB(A) at noise sensitive receivers in SCA 1. There were predicted exceedances of the night time project specific noise goal by up to 5 dB(A) at noise sensitive receivers in SCA2.

Acoustic Shed

The model was re-run with an acoustic shed constructed in the South Stabling Yard at the point closest to noise sensitive receivers and enclosing locomotives idling at this end of the yard. This assessment assumed that the shed walls and ceiling had an Rw of 38 and 50% of the internal surface was treated with a material with an absorption coefficient of 0.6. This resulted in compliance with the project specific noise goals for daytime in SCA1 and for daytime and evening in SCA2 and further reduced predicted noise levels during other time periods.

There were predicted exceedances of the evening and night time project specific noise goals by up to 2 dB(A) at noise sensitive receivers in SCA1. There were predicted exceedances of the night time project specific noise goals by up to 4 dB(A) at noise sensitive receivers in SCA2.

The shed provides better noise mitigation than the barrier due to being completely enclosed.

The magnitude and number of exceedances is discussed in detail in Section 5.4.2.

The extent of the modelled exceedances is shown on the *Concept Plan – Night* noise contour plan included in Appendix A.

Please note that in each case the lower end of the dB(A) scale for the contour plots is set to the minimum criteria for that period.

It is important to note that the assessment represents the results of modelling a worst case scenario and assumes both terminals (all seven berths) are working at maximum capacity at the same time with peak traffic flow rates for each terminal occurring coincidentally while there is an f-class temperature inversion in effect. Furthermore, with mitigation in place in the South Yard, the predicted exceedances are not the result of any large individual impacts but rather the cumulative impact of a large number of relatively low noise impacts.

It should also be noted that existing rail operations in the South Yard take place with no mitigation in place. It is considered likely that any mitigation put in place by PKPC will improve the existing noise environment at nearby noise sensitive receivers.

There are no predicted exceedances of the noise management criteria for commercial and industrial premises as a result of Concept Plan operations.

Tabulated results showing the predicted noise impact at a wide range of representative receivers in SCA1 and SCA2 both with and without mitigation are included in Appendix D.

4.5 Sleep disturbance assessment

An assessment against the INP Application Notes sleep disturbance criteria, and with consideration of the ECRTN sleep disturbance research, has been undertaken. The assessment is applicable to the Concept Plan and Major Project as it relates to loud noises which would be common to all stages of development, such as metal clangs and the sounding of train horns.

The INP Application Notes state the following:

> *"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development.*
>
> *DECC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, DECC recognised that current sleep disturbance criterion of an L_{A1}, (1 minute) not exceeding the L_{A90}, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DECC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*
>
> *The detailed analysis should cover the maximum noise level or L_{A1}, (1 minute), that is, the extent to which the maximum noise level exceeds background noise level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN."*

This indicates that where the L_{A1} (1 minute) exceeds the background noise level L_{A90} (15 minute) by more than 15 dB(A) further analysis is recommended.

The ECRTN concludes as a result of the review of research that:

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

An open bedroom window generally provides an approximate attenuation of about 10 dB(A), which, given that internal levels below 50-55 dB(A) are unlikely to cause awakening reactions, means external levels of 60-65 dB(A) are unlikely to cause awakening reactions.

Metal 'clangs' and noise from train horns are likely to provide the greatest L_{A1} values.

The predicted noise impact of metal 'clangs' from the 'non-weather sensitive' container stacks is shown in Table 28.

Table 28 Predicted Sleep Disturbance – container 'clang'

Receiver	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted impact at receivers L_{max} dB(A)	Predicted Exceedance dB(A)
5-7 Military Road	45	60	50	-
15 Wentworth Avenue	45	60	47	-
1 Jubilee Road	37	52	47	-

The assessment of the L_{max} associated with container clang shows that the predicted noise impact at all nearby noise sensitive receivers is below the sleep disturbance screening criteria.

Train horns are currently sounded at night in three locations within the Port Kembla balloon loop (which includes the South Yard). Horns are currently used as trains cross Old Port Road, Foreshore Road and as trains re-join the main line at Flinders Street Bridge.

The assessment of noise impact resulting from the use of train horns must consider both train horn 'toots' and 'blasts'. A horn 'toot' is generally considered to be less than a second in duration, while a horn 'blast' may persist for 2-3 seconds.

The predicted noise impact at the worst affected noise sensitive receivers resulting from train horn blasts was up to 27 dB(A) above the INP sleep disturbance screening criteria (at 1 Jubilee Road). It is likely that an exceedance of this magnitude would result in complaint from affected residents. Given the lack of complaint associated with current operations it is considered unlikely that this level of train horn noise is currently occurring, which suggests that shorter duration horn toots is the existing operating procedure.

PKPC are happy to commit to the use of short duration horn 'toots' being included in the noise management plan for the Outer Harbour.

The predicted noise impact at representative worst case residential receivers resulting from a train horn 'toot' at each of the current horn sounding locations is presented in Table 29.

Table 29 Predicted noise impact – Sleep Disturbance – Train Horn 'toots'

Horn Sounding Location	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted impact at receivers L_{max} dB(A)	Predicted Exceedance dB(A)
Receiver at 5-7 Military Road (SCA1)				
Old Port Road	45	60	62	2
Foreshore Road			62	2
Flinders Street Bridge			48	-
Receiver at 15 Wentworth Avenue (SCA1)				
Old Port Road	45	60	60	-
Foreshore Road			59	-
Flinders Street Bridge			50	-
Receiver at 1 Jubilee Road (SCA2)				
Old Port Road	37	52	59	7
Foreshore Road			50	-
Flinders Street Bridge			37	-

The predicted noise impact in Table 29 indicates that the use of short duration horn toots at Old Port Road and Foreshore Road, will exceed the sleep disturbance screening criteria by up to 2 dB(A) at the receiver located at 5-7 Military Road. The predicted exceedance at 1 Jubilee Road is 7 dB(A) due to the reduced night time noise management level at this receiver. These are the worst affected receivers included in the modelling.

It is important to consider that the ECRTN concludes that:

'Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'

The predicted external impact at No 1 Jubilee Road is 59 dB(A), giving a likely internal impact (with an open window) of approximately 49 dB(A). This is unlikely to result in waking reactions, which is supported by the fact that train horns are currently sounded at this location without complaint.

The number of existing and proposed night time train horn 'toots' is shown in Table 30. Details of existing train horn use were provided by PKPC as a likely worst case. Current operation on the Port Kembla balloon loop results in up to seven horn soundings per night. Rail movements associated with the Major Project may add up to two additional horn soundings per night. It should be noted that one of the proposed additional horn soundings is located at Flinders Street Bridge and the predicted noise impact resulting from horn use at that location complies with the sleep disturbance screening criteria. The Foreshore Road crossing will not be used for Major Project operations.

The predicted impact from train horn use associated with the Concept Plan will be the same for each event as shown in Table 29. However, as the number of train movements at night is likely to increase from one (Major

Project) to five (Concept Plan), it is likely that the number of times the train horns are sounded will increase for Concept Plan operations.

Table 30 Night time train horn use details – existing and proposed

Train	Night Arrival/Departure time (10pm – 7am)	Horn Sound	Location	Number of horn soundings	Existing
Existing Copper concentrate train	4-6am	Yes	Old Port Road	3	Y
Existing Steel/General Freight Shunting Movements	10pm-12am	Yes	Old Port Road	2	Y
Existing Steel/General Freight Shunting Movements	10pm-12am	Yes	Foreshore Road	1	Y
Existing Steel/General Freight Departure	Midnight	Yes	Near Flinders St Bridge	1	Y
Proposed Major Project PKPC	10pm-7am	Yes	Near Flinders St Bridge	1	N
Proposed Major Project PKPC	10pm-7am	Yes	Old Port Road	1	N

4.6 Road traffic noise assessment

The road traffic assessment has provided data on the number of vehicle movements associated with the site. Figures for 2016 without the development and with the development (Major Project) and 2036 without the development and with the development (Concept Plan) have been assessed. The formula used to calculate the increase in noise level is given below:

$$\text{Increase in Noise Level} = 10\log_{10} (\text{Future Vehicles/Existing Vehicles})$$

One hundred percent of the operational traffic generated by the Major Project and Concept Plan will travel along Flinders Street and Five Islands Road towards the Southern Freeway. The most potentially affected receivers will be located at Cringila, situated around Lake Avenue, adjacent to Five Islands Road (Figure 2) and along Gladstone Avenue, adjacent to Masters Road (Figure 3).

The predicted increase in noise level resulting from the increase in heavy vehicle movements associated with the Major Project and Concept Plan is shown in Table 31.

The maximum predicted increase in noise level resulting from increased traffic flow associated with the Major Project is 0.3 dB(A).

The maximum predicted increase in noise level resulting from increased traffic flow associated with the Concept Plan is 0.6 dB(A).

While the existing road traffic noise levels exceed the recommended criteria in ECRTN, the additional traffic generated by the Major Project and Concept Plan are predicted to increase existing noise levels by less than the 2 dB(A) guideline provided in ECRTN.

Feasible and reasonable road traffic noise mitigation measures are discussed in Section 5.6

Table 31 Predicted Traffic Noise Level Increases

	Major Project			Concept Plan		
	2016 'Do Nothing' Heavy Vehicle Traffic Flows	2016 with Development Heavy Vehicle Traffic Flows	Predicted Increase in Noise Levels dB(A)	2036 'Do Nothing' Heavy Vehicle Traffic Flows	2036 with Development Heavy Vehicle Traffic Flows	Predicted Increase in Noise Levels dB(A)
	AM					
Cringila Receivers	258	272	0.2	315	356	0.5
Masters Road Receivers	200	209	0.2	245	265	0.3
	PM					
Cringila Receivers	228	242	0.3	275	315	0.6
Masters Road Receivers	217	225	0.2	243	263	0.3

4.7 Blasting and Operational Vibration assessment

4.7.1 Blasting Assessment

The blasting impact at nearby residential and industrial/commercial receivers has been assessed. As no trial blasts have yet taken place the assessment uses generic values recommended in *AS 2187.2:2006 Explosives – Storage and use – Use of explosives*. The values used are considered to be conservative.

The ground vibration arriving at a point remote from a blast is a function of many factors, including:

- charge mass of explosive per delay;
- explosive type and coupling;
- distance from blast;
- ground transmission characteristics;
- firing sequence;
- origin of the rock mass;
- presence of bedding and joints; and
- degree and depth of weathering of surface at the point.

Some of these factors are difficult to accurately quantify without specific site knowledge. Many site factors will affect the transmission of vibration through the ground, the most accurate predication graph for a site will be that generated from vibration measurements taken at the site. However, in the absence of such site data, ground vibration can be estimated using the following equation:

$$PPV = K_g \left(\frac{R}{\sqrt{Q}} \right)^{-B}$$

where: PPV = peak particle velocity (mm/s)

Q = Maximum instantaneous charge(kg)

R = distance (m)

K_g, B = Constants related to site and rock properties for estimation purposes

Ground vibration levels depend on the maximum instantaneous charge (effective charge weight per delay), and not the total charge weight, provided the effective delay interval is appropriate.

Constants of K_g 1140 and 5000 and B 1.6 will provide an estimate of vibration levels in 'average' conditions. In practice, due to variations in ground conditions and other factors, the resulting ground vibration levels can vary from two fifths to four times that estimated. In cases where the site parameters have not been reliably determined from prior experience, advice should be obtained from suitably qualified and experienced persons, who may recommend initial trial blasts with conservative charge quantities.

Predicted vibration levels at locations in SCA 1 and SCA 2 are shown in Table 32 and Table 33, respectively.

Table 32 – Predicted vibration at Sensitive Catchment Area 1with a K_g value = 5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)							
		Criteria	1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
5-7 Military Road	630	5	0.2	0.6	1.0	1.4	1.8	2.5	4.4
9 Military Road	635		0.2	0.6	1.0	1.4	1.8	2.5	4.3
11 Military Road	645		0.2	0.6	1.0	1.4	1.8	2.4	4.2
15 Military Road	650		0.2	0.6	1.0	1.4	1.7	2.4	4.2
3 Wentworth Rd	715		0.1	0.5	0.9	1.2	1.5	2.1	3.6
5 Wentworth Rd	705		0.1	0.5	0.9	1.2	1.5	2.1	3.7
7 Wentworth Rd	695		0.1	0.5	0.9	1.2	1.6	2.2	3.8
9 Wentworth Rd	690		0.1	0.5	0.9	1.3	1.6	2.2	3.8
11 Wentworth Road	690		0.1	0.5	0.9	1.3	1.6	2.2	3.8
13 Wentworth Road	700		0.1	0.5	0.9	1.2	1.5	2.1	3.7
15 Wentworth Road	705		0.1	0.5	0.9	1.2	1.5	2.1	3.7
17 Wentworth Road	710		0.1	0.5	0.9	1.2	1.5	2.1	3.6
19 Wentworth Road	720		0.1	0.5	0.8	1.2	1.5	2.0	3.5
1 Third Avenue	1305		0.1	0.2	0.3	0.5	0.6	0.8	1.4
2 Third Avenue	1325		0.1	0.2	0.3	0.4	0.6	0.8	1.3
160 Wentworth Road	1315		0.1	0.2	0.3	0.4	0.6	0.8	1.4

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)							
		Criteria	1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
2 Reservoir Street	1305		0.1	0.2	0.3	0.5	0.6	0.8	1.4

Table 33 – Predicted vibration at Sensitive Catchment Area 2 with a K_g =5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)							
		Criteria	1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
1 Jubilee Road	825	5	0.1	0.4	0.7	0.9	1.2	1.6	2.9
2 Jubilee Road	840		0.1	0.4	0.7	0.9	1.2	1.6	2.8
3 Jubilee Road	830		0.1	0.4	0.7	0.9	1.2	1.6	2.8
4Jubilee Road	855		0.1	0.4	0.6	0.9	1.1	1.5	2.7
5 Jubilee Road	840		0.1	0.4	0.7	0.9	1.2	1.6	2.8
6 Jubilee Road	865		0.1	0.4	0.6	0.9	1.1	1.5	2.6
7 Jubilee Road	845		0.1	0.4	0.7	0.9	1.1	1.6	2.7
8 Jubilee Road	870		0.1	0.4	0.6	0.9	1.1	1.5	2.6
9 Jubilee Road	850		0.1	0.4	0.6	0.9	1.1	1.6	2.7
10 Jubilee Road	875		0.1	0.4	0.6	0.9	1.1	1.5	2.6
11 Jubilee Road	860		0.1	0.4	0.6	0.9	1.1	1.5	2.7
12 Jubilee Road	880		0.1	0.4	0.6	0.8	1.1	1.5	2.6
14 Jubilee Road	885		0.1	0.3	0.6	0.8	1.1	1.5	2.5
16 Jubilee Road	890		0.1	0.3	0.6	0.8	1.0	1.5	2.5
14 Horne Street	850		0.1	0.4	0.6	0.9	1.1	1.6	2.7
16 Horne Street	870		0.1	0.4	0.6	0.9	1.1	1.5	2.6
18 Horne Street	880		0.1	0.4	0.6	0.8	1.1	1.5	2.6

The vibration levels predicted for receivers in both Sensitive Catchment Areas comply with the vibration criteria (DIN Standard 4150 – Structural Vibration in Buildings; Table 15).

Predicted vibration levels at the closest industrial and commercial receivers are shown in Table 34.

Assuming a dominant blast frequency of 15 Hz, the vibration levels predicted for the closest industrial/commercial receiver comply with the criteria vibration criteria (BS 7382-2 Transient vibration guide values for cosmetic damage - Table 16) with the exception of the 60kg charge, which exceeds the criteria by 7.5 mm/s.

The criterion for possible cosmetic damage at 15Hz and above is 20mm/s.

Table 34 – Predicted vibration at closest industrial/commercial receiver with a K_g =5000

Site Number	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)						
		1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
Closest Industrial/Commercial Receiver	200	1.0	3.8	6.6	9.1	11.4	15.8	27.5

The closest industrial receiver is approximately 200m to the south of the blasting area (commercial units on Foreshore Road) and the closest residential receiver approximately 650m to the south of the blasting area (5-7 Military Road). It is unknown at this time what size of charge is to be used.

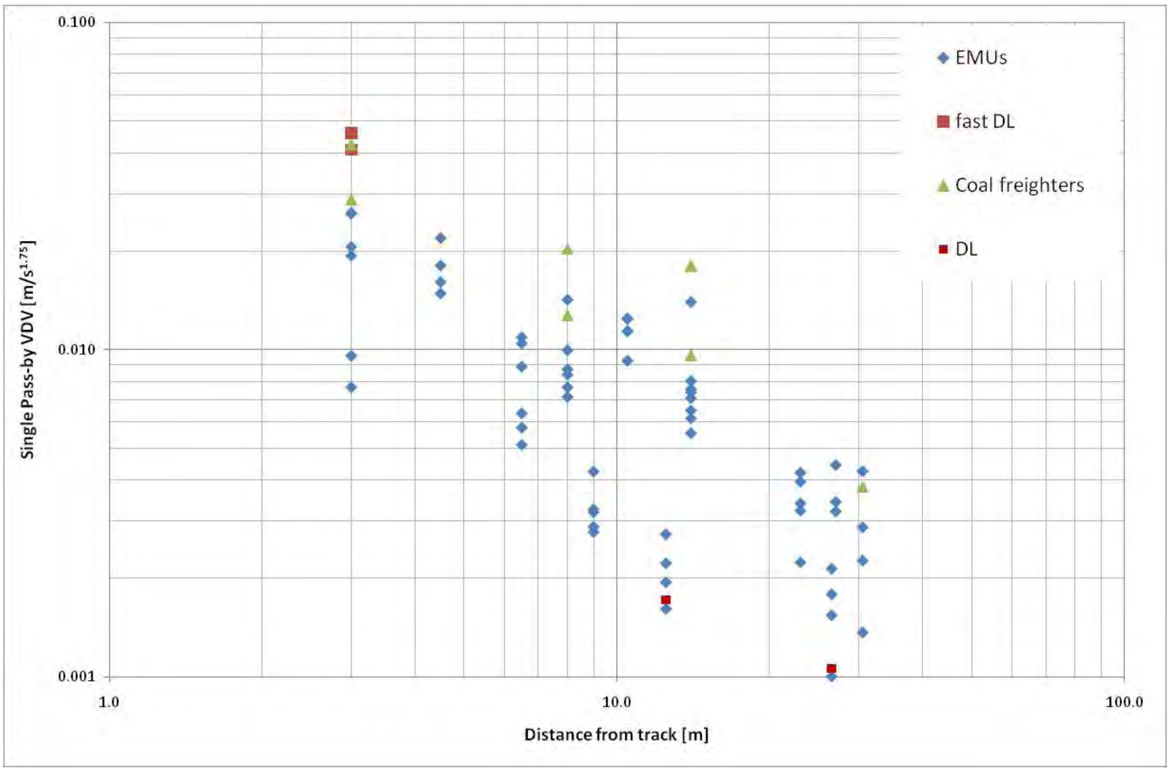
All blasting predictions will be confirmed as part of the blasting management plan prepared by the contractor.

4.7.2 Operational phase – Tactile Vibration

It is considered unlikely that there will be any vibration impact at nearby sensitive receivers as a result of operations (other than rail movements) within the site boundary due to the nature of the activities and the distance to the closest receivers.

The likely impact as a result of rail movements in the South Yard associated with the Concept Plan (worst case) has been assessed. Figure 4 shows typical VDVs associated with train pass-bys on ballasted track versus setback from the track.

Figure 4: Typical individual train pass-by VDVs versus distance for ballasted track.



The closest residential receivers are approximately 100 m setback from the track at the closest location in the South Yard and the closest commercial receivers are approximately 20 m setback from the track (on Foreshore Road). The Vibration Dose Value (VDVs) at these setbacks have been estimated from Figure 4 and conservatively, VDVs of 0.002 m/s$^{1.75}$ and 0.02 m/s$^{1.75}$ have been adopted in the subsequent assessment for single train movements at setbacks of 100 m and 20 m, respectively.

Table 35 Predicted accumulated VDV from train pass by

Setback	Individual pass-by VDV (from Figure 4)	Expected number of train movements	Accumulated VDV	Criterion	Compliance
Commercial @ 20 m	0.02 m/s$^{1.75}$	21	< 0.05	Commercial: 0.4 day & night	**Yes**
Residential @ 100 m	0.002 m/s$^{1.75}$	21	< 0.005	Residential: 0.2 day; 0.13 night	**Yes**

For the closest commercial receiver, located on Foreshore Road at a distance of approximately 20 m setback, the predicted VDVs are 8 times below the recommended level. For the closest residential receivers, located on Wentworth Road at a distance of approximately 100 m setback, the predicted VDVs are approximately 40 times lower than the night time criterion.

It is deemed unlikely that affected residential and commercial receivers will be adversely impacted by tactile vibration due train movement.

4.7.3 Operational phase – Regenerated Noise

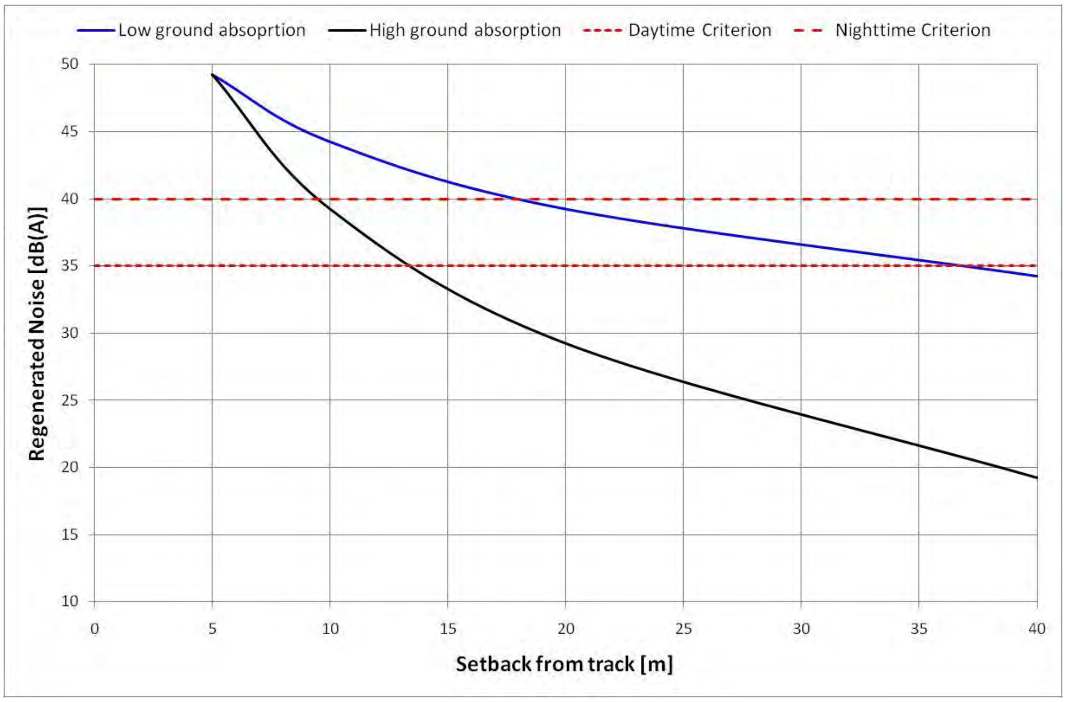
Vibration generated by train movement enters buildings via the ground. This causes the floors, walls and ceilings to vibrate and to radiate noise. This noise is commonly referred to as structure- or ground-borne noise or regenerated noise. Regenerated noise is low frequency and if audible is perceived as a 'rumble'.

In general, ground-borne noise level values are relevant only where they are higher than the airborne noise from the railway operations.

This assessment is undertaken in accordance with DECCW's "*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects*" (see Section).

Figure 5 shows calculated regenerated noise levels versus distance for lowly and highly absorptive ground. The calculations are based on measured train movements on ballasted track in the greater Sydney region.

