

Sydney Theatre Company

STC50

SEARs - Noise and Vibration Report

Acoustics Report

Issue 4 | 9 February 2017

This report takes into account the particular instructions and requirements of our client.

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Job number 250601

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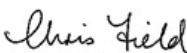
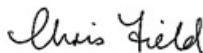
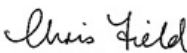
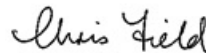


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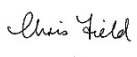
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Appendices

Appendix A

Noise Survey Results

Executive Summary

This report has been produced in response to the Secretary's Environmental Assessment Requirements Application Number SSD 7561 on behalf of The Sydney Theatre Company in support of the State Significant Development Application.

This report addresses issues required for a SSD and specifically responds to Key Point 4 of the Plans and Documents section of the Secretary's Environmental assessment Requirements, which reads:

The EIS shall include a noise and vibration assessment prepared by a suitably qualified acoustic consultant that:

- Assesses construction noise and vibration impacts, consistent with the *Interim Construction Noise Guideline* (Department of Environment, Climate Change and Water 2009), and *Assessing Vibration: a technical guideline* (Department of Environment and Conservation 2006). This assessment must consider cumulative noise and vibration impacts in the event of concurrent construction associated with other works within the Walsh Bay precinct, where relevant information is available;
- Assesses operational noise from the use of the theatre and related activities, and any food and drink premises within the building in accordance with the *NSW Industrial Noise Policy* (Environment Protection Authority, 2000);
- Assesses any operational vibration from the use of the premises in accordance with *Assessing Vibration: a technical guideline* (Department of Environment and Conservation 2006). This must include impacts on other tenants within Wharf 4/5 and other Walsh Bay wharves, and external receivers; and
- Discusses available mitigation and management measures.

The noise and vibration assessment must consider impacts on other tenants within Wharf 4/5 and the Walsh Bay precinct, and noise receivers external to the precinct.

And dot point 13, which reads:

- Noise impact assessment

This report sets out the criteria that relate to noise and vibration from the development affecting the environment and other tenancies in Wharf 4/5 and the Walsh Bay Precinct both during construction and in operation.

Conclusion

This report has addressed the SEARs Issue 4 and demonstrates that the issues in SEARs that relate to noise and vibration can be appropriately resolved. In particular:

- Criteria based on site measurements have been developed for noise from plant affecting the environment. These criteria comply with the *NSW Industrial Noise Policy (EPA 2000)*.
- Noise during construction will be assessed based on the requirements set out in the *Interim Construction Noise Guideline 2009 (EPA)*. The control of noise and vibration during construction will be a strict requirement for the future contractor. The requirements to achieve acceptable construction noise and vibration levels in the development are likely to be more onerous than those to achieve acceptable conditions at the nearest noise sensitive receiver. Most of the construction work will take place within the existing building envelope.

The Works are proposed to be undertaken in conjunction with the Walsh Bay Arts Precinct (WBAP) project. Cumulative noise and vibration considerations from the WBAP have been taken into account for the STC50 assessment. Details of the WBAP noise assessment, however, are only included in the WBAP Stage 2 State Significant Development Application.

Reference has been made to relevant NSW and Australian guidance as well as international experience in arts facility design from within Arup. On the basis of the noise and vibration measurements made on site and the information currently available for the development, we see no impediment to approval.

1 Introduction

This report describes the outcome of a detailed investigation into the environmental noise and vibration issues associated with the proposed development of the STC50 project located within the proposed Walsh Bay Arts Precinct. It includes information presented previously in the Noise Impact Assessment put on public exhibition but, following comments received, has been expanded to include further specific details relating to construction noise and operational noise.

Project Overview

Since the repurposing of Wharf 4/5 (The Wharf) for STC more than 30 years ago, there has not been a significant refurbishment and consequently the existing STC facilities are at the end of their useful life. The lack of proper acoustic treatment in theatre and rehearsal spaces is inadequate for contemporary theatre operations and the outdated approach to accessibility and workplace conditions do not meet modern day community expectations for public buildings. In summary the original fit out has not kept pace with the Company's changing operations over the past 30 years and accordingly is in need of significant change.

The key aims and objectives of the proposed STC internal fit out and refurbishment works are to meet STC's current operational needs and strategic goals and to future proof the company by:

- Creating new, distinctive and flexible theatre spaces commensurate with the Company's position as one of the world's leading theatre companies
- Increasing public space, improve access and visitor amenities
- Increasing saleable seating inventory and revenue earning capacity for long term sustainability
- Reducing running costs
- Improving the staff and user experience
- Improving back of house and technical facilities by providing modern workspaces which are fit for purpose, safe and efficient
- Respecting and enhancing the heritage and architectural value, and
- Creating a world class set of facilities for Australia.

To achieve these objectives the subject works will be undertaken in conjunction with the STC external works which form part of the Walsh Bay Arts Precinct SSDA (SSD 7689).

The proposed internal upgrade of the Sydney Theatre Company's facilities at Wharf 4/5 Walsh Bay will comprise internal alterations and reconfiguration of spaces and uses as outlined below:

Ground level

- New box office / ticketing area at southern end of wharf and administration / staff areas

Mezzanine

- Additional offices at southern end of wharf

Level 1 (Main Floor)

- The co-location of Wharf 1 and 2 Theatres to create two distinct performance spaces that are flexible in seating configuration and use. The new theatres will comprise:
 - A new multi-format flexible studio space (Wharf 1 Theatre) with seating for 350 – 450 and additional height over the seating and stage areas for the rigging of technical equipment.
 - A new studio theatre space (Wharf 2 Theatre auditorium) with retractable or removable seat with a capacity of 150-200 seats in various configurations.
 - New public display space and formal meeting area to south of Wharf 2 Theatre mid wharf with an atrium over
- Upgrade to existing restaurant and bar area at northern end of wharf and terrace balcony including back of house areas
- Improved rehearsal and dressing room spaces and introduction of more flexible spaces including:
 - Co-located rehearsal spaces with shared back of house area
 - Provision for two set up floors at the southern end of the wharf with back of house area to allow transportation of sets to the theatres
- Administration, costume and props areas within the shore sheds

Level 2 (mezzanine)

- Administration area and meeting rooms
- Provision of a new multi-purpose function room with balcony with capacity for 120 persons at the northern end of the wharf overlooking the restaurant and the harbour

Level 3 (under roof)

- Lighting bridge and technical area

Other works

- The removal of the existing fire tunnel within the building and associated reconfiguration of the space into the new layout as above plus addition of new fire stairs

- Improvements to acoustics, amenities and back of house and plant areas / facilities,
- Relocation, reconfiguration and improvements to administration areas centrally within the wharf
- Upgrade of services and infrastructure; and
- New loading and access arrangements to improve movement arrangements between technical and production areas.

The proposal provides for an increase in theatre capacity from existing 550 persons to a maximum of 650 persons in the combined Wharf 1 and 2 theatres. It also provides for a new multi-purpose public/event space with combined capacity for 200 persons over and above the existing Theatre Bar capacity of 500 persons. Accommodation for administrative staff will also increase from existing to a maximum of 200.

Works are as illustrated in detail on the architectural plans prepared by HASSELL.

2 SEARs Issues Addressed

This report addresses issues required for a SSD and specifically responds to Key Point 4 of the Plans and Documents section of the Secretary's Environmental assessment Requirements, which reads:

The EIS shall include a noise and vibration assessment prepared by a suitably qualified acoustic consultant that:

- Assesses construction noise and vibration impacts, consistent with the *Interim Construction Noise Guideline* (Department of Environment, Climate Change and Water 2009), and *Assessing Vibration: a technical guideline* (Department of Environment and Conservation 2006). This assessment must consider cumulative noise and vibration impacts in the event of concurrent construction associated with other works within the Walsh Bay precinct, where relevant information is available;
- Assesses operational noise from the use of the theatre and related activities, and any food and drink premises within the building in accordance with the *NSW Industrial Noise Policy* (Environment Protection Authority, 2000);
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- Discusses available mitigation and management measures.

The noise and vibration assessment must consider impacts on other tenants within Wharf 4/5 and the Walsh Bay precinct, and noise receivers external to the precinct.

And dot point 13, which reads:

- Noise impact assessment

3 Relevant Policies and Guidelines

- NSW Industrial Noise Policy (EPA)
- Assessing Vibration: a technical guideline 2006 (DEC)
- Interim Construction Noise Guideline 2009 (EPA)

Issues associated with air quality and odour are dealt with in separate documents.

4 Existing Environment

The NSW Industrial Noise Policy (INP)¹ sets out a methodology to derive appropriate criteria for noise from plant affecting the environment. This is based on the levels of existing noise around the site which in turn are derived from an extensive survey of existing noise levels, details of which are given below. The derivation of the noise criteria from this data is given in Section 5.1 below.

4.1 Description of Site

4.1.1 Key Receptors

The key receptors are shown below. Residential receivers are referenced as R1, R4, R5 and commercial receivers shown as C2 and C3.

