ACOUSTICS AND AIR

BARANGAROO SOUTH - PUBLIC DOMAIN

CONSTRUCTION NOISE REPORT

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VERSION C

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PREPARED FOR

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GLOSSARY OF ACOUSTIC TERMS

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

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

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

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

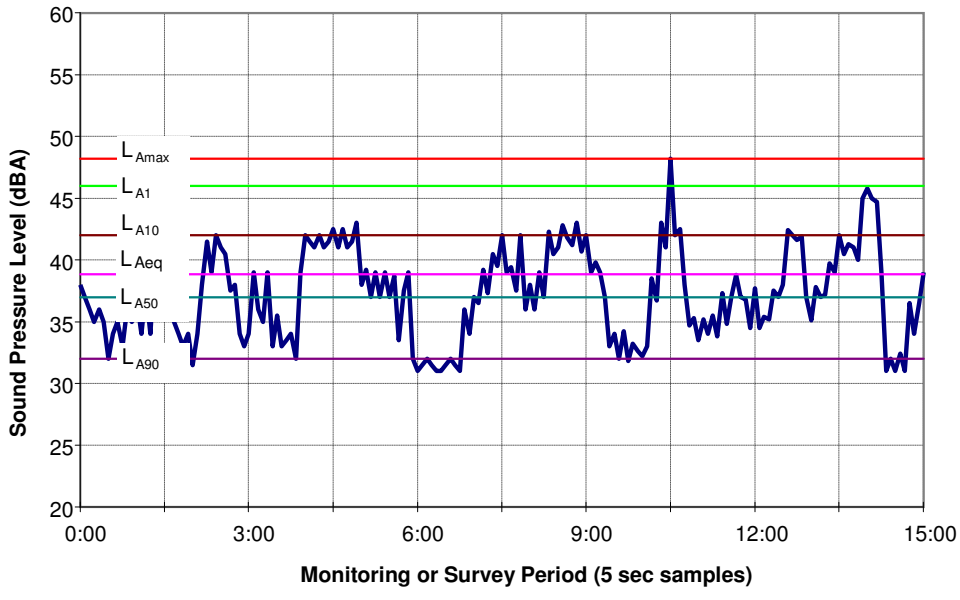
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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

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

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

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

This report supports a State Significant Development Application (SSDA) (SSD 6303) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The SSDA seeks approval for public domain works within Stage 1A at Barangaroo South as described in the Overview of Proposed Development section of this report.

Wilkinson Murray Pty Limited has reviewed and assessed the drawings and relevant documentation prepared in respect of the Significant Development Application (SSDA) submission. Wilkinson Murray has prepared the noise and vibration assessments to support the Development Applications for all major components of the South Barangaroo project.

During the operation stage of the development there are no noise producing sources associated with the Public Domain works. Therefore, no assessment is warranted and has not been dealt with any further in this assessment.

2 OVERVIEW OF PROPOSED MODIFICATION

The Public Domain SSDA seeks approval for the all public domain works within 'Stage 1A' of the Barangaroo South Site. These works include typical public domain features such as street paving, street furniture, lighting and planting.

Additional items, such as shade / weather protection structures, water features and bicycle facilities are also included in the design of the public domain. Various services and infrastructure, such as power and water are incorporated into the proposed works where relevant.

It is noted that the proposed construction activities will not generate significant levels of vibration. Therefore, the issue of construction vibration is not considered further in this report.

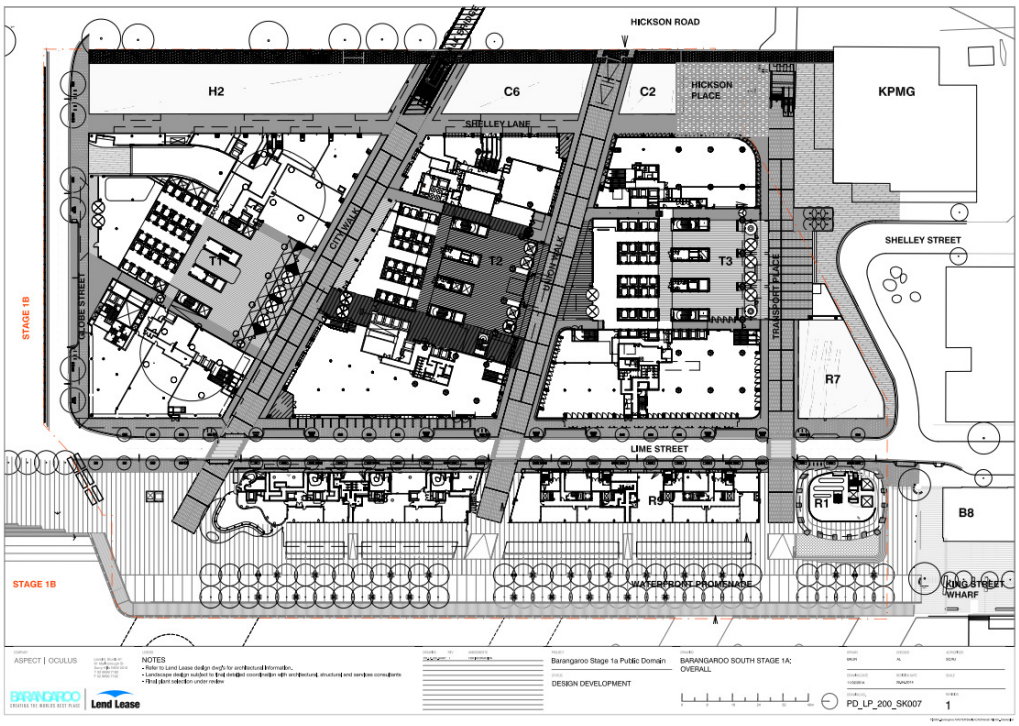
2.1 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District, bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point (for the northern half), The Rocks and the Sydney Harbour Bridge approach to the east; and bounded to the south by a range of new development dominated by large CBD commercial tenants.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) – the Headland Park, Barangaroo Central and Barangaroo South.