Figure 5 Calculated regenerated noise levels versus setback from track and residential day and night-time goals for different ground absorptions.



It is unlikely that the closest residential receives at setbacks of 100 m will be adversely affected by ground-borne noise.

Regenerated noise criteria for the commercial receiver at 20 m is not assessed as it is anticipated that the regenerated noise will be masked by air-borne noise associated with train movements.

5.0 Discussion and Recommendations

5.1 Meteorological Effects

The construction and operational noise assessments were carried out assuming the meteorological conditions specified in Table 8.

The predicted noise levels are lower at night time than during the day, despite an f-class thermal inversion being modelled during the night time scenario. This is largely due to the source to receiver wind speed of 3 m/s included during the daytime scenario. The daytime source to receiver wind speed of 3 m/s results in a higher predicted noise level at noise sensitive receivers than the night time f-class thermal inversion.

In conclusion it is source to receiver wind speeds of 3 m/s that result in the worst case predicted impact at the receivers and not the f-class thermal inversion. The results presented are therefore indicative of the worst possible impact during the daytime and night time periods.

It should be noted that the meteorological data shows that a source to receiver wind of less than 3 m/s occurs for approximately 17% of the time. The INP states that wind affects need to be assessed when '*wind speeds (at 10 m height) of 3 m/s or less occur for 30 per cent of the time or more in any assessment period (day, evening, night) in any season'*. The inclusion of source to receiver winds is therefore seen as conservative and indicative of the worst case.

5.2 Noise and Vibration Management Plan

During discussion with DECCW and PKPC it was agreed that a 'live' noise and vibration management plan for the Outer Harbour be developed.

Given the proposed timescale for development of the Outer Harbour and the various stages involved, it is appropriate that a coherent noise and vibration management plan be developed as construction and operation progresses, commencing with Stage 1 (Major Project).

5.3 Construction Noise and Vibration Impact

5.3.1 Construction Noise

The construction noise impact for the Stage 1 and Stage 2 berth construction works is predicted to comply with the construction noise management levels for the daytime, evening and night time periods at all noise sensitive residential and commercial receivers. Tabulated results are presented in Appendix C (Table 38 and Table 39).

The construction noise impact assessment has considered the potential cumulative noise impact arising from Stage 1 and Stage 2 berth construction and the Stage 1 South Yard construction works taking place concurrently. The predicted impact with all three construction scenarios operating concurrently is dominated by the construction work in the South Stabling Yard, which is discussed further below. The predicted contribution from the berth construction works does not increase the overall predicted impact when South Yard construction is taking place.

The construction noise impact associated with the South Yard is predicted to exceed the daytime construction noise management level by up to 13 dB(A) at the closest residential receivers (Wentworth Avenue). This is a worst case assessment and it is likely that the predicted impact can be reduced.

It is recommended that suitably constructed temporary noise barriers are utilised to shield the use of demolition saws from noise sensitive receivers. This could reduce the predicted impact by up to 10 dB(A) from this piece of plant and up to 5 dB(A) overall. It is important to note that demolition saws are only likely to be operational for a fraction of the assessment period.

Furthermore, it is recommended that the CNVMP for the South Yard construction works identify respite periods when demolition saws cannot be used, for example, before 9 am when local residents may still be at home and from 12-1pm when local residents may be eating lunch.

If the number and type of plant involved in construction varies significantly from that in Table 19 it is recommended that an additional noise assessment be carried out in order to gauge the likely impact at nearby receivers.

The DECCW "*Draft Construction Noise Guidelines"* recommend that the contractor demonstrates best practicable means and include noise mitigation measures in the CNVMP to minimise the noise impact at sensitive receivers. The best mitigation technique for construction can often be keeping the affected people informed as to the duration and progress of the works. Mitigation strategies that should be considered are described below.

Community notification

- Contact potentially noise-affected neighbours at the earliest possible time before any site work begins;
- Inform potentially noise-affected neighbours about the nature of the construction stages and the noisier activities – for example excavation and rock-breaking;
- Give clear indication to potentially noise-affected neighbours of how long noisy activities will take;
- Describe any noise controls, such as walls to be built first that will reduce noise, temporary noise walls, or use of silenced equipment;
- Keep potentially noise-affected neighbours up to date on progress;
- Provide contact details on a site board at the front of the site, and keep a complaints register suited to the scale of works;
- Ask about any concerns that potentially noise-affected neighbours may have and discuss possible solutions;
- Provide a copy of the noise management plan to potentially noise-affected neighbours.

Operate plant in a quiet and efficient manner

- Turn off plant that is not being used;
- Examine, and implement where feasible and reasonable, alternative work practices which generate less noise – for example use hydraulic rock splitters instead of rock breakers, or electric equipment instead of diesel or petrol powered equipment;
- Examine, and implement where feasible and reasonable, the option of using silenced equipment.
- Ensure plant is regularly maintained;
- Locate noisy plant away from potentially noise-affected neighbours or behind barriers, such as sheds or walls; and
- Where reasonable, provide respite periods for very noisy activities.

Involve workers in minimising noise

- Avoid dropping materials from a height;
- Talk to workers about noise from the works and how it can be reduced; and
- Use radios and stereos indoors rather than outdoors.

Handle complaints

- Review, and implement where feasible and reasonable, work practices to minimise noise from construction that are the subject of noise complaints.

5.3.2 Construction vibration

The likelihood of construction activity resulting in structural damage to buildings or human discomfort has been assessed. Minimum safe working distances have been provided for vibration intensive plant. It is recommended that on site vibration measurements are conducted as a part of the Construction Noise and Vibration Management Plan in order to determine site specific safe working distances.

Human reaction to vibration varies significantly from individual to individual and as a result it can be difficult to set appropriate criteria for human comfort in relation to vibration.

Due to the large distances between construction activity and residential receivers it is considered unlikely that construction activities will result in adverse reaction.

Mitigation measures have been discussed and should be developed further in the Construction Noise and Vibration Management Plan.

5.4 Operational noise impact

5.4.1 Major Project

Operations

Rail movements in the South Yard associated with the Major Project operations are predicted to result in exceedance of the project specific noise goals for SCA1. The worst case predicted exceedance is 11 dB(A) at night at three receivers on Wentworth Road, directly opposite the South Yard. In addition to this there is a predicted exceedance of the night time project specific noise goal of 4 dB(A) at one receiver on Jubilee Road.

The predicted exceedances at all receivers are due to an idling locomotive at the southern end of the South Yard. Construction of a 6m high acoustic barrier between the locomotive and the nearby noise sensitive receivers results in compliance with the noise specific noise goals for all time periods at all receivers.

It is considered likely that appropriate mitigation in the South Yard would result in compliance with the project specific noise goals at all noise sensitive receivers.

The noise assessment was undertaken assuming ‘worst case’ operational conditions and adverse weather conditions; 3m/s source to receiver wind speed during the daytime and evening periods and an f-class thermal inversion during the night time.

If it is possible for the night time rail operations associated with the Major Project to be minimised then PKPC will endeavour to do so. It is difficult to predict at this stage exactly when rail movements will take place. As additional information pertaining to PKPCs client needs becomes available this option can be explored further.

PKPC is committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi frequency reversing alarms, visual system reversing warnings, enclosures and shrouds.

Modifying Factor Corrections

DECCW have expressed concern with regard the potential tonality of conveyor drivers associated with the Major Project.

The addition of a +5 dB(A) tonality penalty to conveyor drivers is considered to be overly conservative at this stage. The statement of commitment in Section 5.2.2 mentions shrouds in relation to conveyor systems as well as the sourcing of acoustically considerate equipment. It is recommended that the acoustic performance of conveyor systems be reviewed when plant is chosen and suitable mitigation recommendations made if required. This can be addressed as part of the evolving noise and vibration management plan for the site.

Rail Noise

DECCW has sought an explanation as to why it is not feasible to use only “best practice” rolling stock to service the development and cited Port Waratah’s Kooragang Island Coal Loader Project as an example of new rail generating activities where this is a requirement.

It is not feasible to specify any type of rolling stock for Stage 1 of the Outer Harbour development because the berth and associated terminal space that is proposed for operation will be a multi-purpose, common-user facility for cargo types and points of origin that are not yet known. This is in contrast to operations such as the Kooragang Island Coal Terminal which service regular customers most, if not all, of whom have made long-term commitments to use rail transport to that facility.

PKPC cannot be certain that future customers (i.e. cargo owners or exporters) seeking to transport cargo to the Outer Harbour via rail will be able to secure “best practice” rolling stock at a reasonable cost. PKPC supports the intent of the recommended condition and is willing to liaise with prospective customers on a case-by-case basis to determine whether it is feasible and reasonable for them to use this rolling stock.

It should also be noted that any major exporter of bulk products transported to the Outer Harbour by rail is likely to seek to lease a parcel of land from PKPC to establish a dedicated terminal for that cargo type. If this were to occur, the development of such a terminal would require separate approval and conditions regarding rail noise could be determined at that time.

Sleep Disturbance

Train horns need to be sounded on the Port Kembla balloon loop when the rails cross public roads and when trains pass from privately owned sidings back onto the main line.

PKPC has proposed that operations restrict trains from re-joining the main line at the southern end of the South Yard, which is in close proximity to receivers on Wentworth Avenue and Military Road. Trains will instead pass through the South Yard on a siding and re-join the main line at the Flinders Street Bridge, which is further removed from the closest residential receivers.

PKPC is happy to commit to no train horns being sounded when trains move onto sidings from the main line.

PKPC are currently investigating the possibility of removing train horn use completely. Options being considered include grade separation at Old Port Road to remove the requirement for horn sounding and the removal of the crossing at Foreshore Road, which would also eliminate the need for horn soundings.

The sleep disturbance assessment has considered the impact of short (toots) and long (blasts) duration train horn use in the Port Kembla balloon loop.

The use of train horn blasts was found to exceed that sleep disturbance screening criteria by up to 27 dB(A) at the worst affected receiver. By contrast the use of train horn toots was found to exceed that sleep disturbance criteria by up to 7 dB(A) at the worst affected noise sensitive receiver. It is strongly recommended that shorter duration train horn toots are adopted as a noise management policy and incorporated into the Outer Harbour noise and vibration management plan.

Currently up to seven train horns are sounded during the night time period at one of three locations within the balloon loop; Old Port Road crossing, Foreshore Road crossing and the Flinders Street Bridge. There are predicted exceedances of the sleep disturbance screening criteria of up to 7 dB(A) when horn 'toots' are sounded at Old Port Road and Foreshore Road. The proposed Major Project development will add a maximum of two additional train horn 'toot' soundings, one at Old Port Road and one at Flinders Street Bridge. Only the additional horn use at Old Port Road is predicted to exceed the sleep disturbance screening criteria.

The ECRTN states that '*Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'*. The maximum predicted noise level at a noise sensitive receiver as a result of the additional train horn associated with the Major Project is 62 dB(A). An open bedroom window generally provides an approximate attenuation of about 10 dB(A), meaning that one or two noise events with a maximum external noise level of 60 – 65 dB(A) are unlikely to result in waking reactions.

It is considered unlikely that the additional two train horn soundings associated with the Major Project would result in waking reactions at the worst affected noise sensitive receivers.

5.4.2 Concept Plan

Operations

The Concept Plan operational scenario used in the noise modelling includes activities associated with the planned multi-purpose terminal and container terminals and rail activities in the South Stabling Yard.

With no mitigation in place the Concept Plan operational scenario is predicted to exceed the project specific noise goals for SCA1 by up to 5dB(A) during the daytime, up to 14 dB(A) during the evening and up to 15 dB(A) during the night time. In SCA2 there are predicted exceedances of the project specific noise goals of up to 2 dB(A) during the daytime and up to 8 dB(A) during the night time.

The predicted exceedance of the project specific noise goals is, in most cases, the result of rail activities in the South Yard. The Concept Plan operational scenario was reassessed assuming mitigation is applied in the South Yard. The mitigation options examined at this stage included a 6m high noise barrier running adjacent to the track at the southern end of the South Yard and a shed completely enclosing operations at the southern end of the South Yard.

The shed at the southern end of the South Yard proved to be the most effective mitigation option. The predicted exceedances with the shed in place and the subsequent increase above existing ambient levels are summarised in Table 36.

Table 36 Summary of predicted exceedances with indicative mitigation measures (acoustic shed)

Magnitude of predicted exceedance dB(A)	Number of representative receivers where exccedance is predicted			Predicted increase above existing L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
	SCA1					
1	-	9	3	-	0.5	0.5
2	-	1	8	-	0.6	0.6
3	-	-	1	-	-	0.8
4	-	-	-	-	-	-
	SCA2					
1	-	-	17	-	-	0.6
2	-	-	23	-	-	0.8
3	-	-	26	-	-	1
4	-	-	8	-	-	1.2

As a result of existing industrial noise in the area, the evening and night time project specific noise goals in each case are controlled by the more stringent Amenity Criterion (Table 7). Table 36 shows the predicted increase above existing noise levels assuming appropriate noise mitigation (i.e acoustic shed) is constructed in the South Yard.

It is considered likely that appropriate noise mitigation in the South Yard and elsewhere on site would further reduce the predicted noise levels. It has been demonstrated that the construction of a shed at the southern end of the South Yard could considerably reduce the predicted noise impact at noise sensitive receivers. Other possible noise mitigation measures will be investigated both in addition to and instead of a shed. The noise mitigation constructed on site can be further refined to greater benefit during detailed design for Stages 2 and 3 of the project. PKPC will consider operational controls and additional mitigation where appropriate to further reduce the noise impact of operations associated with the Concept Plan.

Furthermore, it is important to consider that this assessment represents a worst case scenario and to look at how likely this scenario is to occur and how often that occurrence is likely to happen.

The assessment assumes that all berths at the multi-purpose terminal and container terminals are working at maximum capacity at the same time, with the peak traffic flow rates for each terminal occurring coincidentally while there is an f-class temperature inversion in effect.

Based on the unloading times and annual throughput it has been calculated that the average occupancy of each berth is as shown in Table 37. This corresponds to one ship at each of the multi-purpose berths and two ships at the container berths.

Table 37 Likely Berth Occupancy Rate

Terminal	Number of Ships	Likely Maximum Berth Occupancy Time (annual)
1 – Multi-purpose terminal	1	64%
2 – Multi-purpose terminal	1	44%
3 – Container terminals	2	37%

Based on the occupancy rates shown in Table 37 it is unlikely that the maximum workable occupancy at the Outer Harbour (four ships being unloaded at once) will occur during the night time period for more than 10% of the time.

In order to realise the worst case this would have to coincide with the 34% chance of an f-class temperature inversion and the coincidental occurrence of peak truck arrival at each terminal. This situation is likely to occur on only nine or ten days of the year and can be further assessed during the detailed design assessment of the General Goods Terminal and Container Terminal.

Furthermore, the predicted exceedances are not the result of any large individual impacts but rather the cumulative impact of a large number of relatively low noise impacts. For example, at one of the worst affected receivers located at 17A Kembla Street, a noise level of 40 dB(A) is predicted, which is an exceedance of 3 dB(A). However, the single largest contributor at this location only results in a level of 32 dB(A). The predicted level of 41 dB(A) is the result of many noise sources combined, all with predicted impacts at the receiver of 25-31 dB(A).

An exceedance of this nature can be difficult to mitigate using standard mitigation measures such as acoustic barriers. While it may be feasible to reduce the predicted impact level by constructing barriers and screens, the environmental and economic cost associated with this approach is often not reasonable. For example, construction of a 220 m long acoustic barrier 7.5m height along the multi-purpose terminal access road reduces the predicted impact at the receiver by only 0.3 dB(A). This is largely due to receivers being elevated above the noise sources. Given the environmental and economic cost associated with such a mitigation measure this is not considered to be a reasonable approach to noise control.

It is likely that the opportunity to reduce the predicted operational noise exceedances will present itself at several stages of the Concept Plan when subsequent project approvals are required. At this time an additional noise assessment will look at operations in greater detail and allow targeted management controls to be put in place with a view to reducing noise emissions at night.

PKPC is committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi frequency reversing alarms, visual system reversing warnings, enclosures and shrouds. It is also likely that emerging technologies over the next 25 years will present the opportunity to further reduce the predicted noise impact.

Sleep Disturbance

The noise impact from container ‘clang’ associated with operations at the container terminal are predicted to comply with the sleep disturbance criteria at all receivers.

The potential noise impact resulting from use of limited duration train horn soundings (i.e. horn toots) has been assessed at the three locations on the Port Kembla balloon loop where horns are currently sounded. Horn toots at the Old Port Road and Foreshore Road crossings are predicted to exceed the INP sleep disturbance screening criteria by up to 7 dB(A). As a result of Concept Plan operations up to an additional 5 trains could be sounded at night time at Old Port Road, Foreshore Road or Flinders Street Bridge.

PKPC are happy to commit to the investigation and development of all feasible and reasonable mitigation measures to reduce the predicted impact from train horns. This may include the elimination of train horns altogether through removal of the Foreshore Road crossing and grade separation at Old Port Road.

It is understood that a major rail infrastructure planning study for Port Kembla Outer Harbour is to be undertaken in 2010. An assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan should be carried out to compliment this planning study. It is recommended that sleep disturbance impacts arising from increased rail movements associated with the Concept Plan be investigated further as part of applications for planning approval for Stages 2 and 3, and once the rail infrastructure planning study has been carried out.

5.5 Rail Traffic Noise

There are currently up to 61 daily rail movements on the Port Kembla Branch Line. The noise impact resulting from additional rail movements on the main Port Kembla Branch line (i.e. not within the South Yard), as a result of four train movement per day arising from operations associated with the Major Project, is predicted to be less than 2 dB(A). This complies with the IGANRIP criteria outlined in Table 8.

The potential impact resulting from increased rail movements associated with the Concept Plan should be addressed following the rail infrastructure planning study, which is due to take place in 2010.

5.6 Road Traffic Noise

The existing road traffic noise levels are above the ECRTN criteria and that the assessment shows that the proposed development will not increase those levels by more than 2 dB(A). Table 31 shows that the worst predicted increase in road traffic noise levels at noise sensitive receivers as a result of the development is 0.6 dB(A) during the peak PM traffic flow associated with the Concept Plan development (i.e. 2036) and adjacent to receivers on Five Islands Road, Cringila.

Table 1 in the ECRTN states that, where feasible, noise levels should be mitigated to meet the noise criteria specified for the appropriate type of development. Mitigation methodologies suggested include the use of private roads, regulating times of use, using clustering, using ‘quiet’ vehicles and the use of noise barriers. The ECRTN also recognises the difficulty in implementing mitigation measures on roads not linked directly to the proposed development.

It is considered that the use of private roads is not feasible as trucks will be transporting cargo to and from sites which are well beyond the port boundaries. Therefore, public roads must be used.

Furthermore, any attempt to restrict vehicle movements to certain times of day would effectively restrict the efficiency and capacity of the port. Efficient port operations require 24/7 movement of cargo to ensure the utilisation of equipment, vehicles and space is optimised.

The use of noise barriers along Five Islands Road, adjacent to the affected receivers at Cringila, would restrict access to, and reduce the visual exposure of, businesses along that section of Five Islands Road, which is unlikely to be acceptable to the businesses in question.

Rail transport facilities will be included in the proposed development and PKPC will actively promote the use of rail transport.

The worst predicted increase in noise levels at the receivers adjacent to Masters Road is 0.3 dB(A). This is an insignificant increase in noise level and it is not considered reasonable to expect PKPC to fund construction of a noise barrier at this location to mitigate a 0.3 dB(A) predicted increase in noise level.

The predictions do not take into account progress in development of ‘quiet’ vehicles over the next 25 years. It is arguably sensible to assume that ‘typical’ vehicles of the type likely to service the Outer Harbour development will be quieter in 25 years time than those assumed in the model.

5.7 Blasting and Operational Vibration

The vibration levels resulting from blasting associated with Stage 1 construction have been calculated.

The vibration levels have been predicted at receivers in Sensitive Catchments Area 1 and Area 2 for charges ranging from 1 kg to 60 kg. The results have been assessed against the long term structural damage safe limits in DIN 4150. This assessment is considered to be appropriate as the structural resonance frequency of the potentially affected receivers is not known. It is likely that the results are conservative.

The predicted vibration levels comply with the criteria at all receivers in Sensitive Catchments Area 1 and Area 2.

The predicted vibration level at the closest industrial/commercial facility on Foreshore Road exceeds the criteria when a 60 kg charge is assumed. It is not known at this stage what size of charge is to be used in blasting. Trial blasting to determine site specific safety parameters will be carried out prior to the start of construction blasting.

These values have been calculated using non site-specific data. They also assume the shortest possible distance between the site and the receivers. It is recommended that site specific data gathered during trail blasts is used to refine and calibrate the calculations prior to any blasting taking place.

The accumulated VDV resulting from rail movements associated with the Concept Plan (i.e. worst case) has been assessed and shown to comply with the VDV criteria.

It is considered unlikely that affected residential and commercial receivers will be adversely impacted by tactile vibration due to train movements.

6.0 Conclusion

The impact of noise emissions from plant associated with the construction and operation of the Concept Plan and Major Project have been assessed. Construction and operational impact assessments have been carried out based on plant that is likely to be associated with each phase of the development.

6.1 Construction Noise

The modelled construction scenario is considered to be representative of the likely worst case construction noise sources associated with Concept Plan and Major Project. Representative construction activities during Stages 1 and 2 of construction have been modelled at the shortest distance between source and receivers. This is considered to be appropriate given the lack of construction methodology detail at the time of assessment.

The potential cumulative impact of Stage 1 and Stage 2 berth construction activities and the Stage 1 South Yard construction activities have been assessed.

The noise impact of construction noise on the receivers in SCA1 has been assessed. The noise levels at all receivers in SCA1 are predicted to comply with the daytime, evening and night-time noise management levels.

The noise impact of construction noise on the receivers in SCA2 has been assessed. The noise levels at all receivers in SCA2 are predicted to comply with the daytime, evening and night-time noise management levels.

The impact of the South Yard construction noise on the closest receivers in SCA1 has been assessed. The noise levels resulting from construction activities at the South Yard are predicted to exceed the daytime construction noise management levels by up to 13 dB(A) at the closest noise sensitive receivers. This is considered to be a worst case assessment and it is unlikely that this level of exceedance would persist. The construction period for the South Yard works is approximately six weeks and the noisiest activities are likely to occur for only a fraction of this period. It is likely that the predicted noise level will reduce following careful consideration of the construction methodology at the construction management plan stage.

Mitigation of the construction activities associated with the South Yard construction has been discussed. It is likely that use of temporary noise barriers around the noisiest activities could reduce the overall impact by as much as 5 dB(A). Specific mitigation measures will be identified in Construction Noise and Vibration Management Plan.

The impact of increased traffic associated with construction works has been assessed at the worst affected receivers located at Cringila. The increase in noise levels due to construction traffic is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate.

It is recommended that an additional noise impact assessment be carried out should the construction methodology on site differ significantly from that assumed for modelling purposes. The guidelines set out in the DECCW guidance document *'Interim Construction Noise Guideline'* should be implemented to ensure that the impact at receivers from construction noise is minimised as far as is reasonable and feasible.

Minimum safe working distances for vibration intensive plant have been recommended. It is further recommended that site specific safe working distances be calculated and included in the Construction Noise and Vibration Management Plan.

It is unlikely that construction activities will result in adverse human reaction to vibration.

6.2 Operational Noise

6.2.1 Major Project

The operational noise assessment for the Major Project has been carried out based on a likely operational scenario for the multi-purpose terminal.

The impacts of operational noise generated by the Major Project are predicted to comply with the daytime, evening and night time project specific noise goals at all sensitive receivers in SCA1 and SCA 2 following application of basic noise mitigation (6 m high acoustic barrier) in the South Yard to address noise form idling trains.

It is likely that operations associated with the Major Project will comply with the project specific noise goals at all nearby noise sensitive receivers.

