



HEGGIES

A U S T R A L I A

REPORT 10-4309-R5

Revision 0

**White Bay Berth 4 Bulk Liquids Handling
Bow Wind
Ship Noise Monitoring Report**

PREPARED FOR

Sydney Ports Corporation
207 Kent Street
Sydney NSW 2000

22 MARCH 2006



White Bay Berth 4 Bulk Liquids Handling Bow Wind Ship Noise Monitoring Report

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-4309-R5	Revision 0	22 March 2006	Bojan Sevo	Glenn Homes	Glenn Homes



EXECUTIVE SUMMARY

Heggies Australia has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the unloading of Bow Wind (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required by Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No. 12095).

Noise measurements were carried out during Bow Wind cargo handling operations on the night of 1st February 2006. The measured noise levels were assessed against the noise goals imposed by the EPA licence conditions. It was found that LAeq(15 min) measurements complied with the Licence imposed noise goals at the Balmain location, while in Pyrmont the measured LAeq(15 min) noise levels range from complying with the Licence goals to exceeding them by 3 dBA. An LAeq(night) exceedance of up to 6 dBA occurs in Balmain.

Extraneous noise sources unrelated to the WB-4 activities contributed to the measured LAeq level resulting in the exceedance at the Pyrmont monitoring location. Taking the extraneous noise sources into account as well as the relatively constant nature of WB-4 related noise at Pyrmont, the measured LA90 levels are considered to better represent the true (WB-4 related) LAeq levels in absence of extraneous noise. On this basis, the noise levels from the licenced operation are found to comply with all LAeq(15min) criteria.

Bulk liquids terminal related maximum (LAm_{ax}) noise levels were not observed to cause exceedances at the representative monitoring locations for the duration of attended measurements. It has however, been identified that truck based pressure release valve noise had the potential to cause exceedances of the Licence imposed LAm_{ax} criteria in Balmain, and to a lesser extent in Pyrmont.

Subject to feasibility, practicality and reasonability, potential noise control measures that may be considered (as required by condition R4.1) in order to meet the Licence imposed noise goals, and ensure noise amenity remains unchanged in the area include a combination of applying engineering noise controls to shore based pumps and on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Noise Impact Mitigation and Management Strategy (Document No. 10-4309R7-R1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.



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1 INTRODUCTION

Heggies Australia has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the unloading of Bow Wind (a bulk liquids vessel), as required by Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No. 12095).

Noise measurements have been conducted during cargo handling operations at locations considered representative of the potentially most exposed residential receivers. Measurements have been conducted during both unloading of cargo from the ship into road tanker trucks via on-board pumps, as well as loading of cargo from trucks onto the ship via shore based pump units.

Measured noise levels are assessed against the noise goals set out in Table U1 of the Environment Protection Licence. Feasible and reasonable noise mitigation measures are discussed in broad terms, with the aim of minimising the noise impacts from the operations, where the noise goals are exceeded.



2 SITE DESCRIPTION

The White Bay Port facility is located at the southern end of the Balmain peninsula. The facility sits on about 40 hectares of waterfront land, and forms a crescent around White Bay, with a water frontage of about 2,100 m in length.

The facility layout comprises the following main elements:

- Six multiple-use berths spread along the northern side of White Bay.
- Storage warehouse situated to the north east of White Bay, Berth 4 (WB-4); and
- Internal road continuing from Robert Street, providing truck access to storage areas of docks 1 to 6.

Berth 4 is approximately located in the middle of the northern side of White Bay, as shown in **Figure 1**. To the north and north-west of the site is a mixture of residential dwellings consisting of 1 and 2 storey detached houses and terraces. A number of recently constructed 4 and 5 storey residential developments are situated directly west of Berth 4, and incorporate acoustic façade treatments to achieve satisfactory internal noise levels. In addition, buildings in direct view were designed to provide significant acoustical shielding to the rest of the development. The storage warehouse (on port land) to the north-east of WB-4 is about 20 metres at the highest point, and provides significant acoustic shielding to the residential properties directly behind. To the south-east of the site is Glebe Island, another working port area with four berths, two of which are currently used as car terminals, and two as multiple-use berths. To the south west of WB 4, about 550 m across the water is the Pyrmont Peninsula, with a number of high-rise residential apartments near the waterfront.