The Public Domain SSDA Site area is located within Barangaroo South as shown in Figure 2-1. The SSDA Site extends over land generally known and identified in the approved Concept Plan as Blocks 1, 2, 3, and X and the area of the foreshore between Block X and Darling Harbour.

Figure 2-1 Public Domain Application Site Plan



3 AMBIENT NOISE MONITORING

3.1 Ambient Noise Levels at South Barangaroo

Residential and commercial receivers surrounding the site that may be affected by construction noise and vibration have been identified in previous relevant applications for the Barangaroo South site. These receivers are also relevant in assessing noise impacts from the broader site. They are detailed in Table 3-1.

Table 3-1 Surrounding Receivers

Receivers	Comments
Commercial Receivers	
A –Napoleon St	Aon Australia Building Symantec Building
B – 30 Hickson Rd	Top Floor Cafe, Lend Lease offices,
C – Lime St, (King Street Wharf)	Commercial office Retail including indoor / outdoor cafes
D – 37 High St, Millers Point	KU Lance Preschool and Children's Centre
F – Shelley St	Commercial on Cnr of Sussex and Shelley St Commercial on Cnr of Lime and Shelley St
Residential Receivers	
G – 38 Hickson Rd	Multi storey residential building
H – High St, Millers Point	Terrace residences
I – Merriman St, Millers Point	Double storey unit blocks and single storey houses
J – Dalgety Rd, Millers Point	Double storey Community housing
K – Edward St and Little Edward St, Balmain East	Waterfront properties along Balmain peninsula
L – Northern end of Darling Island Rd and Wharf Cr, Darling Island	Multi storey high end apartments
M – Northern end Sydney Wharf Pirrama Rd, Pyrmont	Multi storey high end apartments
Heritage Receivers	
N – Former Grafton Bond Store, Hickson Rd, Millers Point	Former Grafton Bond Store Building
0 – 20-26 Sussex St , Sydney	The Sussex Hotel – Former Moreton's Hotel
P – 2-4 Jenkins St	Former MWS stores

In order to quantify the existing noise environment, long-term ambient noise levels were monitored at eight (8) locations surrounding the site, selected to cover the range of environments in the potentially affected areas.

The locations are presented in Table 3-2. The noise logger locations are shown in Figure 3-1.

Table 3-2 Long-Term Noise Monitoring Locations

Logger	Location	Monitoring Period in 2010	Company*
1	Level 4, The Bond 30-38 Hickson Rd	14 April to 29 April	Arup
2	Middle of South Barangaroo Site	14 April to 29 April	Arup
3	South West of site adjacent to Sussex St and Shelley St	14 April to 29 April	Arup
4	South of site adjacent to King Street Wharf Boulevard	14 April to 29 April	Arup
5	3 High St, Miller Point	31 August – 9 September	WM
6	18 Merriman St, Millers Point	31 August – 6 September	WM
7	25 Edward St, Balmain East	31 August – 9 September	WM
8	Adjacent to 3 Darling Island Rd, Darling Island	31 August – 9 September	WM

* Monitoring conducted by Arup and Wilkinson Murray.