6.2.2 Concept Plan

The operational noise assessment for the Concept Plan has been carried out based on a likely operational scenario for the Major Project and Container terminals.

The impacts of the operational noise generated by the Concept Plan are predicted to comply with the daytime project specific noise goals at all receivers in SCA1 and SCA2 and with the evening project specific noise goals at all receivers in SCA2 following the erection of a suitably constructed acoustic shed in the South Yard.

The impacts of the operational noise generated by the Concept Plan are predicted to exceed the evening and night time project specific noise goals by 1-3 dB(A) at twenty two representative receivers in SCA1. All but one of these exceedances is in the 1-2 dB(A) range and are the result of the cumulative impact of a large number of individually compliant sources. The predicted exceedances may result in a maximum increase above existing noise levels of 0.8 dB(A). It is likely that the exceedances will be further reduced by noise mitigation measures implemented at detailed design phase.

The impacts of the operational noise generated by the Concept Plan are predicted to exceed the night time project specific noise goals by 1-4 dB(A) at seventy four representative receivers in SCA2. Forty of the exceedances are predicted in the 1-2 dB(A) range, with a further twenty six predicted at 3 dB(A). All are the result of the cumulative impact of a large number of individually compliant sources. As with predicted exceedances in SCA1, it is likely that the exceedances will be further reduced by noise mitigation measures implemented at detailed design phase.

The operational scenario modelled to produce the predicted noise levels is considered to be extremely conservative and likely to occur on only 1 or 2 days a year.

In practice, it is likely that the predicted noise impact resulting from operations associated with Concept Plan will actually be lower than modelling results indicate. PKPCs commitment to use acoustically considerate equipment where possible and to consider the acoustic impact of operations at detailed design stage is likely to result in lower noise levels at receivers than those predicted in this assessment.

It is understood that a major planning study with regard the rail infrastructure around the Outer Harbour is to be carried out in 2010. It is recommended that a full assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan be carried out to complement this planning study and prior to commencement of the Stages 2 and 3 of the Concept Plan.

6.3 Road Traffic Noise

The predicted impact arising from increased heavy vehicle movements associated with the Major Project and Concept Plan has been shown to be insignificant. The worst case predicted increase in noise level is 0.6 dB(A), which is below the ECRTN ‘maximum allowable increase’ of 2 dB(A).

The feasibility of road noise mitigation has been discussed and where possible operational management controls will be implemented. The construction of noise barriers to mitigate road noise is not considered reasonable.

6.4 Rail Noise

The predicted impact arising from an additional four daily train movements on the Port Kembla Branch line associated with the Major Project is considered to be insignificant and will comply with the criteria specified in the IGANRIP.

It is recommended that the impact of rail movement on the Illawarra as a result of Concept Plan operations is assessed following the Rail Infrastructure Planning Study scheduled for 2010.

6.5 Sleep Disturbance

The predicted noise impact resulting from the existing and proposed use of train horns associated with the Major Project and Concept Plan has been assessed. Two of the three locations where train horns (short duration ‘toots’) are currently sounded at night are predicted to exceed the INP sleep disturbance screening criteria by up to 7 dB(A). The frequency of the horn soundings has been discussed. Of the two possible night time train horn soundings associated with the Major Project, one is predicted to exceed the INP sleep disturbance screening criterion by up to 7 dB(A) (Old Port Road) and the other by up to 2 dB(A) (Foreshore Road).

The sounding of up to two train horns per night associated with the Major Project is considered unlikely to result in waking reactions at the worst affected receivers.

The predicted noise impact at noise sensitive receivers from train horn ‘toots’ associated with the Concept Plan is the same as for the Major Project, but the frequency will increase from two occurrences to five occurrences per night.

Sleep disturbance as a result of activities associated with the Concept Plan and Major Project has been assessed. Noise generated by container ‘clang’ occurring at the shortest distance between site and receiver has been shown to comply with the sleep disturbance criteria. It is recommended that the issue of sleep disturbance arising from increased rail movements associated with the Concept Plan be investigated further as part of the Outer Harbour rail infrastructure planning study to be carried out in 2010. The number of night time rail movements will increase from one to five as a result of Concept Plan operations.

6.6 Blasting and Vibration

The predicted vibration levels associated with blasting have been shown to comply with the criteria at all receivers in Sensitive Catchment Areas 1 and 2.

The predicted vibration level at the closest industrial/commercial receiver exceeds the criteria when a 60 kg charge is assumed. It is recommended that trial blasting be carried out prior to construction stage blasting to determine safe working charge sizes.

It is recommended that the impact from blasting on specific receivers be calculated from site specific data gathered during trial blasting.

The accumulated VDV for operations associated with the Concept Plan has been shown to comply with the VDV criteria. It is unlikely that nearby commercial and residential receivers will be adversely affected by tactile vibration as a result of rail movements associated with the Concept Plan.

6.7 Noise Management Plans

It is recommended that Noise and Vibration Management Plans (NVMP) be included as part of the CEMPs and OEMPs prepared for the Concept Plan and Major Project to minimise the noise impact at sensitive receivers. The NVMPs should best practice mitigation measures and be prepared in accordance with the DECCW “*Draft Construction Noise Guidelines”*.

Appendix A

Noise Contour Plots

Appendix A Noise Contour Plots

Please note that in each case the lower end of the dB(A) scale for the contour plots is set to the minimum criteria for that period.