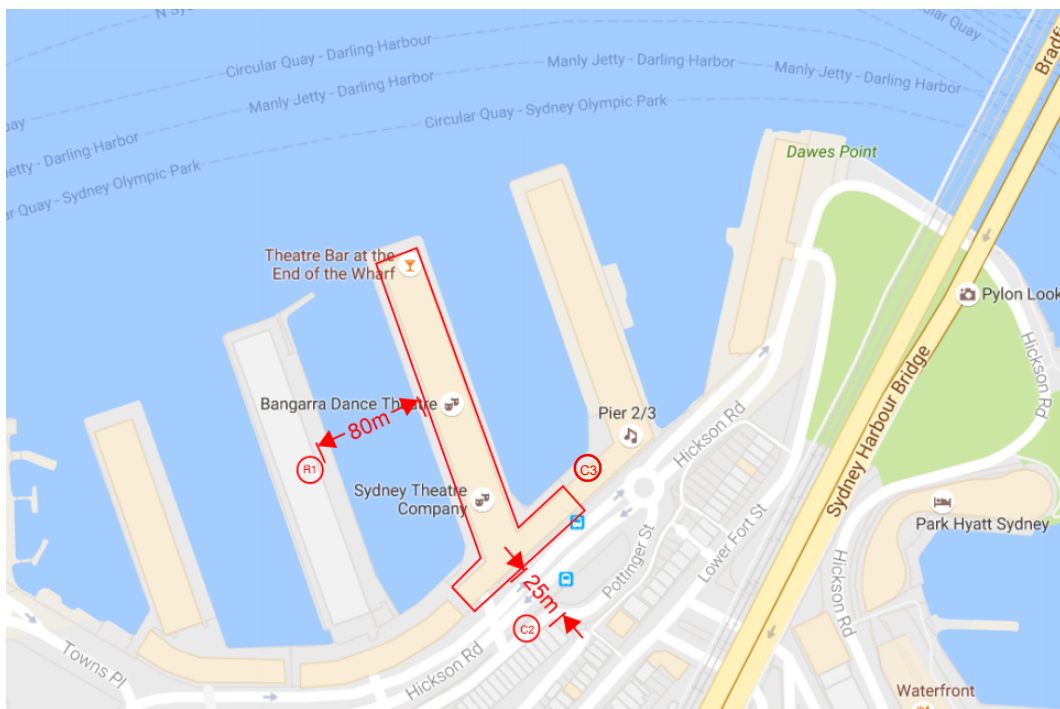


Figure 1: Key Noise Receptors

¹ NSW Industrial Noise Policy. Environment Protection Authority. January 2000



Figure 2: Noise Receptors to the North of the Development (Image taken from WSP report)

4.1.2 Measurement of existing noise levels

The noise measurement locations are shown in Figure 1 and Figure 2 above.

The background noise levels have been determined previously by WSP² and submitted as part of the WBAP Stage 1 SSDA. The results of the measurements are summarised below with full report included as Appendix A of this report. Whilst the data is two years old, it has been shown to be representative of the existing noise climate through validation by Arup using attended and unattended noise measurements at various locations at site over recent months.

Also included in Appendix A are details of some additional noise measurements conducted by Arup which assess noise levels local to the Shore Sheds between Pier 2/3 and Wharf 4/5 (location C3 on Figure 1). This was the most viable secure location to install a noise logger to obtain representative background noise levels from the project site.

² Noise and Vibration Impact Report, WSP, 24 June 2014

5 Acoustic Criteria

5.1 NSW Industrial Noise Policy (INP)

This section outlines applicable external noise limiting criteria. Noise criteria are provided to maintain on site acoustic amenity and avoid adverse acoustic impacts to the surrounding environment.

The INP covers noise emissions from the proposed operation of a facility and from other plant and equipment affecting the proposed facility. Noise from traffic movement on a site (i.e. not on public roads) is assessed as being operational noise under the INP. The INP criteria are also to be used for assessing the internal operational noise breakout from daily operations and use of the STC50 facilities.

The objective of the INP is to protect sensitive receivers, such as residences, from noise generated by commercial, industrial or trade premises. In this context, ‘industrial’ refers to the source of the noise (e.g. plant) rather than the nature of the premises.

Noise limits are set based on land use in the area and existing background noise levels. Compliance is achieved if the adjusted L_{Aeq} noise level at any sensitive receivers affected by noise from the facility is below the noise limit. The adjusted L_{Aeq} is determined by applying corrections for such noise characteristics as duration, intermittency, tonality, and impulsiveness.

The assessment of noise emission under the INP is based on the calculation of a noise limit at a receiver position, taking into account the land-use in the surrounding area and the existing background noise level.

The INP separates the 24 hour day into three different time periods – day, evening and night. These time periods are detailed below in Table 1.

Table 1 Standard INP time periods

Period	Day of Week	Time period
Day	Monday-Saturday	7:00 am-6:00 pm
	Sunday, Public Holidays	8:00 am-6:00 pm
Evening	Monday-Sunday	6:00 pm -10:00 pm
Night	Monday-Saturday	10:00 pm -7:00 am
	Sunday, Public Holidays	10:00 pm -8:00 am

The INP states that background noise levels should be determined over the “days and times of operation of the project”. When setting criteria, only the measured data from the hours of operation of the project should be included.

The INP provides guidance on acceptable noise levels from the introduction of new industrial noise sources to an area. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences; and

- Protecting noise level amenity for particular land uses such as residences, recreation areas and commercial offices etc.

Both of these components result in noise criteria that should not be exceeded in order to avoid any adverse noise impacts on the affected areas. Both criteria have been taken into account when assessing the noise impact of building services noise source(s) associated with the project, and where the intrusiveness and the amenity criterion differ, the most stringent of the noise criteria has been adopted as the 'project-specific' noise criterion. In most cases, the project-specific criterion has been determined by the more-stringent amenity criterion. The Project Specific Noise Emission Criteria derived from the noise measurements by WSP and Arup (see Appendix A) are given below in Table 2.

Table 2: Summary of Project Specific Noise Criteria (free-field noise criteria to be met at boundary of receiver)

Location	Time Period	Project Specific Noise Criteria (L _{Aeq} 15min)
Receiver R1: Residential Apartments	Day (7:00 – 18:00)	57
	Evening (18:00 – 22:00)	52
	Night (22:00 – 7:00)	44
Receiver R2: Terraced houses	Day (7:00 – 18:00)	57
	Evening (18:00 – 22:00)	52
	Night (22:00 – 7:00)	51
Receiver R3: The Sebel Hotel	Day (7:00 – 18:00)	57
	Evening (18:00 – 22:00)	52
	Night (22:00 – 7:00)	51
Receiver R4: McMahon's Point	Day (7:00 – 18:00)	54
	Evening (18:00 – 22:00)	47
	Night (22:00 – 7:00)	42
Receiver R5: McMahon's Point	Day (7:00 – 18:00)	54
	Evening (18:00 – 22:00)	47
	Night (22:00 – 7:00)	42
Receiver C1: Café Restaurants (applicable only when in use)	Day (7:00 – 18:00)	65
	Evening (18:00 – 22:00)	60
	Night (22:00 – 7:00)	58
Receiver C2: Shops and Cafes (applicable only when in use)	Day (7:00 – 18:00)	62
	Evening (18:00 – 22:00)	60
	Night (22:00 – 7:00)	58
Receiver C3: Shops and Cafes and Offices (applicable only when in use)	Day (7:00 – 18:00)	55
	Evening (18:00 – 22:00)	54
	Night (22:00 – 7:00)	44

Assessment of building services noise mitigation requirements to meet these criteria are discussed in Section 6.1 below.

5.2 Limits On Noise Local To The Development

As well as controlling noise affecting nearby residences and the nearby recreation spaces, it is intended to control noise local to the development in order to protect amenity of the outdoor areas and the existing local commercial and retail tenancies.

Based on the site noise survey, it is proposed that normally operating external plant noise egress is limited to 50 dB(A) when measured at any publically accessible location at least 1m from a grille or the façade of the building.

5.3 Operational Event Noise

5.3.1 WBAP Event Noise

A full assessment of event types and associated noise levels from the WBAP project has been undertaken as part of the WBAP Stage 2 State Significant Development Application, and is not presented in this report.

5.3.2 STC50 Community and Private Functions

Noise break-out from normal operational activities and functions would have to be comply with the normal expectations for environmental noise conditions. The noise criteria in the INP have been applied to this source to be consistent with the previous DA submissions for this project.

The relevant INP requirements are given in Table 2 above. An assessment of noise breakout from internal operational use is provided in Section 6 below.

6 Noise Impacts to the Community

The WBAP development is likely to take place at the same time as the works covered by this report. The potential additive effect of noise from the WBAP development (construction noise and operation noise) is assessed in this application.

6.1 Plant Noise

6.1.1 Additive effects of the WBAP development

For plant noise, a factor of 5 dB will be included in the plant noise assessments to account for a potential additive effect from WBAP plant noise where relevant (see Section 6.3 below).

The implications of both the WBAP and STC works on construction noise are noted in the separate Construction Noise and Vibration Management Plan within the WBAP Stage 2 State Significant Development Application.

6.1.2 Noise Control Measures

Total plant noise will be limited to the criteria listed in Section 5.1 above. Currently an allowance of 5 dB will be included for the potential additive effects of the WBAP plant at relevant receivers along with appropriate engineering margins.

At this stage in the project, details of the plant selections are not known. During the detailed design process, appropriate noise and vibration control treatments will be specified to ensure that the noise limits are maintained. These treatments are likely to include:

- Specification of maximum sound power levels for all items of plant as part of the project documentation. Preliminary guidance regarding maximum sound power levels for major plant items are provided below.
- Rectangular and circular attenuators to control fan noise
- Acoustic louvres to control noise from plantroom ventilation openings
- Vibration isolators to reduce vibration input to the building structure
- Acoustic screens around any external plant
- Incorporation of sound absorptive treatments in plantroom spaces where needed.
- Kitchen exhausts with discharge attenuators (treated against kitchen grease)

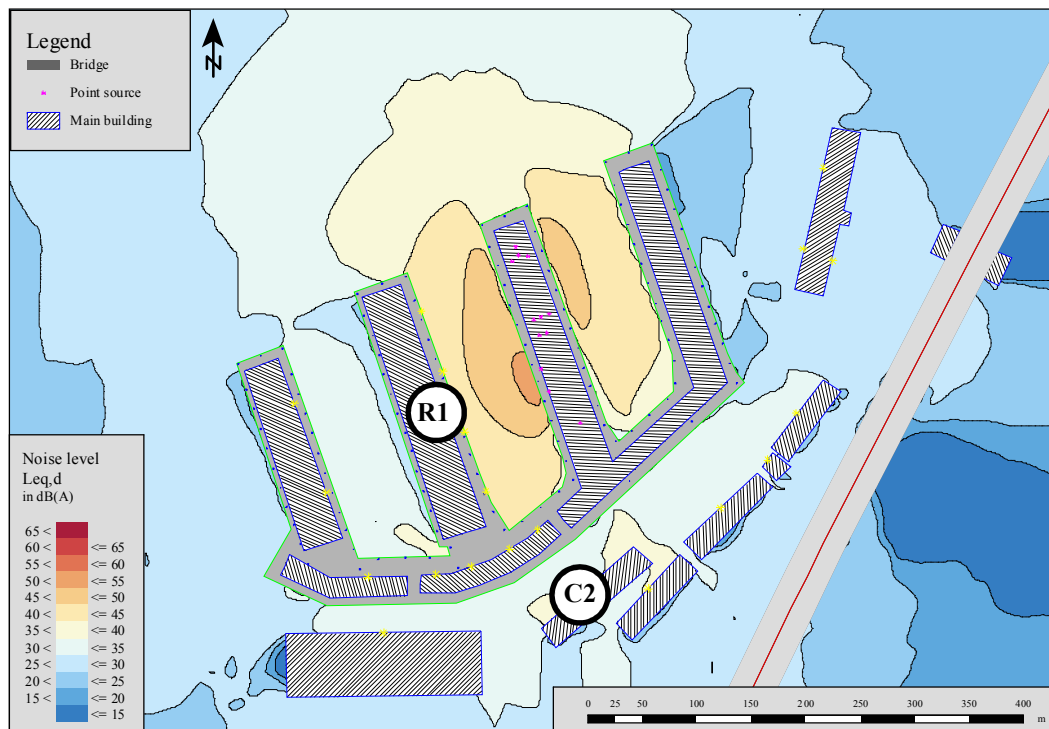
Current plant proposals do not include generator sets.