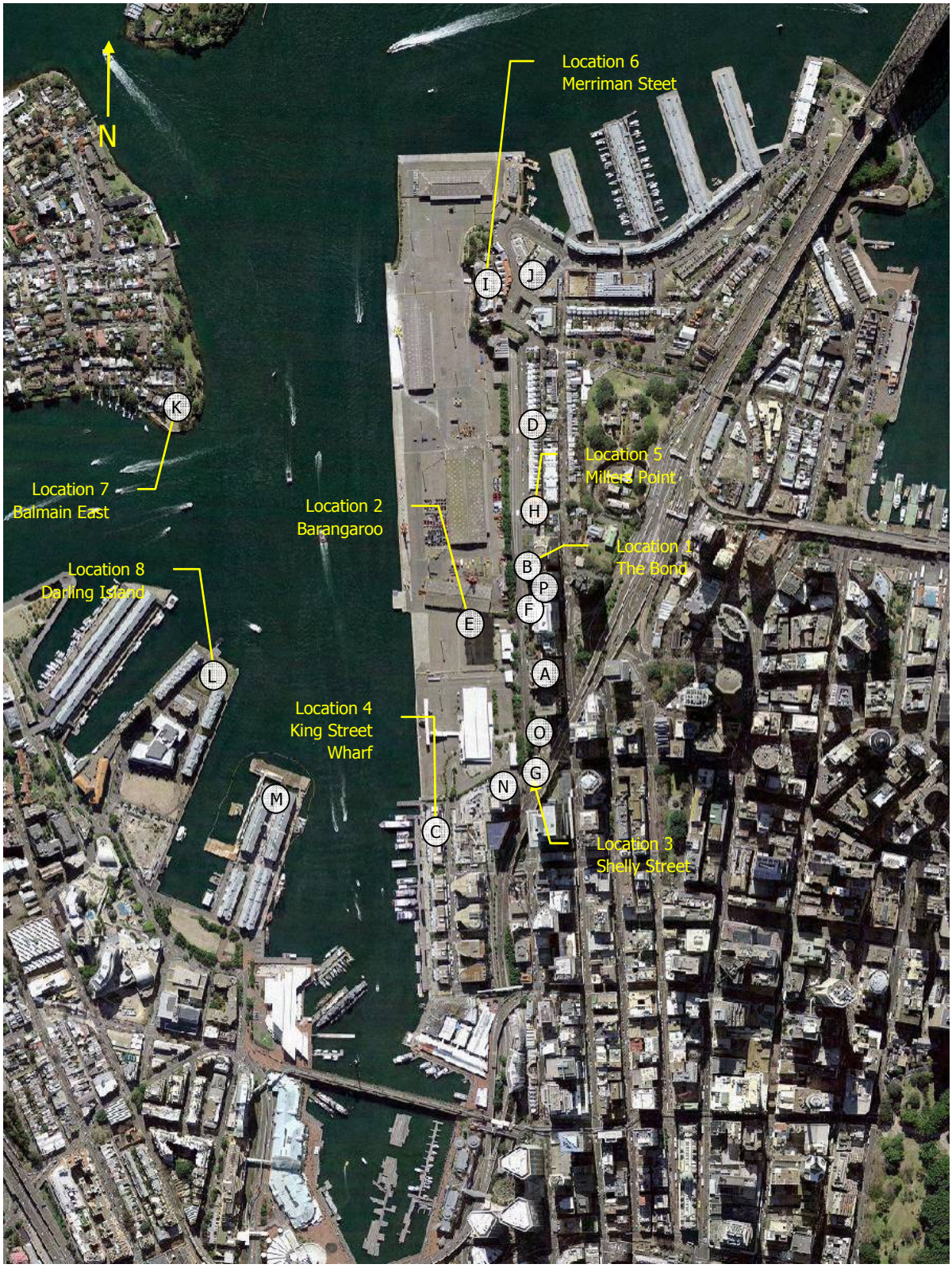
The noise monitoring equipment used for the Wilkinson Murray noise measurements consisted of ARL Type EL-215 environmental noise loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

In the case of noise logging conducted by Arup, the data was reviewed and is considered suitable to use for assessment purposes. The details of the noise measurement equipment and calibration can be referred to within the report.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. The L_{A90} level is normally taken as the background noise level during the relevant period.

Detailed results for each monitoring location are shown in graphical form in Appendix A. The graphs show measured values of L_{Aeq}, L_{A90}, L_{A10} and L_{A1} for each 15-minute monitoring period.

Figure 3-1 Aerial showing Noise Monitoring Locations



*Source Land and Property Management Authority

Table 3-3 summarises the noise results, for daytime, evening and night time periods as defined in the EPA's *Construction Noise Guidelines* (*CNG*). Additionally, noise monitoring results for Saturday (7.00am-5.00pm) has been included as Lend Lease proposes to operate outside standard CNG hours during that time.

Table 3-3 Summary of Measured Noise Levels

Noise Logging Site	RBL (dBA)				$L_{Aeq,period}$ (dBA)			
	Daytime 7am-6pm	Evening 6-10pm	Night Time 10pm-7am	Saturday 7am-5pm	Daytime 7am-6pm	Evening 6-10pm	Night Time 10pm-7am	Saturday 7am-5pm
1	53	53	49	51	62	61	57	60
2	52	50	45	50	56	54	50	56
3	60	59	49	57	67	66	62	66
4	52	60	46	48	60	62	60	60
5	47	44	41	45*	58	55	51	55
6	46	44	40	46*	58	55	50	56
7	49	45	40	46*	67	51	47	56
8	47	44	39	50*	54	49	46	56

* Determined from the afternoon on Saturday 4 September as the morning was affected by rain.

Background noise levels at all locations were free of the influence of extraneous noise sources, such as plant or construction activities. Noise data measured during inclement weather was excluded in accordance with EPA procedures.