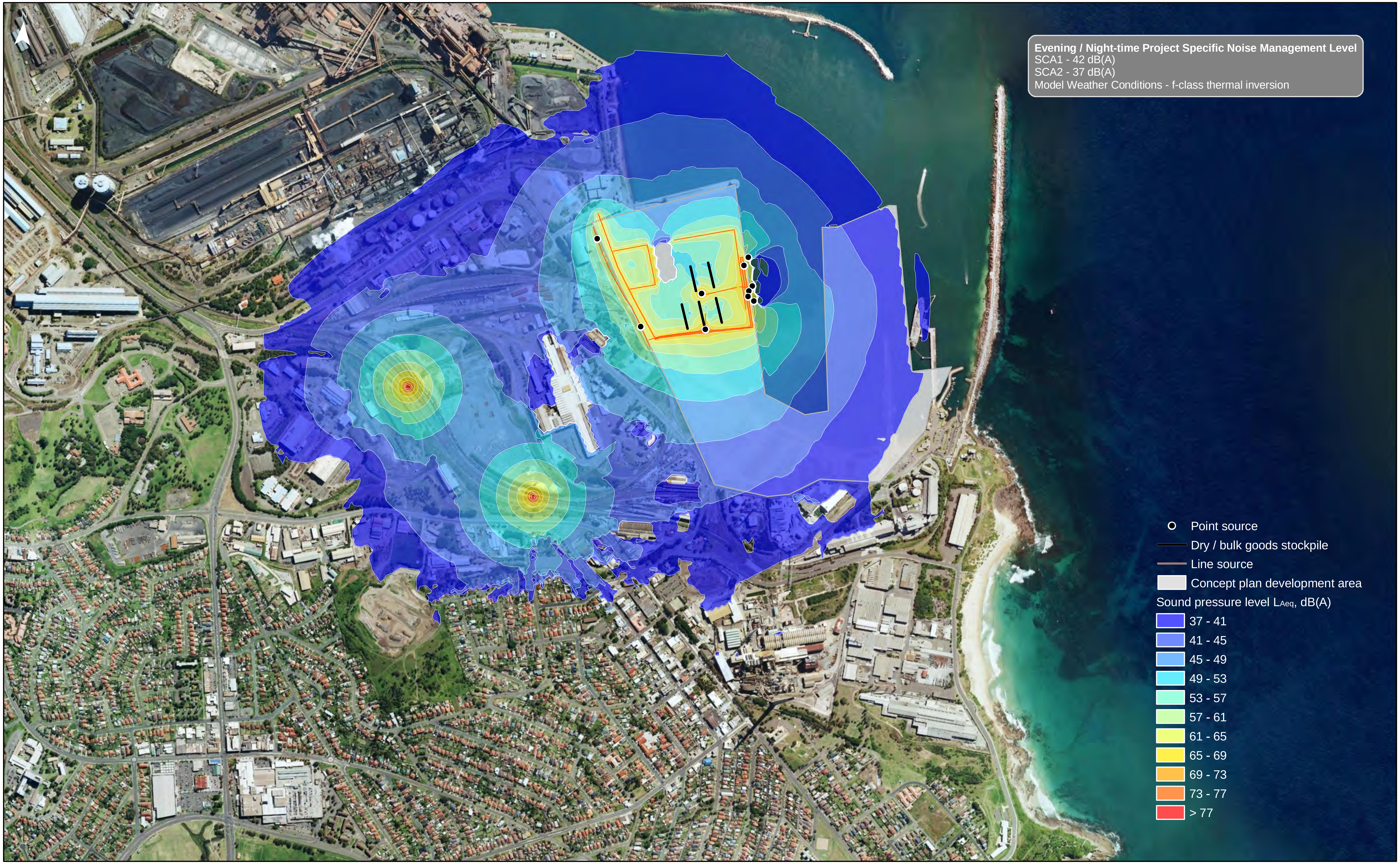
PORT KEMBLA OUTER HARBOUR DEVELOPMENT
MAJOR PROJECT - DAY - NO MITIGATION

SEP 2010
60039301

0 150 300 600 m

Fig. **6**

AECOM



PORT KEMBLA OUTER HARBOUR DEVELOPMENT
MAJOR PROJECT - NIGHT - NO MITIGATION

0 150 300 600 m

SEP 2010
60039301

Fig. **7**

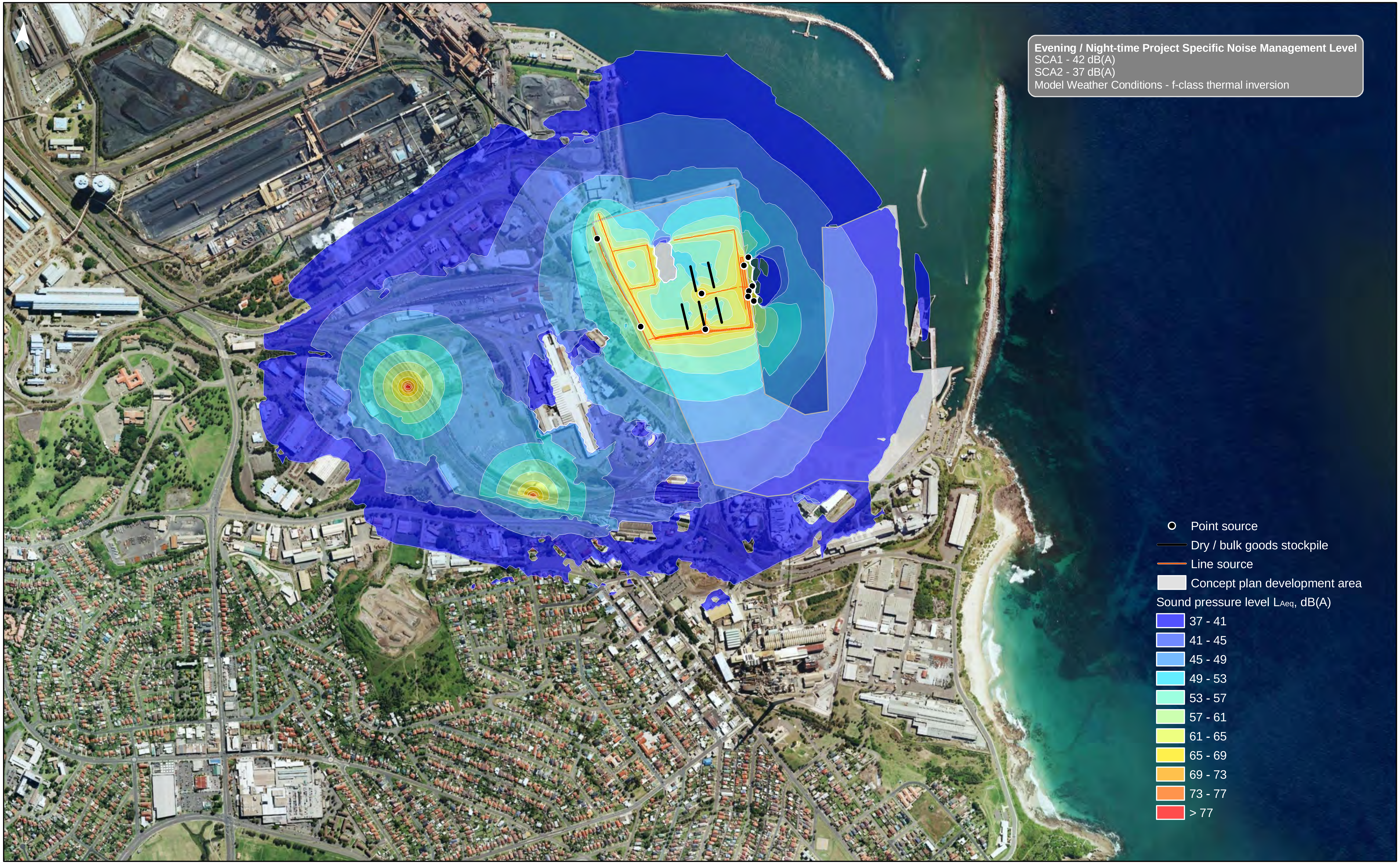
AECOM

PORT KEMBLA OUTER HARBOUR DEVELOPMENT
MAJOR PROJECT - DAY - SOUTH YARD BARRIER

SEP 2010
60039301

0 150 300 600 m

Fig. **8**

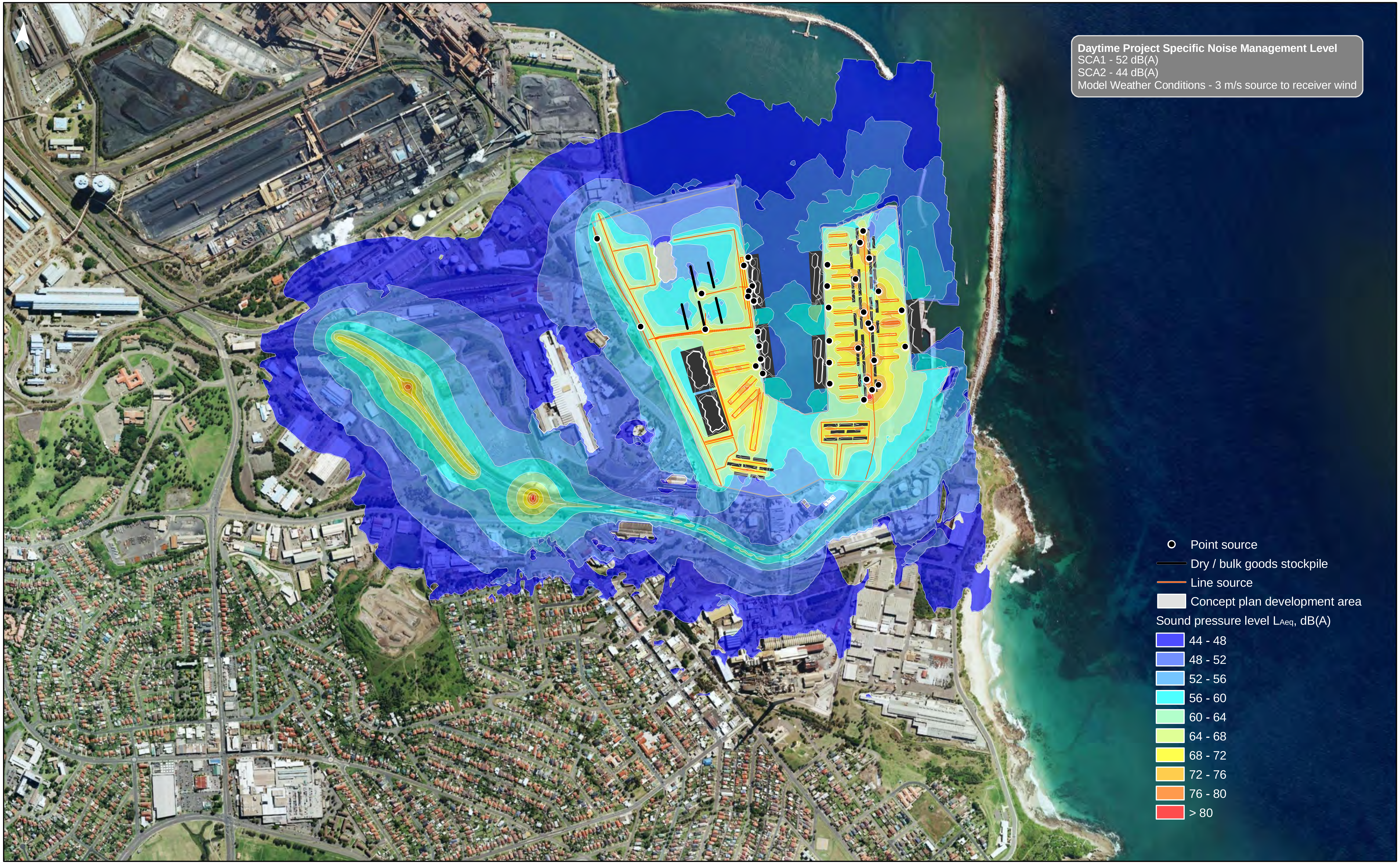


PORT KEMBLA OUTER HARBOUR DEVELOPMENT
MAJOR PROJECT - NIGHT - SOUTH YARD BARRIER

SEP 2010
60039301

0 150 300 600 m

Fig. **9**



PORT KEMBLA OUTER HARBOUR DEVELOPMENT

CONCEPT PLAN - DAY - NO MITIGATION

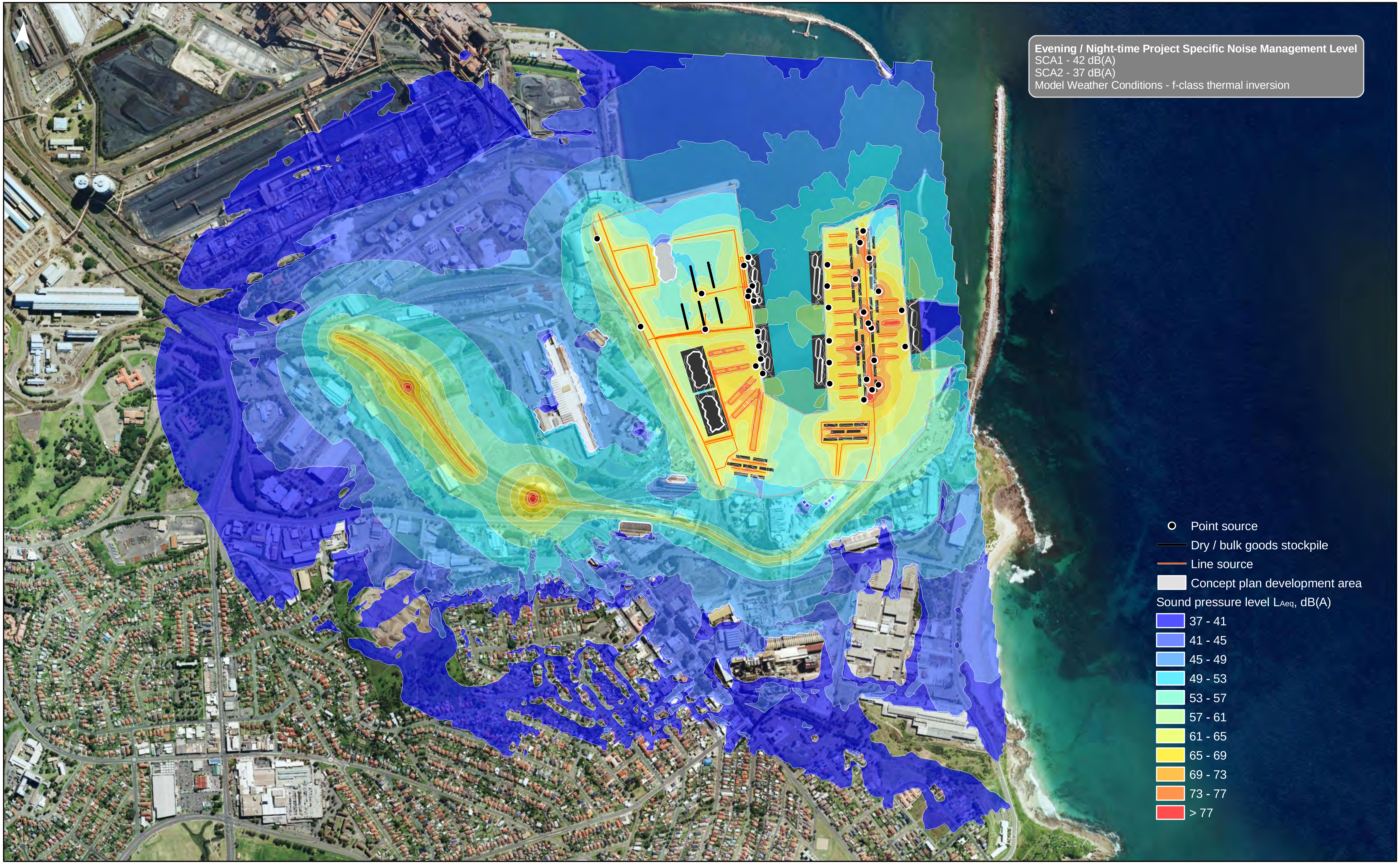
SEP 2010

60039301

0 150 300 600 m

Fig **10**

AECOM

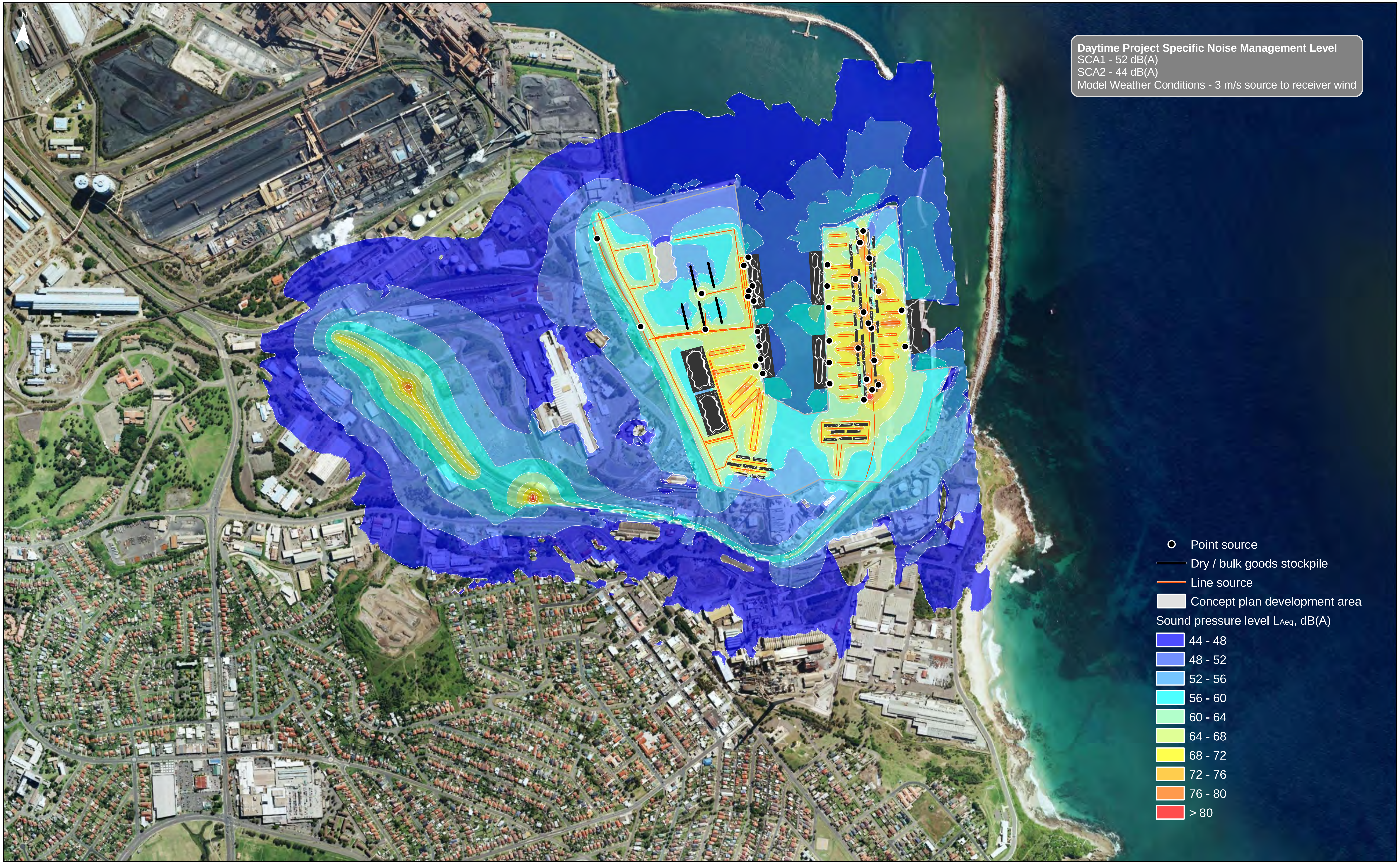


PORT KEMBLA OUTER HARBOUR DEVELOPMENT
CONCEPT PLAN - NIGHT - NO MITIGATION

SEP 2010
60039301

0 150 300 600 m

Fig. **11**



PORT KEMBLA OUTER HARBOUR DEVELOPMENT

CONCEPT PLAN - DAY - SOUTH YARD BARRIER

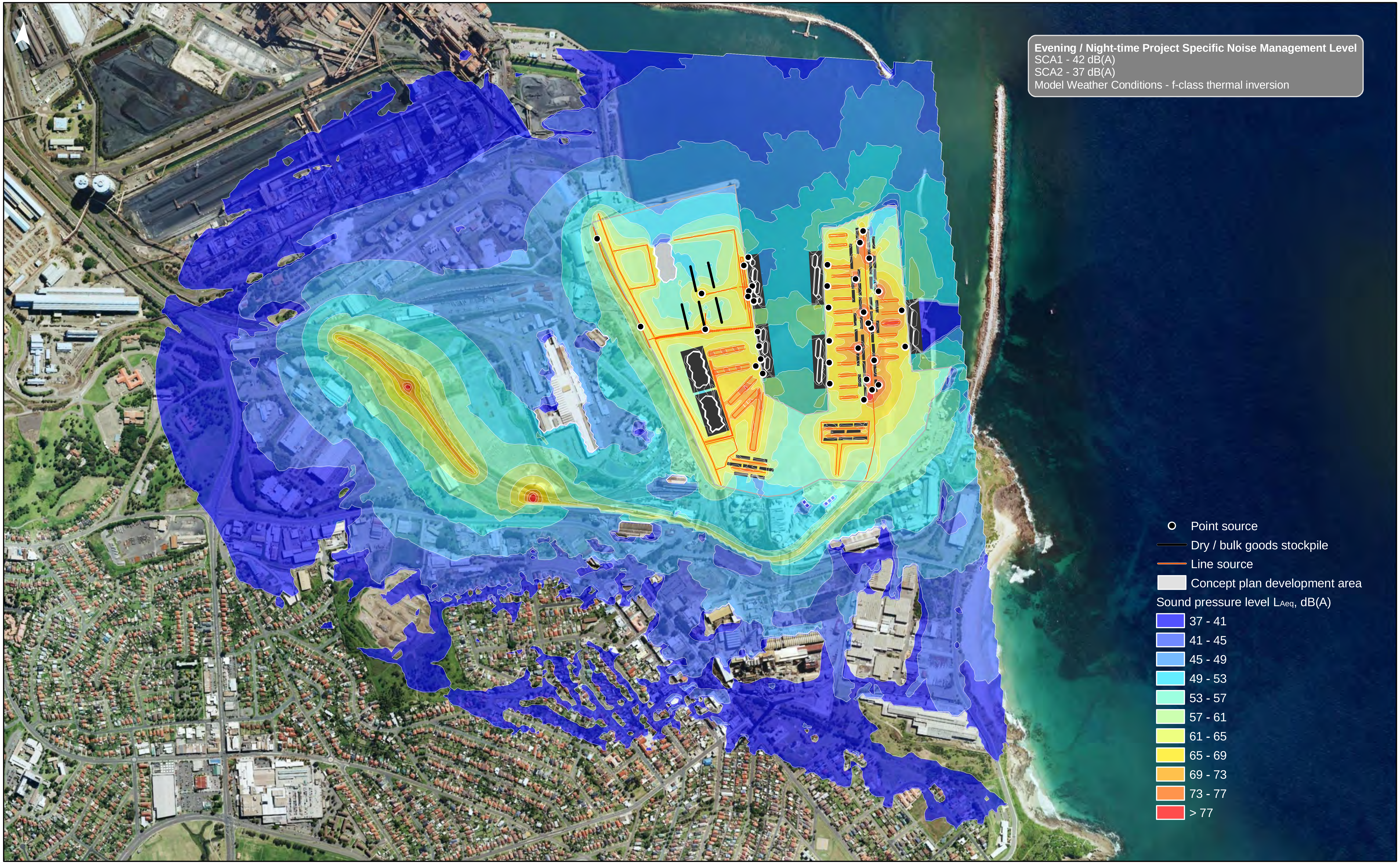
SEP 2010

60039301

0 150 300 600 m

Fig. **12**

AECOM



PORT KEMBLA OUTER HARBOUR DEVELOPMENT

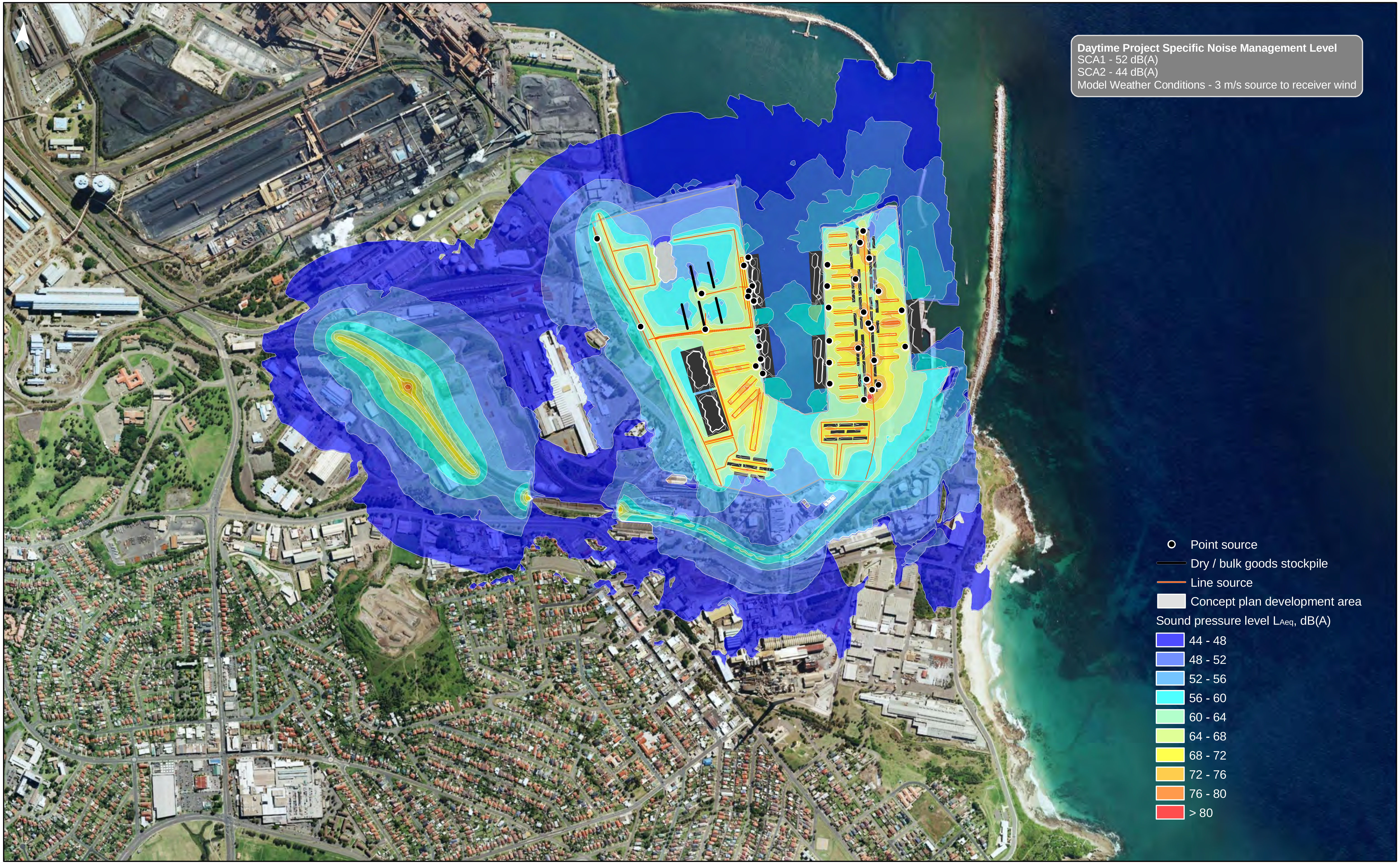
CONCEPT PLAN - NIGHT - SOUTH YARD BARRIER

SEP 2010

60039301

0 150 300 600 m

Fig. **13**



PORT KEMBLA OUTER HARBOUR DEVELOPMENT

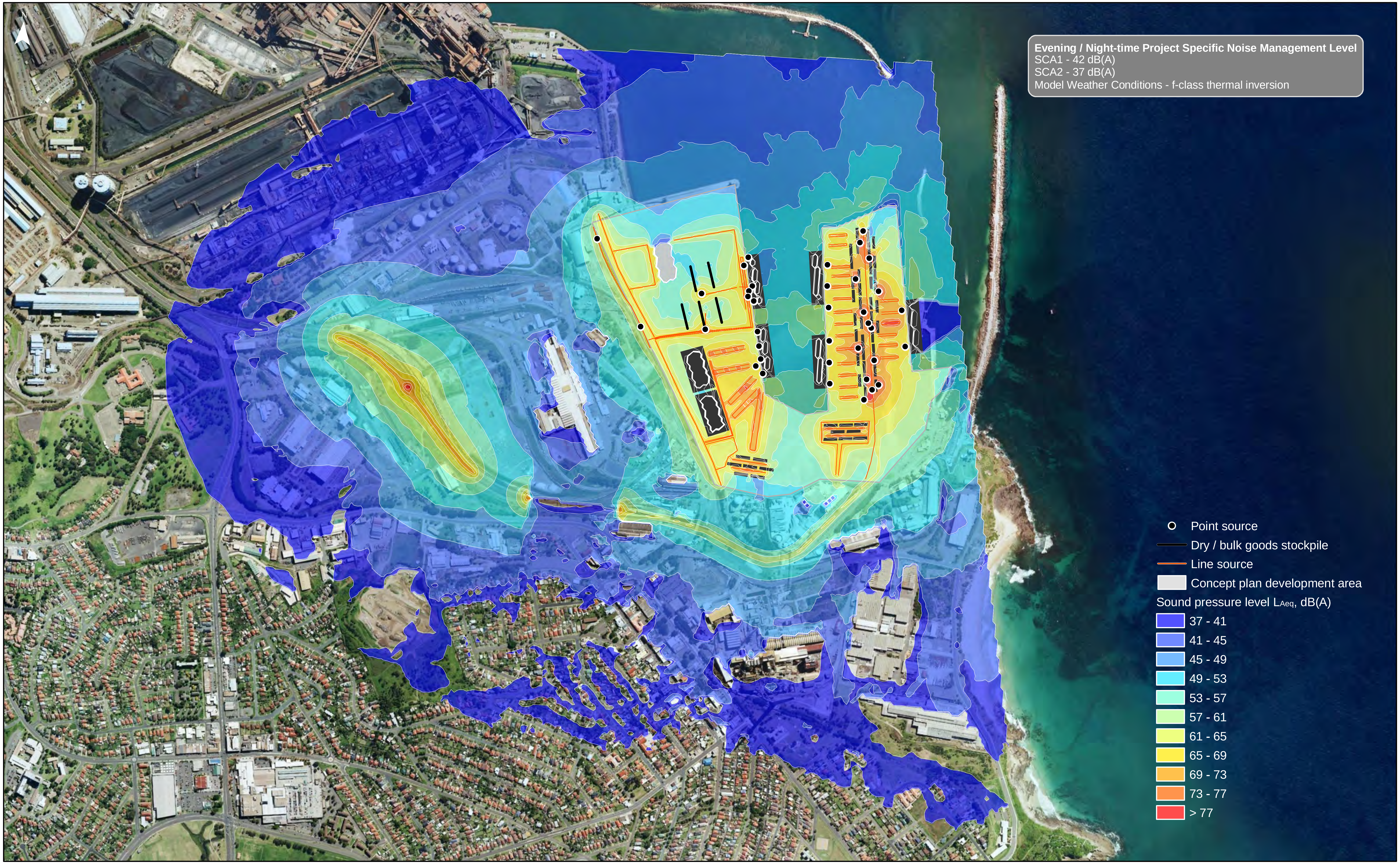
CONCEPT PLAN - DAY - SOUTH YARD SHED

SEP 2010

60039301

0 150 300 600 m

AECOM



PORT KEMBLA OUTER HARBOUR DEVELOPMENT

CONCEPT PLAN - NIGHT - SOUTH YARD SHED

SEP 2010

60039301

0 150 300 600 m

Fig. **15**

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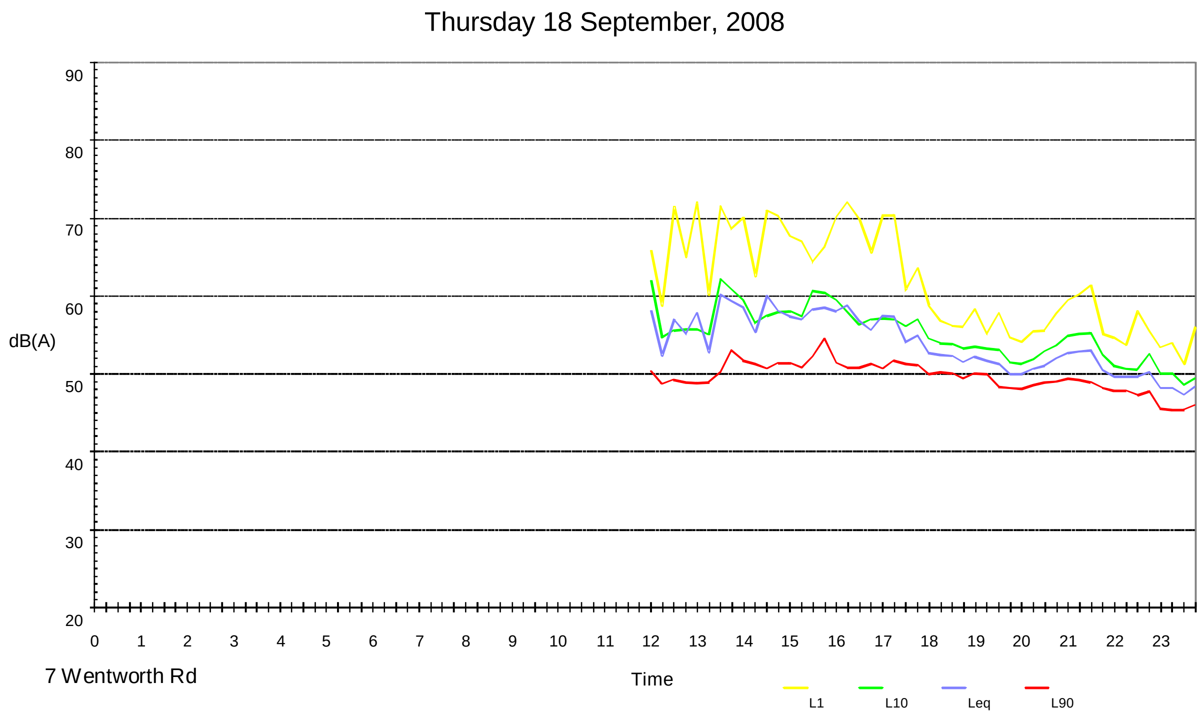
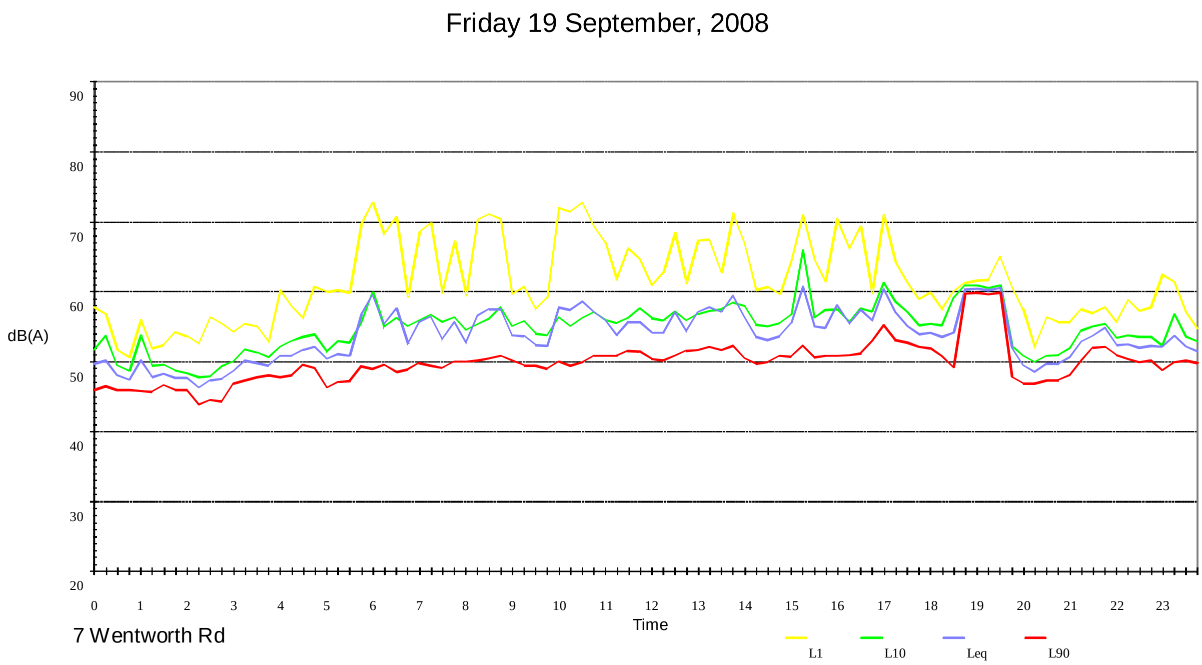
Appendix B

Noise Logging Graphs

Appendix B Noise Logging Graphs

Wentworth Road





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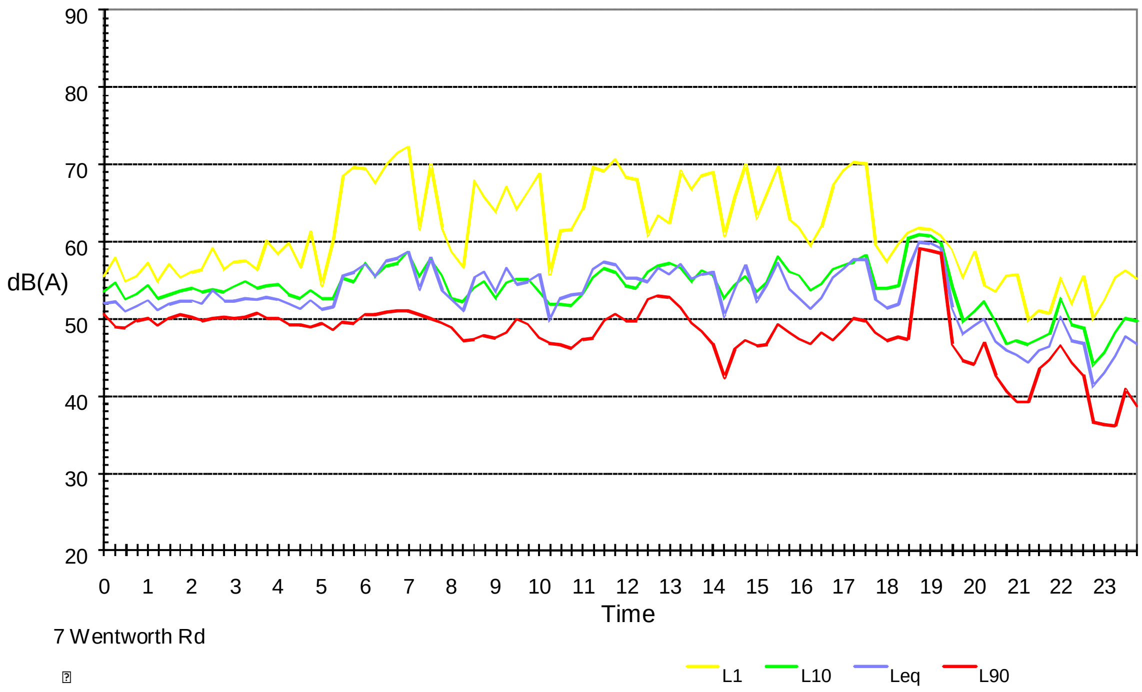
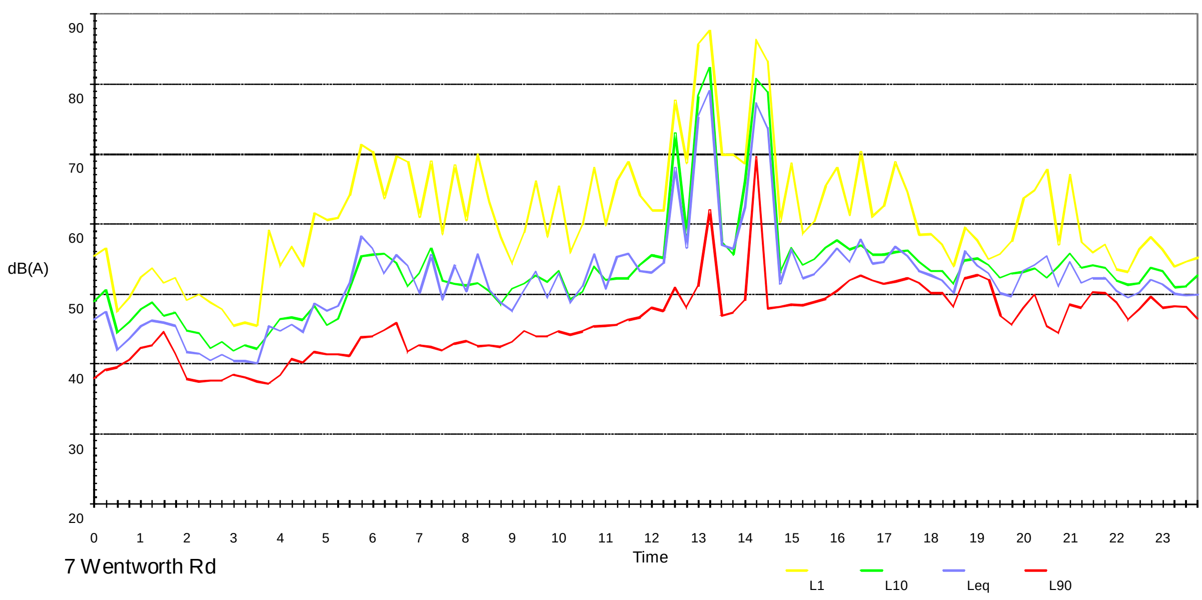
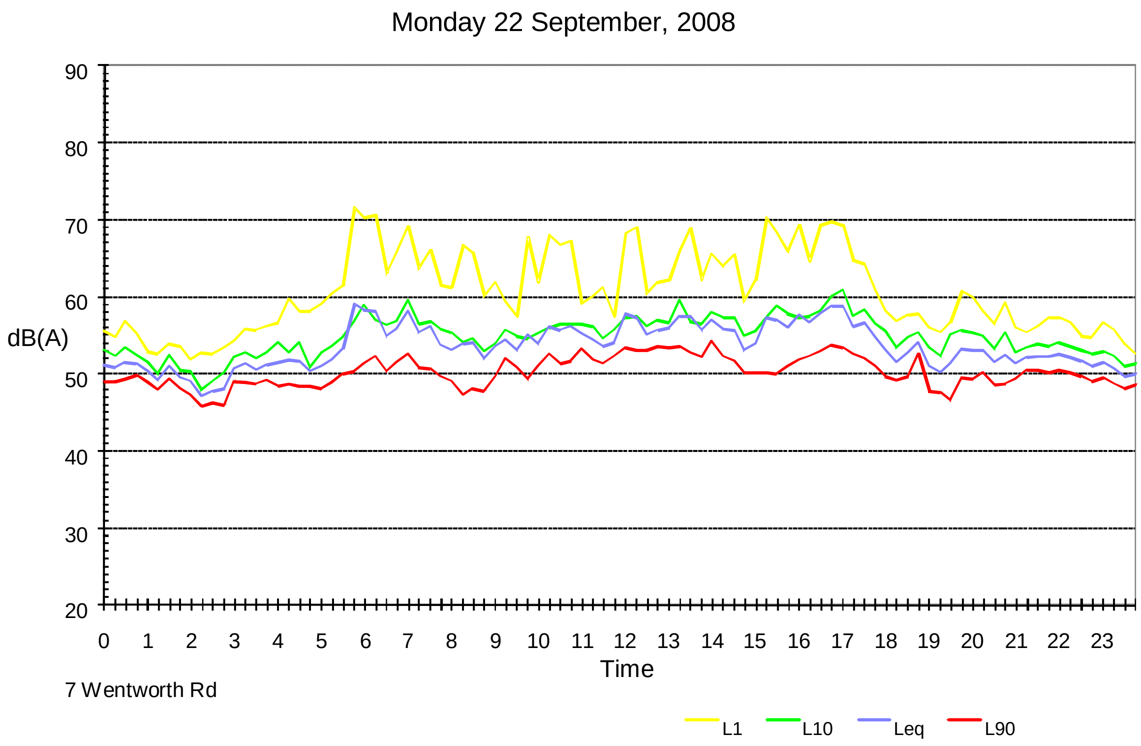