6.1.3 Plant Maximum Sound Power Levels

A preliminary assessment has been carried out of likely allowable maximum sound power levels for externally located plant and grilles located on the building façade. A 3D outdoor acoustic model of the project site and surroundings has been developed using SoundPlan® software to assist in ensuring that cumulative noise levels from operation of plant meets the noise criteria established in Section 5.1. The modelling of the plant noise has taken account of the potential noise from plant associated with other tenancies in the precinct so that the total noise levels from all plant does not exceed the appropriate criteria.

Figure 3 shows an image from the 3D acoustic model. The receiver location R1 is the nearest noise sensitive receiver.

The corresponding allowable maximum sound power levels of known plant to meet noise limits at the nearest sensitive receivers at this stage of the project are



given in Table 3 below. These levels should be used as guidance for the detailed noise mitigation design of building services systems.

Figure 3: SoundPlan® model showing plant noise propagation

Table 3: Summary of maximum sound power levels for industrial noise sources

Plant	Octave Band Centre Frequency, Hz							
	63	125	250	500	1k	2k	4k	8k
Rooftop Chiller	73	74	75	72	74	74	70	63
Rooftop Boiler and Plant	83	81	82	79	79	75	73	72
Theatre 1 O/A Vertical Discharge	84	82	83	80	80	76	74	73
Enclosed Plant O/A and E/A Grilles	84	82	83	80	80	76	74	73
Theatre 1 SEF Exhaust Duct Discharge 1	83	81	82	79	79	75	73	72
Theatre 1 SEF Exhaust Duct Discharge 2	83	81	82	79	79	75	73	72
Theatre 2 SEF Vertical Discharge	84	82	83	80	80	76	74	73
Theatre 2 AHU O/A Duct	84	82	83	80	80	76	74	73
O/A Grilles for Meeting Room FCUs	83	81	82	79	79	75	73	72
E/A for Scenic Art Air Extraction	84	82	83	80	80	76	74	73

The maximum sound power levels given above will be used to provide necessary noise mitigation measures to control operational plant noise to the project specific limits at the nearest noise sensitive receivers.

6.2 Breakout of Internal Activity Noise

6.2.1 Events and Performances

The project is cognisant of the potential for noise from internal activities to affect the nearby residences and other tenancies at Wharf 4/5, particularly in the spaces which are required to be naturally ventilated.

As the envelope of the Wharf 4/5 building is largely being left 'as is' because of the heritage constraints, the design of new internally located constructions such as separating walls, floors and ceilings incorporate the necessary sound insulation performance to adequately control disturbance to both external receivers and other tenancies within Wharf 4/5. These constructions are documented in the Charcoal Blue Acoustic Concept Design report.

The event spaces in the STC50 development are very well insulated acoustically to control noise intrusion to stringent background noise limits set by Charcoal Blue and will therefore be effectively insulated against noise breakout.

Cumulative operational noise considerations, however, for both the STC50 and WBAP projects have been assessed. Details of the WBAP assessment can be found in the WBAP Stage 2 State Significant Development Application. Relevant information from that Application is included here.

The level of noise breakout for the STC50 facilities is shown below in terms of the expected maximum sound pressure level at 1 m from the façade (Figures 4 and 5). Figures 6 and 7 show the corresponding anticipated noise levels for the WBAP development. These assessments are based on an assumed worst-case

noise level in the performance venues of 94 dBL_{Aeq} and similar levels in the WBAP spaces.

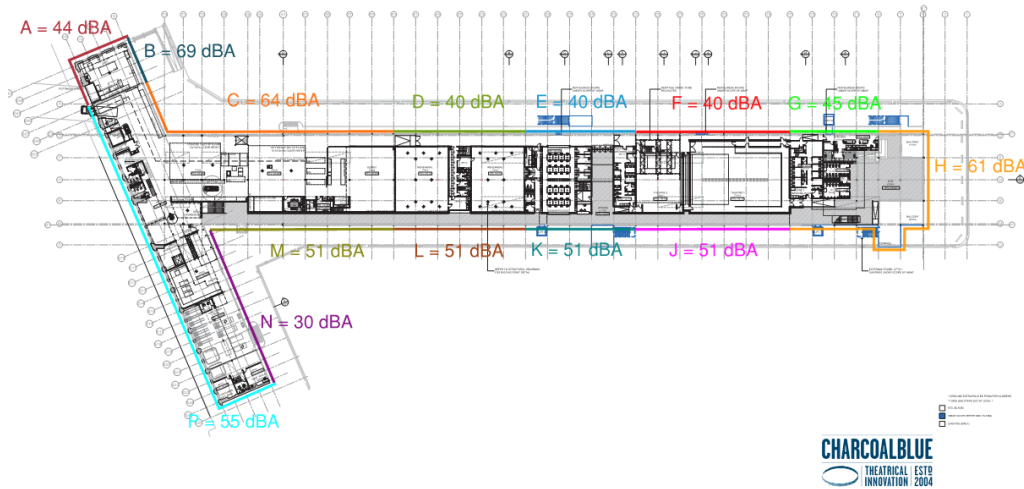


Figure 4: Estimated Sound Pressure Level at 1 m from facade of STC50 facilities (image courtesy of Charcoal Blue)

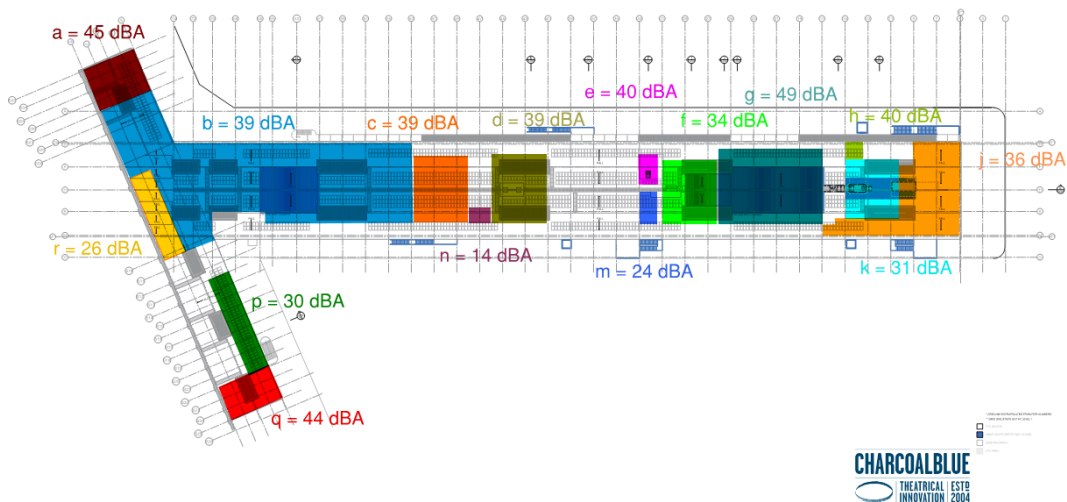


Figure 5: Estimated Sound Pressure Level at 1 m from roof of STC50 facilities (image courtesy of Charcoal Blue)

The layout of the WBAP Pier 2/3 acoustically insulated spaces in the upper floors and roof are shown below along with the estimated sound pressure levels at the façade / roof. Note that the key acoustically sensitive spaces for the WBAP development include facilities for the Australian Chamber Orchestra (ACO) and the Australian Theatre for Young People (ATYP). Both of these significant venues are set in from the façade which helps to reduce the levels of noise breakout.