4 NOISE & VIBRATION CRITERIA

The following sections detail the applicable site-specific noise and vibration criteria based on the guidelines from EPA, being:

- *Interim Construction Noise Guideline*;
- *Assessing Vibration: A Technical Guideline*.
- *Industrial Noise Policy (INP)*, and;
- *Road Noise Policy (RNP).*

4.1 Construction Noise Criteria

The EPA released the "*Interim Construction Noise Guideline*" *(CNG)* in July 2009. The guideline provides noise goals that assist in assessing the impact of construction noise.

For residences, the basic daytime construction noise goal is that the $L_{Aeq,\ 15min}$ noise level should not exceed the background noise by more than 10dBA. This is for standard hours: Monday to Friday 7.00am to 6.00pm, and Saturday 8.00am to 1.00pm. Outside the standard hours, the criterion would be background + 5dBA. Table 4-1 details the CNG noise goals.

Table 4-1 Construction Noise Goals at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. 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 75dBA	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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

In addition, the following construction noise management levels $L_{Aeq,15\ min}$ are recommended for other receivers and areas.

- Active recreation areas (such as parks): external $L_{Aeq\ ,15\ min}$ 65dBA
- Industrial premises: external $L_{Aeq\ ,15\ min}$ 75dBA
- Offices, retail outlets: external $L_{Aeq,15\ min}$ 70dBA
- Classrooms at schools and other educational institutions: internal $L_{Aeq\ ,15\ min}$ 45dBA

Based on the above, Table 4-2 presents the applicable noise management levels for construction activities at surrounding receivers that have been adopted for all applications.

Table 4-2 Site-Specific Construction Noise Management Levels

Location	Construction Noise Management Level, L_{Aeq} – dBA				Highly noise affected Noise Level, L_{Aeq} – dBA
	Day	Evening	Night	Saturday (extended)	
1 – Hickson Road Residences	63	58	54	55	75
5 – High Street Residences	57	49	46	50	75
6 – Merriman St Residences	56	49	45	51	75
7 – Balmain East Residences	59	50	45	51	75
8 – Darling Island Residences	57	49	44	55	75
All Commercial Properties	70				
Schools / Preschools	55*				
Parks / Outdoor Play Areas	65				

* The external noise goal of 55dBA is based on a 10dB reduction through an open window.

4.2 Traffic Noise Criteria

Noise Criteria for assessment of road traffic noise are set out in the NSW Government's *NSW Road Noise Policy (RNP)*. Table 4-3 sets out the assessment criteria for residences to be applied to particular types of project, road category and land use.

Table 4-3 Traffic Noise Criteria extracted from the NSW *RNP*

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ (15\ hour)}$ 55 (external)	$L_{Aeq,\ (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

In summary, the noise level goals at the residential receivers, for this project, based on the *RNP* are:

- $L_{Aeq,1hr}$ day 55dBA; and
- $L_{Aeq,1hr}$ night 50dBA

In addition, where the above criteria are already exceeded as a result of existing traffic the policy notes:

> *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

5 CONSTRUCTION METHODS, EQUIPMENT & NOISE SOURCE LEVELS

Sound Power Levels (SWLs) for typical Public Domain construction plant are identified in Table 5-1. These SWLs have been measured at other similar construction sites. The table gives both Sound Power Level and Sound Pressure Levels (SPL) at 7m for the equipment. Sound Power Level is independent of measurement position.

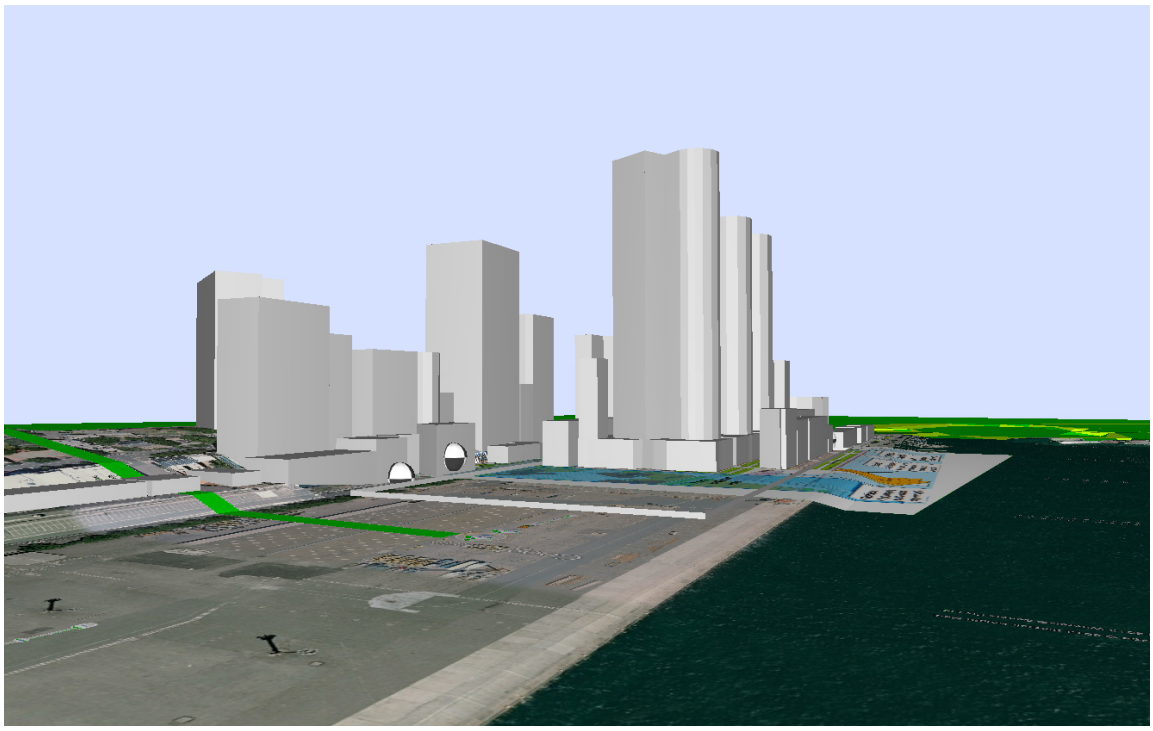
Table 5-1 Typical Construction Plant Sound Levels – dBA