Sunday 21 September, 2008

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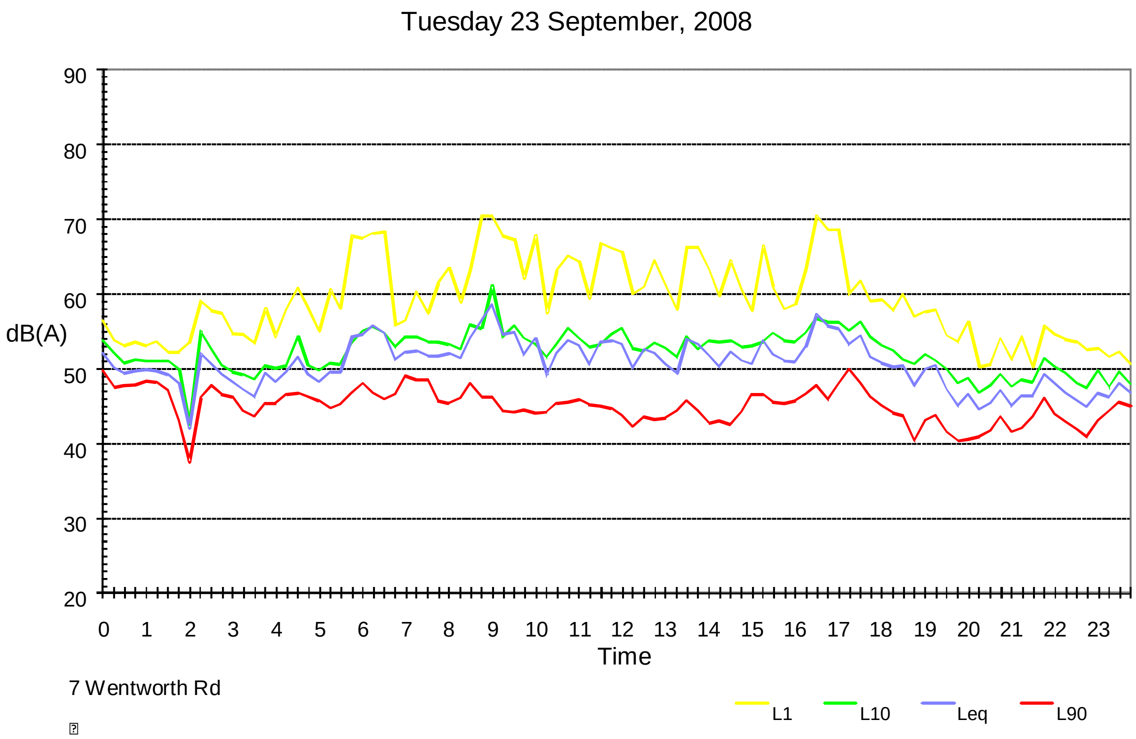
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
7 Wentworth Rd
L1
L10
Leq
L90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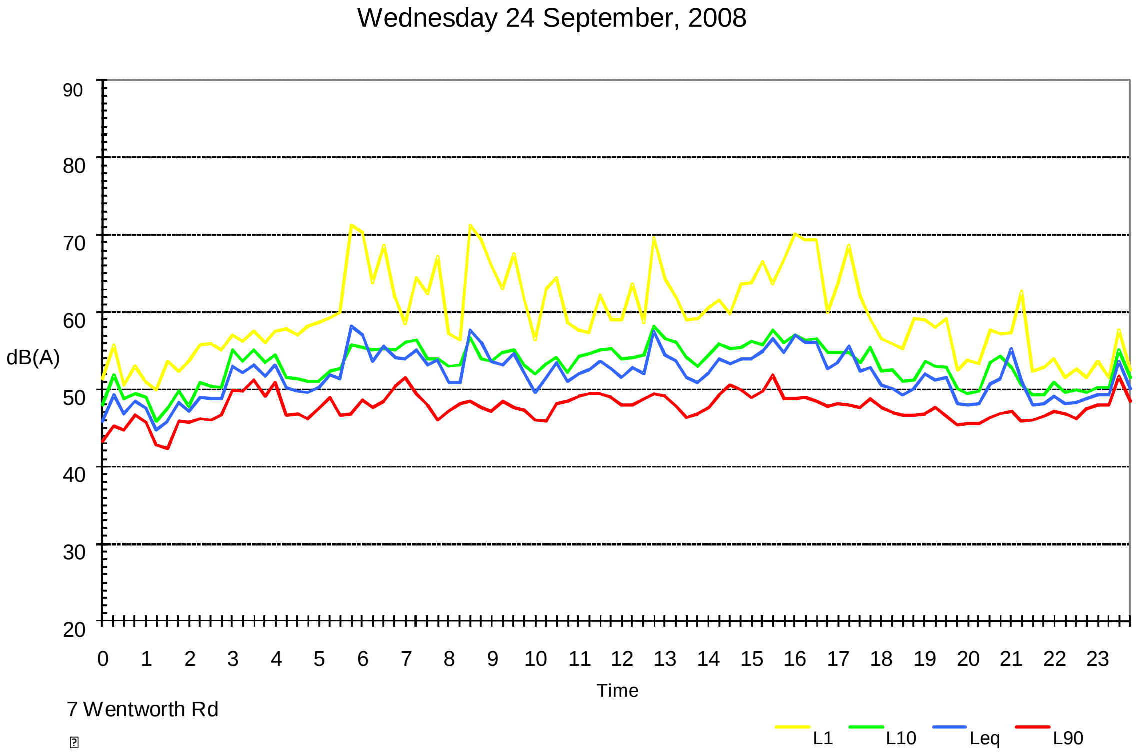
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
7 Wentworth Rd
L1
L10
Leq
L90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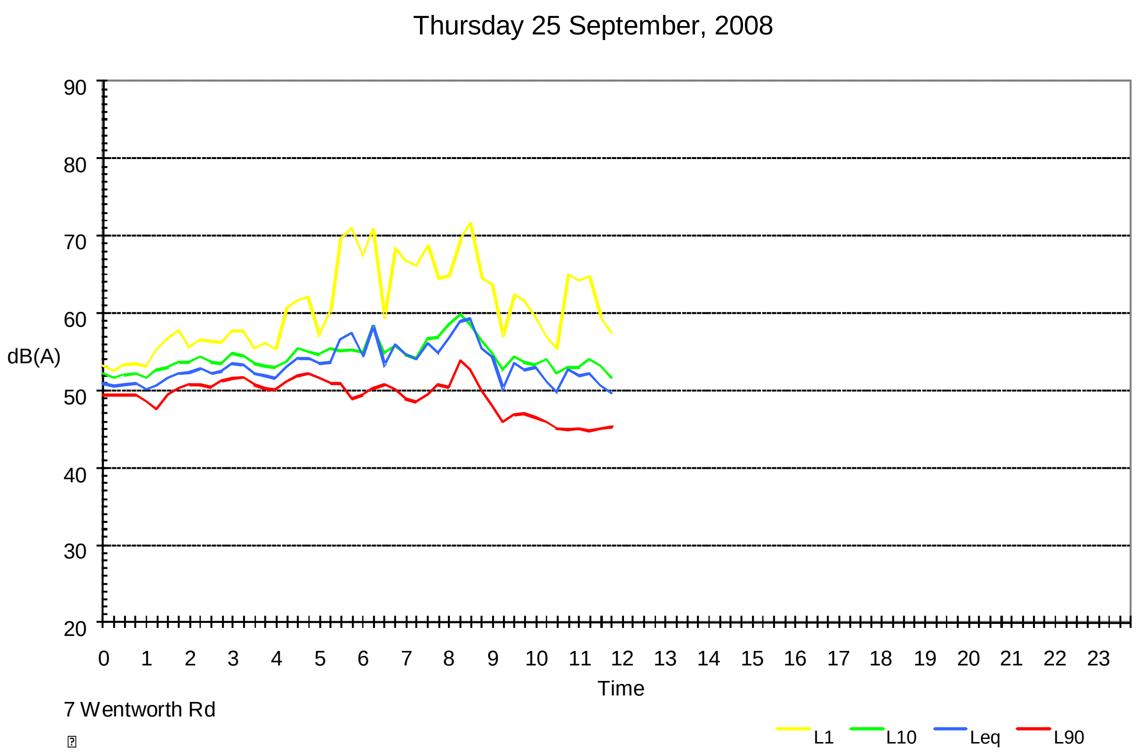
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
7 Wentworth Rd
L1
L10
Leq
L90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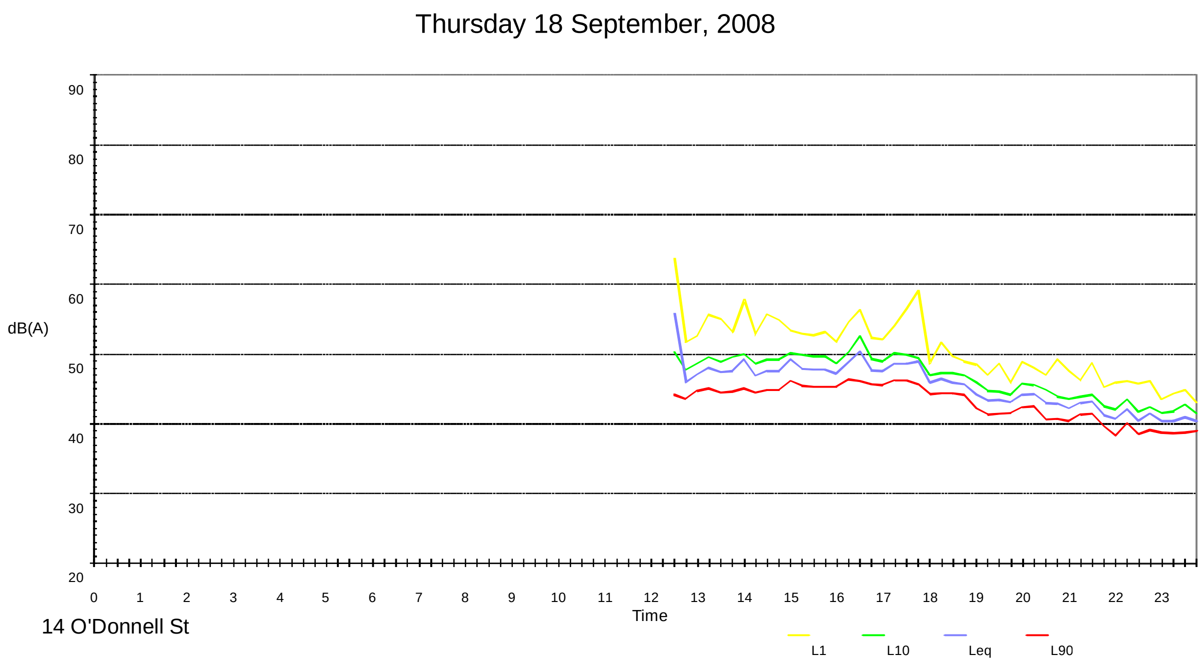
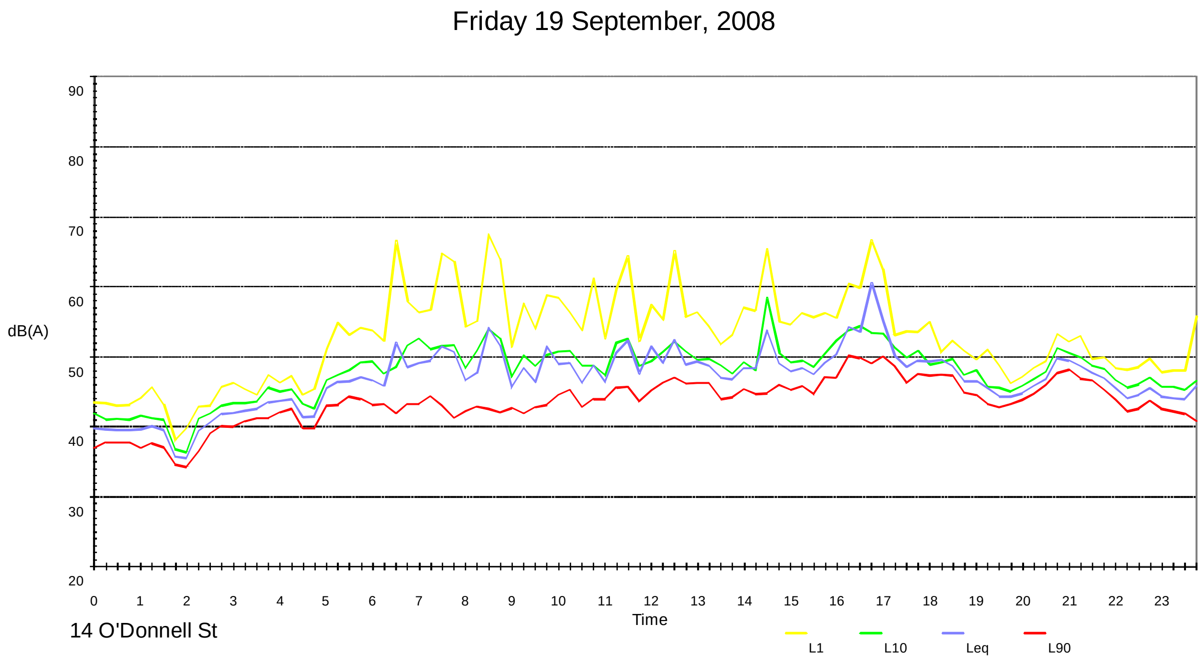
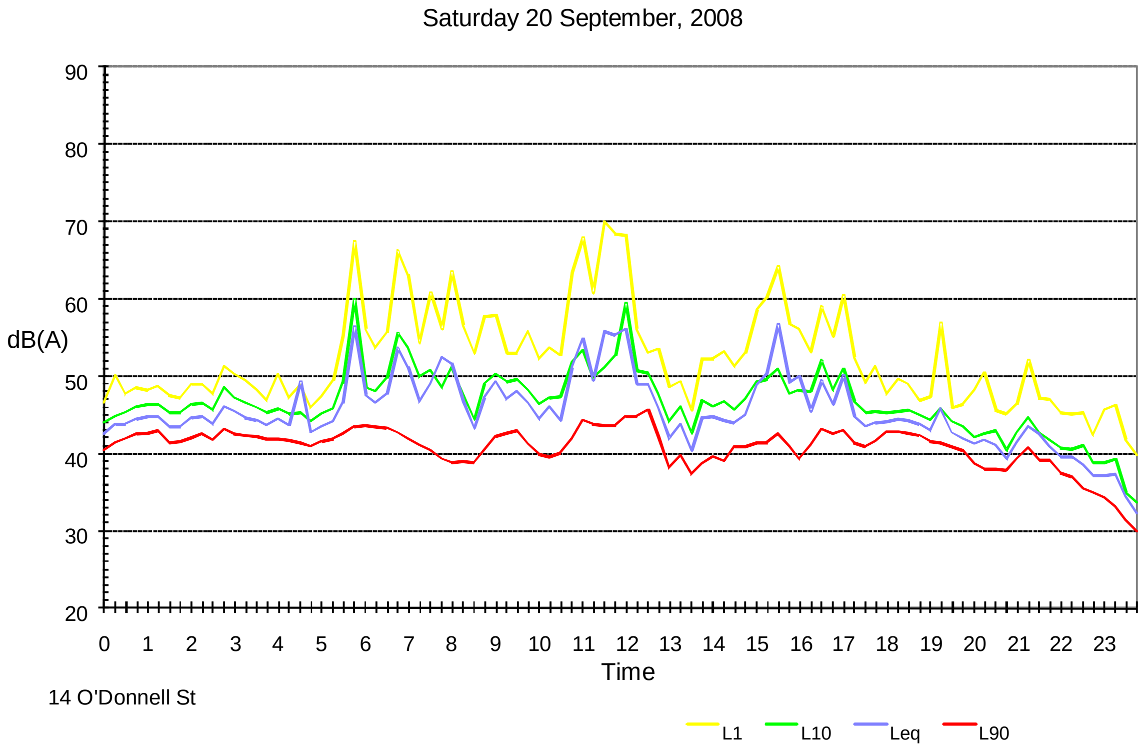
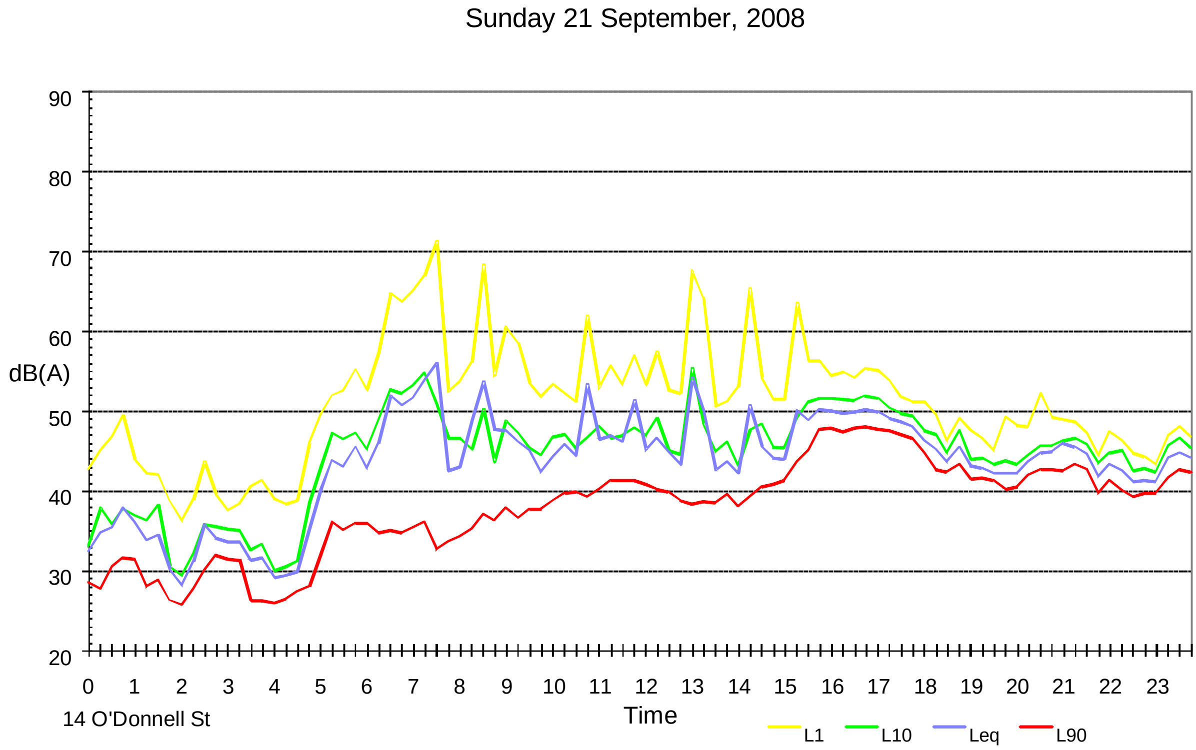
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
7 Wentworth Rd
L1
L10
Leq
L90

O'Donnell Street

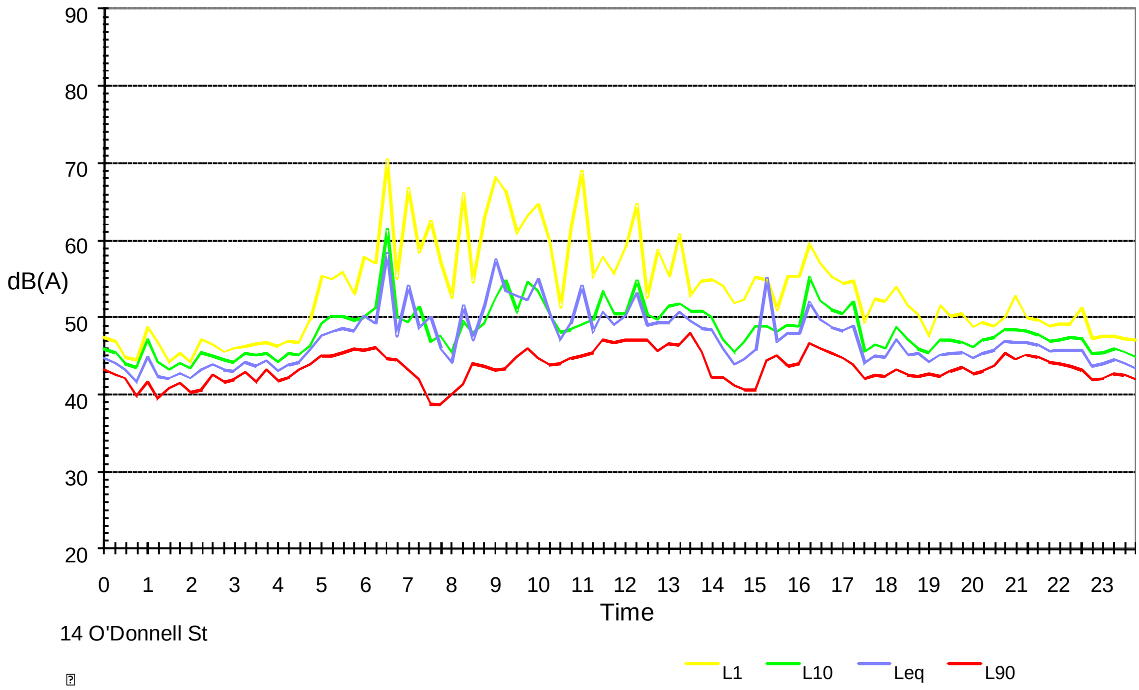





Saturday 20 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1
L10
Leq
L90

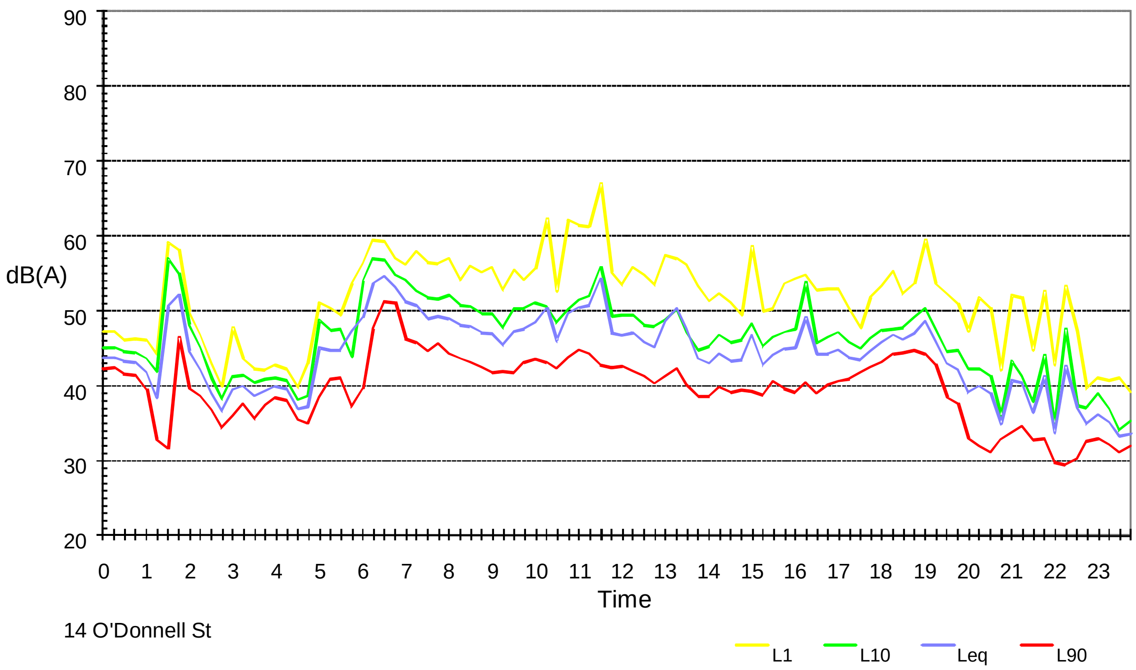

Sunday 21 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
14 O'Donnell St
Time
L1
L10
Leq
L90