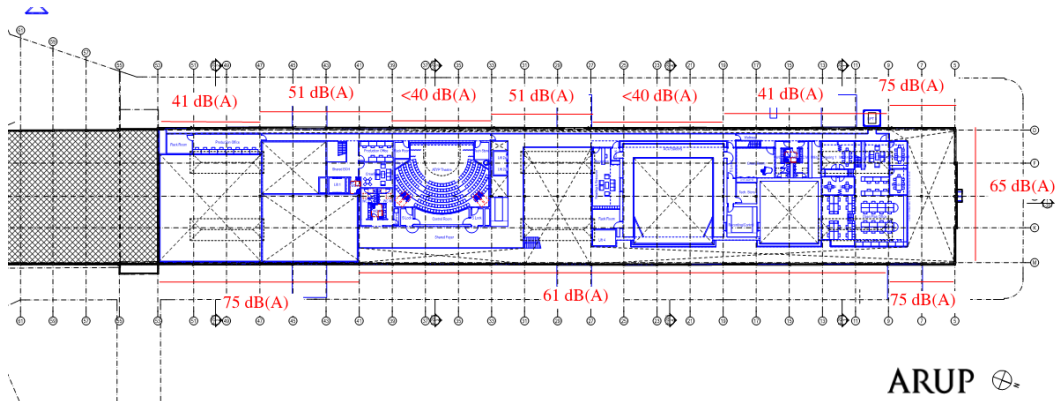


Figure 6: Estimated sound pressure levels at 1 m from upper facade of Pier 2/3 (reproduced from the WBAP Stage 2 State Significant Development Application)

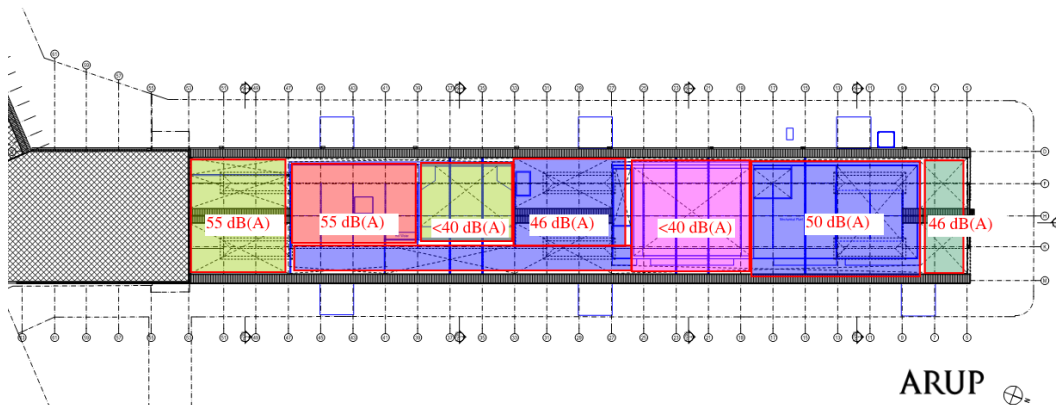


Figure 7: Estimated sound pressure levels at 1 m from external roof of Pier 2/3 (reproduced from the WBAP Stage 2 State Significant Development Application)

As can be seen from the Figures above, breakout noise levels even local to the façade and roof of the acoustically insulated spaces are significantly below the NSW INP targets for noise to atmosphere at noise sensitive receivers.

6.2.2 Set Building Workshop Activities

As part of the STC50 development, the STC set building workshop will be relocated from its current location.

Attended noise measurements of set building activities were undertaken at the existing STC set building workshop to ascertain typical noise levels expected in the new workshop areas. A summary of the noise measurements is provided in Table 4 below.

Table 4: Summary of set workshop building activity noise levels

Activity	Octave Band Centre Frequency, Hz									
	dB(A)		63	125	250	500	1k	2k	4k	8k
Unknown saw type (dremel-like) @ 2m	L _{max}	96	66	72	83	94	91	89	86	77
Unknown saw type (dremel-like) @2m	L ₁₀	91	60	63	80	88	83	85	83	75
Carba-Tec Thicknesser	L _{max}	104	74	78	85	90	97	99	99	87
Carba-Tec Thicknesser	L ₁₀	100	70	74	82	87	87	92	97	83
Band saw @ 2m (sawing timber)	L _{max}	101	77	80	86	90	91	92	95	96
Band saw @ 2m (sawing timber)	L ₁₀	97	66	61	63	74	81	88	93	93
Table saw @ 2m	L _{max}	95	78	81	85	89	92	87	84	77
Table saw @ 2m	L ₁₀	89	75	77	76	82	84	83	80	76
Table saw @ 2m	L _{max}	91	74	77	70	77	82	86	84	81
Table saw @ 2m	L ₁₀	88	73	76	67	72	79	82	83	80
Nail gun @ 2m	L _{max}	92	75	81	85	86	86	86	84	84
Nail gun @ 2m	L ₁₀	84	72	76	77	78	77	78	77	76
Angle grinder @ 2m	L _{max}	91	70	72	70	76	80	84	87	86
Angle grinder @ 2m	L ₁₀	86	67	68	66	71	77	80	81	80
Band saw @ 2m (sawing aluminium)	L _{max}	109	77	77	81	86	86	97	103	108
Band saw @ 2m (sawing aluminium)	L ₁₀	100	66	68	75	83	84	91	96	95

The noise levels measured in Table 4 will assist in the building façade and internal wall/floor partition design to ensure noise break-out is controlled to meet noise limits at the nearest sensitive receiver locations.

6.3 Construction Noise and Vibration

Cumulative construction noise considerations, for both the STC50 and WBAP projects have been assessed in the WBAP Stage 2 State Significant Development Application. Relevant information related to the STC50 project is included here.

6.3.1 Effect on the Community

The importance of the noise and vibration that will be generated by the project construction is recognised. As noted below, noise and vibration will be critical for the existing uses and in some cases, noise control treatments necessary to achieve appropriate noise levels at the existing facilities will help to reduce noise affecting the nearest residential properties.

The control of noise affecting the community will be given a high priority and form a critical part of the eventual Contractor's scope of work. There will be a specific requirement for the Contractor to prepare a detailed Construction Noise and Vibration Management Plan as part of their appointment.

The requirements given in the “**Interim Construction Noise Guideline**³” will apply (this is also in accordance with the relevant policies as listed in the SEARs). For residential receivers this defines noise management levels and work periods based on the Rating Background Level (RBL) as defined in the NSW Industrial Noise Policy, in the case of commercial receivers an absolute ‘noise affected’ noise management level is provided within the ICNG (see Table 5 below). Refer to Appendix A of this report for the site noise measurement details.

In accordance with the ICNG, construction hours will be limited to:

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- No work on Sundays or public holidays

Table 5: Management Levels at receivers during normal working hours

Location	RBL Time Period	RBL	Noise Management Level, $L_{Aeq\ 15\text{minute}}$	
			Noise affected	Highly noise affected
Receiver R1: Residential Apartments	Day (7:00 – 18:00)	52	62	75
Receiver R2: Terraced houses	Day (7:00 – 18:00)	60	70	75
Receiver R3: The Siebel Hotel	Day (7:00 – 18:00)	60	70	75
Receiver R4: McMahons Point	Day (7:00 – 18:00)	49	59	75
Receiver R5: McMahons Point	Day (7:00 – 18:00)	49	59	75
Receiver C1: Café Restaurants	Day (7:00 – 18:00)	60	70	-
Receiver C2: Shops and Cafes	Day (7:00 – 18:00)	60	70	-
Receiver C3: Shops, Cafes, Offices	Day (7:00 – 18:00)	50	70	-

6.3.2 Effect on the Existing Spaces

Much of the construction work will be done internally. Many of the tenants will be decanted during the works although some of the spaces may remain occupied during construction. The eventual contractor will have a key role in managing the noise and vibration levels during the works and this will include:

³ Interim Construction Noise Guideline, Department of Environment & Climate Change, NSW, July 2009

- Appointing a named member of the site staff who will act as the Responsible Person with respect to noise and vibration.
- Ensuring that the Responsible Person keeps the precinct (and local community) advised on expected activities.
- Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable.
- Managing and monitoring the noise and vibration logging equipment installed around the site.
- Ensuring that the Responsible Person controls the working hours on site to ensure that work is only done during the acceptable periods as defined in the Interim Construction Noise Guideline for NSW (7am to 6pm on weekdays and 8am to 1pm on Saturdays. No work on Sundays).
- The impact of noise from construction activity on the precinct may be mitigated by working outside precinct opening hours, provided there are no significant adverse impacts on residential receivers nearby.
- Ensuring that noise levels are kept as low as is reasonably practicable and providing all “feasible and reasonable” noise mitigation methods following the procedures of the NSW Interim Construction Noise guideline, and reference to relevant standards including *AS2436-2010: Guide to noise control on construction, maintenance and demolition sites* and *BS5228-2009 Code of practice for noise and vibration control on construction and open sites*.
- Maintaining appropriate records of complaints.

6.3.3 Construction Noise Levels

The actual noise levels will depend on the final plant selected for the works. At this stage the following construction activities are documented in the Construction Management Plan (CMP), Rev A, dated 31 October 2016, prepared by Cadence Australia:

- Demolition and constructions works will be limited to daytime hours only.
- A mobile barge crane will be used at a location where necessary to remove and install plant and other materials associated with the development. The worst case location within line of sight of residential receivers (location R1) has been assumed.
- Trucks will be used to remove demolition and construction waste from the site, using the ramp on at the Pottinger Street level for access. Truck movements will be restricted to daytime periods only.
- Some vehicle movements will take place on the side of the Wharf building furthest from other neighbouring wharf residences.
- Much of the construction work will be done internally and will therefore be screened by the existing building envelope. The heritage nature of the development means that many of the existing elements are being retained and

the works will primarily involve the construction of new internal partitions and modifications to the roof.

- No piling works are anticipated in this contract.
- Site offices will be accommodated within the existing building structure.
- There will be some concrete removal work required, involving 3 tonne excavators and pulverisers. The equipment used for this will be selected to be as quiet as is reasonably practicable.
- Some remedial works to the heritage façade will be carried out using hand tools.

A preliminary 3D outdoor model of the above construction activities using SoundPlan® software has been developed. The 3D outdoor acoustic model takes into account cumulative noise levels from concurrent construction activities in the Precinct. Results from the model indicate that daytime construction noise limits will be satisfied with the abovementioned construction activities taking place.

Table 6 below shows the predicted cumulative construction noise levels modelled in SoundPlan® software at the nearest receiver locations.

Table 6: Predicted Cumulative Construction Noise Levels at receivers during normal working hours (7am to 6pm)

Location	Predicted Construction Noise Level, L_{Aeq} 15minute	Noise Management Level from ICNG
Receiver R1: Residential Apartments	65	62
Receiver C2: Shops and Cafes	49	70

From Table 6 the predicted noise levels are within the Noise Management Level given in the ICNG at Receiver location C2 and thus noise from the construction works for the STC50 project would not result in the ICNG criteria being exceeded, even with added to that from the WBAP project.