2.1 Measurement Locations

The Noise Impact Assessment (NIA) Study (Report Number 10-4309R1 prepared by Heggies) for the proposed bulk liquid terminal operation has previously identified 5 Waite Street and 36 Refinery Drive as the most affected receiver locations within the Balmain / Rozelle and Pyrmont / Glebe areas respectively.

For the current study, in the Balmain / Rozelle area, monitoring was carried out at 13 Donnelly Street (also assessed in the noise impact assessment) due to the availability of day/night access to the property boundary. Note that noise measurements at 13 Donnelly Street can be carried out off street, whereas at 5 Waite Street, noise measurements require backyard access. Furthermore, the location at 13 Donnelly Street is in close proximity of 5 Waite Street. It is approximately the same distance away and is also directly exposed to unloading operations at WB-4. It is therefore considered to be of similar acoustical environment to that of 5 Waite Street, Balmain.

The monitoring location at 36 Refinery Drive, identified by the NIA as the most affected receiver in the Pyrmont / Glebe area was found to be exposed to high levels of traffic related noise from the Anzac Bridge. Giba Park (a publicly accessible park situated at the top of the 4 level apartment complex at 2 Point Street) was therefore selected as the representative measurement location for the Pyrmont / Glebe area, as it allowed ship noise measurements to be taken in relative absence of traffic noise. Giba Park is considered to be equivalent to level 5, 2 Point Street. **Table 1** below summarises the receiver locations where measurements were conducted in each area, and give a brief description of each location. A more detailed description and photos of the selected monitoring locations are presented in **Appendix B** and **Appendix C**.