Monday 22 September, 2008

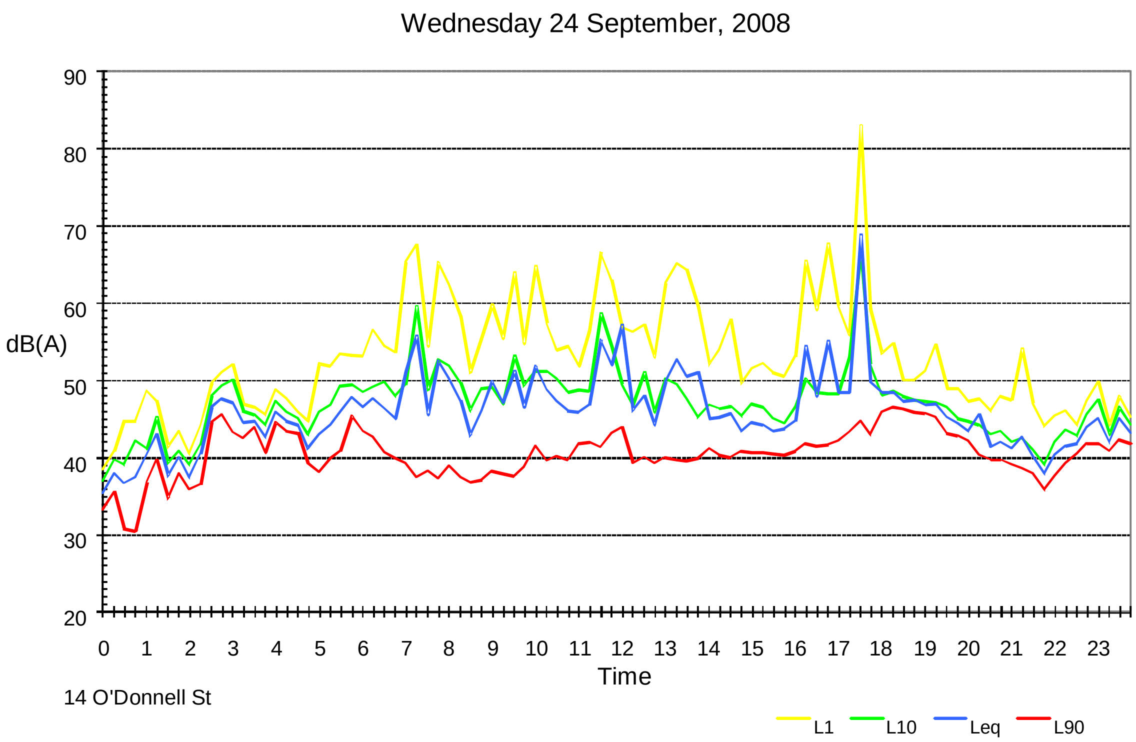


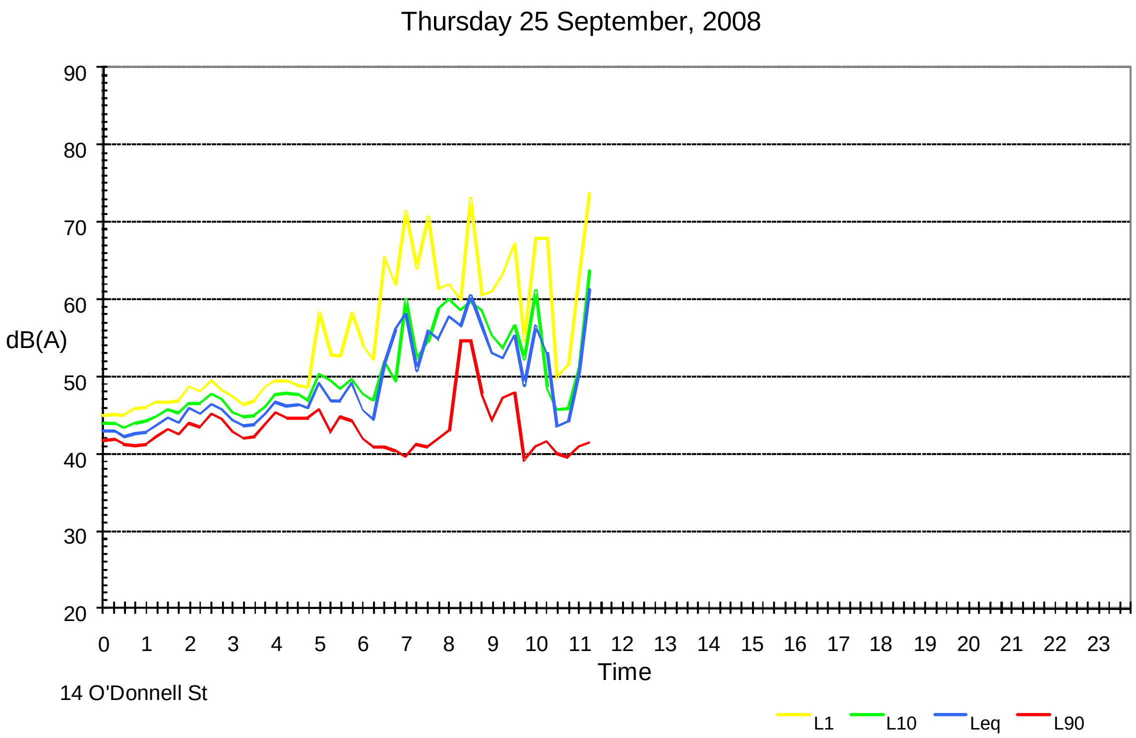
14 O'Donnell St

Tuesday 23 September, 2008

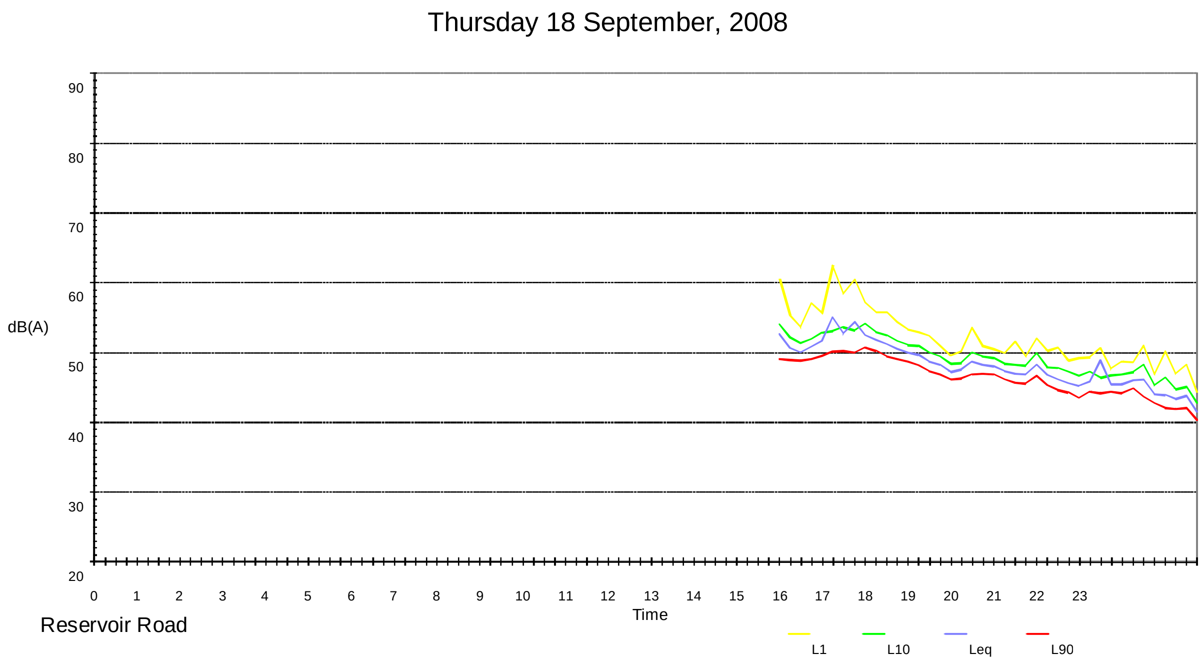


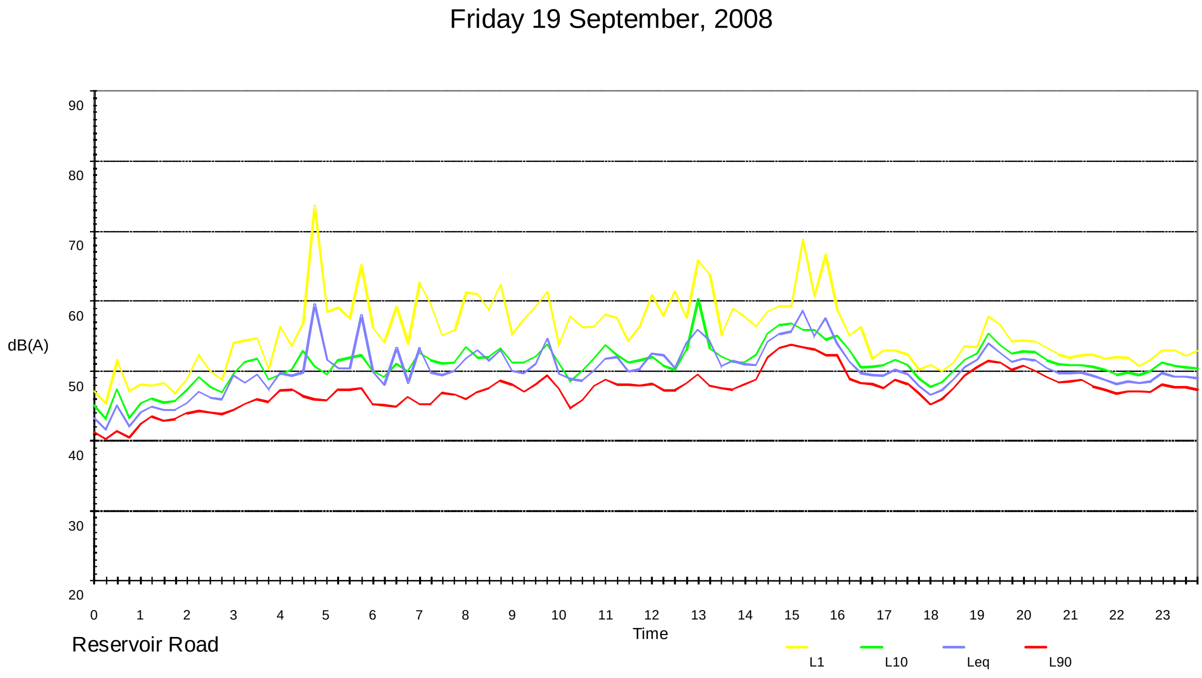
14 O'Donnell St

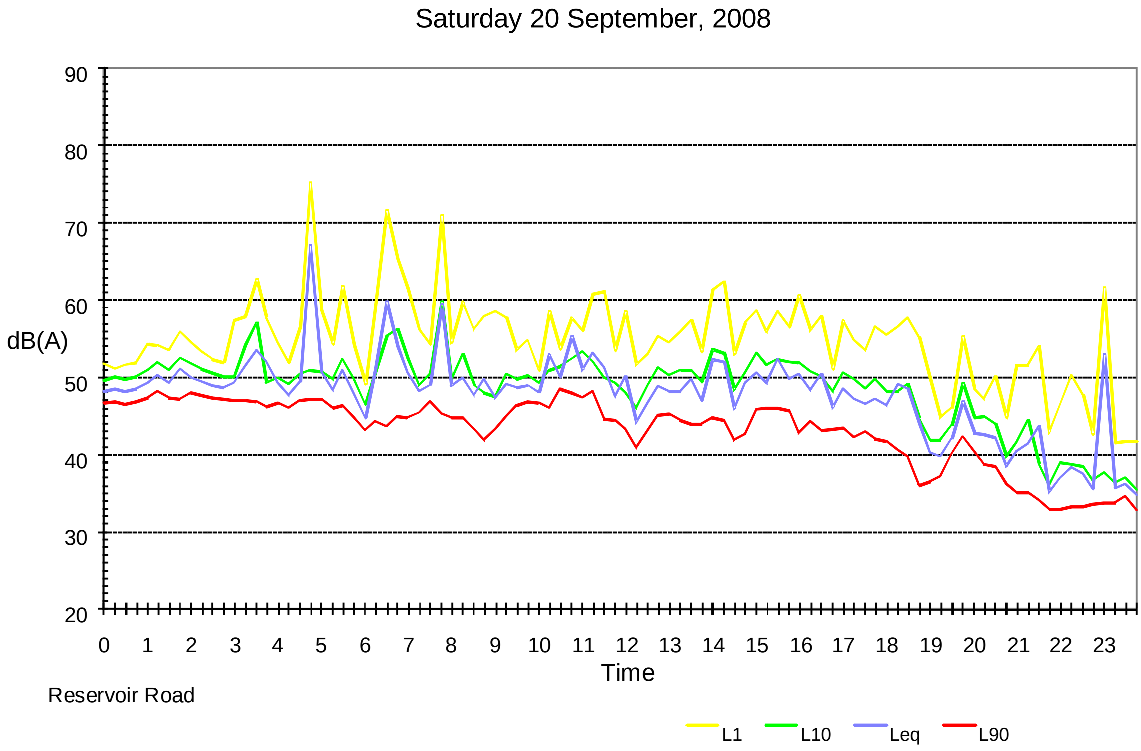

Wednesday 24 September, 2008
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1
L10
Leq
L90

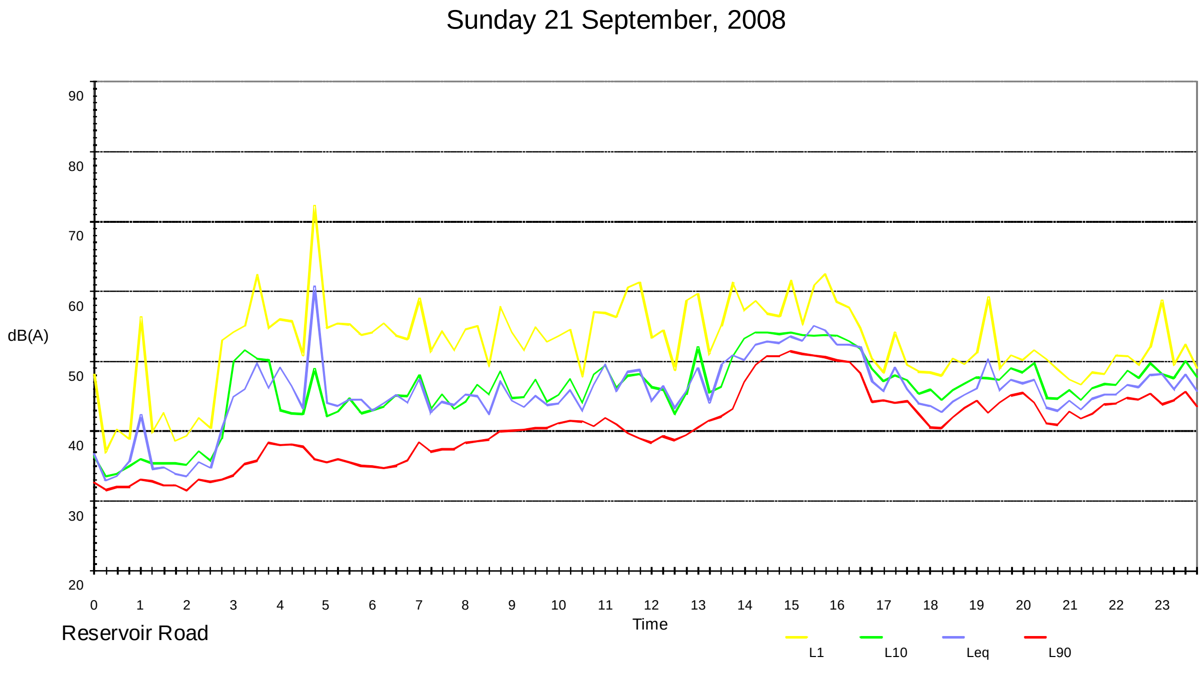

Thursday 25 September, 2008
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
14 O'Donnell St
L1
L10
Leq
L90

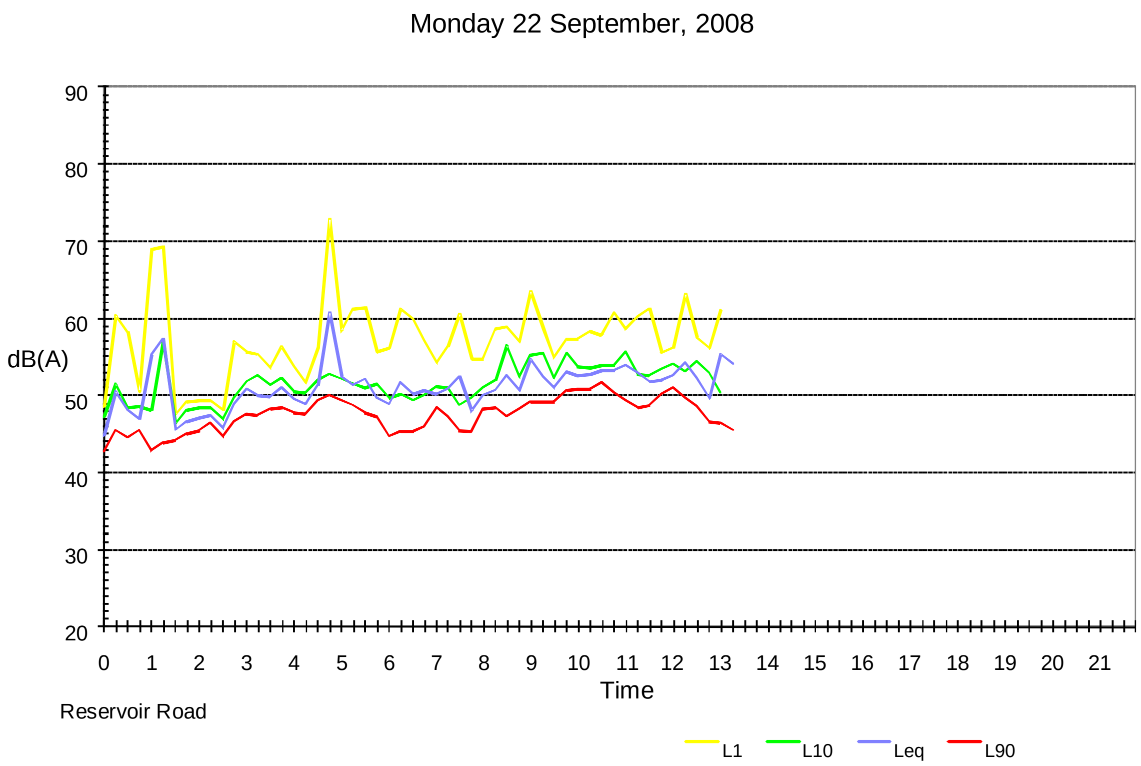
Reservoir Road



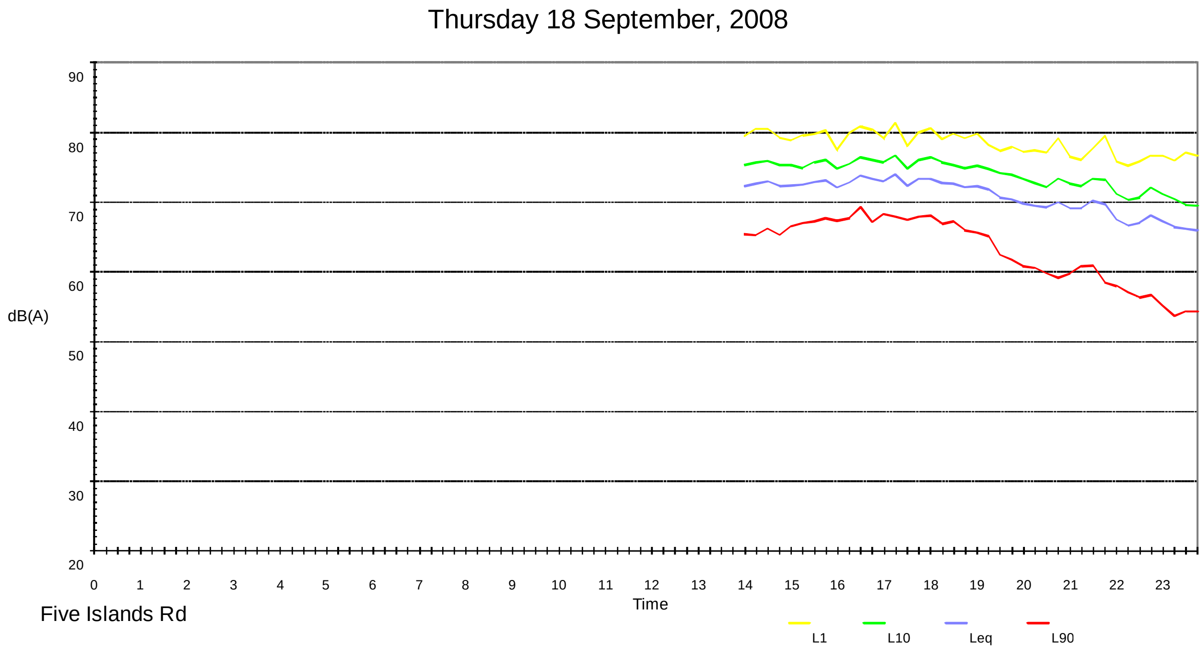


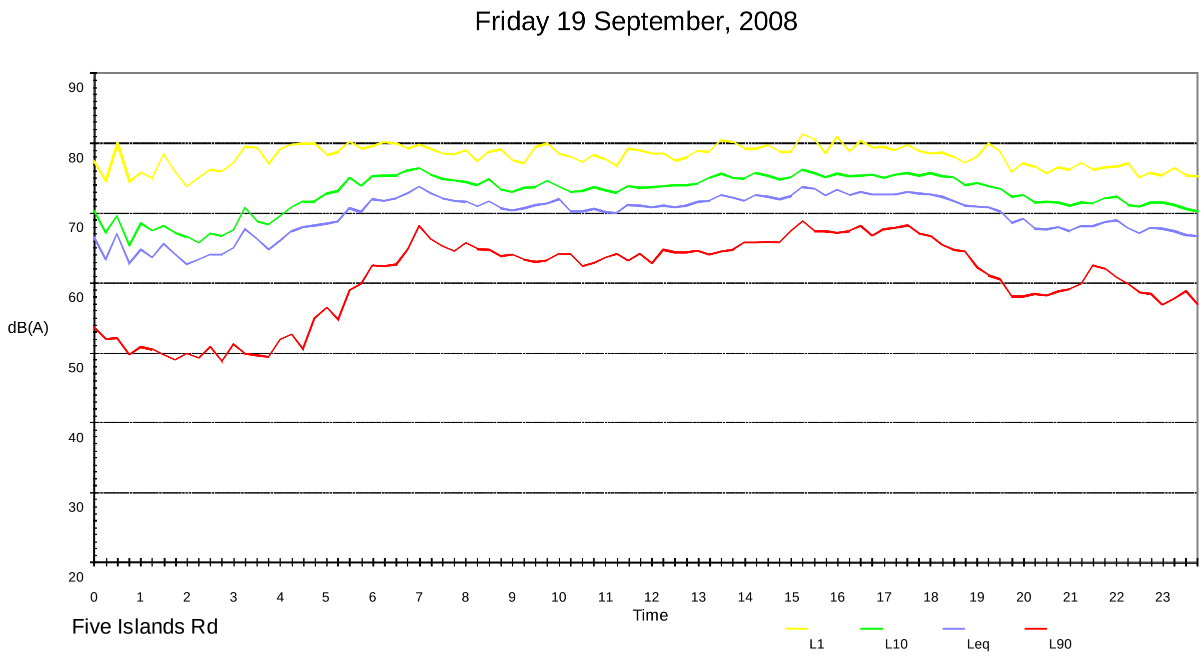

Saturday 20 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Reservoir Road
L1 L10 Leq L90