Plant	Sound Power Level	Sound Pressure Level at 7m
Petrol Portable Generator	102	77
Wheeled Mobile Crane	98	73
Angle Grinder	109	84
Petrol Power Hand Concrete Saw	124	99
Dump Truck	108	83
Paver Cutter	113	88
Compressor (Silenced)	75	50
Bobcat	103	78
Backhoe	96	71
Hand Tools	90	65
Hand Jackhammer	115	90

6 CONSTRUCTION NOISE ASSESSMENT

Assessment of likely noise at surrounding commercial and residential receivers has been assessed for Public Domain works. These works will be conducted when much of the South Barrangaroo development is complete or the structure of the buildings is well progressed. Therefore, noise modelling has been conducted with many of the buildings included. Figure 6-1 shows a perspective of the noise model looking south with South Barangarro Buildings

Figure 6-1 Perspective of Public Domain Noise Model



Site-related noise emissions were modeled with the "CadnaA" noise prediction program, using the ISO 9613 noise prediction algorithms. Factors that are addressed in the noise modeling are:

- equipment sound level emissions and location;
- screening effects from buildings;
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;
- ground absorption; and
- atmospheric absorption.

Modelling has been conducted for a number of construction scenarios. The three works scenarios considered are summarised in Table 6-1.

Table 6-1 Construction Scenarios for Public Domain Works

Scenario	Description	Works
A	Paving Works	The installation of paving on domain area. Equipment includes: • Truck • Compressor • Paving Saw • Hand Tools
B	Landscaping	This scenario includes installation of soil, mulch and plants • Truck • Compressor • Bobcat • Hand Tools
C	Above-Ground Services (Lighting Signs etc)	This scenario includes installation lights and signs. • Truck • Compressor • Mobile Crane • Hand Tools • Hand Jackhammer

The public domain work will be conducted in localised areas around the site where the works will move around and buildings of the precinct. This is in contrast to major elements of the project where construction activities are more contained to one area.

Therefore, noise modelling has been conducted by locating public domain construction activities around site in calculating noise levels at surrounding receivers. The modelling assumes a "typical worst case" scenario whereby all plant is running continuously.

As such, the modelling represents likely noise levels that would occur during intensive periods of construction. Therefore, the presented noise levels can be considered in the upper range of noise levels that can be expected at surrounding receivers when the various construction scenarios occur.

Once noise sources have been applied to the model, the resultant noise levels at identified surrounding receivers are predicted. These results are then compared with established site-specific noise criteria.

The following tables detail results of noise modelling for each scenario.

Table 6-2 Predicted Construction Noise Levels at Residence – $L_{Aeq(15\ min)}$ – dBA

Residential Receiver	Work Location				Max	Weekday NML*	Sat NML*
	South	Centre	NW	East	Level	dBA	dBA
Scenario A – Paving							
1 – Hickson Road Residences	26	31	55	56	**56**	63	55
5 – High Street Residences	19	21	45	38	**45**	57	50
6 – Merriman Street Residences	21	19	37	36	**37**	56	51
7 – Balmain East Residences	31	20	36	20	**36**	59	51
8 – Darling Island Residences	38	40	47	19	**47**	57	55
9 – Sydney Wharf Residences	47	33	45	25	**47**	57	55
Scenario B – Landscaping							
1 – Hickson Road Residences	26	30	44	54	**54**	63	55
5 – High Street Residences	19	23	45	37	**45**	57	50
6 – Merriman Street Residences	21	24	38	36	**38**	56	51
7 – Balmain East Residences	34	18	38	24	**38**	59	51
8 – Darling Island Residences	42	40	43	19	**43**	57	55
9 – Sydney Wharf Residences	49	39	44	24	**49**	57	55
Scenario C – Above-Ground Services							
1 – Hickson Road Residences	26	31	47	57	**57**	63	55
5 – High Street Residences	19	21	47	38	**47**	57	50
6 – Merriman Street Residences	21	19	43	40	**43**	56	51
7 – Balmain East Residences	34	19	44	29	**44**	59	51
8 – Darling Island Residences	48	47	51	20	**51**	57	55
9 – Sydney Wharf Residences	54	32	51	24	**54**	57	55