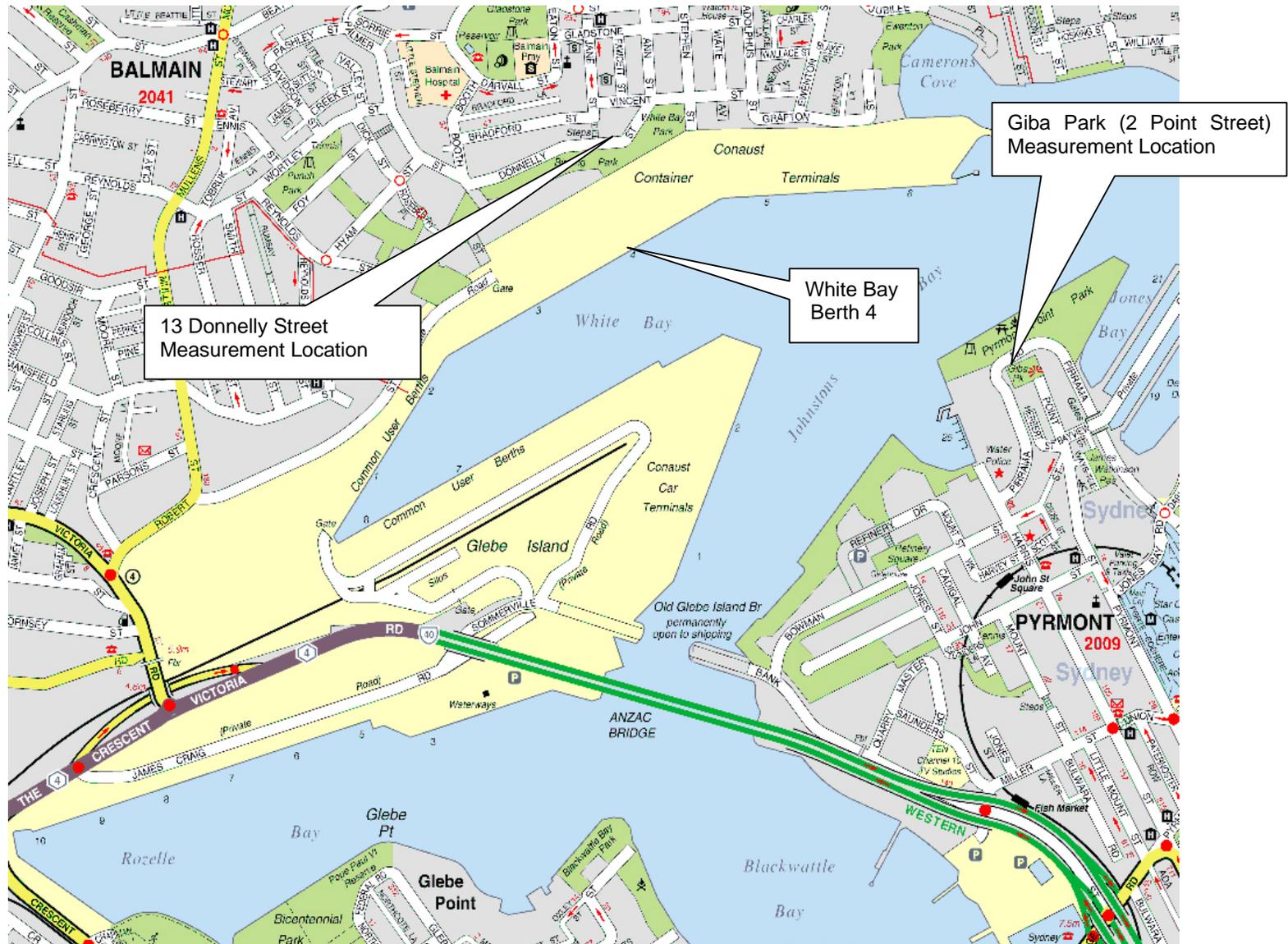


Table 1 Representative Receiver Locations

Location	Representative Receiver Location	Description
Balmain and Rozelle	13 Donnelly Street, Balmain	Ground level at the front of residence, about 7 m away from the façade
Pymont and Glebe	2 Point Street, Pymont	At Giba Park, on top of a 4 storey building at 2 Point Street (i.e. height equivalent of a 5 storey building)



Figure 1 White Bay / Glebe Island Layout with Attended Noise Monitoring Locations





3 EPA LICENCE NOISE GOALS

For the purpose of the bulk liquid cargo handling operations at White Bay Berth 4 (WB-4), the environment protection licence granted by the EPA sets out the project noise goals at the neighbouring residential communities. The noise goals are set out in Table U1 of the licence conditions and reproduced in **Table 2** below.

Table 2 EPA License Noise Goals (Reproduced from Table U1)

Location	Night		
	LAeq(15 min)	LAeq(night)	LA(max)
Balmain and Rozelle	49 dBA	41 dBA	59 dBA
Pymont and Glebe	41 dBA	Not Applicable	51 dBA

Explanatory notes:

1. LA(max) means maximum A-weighted sound pressure level measured on fast time weighting during the time over which sound is measured
2. All other acoustic terms including 'night' have the same meaning as in the INP
3. Not Applicable: In instances where the amenity criteria LAeq(night) has been determined to be a higher number than the intrusive criteria LAeq(15 min) that the amenity criteria is less stringent than the intrusive criteria, then the amenity criteria becomes 'not applicable'. This is because compliance with the criteria will ensure compliance with the intrusive criteria will ensure compliance with the amenity criteria.



4 MEASUREMENT METHODOLOGY AND INSTRUMENTATION

Sound pressure measurements were carried out at 1.5 m above ground level at 13 Donnelly Street and 1.5 m above ground level at Giba Park, located on top of the residential apartment complex at 2 Point Street, Pyrmont. The measurements were carried out using a precision sound level meter conforming to the requirements of AS 1259-1982 "Sound Level Meters". Calibration was checked prior to and subsequent to the survey. Any drift in calibration was within 0.5 dBA and considered acceptable.

The survey instrumentation used during the studies is set out in **Table 3**.

Table 3 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2260	2335702	Brüel & Kjær Modular Precision Sound Level Meter
4189	2378026	Brüel & Kjær 12.5 mm Prepolarised Condenser Microphone
4231	2022772	Brüel & Kjær Calibrator

The licence calls for L_{Aeq} (A-weighted equivalent continuous) sound pressure level measurements to be carried out at locations representative of those potentially most affected (i.e. waterfront) locations during periods of inactivity (e.g. ship Auxiliary Power Units (APUs) operating) and during unloading operations (e.g. ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1 (2).

A window of opportunity to measure ship noise levels during periods of unloading inactivity exists immediately after the ship berths, while the unloading equipment is being set up (hoses unrolled and connected to the ship's manifold etc). The equipment setup phase usually lasts less than 2 hours, after which the unloading is continuous, with one road tanker being filled at any one time. Ship noise measurements during periods of activity can be measured at any time after unloading commences.

A previous ship noise monitoring report prepared by Heggies (Report Number 10-4309R2R1) concluded that measurements are best carried out at night (preferably after 1 am). Extraneous noise (not related to the activity) is generally at a minimum at this time and results are likely to be much more meaningful.