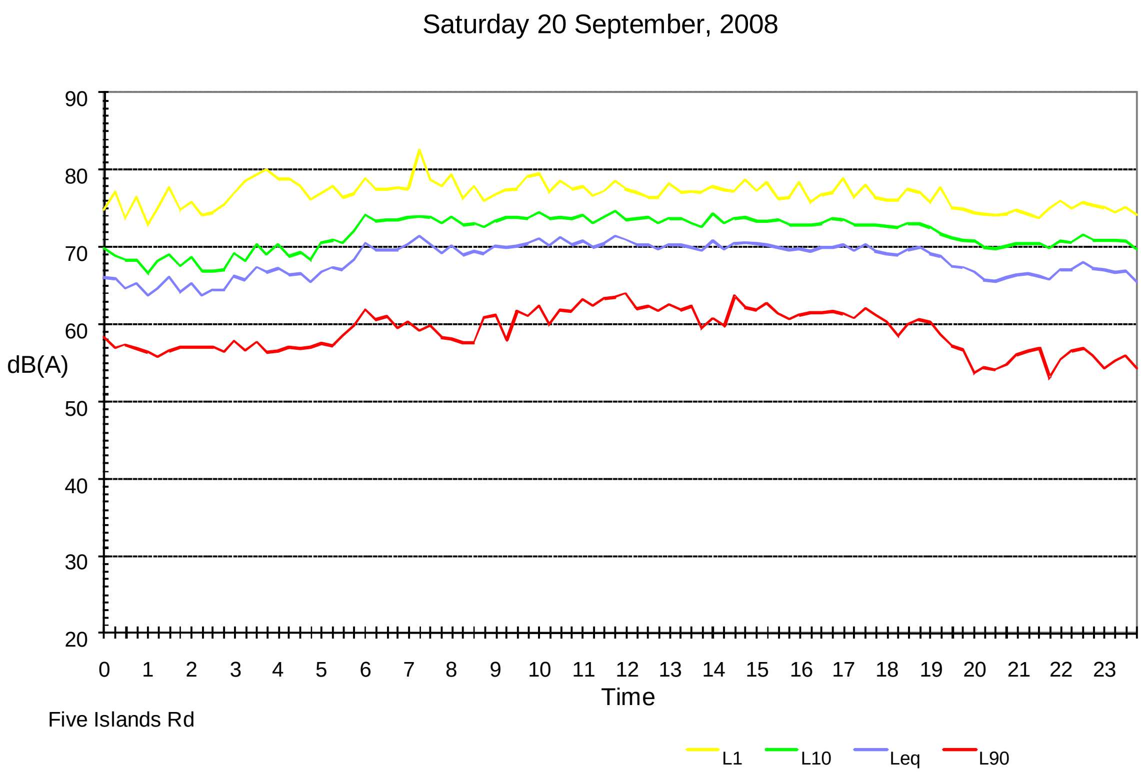

Sunday 21 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Reservoir Road
L1 L10 Leq L90



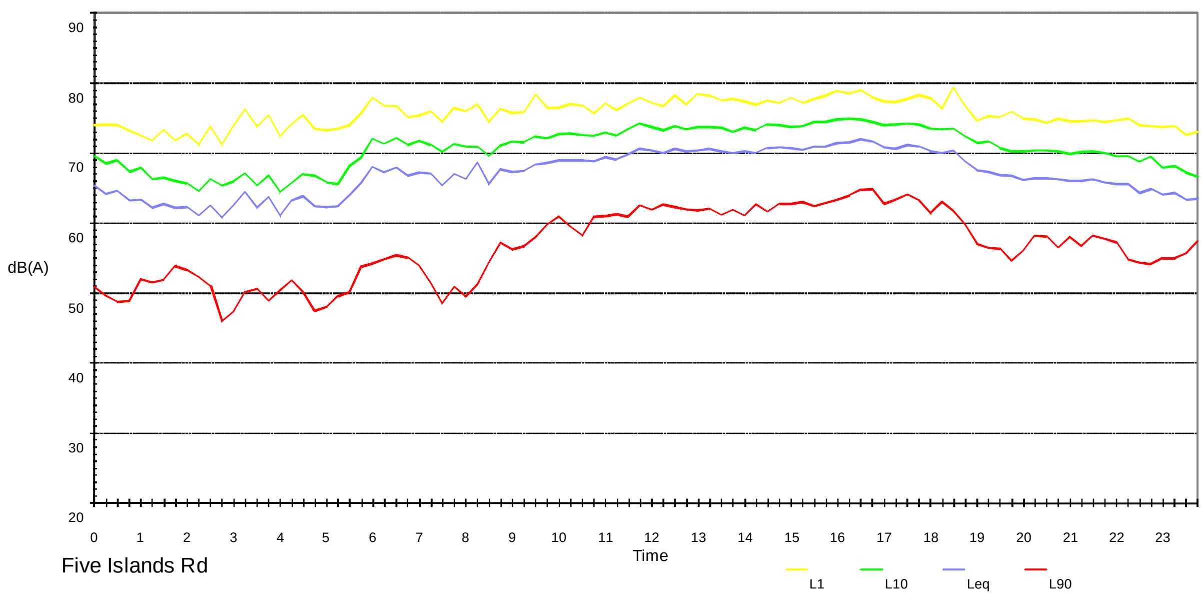
Five Islands Road – Traffic Noise




Friday 19 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90


Saturday 20 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time
Five Islands Rd
L1
L10
Leq
L90

Sunday 21 September, 2008



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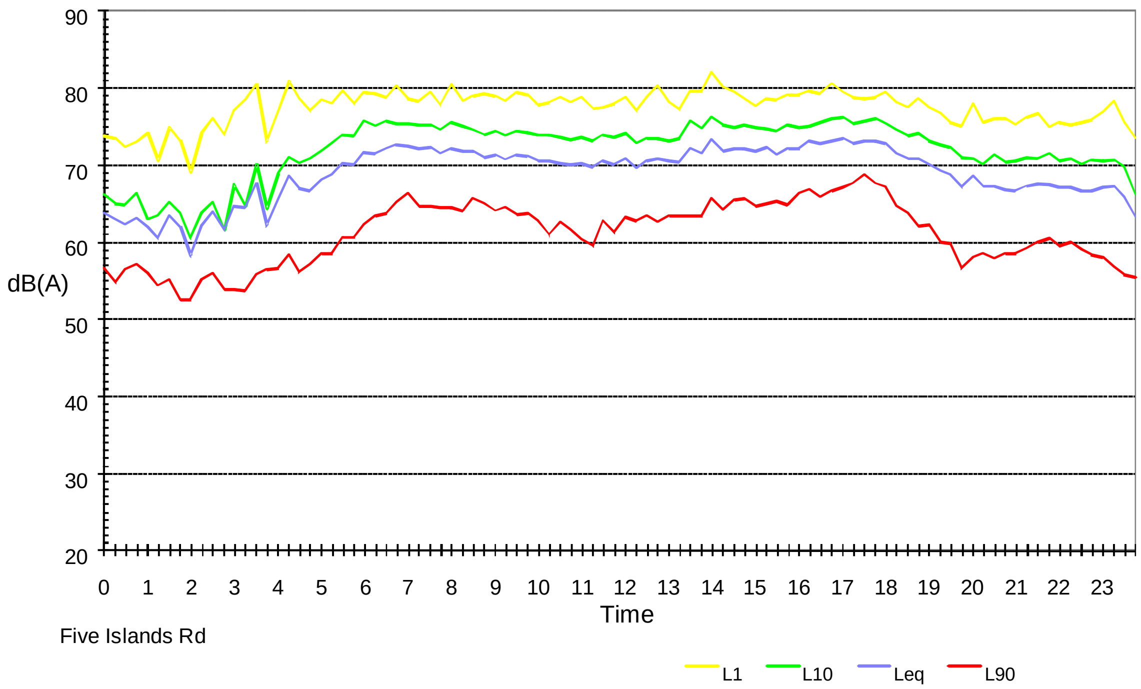

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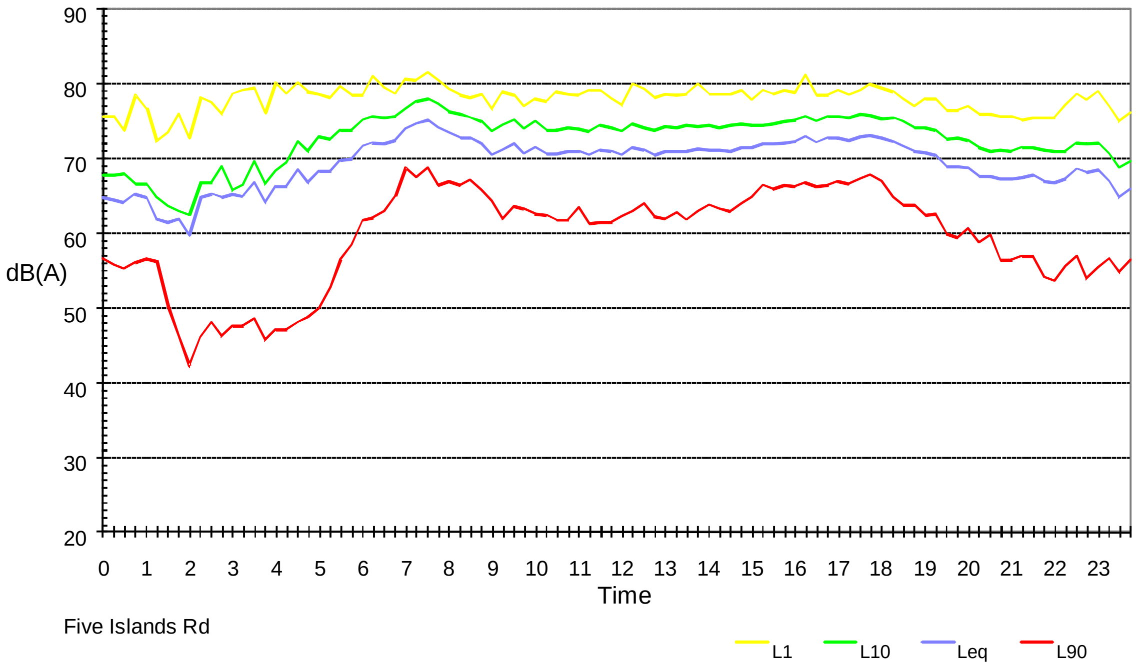

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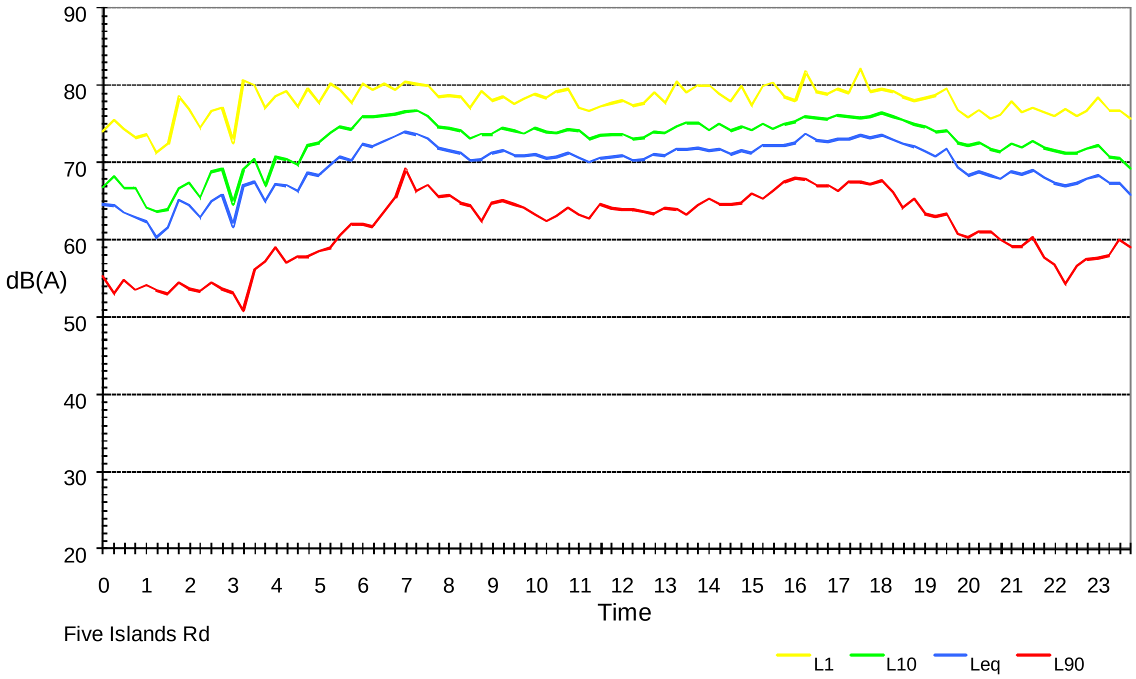

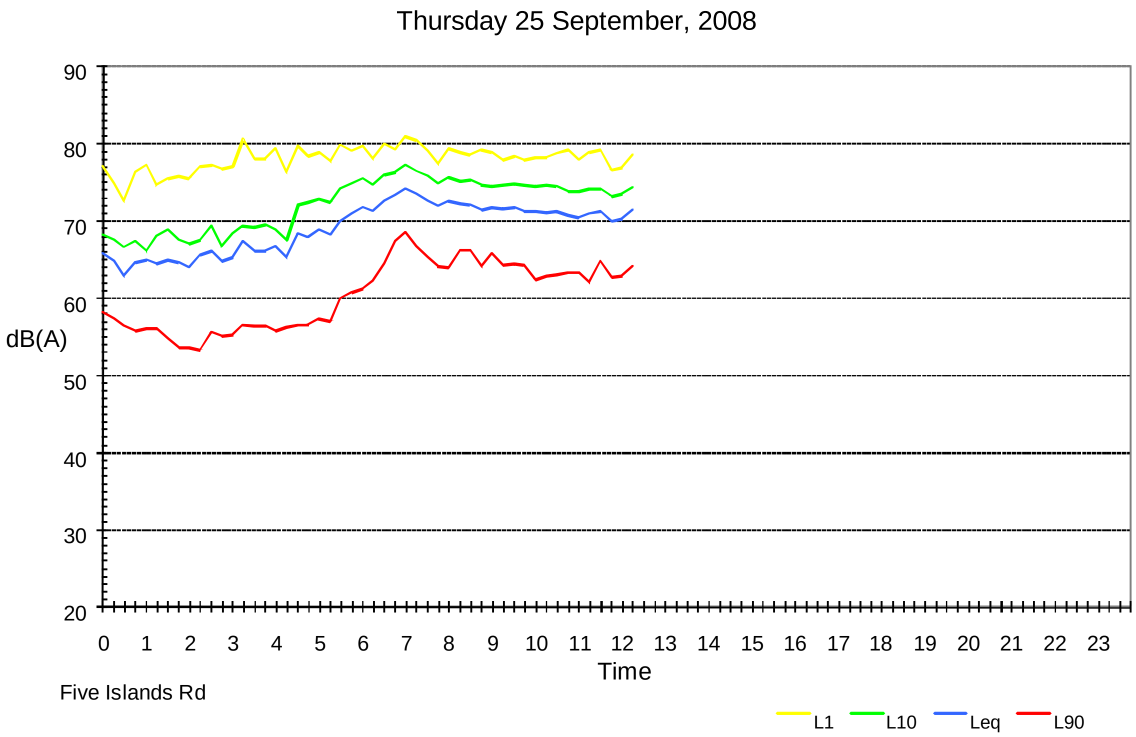
Thursday 25 September, 2008
90
80
70
60
50
40
30
20
dB(A)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Time
Five Islands Rd
L1
L10
Leq
L90

Appendix C

Predicted Construction Noise Levels

Appendix C Predicted Construction Noise Levels

Table 38 Predicted construction noise levels in SCA 1

Receiver	Construction Noise Limit dB(A)		Predicted L_{Aeq} Noise Levels, dB(A)		Predicted Exceedance dB(A)	
	Day	Night	Day	Night	Day	Night
5-7 Military Road	57	50	50	41	-	-
9 Military Road			50	41	-	-
11 Military Road			50	41	-	-
15 Military Road			50	41	-	-
3 Wentworth Road			48	39	-	-
5 Wentworth Road			48	39	-	-
7 Wentworth Road			48	39	-	-
9 Wentworth Road			49	39	-	-
11 Wentworth Road			49	39	-	-
13 Wentworth Road			49	40	-	-
15 Wentworth Road			49	40	-	-
17 Wentworth Road			49	40	-	-
19 Wentworth Road			49	40	-	-
1 Third Avenue			44	36	-	-
2 Third Avenue			44	36	-	-
160 Wentworth Road			43	35	-	-
2 Reservoir Street			44	37	-	-

Table 39 Predicted construction noise levels in SCA 2

Receiver	Construction Noise Limit dB(A)		Predicted L_{Aeq} Noise Levels, dB(A)		Predicted Exceedance dB(A)	
	Day	Night	Day	Night	Day	Night
1 Jubilee Road	49	42	48	39	-	-
2 Jubilee Road			47	38	-	-
3 Jubilee Road			47	39	-	-
4 Jubilee Road			46	37	-	-
5 Jubilee Road			46	38	-	-
6 Jubilee Road			47	38	-	-
7 Jubilee Road			48	38	-	-
8 Jubilee Road			45	37	-	-
9 Jubilee Road			45	37	-	-
10 Jubilee Road			45	33	-	-
11 Jubilee Road			37	27	-	-
12 Jubilee Road			47	32	-	-
14 Jubilee Road			36	29	-	-
16 Jubilee Road			37	28	-	-
14 Horne Street			40	35	-	-
16 Horne Street			40	35	-	-
18 Horne Street			46	36	-	-
20 Horne Street			48	34	-	-
2 Lawarra Street			42	33	-	-
29 Keira Street			42	34	-	-
33 Keira Street			42	36	-	-
37 Keira Street			42	34	-	-
43 Keira Street			42	34	-	-
47 Keira Street			42	34	-	-

Appendix D

Predicted Operational Noise Levels

Appendix D Predicted Operational Noise Levels

Table 40 Major Project – Operational Noise Levels SCA 1 – No South Stabling Yard Mitigation

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5-7 Military Road	52	43	42	44	43	0	0	1
9 Military Road				40	40	0	0	0
11 Military Road				40	40	0	0	0
15 Military Road				44	43	0	0	1
3 Wentworth Road				53	53	1	10	11
5 Wentworth Road				53	53	1	10	11
7 Wentworth Road				53	53	1	10	11
9 Wentworth Road				52	52	0	9	10
11 Wentworth Road				51	51	0	8	9
13 Wentworth Road				50	50	0	7	8
15 Wentworth Road				50	50	0	7	8
17 Wentworth Road				49	49	0	6	7
19 Wentworth Road				47	47	0	4	5
66 Darcy Road				44	43	0	0	1
68 Darcy Road				45	45	0	2	3
1 Third Avenue				28	27	0	0	0
2 Third Avenue				32	32	0	0	0
160 Wentworth Road				31	30	0	0	0
2 Reservoir Street				32	32	0	0	0
3 Marne Street				28	28	0	0	0
7 Marne Street				29	28	0	0	0
25 Brody Street				29	29	0	0	0
28 Gallipoli Street				26	25	0	0	0
30 Gallipoli Street				29	28	0	0	0
32 Gallipoli Street				29	28	0	0	0

Table 41 Major Project – Operational Noise Levels SCA1 – 6m barriers in South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5-7 Military Road	52	43	42	40	39	0	0	0
9 Military Road				39	38	0	0	0
11 Military Road				39	38	0	0	0
15 Military Road				40	39	0	0	0
3 Wentworth Road				42	42	0	0	0
5 Wentworth Road				42	42	0	0	0
7 Wentworth Road				42	42	0	0	0
9 Wentworth Road				42	42	0	0	0
11 Wentworth Road				42	41	0	0	0
13 Wentworth Road				41	40	0	0	0
15 Wentworth Road				41	40	0	0	0
17 Wentworth Road				40	40	0	0	0

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
19 Wentworth Road				40	39	0	0	0
66 Darcy Road				37	37	0	0	0
68 Darcy Road				39	38	0	0	0
1 Third Avenue				27	26	0	0	0
2 Third Avenue				31	30	0	0	0
160 Wentworth Road				28	28	0	0	0
2 Reservoir Street				31	31	0	0	0
3 Marne Street				28	28	0	0	0
7 Marne Street				29	28	0	0	0
25 Brody Street				28	28	0	0	0
28 Gallipoli Street				26	25	0	0	0
30 Gallipoli Street				28	27	0	0	0
32 Gallipoli Street				28	27	0	0	0