At location R1 where construction noise slightly exceeds the Noise Management Level during standard hours, all “feasible and reasonable” mitigation levels will be implemented in accordance with the requirements of the Interim Construction Noise Guideline to reduce the noise levels.

6.3.4 Proposed Construction Noise and Vibration Management

The contractor will have a key role in managing the noise and vibration levels during the works so as to reduce noise and vibration as far as is reasonably practicable.

6.3.4.1 Noise and Vibration Management Plan

The contractor will be required to prepare a noise management and vibration plan as soon as they are appointed. This will specify the actual plant to be used and will include updated estimates of the likely levels of noise and the scheduling of activities.

6.3.4.2 Staffing

- Appointing a named member of the site staff who will act as the Responsible Person with respect to noise and vibration.
- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise.
- Ensuring good work practices are adopted to avoid issues such as noise from dropped items, noise from communication radios is kept as low as is practicable.
- Avoid the use of radios or stereos outdoors.
- Avoid shouting, and minimise talking loudly and slamming vehicle doors.

6.3.4.3 Plant and Equipment

- Turn off all vehicles, plant and equipment when not in use.
- Tile cutting to be done behind an acoustic screen.
- Ensuring that the Responsible Person checks the conditions of the powered equipment used on site daily to ensure plant is properly maintained and that noise is kept as low as practicable

6.3.4.4 Scheduling

- Ensuring that the Responsible Person controls the working hours on site to ensure that work is only done during the acceptable periods as defined in the ICNG (7am to 6pm on weekdays and 8am to 1pm on Saturdays. No work on Sundays or public holidays).

6.3.4.5 Noise Logging

- A noise logger will be installed and maintained which can be interrogated remotely by precinct management staff as well as the contractor. The logger will also be required to automatically send a text message to the Responsible Person on site once the 'warning' threshold (5 dB below the noise management threshold set out in Table 5 above) has been breached.

- The Precinct Management representative will also be copied in with the warning texts.
- The data from the noise logger will be used to inform the contractor on the noise levels being generated so that particularly noisy activities can be identified and practicable options investigated to reduce noise levels further.

6.3.4.6 Community Liaison

- Ensure Responsible Person periodically (ie once per week) checks the commercial tenants around the site and nearby residences for noise problems so that solutions can be quickly applied.
- Ensuring that the Responsible Person keeps the precinct (and local community) advised on expected activities and coordinates scheduling and locations of noisy works around any critical user events where practicable. This shall include face to face meetings with tenants if requested and a letter box drop.
- Maintaining appropriate records of complaints to include timing, reported issues, actions taken and measures to be included for ongoing works. The complaints log will need to be filed with the Precinct Management.

6.3.4.7 Respite

It is likely that noise levels during construction will be below the Management Levels in the ICNG for most of the construction period. As such, no respite periods are expected to be strictly necessary. In any event, the introduction of respite periods would not reduce the overall long term 'noise dose' given that it would just extend the programme.

The potential for construction work to impact on the existing uses of the WBAP and STC facilities and surrounds is recognised. The contractor will be required to liaise with the Precinct Management so that noise from construction does not impact on any critical events taking place within the existing accommodation.

7 Impact of Environmental Noise and Vibration on the Development

7.1 Noise and Acoustic Privacy

A detailed assessment of noise intrusion is being conducted as part of the acoustic design of the project and will achieve appropriate acoustic privacy between the inside and outside of the building. The design is documented in the Charcoal Blue Acoustic Concept Design Report.

Surveys have been conducted to assess all the significant noise sources, which include:

- Marine traffic (noise from boat engines and occasional horns)
- Rail traffic on the Sydney Harbour Bridge
- Regular civilian helicopter traffic
- Occasional military helicopter traffic
- Distant aircraft noise
- General activity noise from users of the existing facilities

This process is ongoing and includes detailed calculations of noise intrusion through the key elements (facades, openings and roofs) and the development of architectural and acoustic designs. These factor in all the acoustical parameters that influence the resulting internal noise levels, recognising that there are many non-acoustic parameters and heritage factors that will also influence the constructions that will eventually be installed.

The most acoustically critical spaces will have full mechanical ventilation, with other spaces relying on a mixture of natural ventilation or a mixed mode operation where the natural ventilation can be supplemented by mechanical systems.

8 Conclusion

This report has addressed the SEARs Issue 4 and demonstrates that the issues in SEARs that relate to noise and vibration can be appropriately resolved. In particular:

- Criteria based on site measurements have been developed for noise from plant affecting the environment. These criteria comply with the *NSW Industrial Noise Policy (EPA 2000)*.
- Noise during construction will be assessed based on the requirements set out in the *Interim Construction Noise Guideline 2009 (EPA)*. The control of noise and vibration during construction will be a strict requirement for the future contractor. The requirements to achieve acceptable construction noise and vibration levels in the development are likely to be more onerous than those to achieve acceptable conditions at the nearest noise sensitive receiver. Most of the construction work will take place within the existing building envelope.
- An assessment has been made of the cumulative noise from the WBAP project which is likely to progress in parallel with the STC50 project. Controls on noise and vibration for WBAP are set out in the WBAP SSDA documentation and the assessment of the combined noise from both projects (construction and operational) shows that the cumulative noise impacts are not expected to exceed acceptable levels.

Reference has been made to relevant NSW and Australian guidance as well as international experience in arts facility design from within Arup. On the basis of the noise and vibration measurements made on site and the information currently available for the development, we see no impediment to approval.

Appendix A

Noise Survey Results

A1 Results obtained by WSP

2. Site and Project Description

At a glance

This section outlines the Site and Project Description.

2.1 Background

Arts NSW is proposing to develop a new arts precinct at Walsh Bay which will expand and strengthen the existing cluster of cultural institutions and attractions along Sydney's "Arts and Cultural Ribbon". The arts precinct includes Wharf 4/5, Pier 2/3 and Sydney Theatre. The concept provides for an integrated performing arts and cultural precinct within an enhanced public domain at Walsh Bay. It is envisaged that the arts and cultural program within the Walsh Bay Arts Precinct (WBAP) will complement the other cultural initiatives in surrounding areas, including those proposed at nearby Barangaroo (currently under development).

In 2011/12 Arts NSW engaged the NSW Government Architect to prepare a master plan for the precinct. The master plan proposed:

- The transformation of Pier 2/3 to accommodate the Australian Chamber Orchestra, Bell Shakespeare and Australian Theatre for Young People
- The retention of a large "raw" space in Pier 2/3 for events, festivals and functions
- A major upgrade of ground floor facilities at Wharf 4/5, allowing Bangarra to confirm its place as the premier Indigenous performing arts company and maximise new tourist and engagement opportunities
- The expansion of creative and commercial activities along the shore sheds offering cafes, restaurants, retail and commercial activities to further enhance the visitor experience
- A new north facing waterfront square supported with new boardwalks which will significantly increase public open space and create a central platform for activity, collaborative outdoor performances, events, festivals and public art.

2.2 The Site and Surrounds

The WBAP site is part of the Walsh Bay area which is located adjacent to Sydney Harbour within the suburb of Dawes Point. Walsh Bay is strategically located to the north of Sydney's CBD in the vicinity of major tourist destinations including the Sydney Harbour Bridge, the historic areas of Millers Point and The Rocks, Circular Quay and the Sydney Opera House. The Barangaroo redevelopment precinct is located immediately to the south-west and McMahon's Point lies directly on the opposite side of the harbor to the north.

The location of the WBAP site is shown in Figures 1 and 2 overleaf.

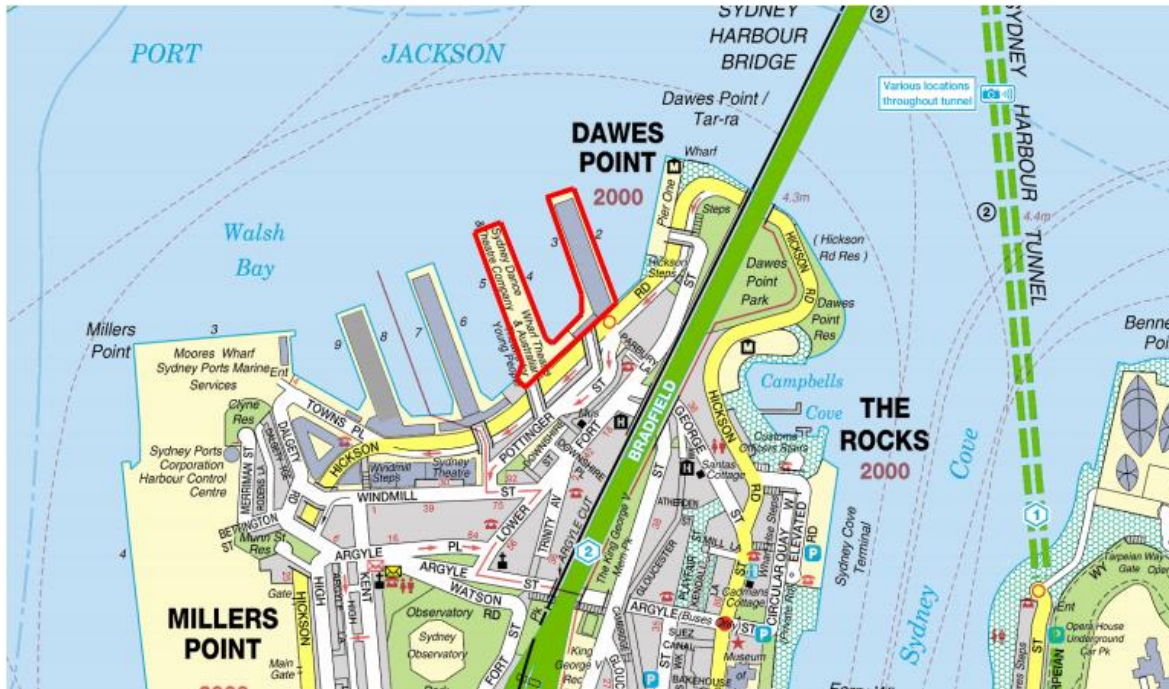


Figure 1 - Site Location (Source: UBD Digital Edition 2004)



Figure 2 - WBAP site (Source: Google Maps)

Walsh Bay comprises ten berths constructed between 1908 and 1922 for international and inter-state shipping. These are collectively known as the Walsh Bay Wharves. The Walsh Bay Wharves Precinct is listed as an item on the State Heritage Register. Much of Walsh Bay

(excluding Wharf 4/5 and Pier 2/3) was redeveloped between 1997 and 2004 by the NSW Government in partnership with the Walsh Bay Partnership (Mirvac and Transfield). The Walsh Bay Wharves comprise the following:

- Pier One which contains the Sebel Pier One Sydney Hotel
- Pier 2/3 is the last remaining undeveloped pier. It has approval for cultural uses, temporary arts events and some commercial events.
- Wharf 4/5 which is occupied by the Sydney Theatre Company, Australian Theatre for Young People, Bangarra Dance Theatre and other arts organisations.
- Pier 6/7 which has been redeveloped for residential apartments and associated boat marina
- Pier 8/9 which has been redeveloped for office uses
- Shore Sheds which contain a range of commercial activities, including restaurants, bars, shops and offices.