The bulk liquids ship Bow Wind was scheduled to berth at 9:00 am on Tuesday 28 February 2006. In light of the expected high levels of extraneous noise from peak traffic during this time, noise measurements during ship inactivity prior to unloading commencement were not carried out on this occasion.

Measurements during periods of activity were carried out on the night of the 1st of March, commencing at approximately 1:15 am, as the extraneous ambient noise is generally at a minimum at this time. Loading of bulk liquids cargo from road tanker trucks onto the ship via a shore based pump unit was observed during the measurements. An acoustic measurement of the loading operation was carried out at the representative receiver on the Balmain side.

Environmental noise measurements were carried out with reference to the guidelines contained within the NSW Industrial Noise Policy (INP). In circumstances where it was not practical to carry out measurements at the potentially worst affected receiver locations as predicted by the Noise Impact Assessment, locations of similar noise characteristics were chosen, as described in **Section 2.1**.

Given the relatively constant nature of noise related to the bulk liquids cargo handling operations, short term measurements (15 minute duration) were considered to be sufficient to provide an estimate of the $L_{Aeq(night)}$ noise levels at the selected residential receivers. A brief description of acoustic terminology used in this report is presented in **Appendix A**.



5 RESULTS

The results of the 15 minute duration attended noise measurements are summarised in **Table 4** below. Discussion of the results is presented in **Section 6** of this report. It should be noted that the measured levels include noise from the bulk liquids cargo handling facility as well as ambient noise unrelated to the facility.

Table 4 Measured Noise Levels - Unloading Activity

Address	Start Time	LAeq	LA90	WB-4 Related L _{Amax} Range
13 Donnelly Street (Balmain / Rozelle)	02:00 am	46 dBA	45 dBA	54 dBA
	03:15 am	47 dBA	46 dBA	52 dBA
Level 5, 2 Point Street (Pyrmont / Glebe)	02:00 am	44 dBA	40 dBA	None observed during monitoring period
	02:35 am	41 dBA	39 dBA	None observed during monitoring period

During the first measurement at 2 Point Street (at approximately 2:00 am), the measured noise levels were generally subject to noise from seagulls and occasional traffic noise from the Anzac bridge. Due to the relatively high level of ambient noise and the generally constant nature of WB-4 related noise at Pyrmont, the measured LA₉₀ levels are considered to better represent the true (WB-4 related) LA_{eq} noise levels on this occasion.

The second measurement at Point Street was relatively free from significant extraneous sources. A small 2 dBA difference can be seen between the measured LA_{eq} and LA₉₀ noise levels during this measurement, as is expected in absence of significant extraneous noise sources.

At 13 Donnelly Street on the other hand, the measured noise levels appeared to be dominated by noise related to the bulk liquids unloading operations. Ratchet-like noise emanating from the WB-4 deck was observed during the first measurement at approximately 2:00 am. This is believed to have been caused by a loose metal guard (rattling) on the shore based pump unit. Although it is possible that rattle-type noise was of the order of 3 dBA quieter than the drone noise of the loading / unloading operation, it was perceptively more audible due to its distinctive character.

Noise from both the ship's Auxiliary Power Units (APUs) and pump / fan operations was constant in nature. Noise from trucks was observed to be the main contributor to maximum (L_{Amax}) noise level events. Detailed summary of the L_{Amax} events at Balmain side are presented in **Table 5**. WB-4 related L_{Amax} events were not observed at the Pyrmont monitoring location.

An assessment of the measured noise levels against goals listed in the Licence Conditions are presented in **Table 6**, **Table 7** and **Table 8**.



Table 5 Summary of Attended L_{Amax} Noise Levels at 13 Donnelly Street, Balmain

L _{Amax} Source	L _{Amax} Range	Notes
Pressure release valve (truck based)	52 dBA – 54 dBA	Truck based pressure release valve (possibly related to use of hand brakes) could be heard coming from the truck at arrival and immediately prior to departure from the site. The events last for approximately 1 second

Table 6 Assessment of Measured Noise Levels Against L_{Aeq}(15 min) Noise Goals

Measurement Location	Measured levels		L _{Aeq} (15 min) Noise Goals	L _{Aeq} (15 minute) Exceedance of Licence Goals	LA ₉₀ Exceedance of Licence Goals
	L _{Aeq}	LA ₉₀			
13 Donnelly Street (Balmain / Rozelle)	46 dBA	45 dBA	49 dBA	No Exceedance	N/A ²
	47 dBA	46 dBA		No Exceedance	N/A ²
Level 5, 2 Point Street (Pyrmont / Glebe) ¹	44 dBA	40 dBA¹	41 dBA	3 dBA	No Exceedance¹
	41 dBA	39 dBA		No Exceedance	N/A ²