Table 42 Major Project Operational Noise Levels in SCA 2 – No Mitigation

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
1 Jubilee Road	44	45	37	42	41	0	0	4
2 Jubilee Road				37	36	0	0	0
3 Jubilee Road				36	36	0	0	0
4 Jubilee Road				39	38	0	0	1
5 Jubilee Road				36	35	0	0	0
6 Jubilee Road				34	33	0	0	0
7 Jubilee Road				37	36	0	0	0
8 Jubilee Road				35	34	0	0	0
9 Jubilee Road				33	32	0	0	0
10 Jubilee Road				34	34	0	0	0
5 Kembla Street				32	32	0	0	0
7 Kembla Street				34	33	0	0	0
9 Kembla Street				34	33	0	0	0
11 Kembla Street				35	34	0	0	0
13 Kembla Street				36	35	0	0	0
15 Kembla Street				36	35	0	0	0
16 Kembla Street				33	32	0	0	0
17 Kembla Street				35	35	0	0	0
17A Kembla Street				36	36	0	0	0
18 Kembla Street				34	33	0	0	0
19 Kembla Street				34	34	0	0	0
20 Kembla Street				34	33	0	0	0
21 Kembla Street				37	36	0	0	0
22 Kembla Street				34	33	0	0	0
23 Kembla Street				36	35	0	0	0
24 Kembla Street				33	32	0	0	0
25 Kembla Street				36	35	0	0	0
26 Kembla Street				34	33	0	0	0
27 Kembla Street				34	34	0	0	0
28 Kembla Street				33	32	0	0	0
29 Kembla Street				35	34	0	0	0
30 Kembla Street				33	33	0	0	0
31 Kembla Street				35	34	0	0	0
32 Kembla Street				34	33	0	0	0
33 Kembla Street				32	31	0	0	0
35 Kembla Street				35	34	0	0	0
40 Kembla Street				34	34	0	0	0
41-47 Kembla Street				34	33	0	0	0
42 Kembla Street				32	32	0	0	0
44 Kembla Street				34	33	0	0	0
46 Kembla Street				34	33	0	0	0
48 Kembla Street				31	31	0	0	0
50 Kembla Street				31	30	0	0	0
7 O’Donnell Street				33	33	0	0	0
8 O’Donnell Street				35	34	0	0	0
9 O’Donnell Street				32	31	0	0	0
10 O’Donnell Street				35	34	0	0	0
11 O’Donnell Street				33	32	0	0	0

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
12 O'Donnell Street				32	31	0	0	0
13 O'Donnell Street				33	32	0	0	0
14 O'Donnell Street				33	32	0	0	0
15 O'Donnell Street				32	31	0	0	0
18 O'Donnell Street				34	33	0	0	0
20 O'Donnell Street				34	33	0	0	0
23 O'Donnell Street				32	32	0	0	0
24 O'Donnell Street				33	33	0	0	0
25 O'Donnell Street				32	31	0	0	0
26 O'Donnell Street				33	33	0	0	0
30 O'Donnell Street				33	32	0	0	0
32 O'Donnell Street				33	32	0	0	0
34 O'Donnell Street				32	32	0	0	0
36 O'Donnell Street				31	30	0	0	0
38 O'Donnell Street				31	30	0	0	0
45 O'Donnell Street				32	31	0	0	0
51 O'Donnell Street				20	19	0	0	0
52 O'Donnell Street				26	26	0	0	0
16 Horne Street				37	36	0	0	0
18 Horne Street				34	33	0	0	0
20 Horne Street				35	34	0	0	0
33 Horne Street				36	35	0	0	0
41 Horne Street				33	32	0	0	0
49 Horne Street				33	33	0	0	0
4 Keira Street				33	33	0	0	0
16 Keira Street				36	35	0	0	0
20 Keira Street				36	35	0	0	0
24 Keira Street				35	35	0	0	0
28 Keira Street				35	34	0	0	0
32 Keira Street				35	34	0	0	0
36 Keira Street				35	34	0	0	0
38 Keira Street				33	33	0	0	0
40 Keira Street				34	34	0	0	0
42 Keira Street				34	33	0	0	0
44 Keira Street				34	34	0	0	0
46 Keira Street				33	33	0	0	0
48 Keira Street				36	35	0	0	0

Table 43 Major Project – Operational Noise Levels is SCA2 – 6m barriers in South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
1 Jubilee Road	44	45	37	36	36	0	0	0
2 Jubilee Road				34	34	0	0	0
3 Jubilee Road				35	34	0	0	0
4 Jubilee Road				35	34	0	0	0

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5 Jubilee Road				35	34	0	0	0
6 Jubilee Road				32	32	0	0	0
7 Jubilee Road				34	34	0	0	0
8 Jubilee Road				33	32	0	0	0
9 Jubilee Road				30	29	0	0	0
10 Jubilee Road				34	33	0	0	0
5 Kembla Street				32	32	0	0	0
7 Kembla Street				33	32	0	0	0
9 Kembla Street				33	33	0	0	0
11 Kembla Street				34	34	0	0	0
13 Kembla Street				35	35	0	0	0
15 Kembla Street				35	34	0	0	0
16 Kembla Street				33	32	0	0	0
17 Kembla Street				34	34	0	0	0
17A Kembla Street				35	34	0	0	0
18 Kembla Street				33	33	0	0	0
19 Kembla Street				33	32	0	0	0
20 Kembla Street				33	33	0	0	0
21 Kembla Street				35	34	0	0	0
22 Kembla Street				34	33	0	0	0
23 Kembla Street				35	34	0	0	0
24 Kembla Street				33	32	0	0	0
25 Kembla Street				35	34	0	0	0
26 Kembla Street				33	32	0	0	0
27 Kembla Street				33	32	0	0	0
28 Kembla Street				32	32	0	0	0
29 Kembla Street				33	32	0	0	0
30 Kembla Street				33	32	0	0	0
31 Kembla Street				32	32	0	0	0
32 Kembla Street				33	32	0	0	0
33 Kembla Street				32	31	0	0	0
35 Kembla Street				31	31	0	0	0
40 Kembla Street				32	32	0	0	0
41-47 Kembla Street				32	31	0	0	0
42 Kembla Street				31	31	0	0	0
44 Kembla Street				32	31	0	0	0
46 Kembla Street				32	31	0	0	0
48 Kembla Street				31	30	0	0	0
50 Kembla Street				30	29	0	0	0
7 O'Donnell Street				33	33	0	0	0
8 O'Donnell Street				34	34	0	0	0
9 O'Donnell Street				32	31	0	0	0
10 O'Donnell Street				34	33	0	0	0
11 O'Donnell Street				33	32	0	0	0
12 O'Donnell Street				32	31	0	0	0
13 O'Donnell Street				33	32	0	0	0
14 O'Donnell Street				33	32	0	0	0
15 O'Donnell Street				32	31	0	0	0
18 O'Donnell Street				34	33	0	0	0
20 O'Donnell Street				34	33	0	0	0

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
23 O'Donnell Street				32	32	0	0	0
24 O'Donnell Street				33	33	0	0	0
25 O'Donnell Street				31	31	0	0	0
26 O'Donnell Street				33	33	0	0	0
30 O'Donnell Street				33	32	0	0	0
32 O'Donnell Street				33	32	0	0	0
34 O'Donnell Street				32	32	0	0	0
36 O'Donnell Street				31	30	0	0	0
38 O'Donnell Street				31	30	0	0	0
45 O'Donnell Street				30	30	0	0	0
51 O'Donnell Street				19	19	0	0	0
52 O'Donnell Street				26	25	0	0	0
16 Horne Street				34	33	0	0	0
18 Horne Street				33	33	0	0	0
20 Horne Street				32	32	0	0	0
33 Horne Street				33	32	0	0	0
41 Horne Street				32	32	0	0	0
49 Horne Street				32	31	0	0	0
4 Keira Street				32	32	0	0	0
16 Keira Street				32	32	0	0	0
20 Keira Street				32	32	0	0	0
24 Keira Street				32	31	0	0	0
28 Keira Street				32	31	0	0	0
32 Keira Street				32	31	0	0	0
36 Keira Street				32	31	0	0	0
38 Keira Street				31	30	0	0	0
40 Keira Street				32	31	0	0	0
42 Keira Street				31	30	0	0	0
44 Keira Street				32	31	0	0	0
46 Keira Street				31	30	0	0	0
48 Keira Street				32	32	0	0	0

Table 44 Concept Plan – Operational Noise Impact in SCA1 – No Mitigation

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5-7 Military Road	52	43	42	49	49	0	6	7
9 Military Road				48	47	0	4	5
11 Military Road				47	47	0	4	5
15 Military Road				49	48	0	5	6
3 Wentworth Road				57	57	5	14	15
5 Wentworth Road				57	56	5	13	14
7 Wentworth Road				57	56	5	13	14
9 Wentworth Road				56	56	4	13	14
11 Wentworth Road				55	55	3	12	13

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
13 Wentworth Road				54	53	2	10	11
15 Wentworth Road				54	54	2	11	12
17 Wentworth Road				53	52	1	9	10
19 Wentworth Road				51	51	0	8	9
66 Darcy Road				48	48	0	5	6
68 Darcy Road				49	49	0	6	7
1 Third Avenue				39	38	0	0	0
2 Third Avenue				41	40	0	0	0
160 Wentworth Road				39	38	0	0	0
2 Reservoir Street				42	41	0	0	0
3 Marne Street				40	39	0	0	0
7 Marne Street				40	39	0	0	0
25 Brody Street				40	39	0	0	0
28 Gallipoli Street				38	37	0	0	0
30 Gallipoli Street				40	39	0	0	0
32 Gallipoli Street				39	39	0	0	0

Table 45 Concept Plan – Operational noise impact SCA1 – 6m barriers in South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5-7 Military Road	52	43	42	46	45	0	2	3
9 Military Road				45	44	0	1	2
11 Military Road				45	44	0	1	2
15 Military Road				47	46	0	3	4
3 Wentworth Road				49	49	0	6	7
5 Wentworth Road				49	49	0	6	7
7 Wentworth Road				49	49	0	6	7
9 Wentworth Road				49	48	0	5	6
11 Wentworth Road				48	48	0	5	6
13 Wentworth Road				47	47	0	4	5
15 Wentworth Road				47	47	0	4	5
17 Wentworth Road				47	46	0	3	4
19 Wentworth Road				46	45	0	2	3
66 Darcy Road				44	44	0	1	2
68 Darcy Road				46	45	0	2	3
1 Third Avenue				38	38	0	0	0
2 Third Avenue				40	40	0	0	0
160 Wentworth Road				38	38	0	0	0
2 Reservoir Street				41	40	0	0	0
3 Marne Street				39	39	0	0	0
7 Marne Street				40	39	0	0	0
25 Brody Street				39	39	0	0	0
28 Gallipoli Street				38	37	0	0	0
30 Gallipoli Street				40	39	0	0	0
32 Gallipoli Street				39	38	0	0	0

Table 46 Concept Plan – Operational noise impact SCA1 – Acoustic shed in South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted LAeq Noise Levels, dB(A)*		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
5-7 Military Road	52	43	42	45	44	0	1	2
9 Military Road				45	44	0	1	2
11 Military Road				45	44	0	1	2
15 Military Road				45	44	0	1	2
3 Wentworth Road				45	45	0	2	3
5 Wentworth Road				45	44	0	1	2
7 Wentworth Road				45	44	0	1	2
9 Wentworth Road				45	44	0	1	2
11 Wentworth Road				45	44	0	1	2
13 Wentworth Road				44	43	0	0	1
15 Wentworth Road				44	43	0	0	1
17 Wentworth Road				43	43	0	0	1
19 Wentworth Road				43	42	0	0	0
66 Darcy Road				43	42	0	0	0
68 Darcy Road				45	44	0	1	2
1 Third Avenue				39	38	0	0	0
2 Third Avenue				40	40	0	0	0
160 Wentworth Road				38	38	0	0	0
2 Reservoir Street				41	41	0	0	0
3 Marne Street				40	39	0	0	0
7 Marne Street				40	39	0	0	0
25 Brody Street				39	39	0	0	0
28 Gallipoli Street				38	37	0	0	0
30 Gallipoli Street				40	39	0	0	0
32 Gallipoli Street				39	38	0	0	0

Table 47 Concept Plan – Operational noise impact SCA2 – No Mitigation

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
1 Jubilee Road	44	45	37	46	45	2	0	8
2 Jubilee Road				43	42	0	0	5
3 Jubilee Road				43	42	0	0	5
4 Jubilee Road				44	43	0	0	6
5 Jubilee Road				42	41	0	0	4
6 Jubilee Road				42	41	0	0	4
7 Jubilee Road				43	42	0	0	5
8 Jubilee Road				41	40	0	0	3
9 Jubilee Road				41	40	0	0	3
10 Jubilee Road				40	39	0	0	2
5 Kembla Street				40	39	0	0	2
7 Kembla Street				41	40	0	0	3
9 Kembla Street				41	40	0	0	3

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
11 Kembla Street				42	41	0	0	4
13 Kembla Street				42	41	0	0	4
15 Kembla Street				42	41	0	0	4
16 Kembla Street				40	40	0	0	3
17 Kembla Street				41	40	0	0	3
17A Kembla Street				43	42	0	0	5
18 Kembla Street				41	40	0	0	3
19 Kembla Street				42	41	0	0	4
20 Kembla Street				41	40	0	0	3
21 Kembla Street				43	42	0	0	5
22 Kembla Street				41	40	0	0	3
23 Kembla Street				43	42	0	0	5
24 Kembla Street				41	40	0	0	3
25 Kembla Street				42	41	0	0	4
26 Kembla Street				41	40	0	0	3
27 Kembla Street				41	40	0	0	3
28 Kembla Street				41	40	0	0	3
29 Kembla Street				41	40	0	0	3
30 Kembla Street				41	40	0	0	3
31 Kembla Street				41	40	0	0	3
32 Kembla Street				41	40	0	0	3
33 Kembla Street				40	39	0	0	2
35 Kembla Street				41	40	0	0	3
40 Kembla Street				41	41	0	0	4
41-47 Kembla Street				41	40	0	0	3
42 Kembla Street				40	40	0	0	3
44 Kembla Street				41	40	0	0	3
46 Kembla Street				40	39	0	0	2
48 Kembla Street				39	38	0	0	1
50 Kembla Street				36	35	0	0	0
7 O'Donnell Street				40	39	0	0	2
8 O'Donnell Street				40	40	0	0	3
9 O'Donnell Street				40	39	0	0	2
10 O'Donnell Street				41	40	0	0	3
11 O'Donnell Street				40	39	0	0	2
12 O'Donnell Street				39	38	0	0	1
13 O'Donnell Street				39	39	0	0	2
14 O'Donnell Street				41	40	0	0	3
15 O'Donnell Street				39	38	0	0	1
18 O'Donnell Street				41	40	0	0	3
20 O'Donnell Street				40	40	0	0	3
23 O'Donnell Street				40	39	0	0	2
24 O'Donnell Street				40	40	0	0	3
25 O'Donnell Street				40	39	0	0	2
26 O'Donnell Street				41	40	0	0	3
30 O'Donnell Street				40	40	0	0	3
32 O'Donnell Street				40	39	0	0	2
34 O'Donnell Street				41	40	0	0	3
36 O'Donnell Street				39	38	0	0	1
38 O'Donnell Street				39	38	0	0	1

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
45 O'Donnell Street				39	38	0	0	1
51 O'Donnell Street				29	28	0	0	0
52 O'Donnell Street				31	30	0	0	0
16 Horne Street				42	41	0	0	4
18 Horne Street				41	40	0	0	3
20 Horne Street				41	40	0	0	3
33 Horne Street				41	41	0	0	4
41 Horne Street				40	39	0	0	2
49 Horne Street				40	39	0	0	2
4 Keira Street				40	39	0	0	2
16 Keira Street				41	40	0	0	3
20 Keira Street				41	40	0	0	3
24 Keira Street				41	40	0	0	3
28 Keira Street				41	40	0	0	3
32 Keira Street				41	40	0	0	3
36 Keira Street				41	40	0	0	3
38 Keira Street				39	38	0	0	1
40 Keira Street				40	39	0	0	2
42 Keira Street				40	39	0	0	2
44 Keira Street				40	40	0	0	3
46 Keira Street				39	39	0	0	2
48 Keira Street				41	40	0	0	3

Table 48 Concept Plan – Operational noise impact SCA2 – 6m barrier sin South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
1 Jubilee Road	44	45	37	43	42	0	0	5
2 Jubilee Road				42	41	0	0	4
3 Jubilee Road				41	41	0	0	4
4 Jubilee Road				41	40	0	0	3
5 Jubilee Road				41	40	0	0	3
6 Jubilee Road				41	40	0	0	3
7 Jubilee Road				42	41	0	0	4
8 Jubilee Road				41	40	0	0	3
9 Jubilee Road				40	39	0	0	2
10 Jubilee Road				39	39	0	0	2
5 Kembla Street				40	39	0	0	2
7 Kembla Street				41	40	0	0	3
9 Kembla Street				40	39	0	0	2
11 Kembla Street				41	40	0	0	3
13 Kembla Street				42	41	0	0	4
15 Kembla Street				42	41	0	0	4
16 Kembla Street				40	39	0	0	2
17 Kembla Street				41	40	0	0	3
17A Kembla Street				42	41	0	0	4

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
18 Kembla Street				41	40	0	0	3
19 Kembla Street				41	40	0	0	3
20 Kembla Street				41	40	0	0	3
21 Kembla Street				42	41	0	0	4
22 Kembla Street				41	40	0	0	3
23 Kembla Street				42	41	0	0	4
24 Kembla Street				40	39	0	0	2
25 Kembla Street				41	40	0	0	3
26 Kembla Street				41	40	0	0	3
27 Kembla Street				40	39	0	0	2
28 Kembla Street				40	39	0	0	2
29 Kembla Street				40	39	0	0	2
30 Kembla Street				41	40	0	0	3
31 Kembla Street				40	39	0	0	2
32 Kembla Street				41	40	0	0	3
33 Kembla Street				40	39	0	0	2
35 Kembla Street				39	39	0	0	2
40 Kembla Street				41	40	0	0	3
41-47 Kembla Street				40	39	0	0	2
42 Kembla Street				40	39	0	0	2
44 Kembla Street				40	39	0	0	2
46 Kembla Street				39	39	0	0	2
48 Kembla Street				38	37	0	0	0
50 Kembla Street				35	34	0	0	0
7 O'Donnell Street				40	39	0	0	2
8 O'Donnell Street				40	39	0	0	2
9 O'Donnell Street				39	38	0	0	1
10 O'Donnell Street				41	40	0	0	3
11 O'Donnell Street				40	39	0	0	2
12 O'Donnell Street				39	38	0	0	1
13 O'Donnell Street				39	38	0	0	1
14 O'Donnell Street				40	40	0	0	3
15 O'Donnell Street				39	38	0	0	1
18 O'Donnell Street				40	40	0	0	3
20 O'Donnell Street				40	39	0	0	2
23 O'Donnell Street				39	38	0	0	1
24 O'Donnell Street				40	39	0	0	2
25 O'Donnell Street				39	38	0	0	1
26 O'Donnell Street				40	40	0	0	3
30 O'Donnell Street				40	39	0	0	2
32 O'Donnell Street				40	39	0	0	2
34 O'Donnell Street				40	40	0	0	3
36 O'Donnell Street				38	38	0	0	1
38 O'Donnell Street				39	38	0	0	1
45 O'Donnell Street				38	38	0	0	1
51 O'Donnell Street				28	27	0	0	0
52 O'Donnell Street				30	29	0	0	0
16 Horne Street				40	39	0	0	2
18 Horne Street				41	40	0	0	3
20 Horne Street				39	38	0	0	1

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
33 Horne Street				40	39	0	0	2
41 Horne Street				39	39	0	0	2
49 Horne Street				39	39	0	0	2
4 Keira Street				39	38	0	0	1
16 Keira Street				39	38	0	0	1
20 Keira Street				39	38	0	0	1
24 Keira Street				39	38	0	0	1
28 Keira Street				39	38	0	0	1
32 Keira Street				39	38	0	0	1
36 Keira Street				39	38	0	0	1
38 Keira Street				38	37	0	0	0
40 Keira Street				39	38	0	0	1
42 Keira Street				38	38	0	0	1
44 Keira Street				39	38	0	0	1
46 Keira Street				38	37	0	0	0
48 Keira Street				39	38	0	0	1

Table 49 Concept Plan – Operational noise impact SCA 2 – Acoustic shed in South Stabling Yard

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
1 Jubilee Road	44	45	37	42	41	0	0	4
2 Jubilee Road				42	41	0	0	4
3 Jubilee Road				41	41	0	0	4
4 Jubilee Road				40	40	0	0	3
5 Jubilee Road				41	40	0	0	3
6 Jubilee Road				41	40	0	0	3
7 Jubilee Road				42	41	0	0	4
8 Jubilee Road				41	40	0	0	3
9 Jubilee Road				40	39	0	0	2
10 Jubilee Road				40	39	0	0	2
5 Kembla Street				40	39	0	0	2
7 Kembla Street				41	40	0	0	3
9 Kembla Street				41	40	0	0	3
11 Kembla Street				41	40	0	0	3
13 Kembla Street				42	41	0	0	4
15 Kembla Street				42	41	0	0	4
16 Kembla Street				40	39	0	0	2
17 Kembla Street				41	40	0	0	3
17A Kembla Street				42	41	0	0	4
18 Kembla Street				41	40	0	0	3
19 Kembla Street				41	41	0	0	4
20 Kembla Street				41	40	0	0	3
21 Kembla Street				42	41	0	0	4
22 Kembla Street				41	40	0	0	3
23 Kembla Street				42	41	0	0	4

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
24 Kembla Street				41	40	0	0	3
25 Kembla Street				41	40	0	0	3
26 Kembla Street				41	40	0	0	3
27 Kembla Street				40	39	0	0	2
28 Kembla Street				41	40	0	0	3
29 Kembla Street				40	39	0	0	2
30 Kembla Street				41	40	0	0	3
31 Kembla Street				40	39	0	0	2
32 Kembla Street				41	40	0	0	3
33 Kembla Street				40	39	0	0	2
35 Kembla Street				40	39	0	0	2
40 Kembla Street				41	40	0	0	3
41-47 Kembla Street				40	39	0	0	2
42 Kembla Street				40	39	0	0	2
44 Kembla Street				40	39	0	0	2
46 Kembla Street				39	39	0	0	2
48 Kembla Street				38	38	0	0	1
50 Kembla Street				35	34	0	0	0
7 O’Donnell Street				40	39	0	0	2
8 O’Donnell Street				40	39	0	0	2
9 O’Donnell Street				39	39	0	0	2
10 O’Donnell Street				41	40	0	0	3
11 O’Donnell Street				40	39	0	0	2
12 O’Donnell Street				39	38	0	0	1
13 O’Donnell Street				39	38	0	0	1
14 O’Donnell Street				41	40	0	0	3
15 O’Donnell Street				39	38	0	0	1
18 O’Donnell Street				41	40	0	0	3
20 O’Donnell Street				40	40	0	0	3
23 O’Donnell Street				39	39	0	0	2
24 O’Donnell Street				40	40	0	0	3
25 O’Donnell Street				39	39	0	0	2
26 O’Donnell Street				41	40	0	0	3
30 O’Donnell Street				40	40	0	0	3
32 O’Donnell Street				40	39	0	0	2
34 O’Donnell Street				41	40	0	0	3
36 O’Donnell Street				39	38	0	0	1
38 O’Donnell Street				39	38	0	0	1
45 O’Donnell Street				38	38	0	0	1
51 O’Donnell Street				29	28	0	0	0
52 O’Donnell Street				30	29	0	0	0
16 Horne Street				40	39	0	0	2
18 Horne Street				41	40	0	0	3
20 Horne Street				39	38	0	0	1
33 Horne Street				39	39	0	0	2
41 Horne Street				39	39	0	0	2
49 Horne Street				39	39	0	0	2
4 Keira Street				39	38	0	0	1
16 Keira Street				39	38	0	0	1
20 Keira Street				39	38	0	0	1

Receiver	Operational Noise Limit dB(A)			Predicted Laeq Noise Levels, dB(A)		Predicted Exceedance dB(A)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
24 Keira Street				39	38	0	0	1
28 Keira Street				39	38	0	0	1
32 Keira Street				39	38	0	0	1
36 Keira Street				39	38	0	0	1
38 Keira Street				38	37	0	0	0
40 Keira Street				39	38	0	0	1
42 Keira Street				38	37	0	0	0
44 Keira Street				39	38	0	0	1
46 Keira Street				38	37	0	0	0
48 Keira Street				39	38	0	0	1