* NML is the noise management level

A review of results indicates that compliance with noise management levels will be achieved at all surrounding residences for during week day construction. On Saturdays, a marginal exceedance is predicted at residences on Hickson Road when works are being conducted in the proximity of these residences. This level is considered acceptable and manageable by the existing Construction Management Plan

Predicted noise levels at commercial receivers are presented in Table 6-3 as follows;

Table 6-3 Predicted Construction Noise Levels at Commercial – $L_{Aeq(15\ min)}$ – dBA

Commercial Receiver	Work Location				Max	Weekday NML*	Sat NML*
	South	Centre	NW	East	Level	dBA	dBA
Scenario A – Paving							
Lime Street, (King Street Wharf)	59	36	30	28	59	70	70
30 Hickson Road	25	29	49	52	52	70	70
Shelly Street	54	38	25	40	54	70	70
The Sussex Hotel	38	42	28	62	62	70	70
Scenario B – Landscaping							
Lime Street, (King Street Wharf)	58	39	30	26	58	70	70
30 Hickson Road	25	28	45	49	49	70	70
Shelly Street	54	34	26	36	54	70	70
The Sussex Hotel	41	38	29	55	55	70	70
Scenario C – Above-Ground Services							
Lime Street, (King Street Wharf)	66	38	31	27	66	70	70
30 Hickson Road	25	30	50	53	53	70	70
Shelly Street	59	38	26	43	59	70	70
The Sussex Hotel	52	41	30	61	61	70	70

* NML is the noise management level

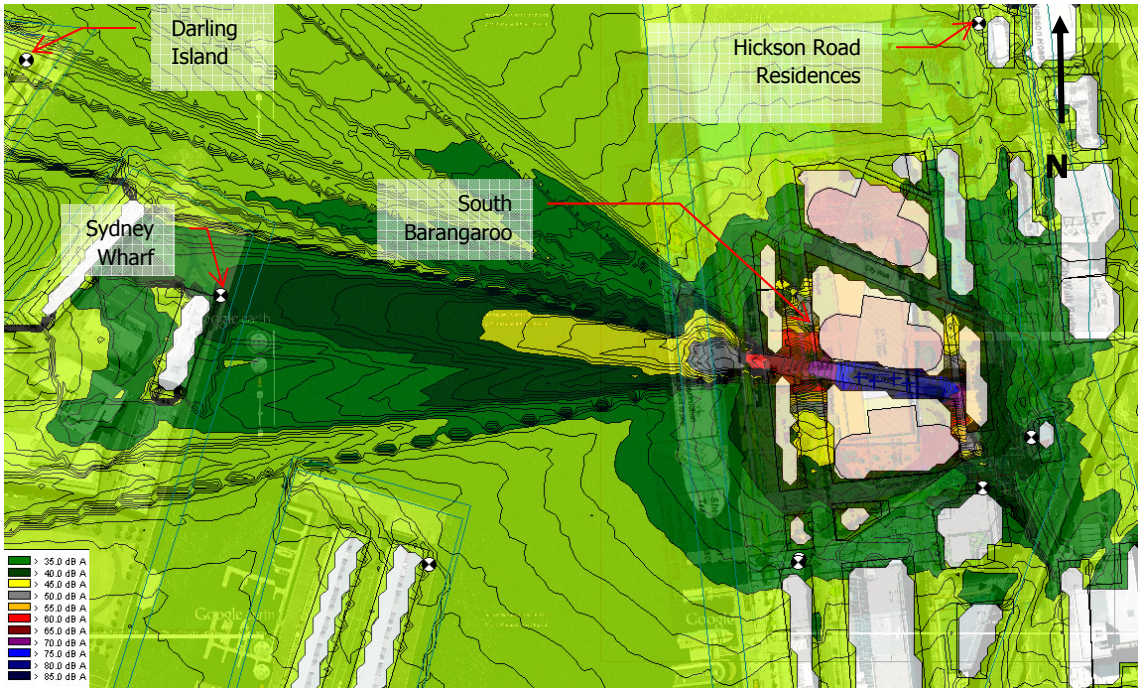
A review of the results indicated that noise from the proposed construction works associated with the public domain will comply with all commercial criteria.

6.1 Discussion of Results

It is noted that construction noise from the proposed public domain works will not generate excessive levels of construction noise at surrounding receivers. These works are not generally noise intensive in that smaller equipment will be used for these works whereby hand held tools and manual labour activities will occur for much of the time.

In addition, buildings within the precinct will provide noise shielding to surrounding residences. Figure 6-1 illustrates noise containment when these activates occur on site.

Figure 6-1 Construction Noise Levels – Scenario A (Central Works)



The duration of these works in one location will be limited and will tend to be complete when other major construction activities, such as excavation, have been completed.

6.2 Noise Mitigation Measures

Based on the investigations and findings of this assessment, there are no specific noise and vibration measures that have been identified that need to be adopted for Public Domain construction works.