- 1 Significant extraneous noise sources such as bird and road traffic noise were identified during the first measurement at the Point Street location. The measured LA₉₀ level during this measurement is therefore considered to better represent the relatively constant WB-4 related L_{Aeq} noise level, as this descriptor is less sensitive to extraneous noise. (Descriptors considered representative of the WB-4 related noise emissions at Point Street are bolded).
- 2 The contribution of extraneous noise sources to the overall levels during all other measurements is not considered significant. The measured L_{Aeq} levels are therefore representative of the WB-4 related noise emissions.

Table 7 Assessment of Measured Noise Levels Against L_{Aeq}(night) Noise Goals

Measurement Location	Measured levels		L _{Aeq} (night) Noise Goals	L _{Aeq} Exceedance of Licence Goals	LA ₉₀ Exceedance of Licence Goals
	L _{Aeq}	LA ₉₀			
13 Donnelly Street (Balmain / Rozelle)	46 dBA	45 dBA	41 dBA	5 dBA	N/A ¹
	47 dBA	46 dBA		6 dBA	N/A ¹
Level 5, 2 Point Street (Pyrmont / Glebe)	44 dBA	40 dBA	N/A	N/A	N/A
	41 dBA	39 dBA			

- 1 The contribution of extraneous noise sources to the overall levels measured at 13 Donnelly Street is not considered to be significant. The measured L_{Aeq} levels are therefore representative of the WB-4 related noise emissions.

Table 8 Assessment of (WB-4 Related) Measured Noise Levels Against L_{Amax} Noise Goals

Measurement Location	Range of Maximum Measured Levels (L _{Amax} Range)	L _{Amax} Noise Goals	Range of Recorded L _{Amax} Exceedances of the Licence Noise Goals
13 Donnelly Street (Balmain / Rozelle)	50 dBA – 54 dBA	59dBA	No Exceedance
Level 5, 2 Point Street (Pyrmont / Glebe)	N/A ¹	51 dBA	N/A

- 1 No L_{Amax} events were observed during the two 15 minute monitoring periods at 2 Point Street, Pyrmont.



6 DISCUSSION

Measured $L_{Aeq(15\text{ min})}$ noise levels comply with the Licence imposed noise goals at the representative Balmain location, whilst in Pyrmont, the measured $L_{Aeq(15\text{ min})}$ levels range from compliance with the Licence goals to exceeding them by 3 dBA. An $L_{Aeq(\text{night})}$ exceedance of up to 6 dBA was observed in Balmain.

Extraneous noise sources unrelated to the WB-4 activities contributed to the measured L_{Aeq} level resulting in the exceedance at the Pyrmont monitoring location. Taking the extraneous noise sources into account as well as the relatively constant nature of WB-4 related noise at Pyrmont, the measured L_{A90} levels are considered to better represent the true (WB-4 related) L_{Aeq} levels in absence of extraneous noise. On this basis, the noise levels from the licenced operation are found to comply with $L_{Aeq(15\text{ min})}$ criteria. A ratchet-type noise source thought to be associated with a shore based pump unit was identified at the most exposed Balmain receivers due to its distinctive character.

A comparison of the measured noise levels with those predicted by the NIA model (based on Botany Treasure) with consideration to extraneous noise contributions indicates that the noise model generally over-predicts the observed noise emissions. This would indicate that Bow Wind is a relatively quieter vessel in comparison to the Botany Treasure. This observation is supported by noise monitoring results of other bulk liquids ships to date.

In order to fulfil the requirement of Licence condition R4.1 and in relation to compliance with Licence conditions O4.1 and O4.2, the potential noise control measures are discussed below in concept for the sources identified during attended monitoring.

Bulk liquids terminal related maximum (L_{Amax}) noise levels were not observed to cause exceedances at the representative monitoring locations for the duration of attended measurements. It has however, been identified that truck based pressure release valve noise had the potential to cause exceedances of the Licence imposed L_{Amax} criteria in Balmain, and to a lesser extent in Pyrmont.