The Sydney Theatre is within the WBAP however it is not part of the proposed redevelopment. Given the significant difference in grade between Walsh Bay and Millers Point, there are a number of bridges over Hickson Road which provide pedestrian access between the site and Millers Point. The bridge linking Pottinger Street and Wharf 4/5 is also used for vehicular parking. To the south-west of the wharves is Hickson Road, which provides the major vehicular access to the site. Hickson Road links the site to Barangaroo to the south-west and Circular Quay and The Rocks to the north-east. Other roads providing access to the site include Pottinger Street which provides access to Millers Point, and Towns Place which also provides access to Millers Point via Dalgety Road and Argyle Street.

The Barangaroo redevelopment project to the south of Walsh Bay comprises three redevelopment areas – the Headland Park, Central Barangaroo and Barangaroo South. The Headland Park is to be located adjacent to the Walsh Bay Precinct and is currently under construction. The park is being built up to reflect a similar landform to other headlands around Sydney Harbour. It is proposed that a 300 space car park and an as yet undefined cultural facility will be located inside the headland. Master planning for Central Barangaroo is currently underway with the intention that it will be the cultural and civic focal point for recreation, events and entertainment. Barangaroo South is being developed as a major commercial and mixed use centre.

2.2.1 Pier 2/3

Pier 2/3 is a finger wharf comprising two storeys (and associated shore sheds) and was constructed between 1912 and 1921. It is Sydney's last wharf structure in its original state. Much of it is an empty shell however it does contain some commercial uses. There is a 99 year lease between the Maritime Authority of NSW (now Roads and Maritime Services) and Communities NSW (which now rests with Arts NSW, Department of Trade and Investment) for the finger wharf, the portion of open air wharf apron, the pedestrian link bridge and the wharf substructure. The granting of this lease, amongst other things, allows Pier 2/3 to be used for arts, cultural and creative purposes. The City of Sydney has granted consent for Pier 2/3 to be used as a cultural facility for a range of uses such as rehearsals, exhibitions, workshops, filming and events, including the Sydney Writers' Festival and the Biennale of Sydney. The consent was granted on 21 September 2011 and is for a period of 3 years.

2.2.2 Wharf 4/5

Wharf 4/5 is a four storey timber building which was built around 1917 and used as a steamship berthing and cargo storage facility until the mid-1970s. The Wharf has been progressively upgraded and adaptively reused since the early 1980s. Ten arts and cultural organisations use the facility which comprises a range of performance venues, rehearsal and workshop spaces, a recording studio, café/restaurants and office accommodation.

Wharf 4/5 is recognised as a highly successful adaptive reuse of an important heritage item. Its redevelopment 30 years ago was the subject of numerous architectural and design awards. However, many of its spaces are not fit for purpose and use of the space is not optimised.

2.3 Site Ownership

The land is legally described as follows:

- Pier 2/3 - Lot 11 DP 1138931
- Pier 2/3 Shore Sheds – Lot 24 DP 1071597
- Wharf 4/5 - Lot 65 in DP 1048377

The land owner of the WBAP site is the Roads and Maritime Services (RMS). Both Pier 2/3 and Wharf 4/5 are occupied under various lease arrangements with Arts NSW, Department of Trade and Investment, primarily for arts and cultural uses. The area of water that the project proposes to build over, with walkways and the bridge, is also owned by RMS. Its land title description is Lot 12 in DP 1138931.

2.4 The Project

The Concept Design more than doubles the arts and cultural offerings at Walsh Bay, with new and upgraded production, rehearsal, studio and performance venues. It remains a working arts precinct, with complimentary commercial opportunities

Following the Master Plan, the Concept Design has responded to stakeholder feedback and greater design investigation, resulting in a more resolved concept, with the following key differences from the Master Plan:

- Floating pontoons and connecting bridge have been removed;
- Heritage impacts have been interrogated and minimised;
- Internal planning has been further articulated to meet arts tenants requirements; and
- A stage area canopy has been introduced into the waterfront square.

The main features of the development of Pier 2/3 include:

- New homes for Bell Shakespeare, Australian Chamber Orchestra and the Australian Theatre for Young People, including office accommodation, rehearsal space and performance spaces; and
- Retention of raw heritage space for a range of events and functions, with some improved ancillary facilities.

The proposed refurbishment of Wharf 4/5 ground floor includes:

- Upgraded facilities for Bangarra Dance Theatre and Sydney Dance Company (Sydney Theatre Company facilities are not included in this proposed development)

- Several arts organisations - Accessible Arts, Regional Arts, and the choirs are to relocate from this building

The proposed modifications to Wharf 4/5 Shore Sheds include the provision of upgraded choirs office accommodation and rehearsal space, and new commercial spaces.

The Waterfront Square has been further developed from the public domain proposed in the Master Plan to include a central square for events, festivals, markets and public art. As noted above, the pontoons and bridges have been removed and a shade structure/canopy has been introduced over the notional stage area of the Waterfront Square.

3. Site analysis

At a glance

This section outlines the primary noise & vibration sources impacting the site, and establishes all surrounding noise and vibration sensitive receptors. This section also details the noise survey that has been undertaken and quantifies the existing ambient noise levels on site and at the noise sensitive receivers.

3.1 Key Noise & Vibration Site Analysis

3.1.1 Primary Noise & Vibration Sources

The site is subject to the following existing noise sources:

- Road and rail traffic from Sydney Harbour Bridge
- Marine activity on Sydney Harbour
- Low levels of air traffic noise from aircraft using Sydney Airport
- Occasional but regular light aircraft (Helicopter) noise.
- Existing restaurants & bars
- Existing noise generation from Pier 2/3 tenancies.

3.1.1 Surrounding Noise and Vibration Sensitive Receivers

The site has nearby residential and commercial areas. The closest residential properties are on Pier 6/7 and across Hickson Road sitting approximately 9m higher than the Piers. The closest commercial properties are local stores and cafés across Hickson Road, on street level. To the east, at Pier 1, a hotel with restaurants/cafes sits along the waterfront.

The following table and figure identify the most effected noise sensitive receivers for use throughout the assessments. These will be referenced throughout.

Table 1- Nearby noise sensitive receivers

Receiver	Building	Closest distance from site façade (horizontal)
R1	Residential Apartments	80m
R2	Residential Terrace houses	50m
R3	Residential Hotel – The Seibel Pier One	67m
R4	Residential Apartments – McMahons Point	540m
R5	Residential – McMahons Point	624m
C1	Commercial premises – Café Restaurants	67m
C2	Commercial Premises – Shops and cafes	25m



Figure 3 - Surrounding Noise Sensitive Receptors. Background image courtesy of Google Maps 2014

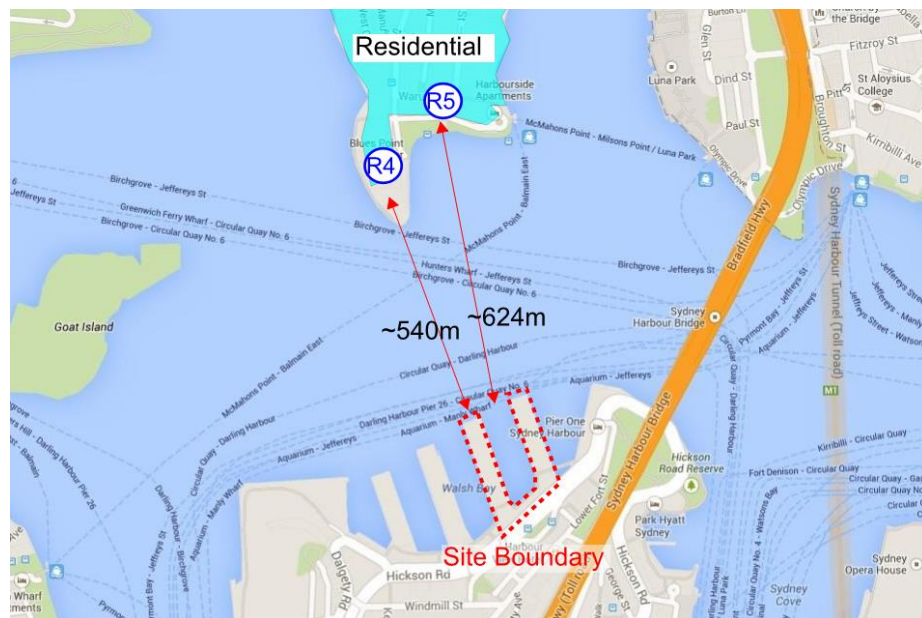


Figure 4 – Surrounding Noise Sensitive Receptors Mc Mahons Point. Background image courtesy of Google Maps 2014

3.3 Existing Prevailing Noise Environment

The existing noise environment has been to and from the site have been determined using site measurements and predictive methods. These methods and results are detailed within the following sections.

