HEGGIES
AUSTRALIA

REPORT 10-4309R2
Revision 1

White Bay Berth 4 Bulk Liquids Terminal
Marine Pioneer
Ship Noise Monitoring Report

PREPARED FOR

Sydney Ports Corporation
207 Kent Street
Sydney NSW 2000

8 NOVEMBER 2005

White Bay Berth 4 Bulk Liquids Terminal

Marine Pioneer

Ship Noise Monitoring Report

PREPARED BY:

Heggies Australia Pty Ltd
ABN 29 001 584 612
Level 2, 2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com.au Web www.heggies.com.au

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-4309R2	Revision 1	8 November 2005	Bojan Sevo	Glenn Homes	Glenn Homes
10-4309R2	Revision 0	7 November 2005	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 Marine Pioneer (a bulk liquids vessel), as required by Clause M7.1(1a) of the EPA's Environment Protection Licence (Licence No. 12095).

L_{Aeq} and L_{A90} noise levels related to the unloading of Marine Pioneer were measured on the night between the 18th and the 19th of October 2005. The noise levels are assessed against the noise goals imposed by the EPA licence conditions (**Table 2**). It is found that $L_{Aeq(15\ min)}$ exceedances of noise goals range from between 1 dBA in Balmain, to 4 dBA in Pyrmont, while in Balmain, an $L_{Aeq(night)}$ exceedance of 7 dBA was observed. The results of assessment are summarised in **Table 8**, **Table 9** and **Table 10** of this report.

Relatively high levels of ambient noise were observed between 10 pm and 12 midnight. This is thought to have contributed to the overall L_{Aeq} levels. Taking into account the relatively high levels of ambient noise and the generally constant nature of port-related noise from the subject activity, the measured L_{A90} levels are considered to better represent the true L_{Aeq} levels from the activity, as this descriptor is less sensitive to transient extraneous noise. On this basis, the noise levels from the licenced operations are found to comply with the criteria in Pyrmont and $L_{Aeq(15\ min)}$ criteria in Balmain, but exceed the Balmain $L_{Aeq(night)}$ and L_{Amax} criteria by 5 dBA and 12 dBA respectively.

Bulk liquid terminal related maximum (L_{Amax}) noise levels were generated by a noisy winch used to lower the ship's gangplank, and both truck and ship based pressure release (blow-off) valves.

Potential noise control measures required to meet the Licence imposed noise goals that may be considered (as required by condition R4.1) subject to feasibility, practicality and reasonability include a combination of engineering noise controls and on-site noise management strategy.

TABLE OF CONTENTS

1 INTRODUCTION

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

The measurements of activities have been conducted at locations representative of the most exposed residential receivers, during periods of inactivity (ship Auxiliary Power Units (APUs) operating only) and during unloading operations (ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1 (2).

Measured noise levels are assessed against the noise goals set out in Table U1 of the Environment Protection Licence. The 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 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.

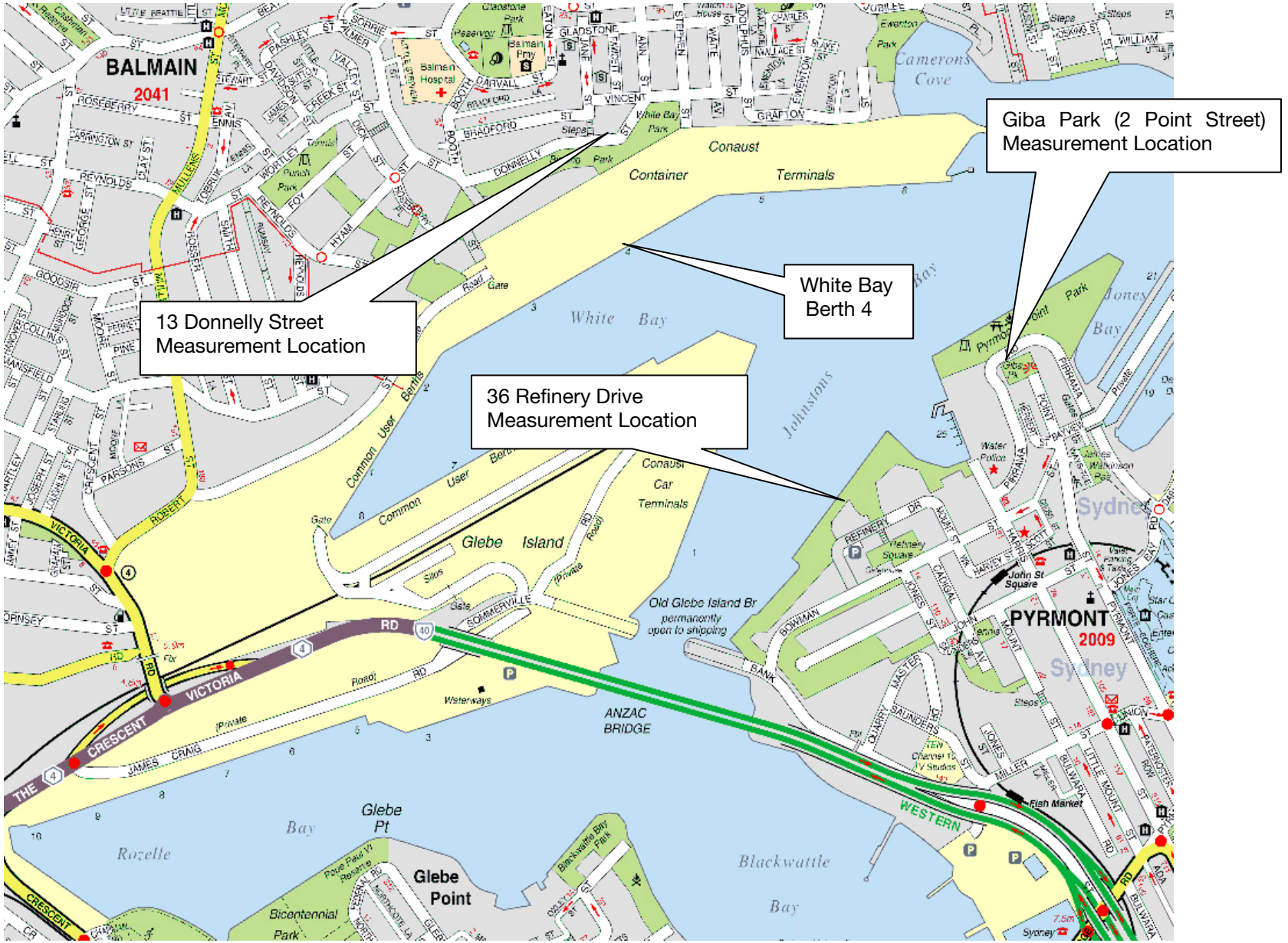
For the current Study, in the Balmain / Rozelle area, monitoring was carried out at 13 Donnelly Street (also assessed in the noise impact assessment) due to the availability of day/night access to the property boundary. Note that noise measurements at 13 Donnelly Street can be carried out off street, 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, 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.