Based on subjective observations, two significant sources of noise were identified on the ship. These are engine noise emanating from approximately deck height and a noise source emanating from mid-deck level (possibly pump noise).

A Noise Impact Mitigation and Management Strategy (Document No. 10-4309R7-R1) has been prepared for the operation. Taking into consideration the infrequency and limited duration of the operation, expected costs, development times, uncertainty of effective outcome, and the impact on flexibility in relation to ships that may be used in the operation, the implementation of ship specific engineering noise control measures is not considered practical nor reasonable within the Noise Impact Mitigation and Management Strategy. Instead, the document recommends an on-site mitigation management strategy be implemented based on operator awareness and procedures to identify and repair abnormally noisy equipment, as outlined within the Noise Impact Mitigation Action Plan.



7 CONCLUSION

Noise measurements were carried out during Bow Wind cargo handling operations on the night of 1st February 2006. The measured noise levels were assessed against the noise goals imposed by the EPA licence conditions. It was found that $L_{Aeq(15\text{ min})}$ measurements comply with the Licence imposed noise goals at the Balmain location, while in Pyrmont the measured $L_{Aeq(15\text{ min})}$ noise levels range from compliance with the Licence goals to exceeding them by 3 dBA. An $L_{Aeq(night)}$ exceedance of up to 6 dBA occurs in Balmain.

Extraneous noise sources unrelated to the WB-4 activities contributed to the measured L_{Aeq} level resulting in the exceedance at the Pyrmont monitoring location. Taking the extraneous noise sources into account as well as the relatively constant nature of WB-4 related noise at Pyrmont, the measured L_{A90} levels are considered to better represent the true (WB-4 related) L_{Aeq} levels in absence of extraneous noise. On this basis, the noise levels from the licenced operation are found to comply with all $L_{Aeq(15\text{min})}$ criteria.

Bulk liquids terminal related maximum (L_{Amax}) noise levels were not observed to cause exceedances at the representative monitoring locations for the duration of attended measurements. It has however, been identified that truck based pressure release valve noise had the potential to cause exceedances of the Licence imposed L_{Amax} criteria in Balmain, and to a lesser extent in Pyrmont.

Potential noise control measures that may be considered to meet the Licence imposed noise goals (as required by condition R4.1) subject to feasibility, practicality and reasonability, include a combination of applying engineering noise control measures to shore based pumps and an on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Noise Impact Mitigation and Management Strategy (Document No. 10-4309R7-R1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.

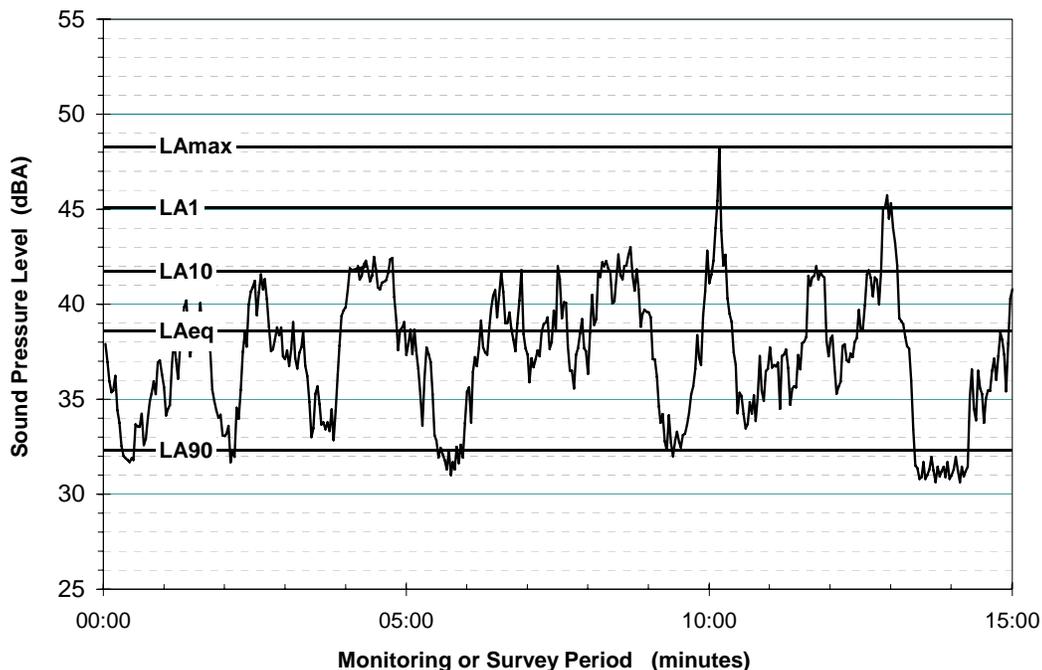
ACOUSTIC TERMINOLOGY USED IN THE REPORT

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the LA10, LA90 and LAeq and LAmax noise levels.