3.3.1 Ambient Noise Survey Methodology

Noise measurements have been undertaken around the site to benchmark the prevailing noise environment surrounding the site. Long term noise logging was undertaken taken over 7 days at Walsh Bay from 5/11/2013 - 11/11/2013 and at McMahons Point from 14/03/2014 – 19/03/2014. All logging time periods included typical weekday and weekend periods. Spot measurements were also taken at various locations around the site to inform and calibrate predictions and noise modelling.



Figure 5 - Noise measurement locations. Background image courtesy of Google Maps 2014

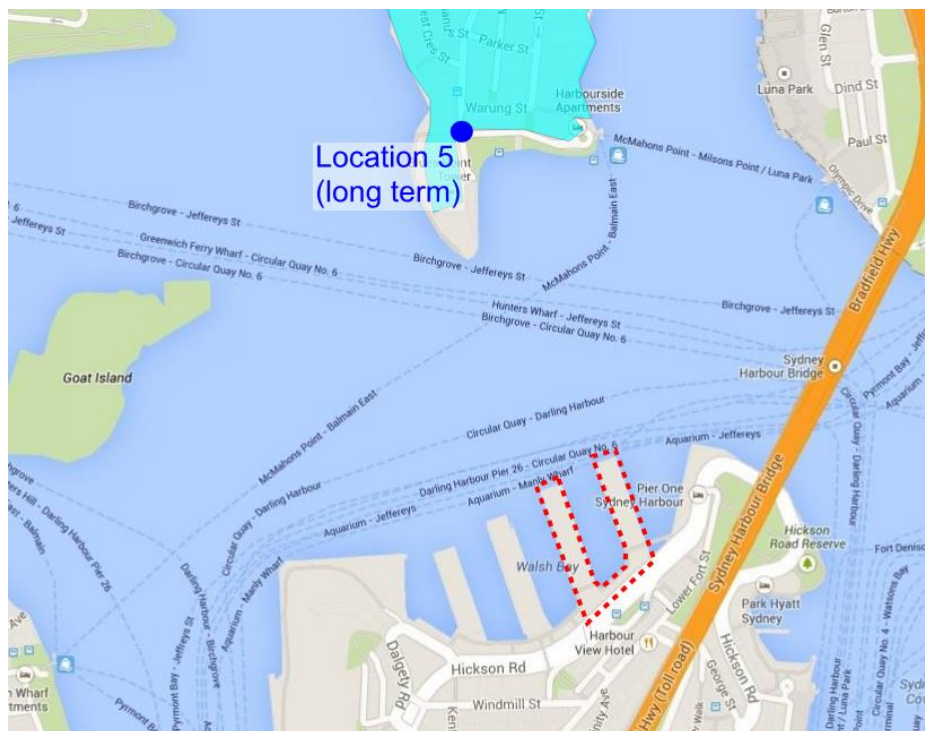


Figure 6 - Noise measurement locations McMahon's Point. Background image courtesy of Google Maps 2014

The measurements made during this visit were conducted in accordance with Australia Standard AS1055 “Acoustics-Description and Measurement of Environmental Noise”.

The equipment used during the survey is as follows:

Table 2 - Equipment used

Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
Sound Level Meter*	Norsonic – Nor140	1404791	21/10/2014

Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
Microphone	Norsonic - 1227	14105	21/10/2014
Preamplifier	Norsonic – 1209	14105	21/10/2014
Sound Level Meter*	NTI XL2	05718	01/10/2014
Microphone	M2210	2408	01/10/2014
Calibrator	Pulsar Model 105	55041	21/10/2014

* Class 1 sound level meter as described by IEC 61672-01:2002

Meteorological conditions for the duration of the noise survey were conducive to the measurement of environmental noise, being predominantly dry and with little wind.

The sound level meter was fitted with a windshield during the survey and was calibrated prior to, and on completion of the survey with the associated acoustic calibrator listed above. No significant calibration drift occurred (i.e. less than 0.5 dBA).

All measurements were taken at a height of 1.5m in the free field. Spot measurements were taken for 15 minute durations to mirror the assessment parameters discussed in the later section of this report.

All spot measurements (locations 2, 3 and 4) were undertaken multiple times throughout the daytime period on a 15-minute duration measurement in order to obtain an accurate measurement of the prevailing noise environment at the relevant locations. These measurements were time-synchronised to the long-term measurement at position 1; such that the prevailing noise levels all locations around the precinct could be accurately interpolated.

3.3.2 Noise survey results

The logging measurements over a seven day period are graphed below. All measurement levels are summarised in Table 3 below and broken into the relevant periods for the INP2000 assessment:

- Day time 0700hrs – 1800hrs
- Evening 1800hrs – 2200hrs
- Night time 2200hrs – 0700hrs

Table 3 – Long-Term Measurement results

	Measurement duration	Background noise dB $L_{A90,15min}$			Ambient noise, dB $L_{Aeq,15min}$		
		Day	Eve	Night	Day	Eve	Night
Location 1	Long Term	59	54	52	63	58	57
Location 5	Long Term	49	50	42	57	56	51

Table 4 – Spot-Measurement results

	Measurement time period, T	Background noise dB $L_{A90,T}$	Ambient noise, dB $L_{Aeq,T}$
		Day	Day
Location 2	15 minutes	60	67

	Measurement time period, T	Background noise dB	Ambient noise, dB
		$L_{A90,T}$	$L_{Aeq,T}$
		Day	Day
Location 3	15 minutes	52	55
Location 4	15 minutes	54	58

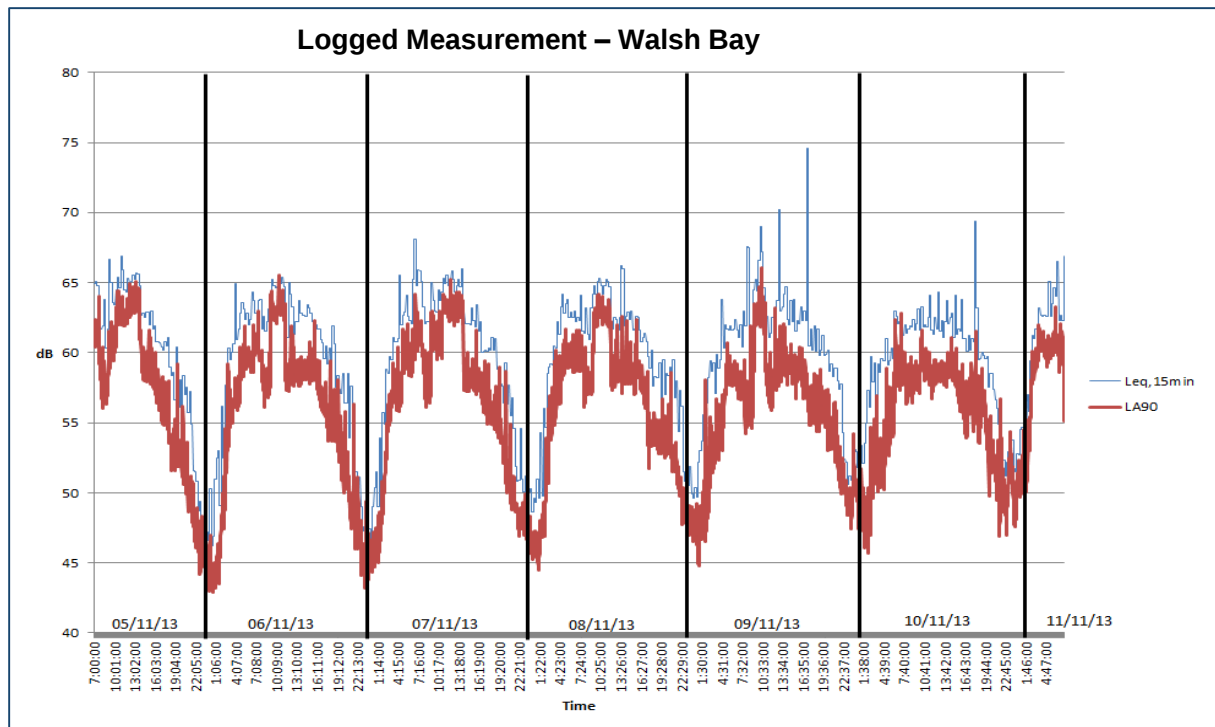


Figure 7 - Noise logging results (Location 1)

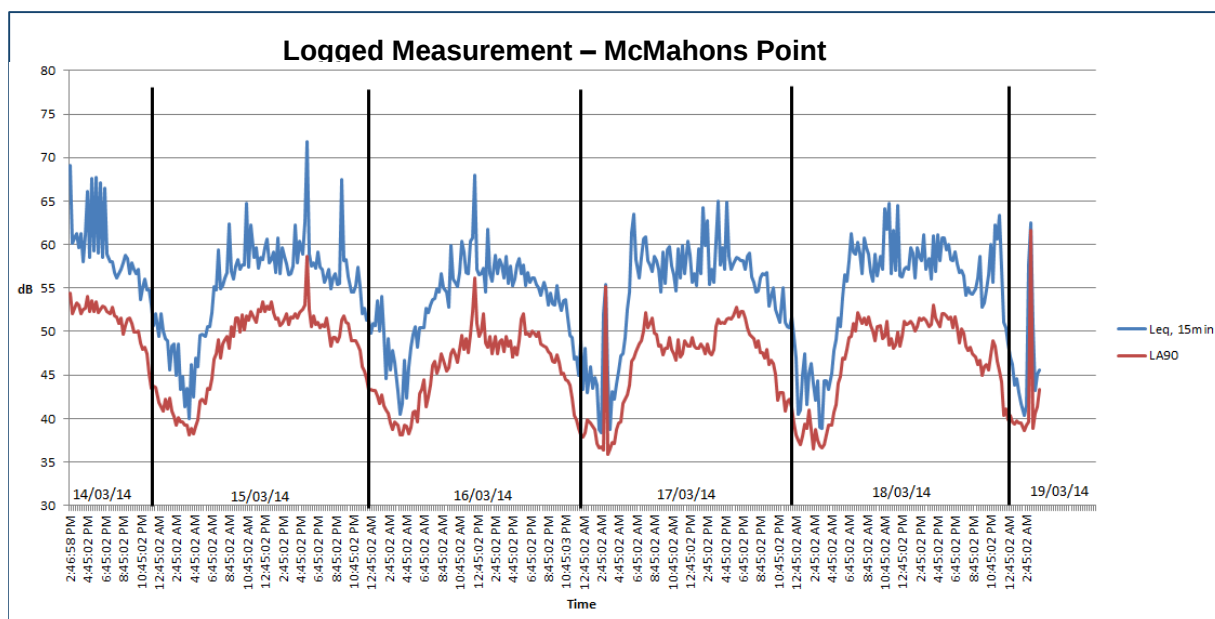


Figure 8 - Noise Logging Results (Location 5)

3.3.3 Establishing Existing Noise Levels at Noise Sensitive Receivers

Access was not available to undertake long-term noise measurements at the exact location of a number of the noise-sensitive locations identified. As such, the noise levels at these locations have been calculated based on the time-synchronised spot measurements and long-term logged noise data. This calculation was undertaken using an acoustic computer modelling program (see Section 6.1.1), which was calibrated to the measurement results obtained. As such, the noise levels presented at all noise sensitive receptors can be considered an accurate representation of the prevailing noise levels at these locations.