It is considered that the procedures and management measures that are included in the existing site Environmental Management Plan are more that adequate to address any noise or vibration generated by the Public Domain construction works.

6.3 Cumulative Noise Impact

There are other projects that will be under various stages of construction when the public domain works occur. These include elements of the South Barangaroo project site along with the other major projects at Barangaroo, being:

South Barangaroo Projects

- Stage 1A Basement
- T1/C3
- T2/C4
- T3/C5

- R8 & R9
- Stage 1A Public Domain
- Basement Risers (additional to basement)
- Stage 1B Remediation of Block 4 and construction of Stage 1B Basement D-Wall
- Temporary Concrete Batching Plant
- Waste water plant and
- Wynyard Walk Bridge

OTHER Barangaroo Projects

- Barangaroo Central Waterfront Promenade and Interim Public Domain
- Wynyard Walk
- Headland Park and Northern Cove – Main Works

Construction noise levels associated with the South Barangaroo projects have predicted based on noise modelling conducted for these projects associated with the project applications prepared for these projects. In addition, we have reviewed the potential cumulative noise increase based on previous noise assessment prepared by Wilkinson Murray as follows;

- Headland Park – "*Barangaroo Headland Park – Construction Noise and Vibration Assessment*"conducted by Wilkinson Murray Report 12213 Version C dated August 2012".
- Barangaroo Central - "*Barangaroo Central - Construction and operational Noise & Vibration Management Assessment*" conducted by Wilkinson Murray Report 12228 – Version B dated September 2012.

In the case of Wynyard Walk, this period correlates to the construction of the Sussex Street Bridge and associated earthworks. Wilkinson Murray has been engaged by Thiess (the company constructing Wynyard Walk) to assess noise associated with construction. Based on a review of the current assessment it has been determined that a construction sound power level of 112 dBA is appropriate for this stage of the works. This information has been used in the WM noise model to predict the resultant noise levels associated with Wynyard Walk at residential receivers consistent with this assessment.

Based on these assessments, noise levels at residences potentially affected by these sites have been assessed based on noise levels predicted in 2014. Table 6-4 presents cumulative noise impact from Wilkinson Murray's predictions of this assessment and the Headland Park, Barangaroo Central and Wynyard Walk Assessments.

Table 6-4 Cumulative Construction Noise Levels with South Barangaroo Headland Park, Barangaroo Central and Wynyard Walk Operations – $L_{Aeq(15\ minutes)}$ – dBA

Residences	Block 4 Remediation Works / C3/ C4 / C5 / R8 / R9 Building Basement Works & Batch Plant and Water Treatment Construction	Headland Park Construction Noise 2014	Barangaroo Central Construction Noise 2014	Wynyard Walk Bridge Construction	Wynyard Walk Bridge Construction	Cumulative (without Public Domain Works)	Cumulative (with Public Domain Works)
Dawes Point	55	63	66*	35	43	68	68
Balmain East	54	51	51	37	44	57	57
37 High Street	68	57	72*	27	47	74	74
38 Hickson Road	76	50	63*	49	57	76	76

*Includes a 5 dBA penalty for impulsive noise from Rockbreakers

A review of the above noise levels in the table reveals that construction noise from the Public Domain in 2014 will be more than 10dBA below the cumulative noise levels of other construction works thereby not resulting in any increase in construction noise levels at surrounding residences.

Given this fact, the predicted public domain construction noise levels at residences will be relatively low by construction standards. Therefore it is concluded that the Public Domain works will not result in cumulative construction noise increase at surrounding noise sensitive receivers.

The above consideration does not preclude the application of the management procedures contained in the site environmental management plan which of course should be consistently applied to the Public Domain construction works.