- The LA10 is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound over the same measurement period. The LAeq(15hour) is the measurement parameter used to describe the road traffic noise level over the entire daytime (7.00 am to 10.00 pm) period. The LAeq(9hour) is the measurement parameter used to describe the road traffic noise level over the entire night-time (10.00 pm to 7.00 am) period. Similarly, the LAeq(1hour) is the measurement parameter used to describe the road traffic noise level during the loudest 1-hour period during the daytime or night-time periods.
- The LA90 noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the “background” level.
- The LAmax noise level is the maximum A-weighted noise level associated with road traffic movements.

Graphical Display of Typical Noise Indices



Typical Noise Levels

The following table presents examples of typical noise levels.

Typical Noise Levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerb side of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to
50	General Office	Quiet
40	Inside private office	Quiet to
30	Inside bedroom	Very quiet
20	Unoccupied recording studio	Almost silent

A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, which is measured using the “A-weighting” filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the “loudness” of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

Sensitivity of People to Noise Level Changes

A change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness

13 DONNELLY STREET, BALMAIN

The location is situated approximately 170 m away from and directly overlooking White Bay Berth 4 (across the park). It is elevated some 15 m above dock level. The measurement was conducted from street level (from a footpath) with Donnelly Street traffic less than 2 m away.



Aerial Photo showing the monitoring location at 13 Donnelly Street, relative to White Bay Berth 4 (WB-4).



View from WB-4 deck towards 13 Donnelly Street



View from 13 Donnelly St towards a bulk liquids ship berthed at WB-4

Appendix C

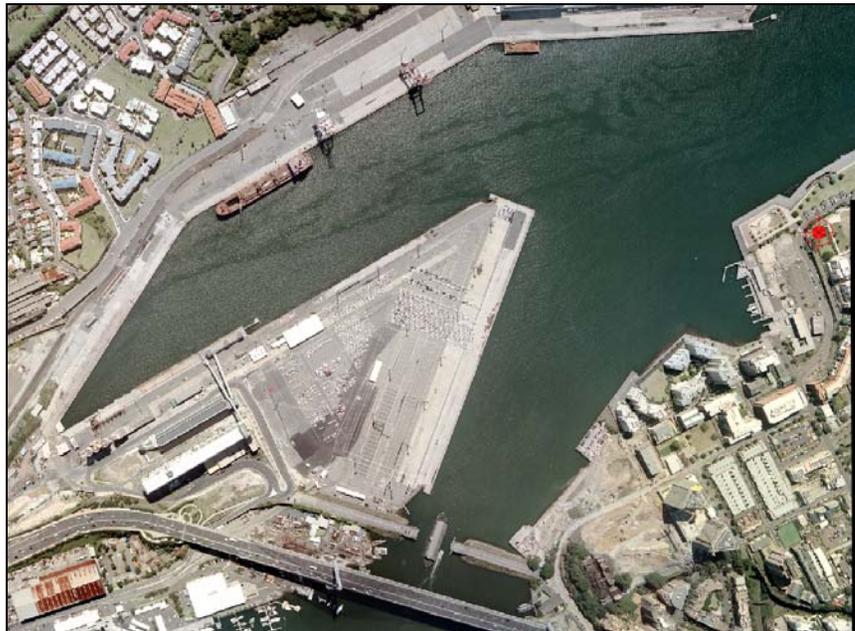
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2 POINT STREET, PYRMONT

2 POINT STREET, PYRMONT

This monitoring location is situated approximately 660 m away from White Bay Berth 4 (across the bay). Monitoring was conducted at a height equivalent of a 5 storey building, on the cliffs edge. Pirrama Road encircles the park from west, north and east sides, approximately 15 m below.



Aerial Photo showing the monitoring location at 2 Point Street, relative to White Bay Berth 4 (WB-4).



View from WB-4 deck towards 2 Point Street



View from 2 Point Street towards a bulk liquids ship berthed at WB-4