A predictive assessment has also been undertaken to determine the existing noise generated by Pier 2/3 activities, based on measured source noise levels for these activities. This has been completed through the use of a computer model using dedicated software (Cadna/A). This modelling process is fully detailed within Section 6.1.1.

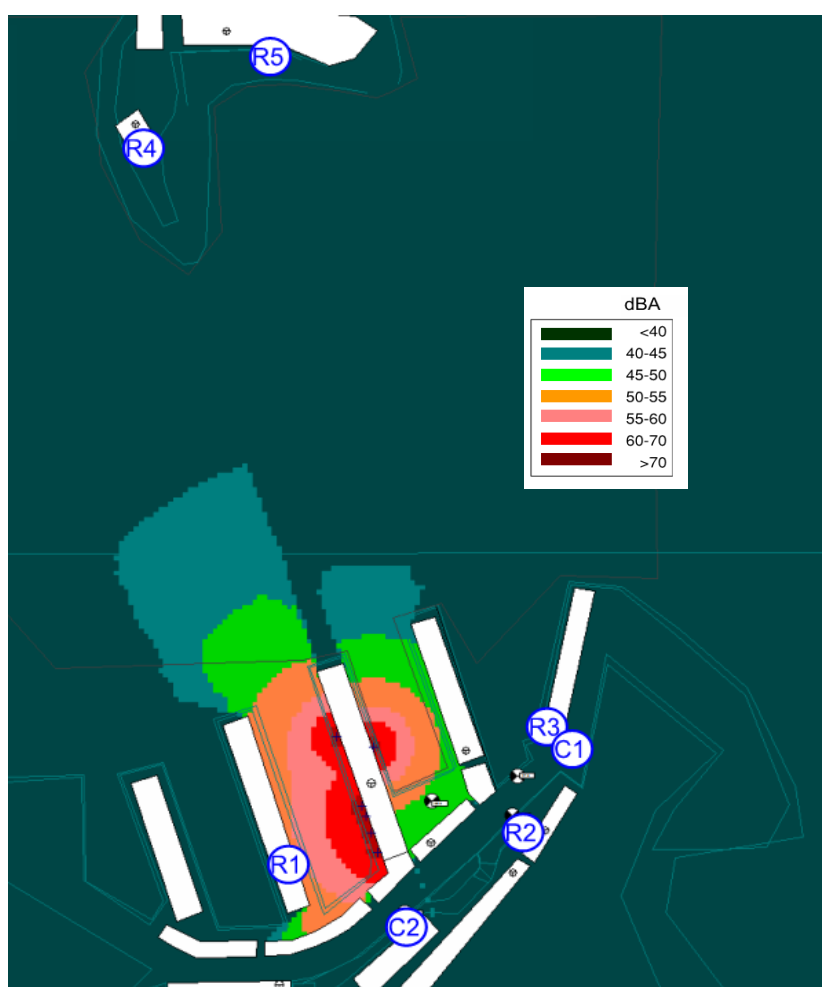


Figure 9 - Existing activity noise levels generated in Pier 2/3 on surrounding receptors

3.3.4 Existing Prevailing Noise Levels - Results

Table 5 below outlines the existing noise levels measured and predicted at each of the identified noise sensitive receivers.

Background noise and ambient noise levels are taken from the measurements of the existing environment.

Activity noise levels have been taken directly from the noise model described in Section 3.3.2 and represent only noise from activities within the existing cultural institutions.

Table 5 - Receiver noise levels based on measurements

Receiver	Background noise, dB $L_{A90,15min}$			Ambient noise, dB $L_{Aeq,15min}$			Existing activity noise level*, dB L_{Aeq}
	Day	Eve	Night	Day	Eve	Night	
R1	52	47	45	55	50	49	56
R2	60	55	53	67	62	61	30
R3	60	55	53	67	62	61	29
R4	49	50	42	57	56	51	35
R5	49	50	42	57	56	51	28
C1	60	55	53	67	62	61	29
C2	60	55	53	67	62	61	33

* For time periods when Pier 2/3 is in use

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Job number

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File reference

Prepared by Daniel Jimenez

Date

11 January 2017

Subject Additional Noise Monitoring

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1 Introduction

This document presents the methodology and results of the additional noise monitoring carried out in the vicinity of Walsh Bay Wharf 2/3 as part of the Walsh Bay Arts Precinct Project to characterize the noise environment on site.

2 Noise Survey

An unattended noise monitoring device was installed onsite from 16 to 23 December, 2016 at the location shown in Figure 1.

Noise measurements were extracted in 15-minute intervals, with a 'fast' time weighting for broadband L_{Aeq} , L_{A10} and L_{A90} statistical parameters. This equipment measured continuous noise data for 7 days.

Technical Note

248995

11 January 2017

2.1 Measurement Location

Figure 1 shows the location where the noise monitor was installed. The location was chosen as representative of the current conditions at the project site, and of the nearest potentially affected receivers. This location was secure and did not obstruct normal traffic (pedestrian and occasional vehicle movements) around the wharf. Being located above local ground level, the noise levels measured may be slightly lower than would otherwise be the case for a meter located at ground level.

The main sources of noise identified were rail and roads noise from the Harbour Bridge and marine activity in the harbour. No mechanical services plant noise was significantly affecting the noise environment at the measurement location.

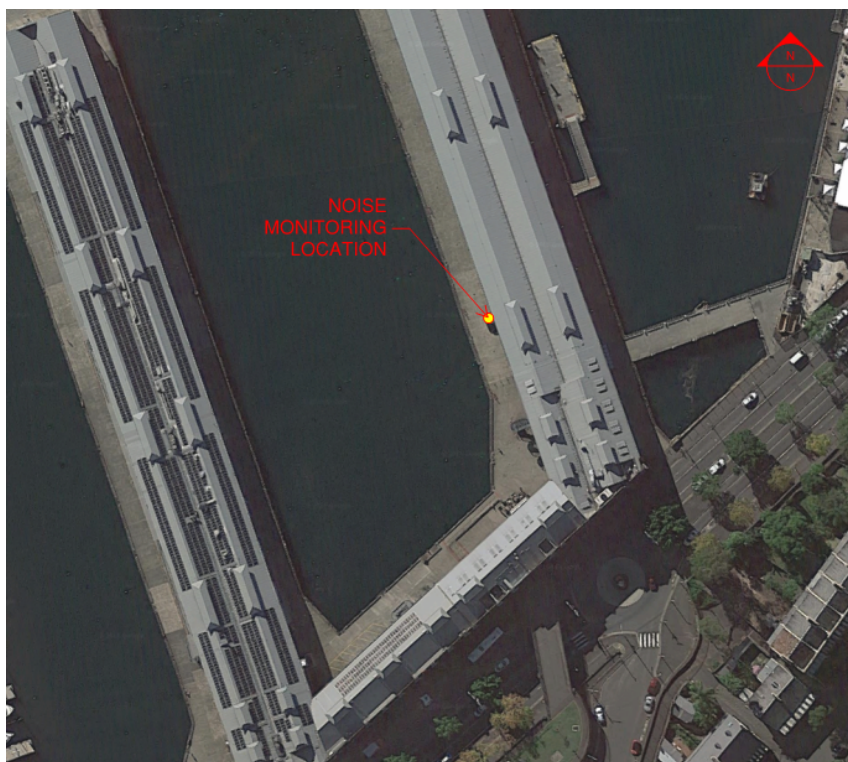


Figure 1: Noise monitoring location

2.2 Equipment

Equipment used to measure the baseline noise levels is detailed in Table 1. All equipment was checked for calibration before and after measurements with no significant drift in calibration being observed. All equipment held a current NATA calibration certificate at the time of the survey.

Table 1: Noise Survey Equipment

Equipment manufacturer and type	Description of Equipment	Serial No.
Ngara™ Real Time Sound Acquisition System	Sound logging meter	8780E5
Brüel and Kjær 4231	Sound level meter calibrator	2445716

Figure 2 shows views of the noise monitoring equipment at the survey location.

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Figure 2: Noise logger at location, on staircase looking north (left) and at ground level looking south-east (right)

2.3 Results

A summary of measured unattended noise levels is provided in Table 2. Results are presented for the day, evening and night-time periods as defined in the NSW Industrial Noise Policy.

Table 2: Summary of measured noise levels for the measurement period

Location	Time Period	Rating Background Level (RBL) – dB(A)	L _{Aeq} (period) , dB
Walsh Bay Wharf 2/3	Day (7:00 – 18:00)	50	56
	Evening (18:00 – 22:00)	49	55
	Night (22:00 – 7:00)	39	50

Detailed results are presented as attachments to this note. The shaded areas on the graphs indicate times when the data may have been influenced by weather (wind or rain).

It should be noted that normally noise measurements are conducted during normal school term time (because of the increased road traffic noise from the school trips). These measurements were taken during school holidays and as such are ‘worst case’ (ie quieter).

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DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
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