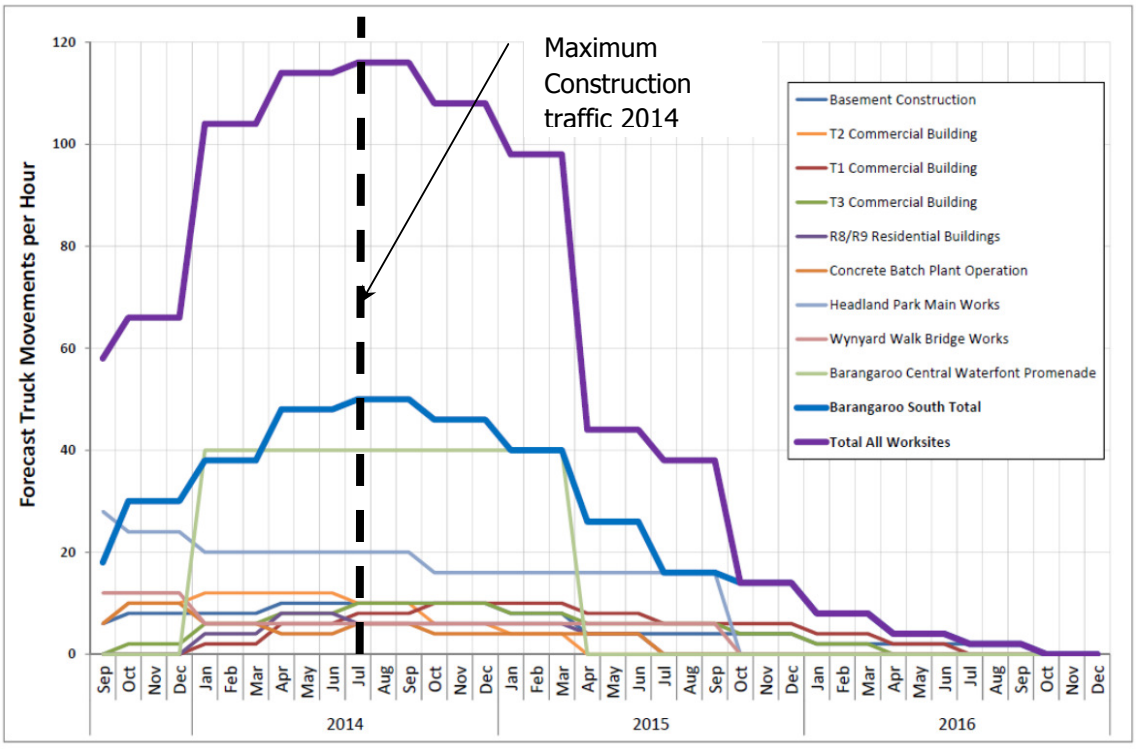
6.4 Construction Traffic Noise

Arup, the traffic consultants, in their report titled "*Barangaroo South Public Domain Works Stage 1A Traffic Assessment dated 12 December 2013*" advises the following with respect to the public domain works:

> *The works associated with construction of the public domain including Globe and Lime Streets will be spread over a 3 to 6 months period with truck movements peaking at 8 trucks per hour during high intensity activities. On average a typical hour would involve 4 truck movements. This activity will be occurring at the anticipated peak period of July 2014 and represents a 3 to 6% increase in activity.*

Based on the traffic report, the 8 additional trucks will occur when all other projected construction heavy vehicles will result in 116 truck movements per hour. This illustrated in Figure 6-1.

Figure 6-1 Forecast Peak Hour Cumulative Construction Vehicle Movements



The proposed haulage routes are generally located to the west of the site boundary, thereby avoiding the passby by haulage trucks of residences on Hickson Road. The main southern haulage truck route for off-site disposal would be along Sussex Street to the Western Distributor and / or Cross City Tunnel / Eastern Distributor. Of the roads with adjacent residences, the one with the highest predicted additional traffic volumes is Sussex Street.

The results of previous pre construction noise logging at Sussex Street have been processed to determine an existing daytime peak hour traffic noise level of $L_{Aeq(1\ hrs)}$ 68.1dBA (8.00am to 9.00 am). It should be noted that existing traffic noise in relevant areas already exceeds the "base" noise criteria detailed in Table 4-3. As any increase in traffic volumes associated with this project would be temporary in nature, the 2dBA allowance goal applies.

The noise contribution of half of these truck movements along Sussex Street has been assessed with respect to the total $L_{Aeq,1hr}$ peak hour traffic noise level at Sussex Street residences, using the *Calculation of Road Traffic Noise (CORTN)* traffic noise prediction technique. (Note it has been assumed that half of trucks will use the south route on Sussex Street.) .

Table 6-1 details predicted future traffic noise levels due peak traffic movements July 2014 with and without public domain construction traffic.

Table 6-1 Predicted July 2014 Daytime Traffic Noise Levels at Sussex Street – $L_{Aeq,1hr}$ – dBA

Construction Traffic	Existing Traffic Noise Level	Construction Noise Contribution	Total Noise Level
Public Domain Traffic Only	68.1	56.7	68.4
Construction Traffic All Other Works	68.1	66.2	70.3
Total Construction Traffic with Public Domain Traffic	68.1	66.4	70.4

A review of predictions indicates the following;

- Peak Public Domain construction traffic will increase traffic noise levels at Sussex Street residences by a very small amount (0.3 dBA),
- In July 2014, traffic noise levels are predicted to exceed the 2dBA objective by a marginal 0.2dBA,
- When Public Domain traffic is added the exceedance is increased by 0.1dBA.

An increase of 0.1 dBA will be imperceptible to any receivers and is not considered acoustically significant. Therefore, it is concluded that the construction traffic associated with the Pubic Domain Works will not adversely impact on residents. Further, it is noted that these noise levels will reduce after 2014 when construction traffic reduces.

7 CONCLUSION

A noise and vibration review of the Public Domain areas has been conducted for Barangaroo South.

Site-specific noise criteria that are applicable to this project have been presented. The have been determined for surrounding receivers to be applied on all state significant development applications.

A noise and vibration assessment has been conducted of the proposed construction activities associated with the construction of the Public Domain to determine the potential for noise and vibration impact at surrounding receivers.

Vibration and traffic noise associated with on-site construction activities is considered to be negligible. No specific management and mitigation measures to reduce noise impact at receivers have been identified beyond the normal measures

A Noise and Vibration Management Plan has been prepared to assist Lend Lease in managing the environmental issues associated with this project.