An attended measurement was carried out at 36 Refinery Drive, considered representative of the most affected receivers in the Pyrmont / Glebe area, however it 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 chosen as the representative measurement location for the Pyrmont / Glebe area. 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 1.5 m away from the facade
Pyrmont and Glebe	2 Point Street, Pyrmont	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		
	$L_{Aeq(15\ min)}$	$L_{Aeq(night)}$	$L_{A(max)}$
Balmain and Rozelle	47dBA	41 dBA	57dBA
Pyrmont and Glebe	41 dBA	Not Applicable	51 dBA

Explanatory notes:

1. $L_{A(max)}$ 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 $L_{Aeq(night)}$ 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.

Heggies is aware that SPC is currently engaged in discussion with DEC regarding the LAeq(15 min) and LAmax noise goals.

4 MEASUREMENT METHODOLOGY AND INSTRUMENTATION

Sound pressure measurements were made 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 L_{Aeq} (A-weighted equivalent continuous) sound pressure level measurements were carried out at locations representative of those potentially most affected (i.e. waterfront locations) during periods of inactivity (ship Auxiliary Power Units (APUs) operating only) and during unloading operations (ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M7.1 (2). The measurements were carried out with reference to the guidelines conatained 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 LAeq(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 attended noise monitoring are summarised in **Table 4** and **Table 5** below. Discussion of the results is presented in **Section 6** of this report. It should be noted that the measured levels include noise from unloading activities as well as ambient noise unrelated to the unloading activity.

Table 4 Measured Noise Levels - No Unloading Activity

Address	Start time	LAeq	LA90	LAmax Range[1]
13 Donnelly Street (Balmain / Rozelle)	22:40	54 dBA	48 dBA	54 dBA – 72 dBA (54 dBA - 64 dBA)
Level 1, 36 Refinery Drive (Pyrmont / Glebe)	23:29	47 dBA	43 dBA	47 dBA – 57 dBA (N/A[2])
Level 5, 2 Point Street (Pyrmont / Glebe)	00:10	44 dBA	41 dBA	46 dBA – 68 dBA (46 dBA)

Notes: 1. Range of observed LAmax values with port related LAmax noise levels shown in brackets

2. No noise related to berthed ship activity could be heard over traffic noise from Anzac Bridge and constant seagull squeaks from the Fish Markets nearby.

Table 5 Measured Noise Levels - Unloading Activity

Address	Start Time	LAeq	LA90	LAmax Range[1]
13 Donnelly Street (Balmain / Rozelle)	02:11	48 dBA	46 dBA	48 dBA - 69 dBA (48 dBA - 69 dBA)
Level 5, 2 Point Street (Pyrmont / Glebe)	01:08	45 dBA	41 dBA	44 dBA – 58 dBA (44 dBA)

Notes: 1 Range of observed LAmax values with port related LAmax noise levels shown in brackets

During measurements, it was noted that generally, the ambient noise levels (independent of the ship unloading activities) were relatively higher between the hours of 10 pm and 12 midnight when compared with the period between 1 am and 3 am.. This is evident from the results, as higher L_{Aeq} and L_{A90} levels were recorded in the earlier part of the night-time period (10 pm to 12 midnight), even though the ship was not engaged in any unloading activities at the time. We note that the ship unloading activities commenced at approximately 1:00 am. The higher ambient noise levels were observed to be due to a combination of:

- Higher level of activity in the area, including traffic noise and bird noise and
- Noise from park patrons and their associated activities.

Noise from both the ship's Auxiliary Power Units (APUs) and pump operations were constant in nature, with trucks and occasional, or one off ship operations (such as lowering of the gang-plank or the release of pressure from a blow-off valve) being the main contributors to (L_{Amax}) maximum noise level events. Detailed summaries of the L_{Amax} events are presented in **Table 6** and **Table 7**. The duration of such (port-related) maximum noise level events was generally found not to be sufficient enough to affect $L_{Aeq(15\ minute)}$ level readings. The $L_{Aeq(15\ minute)}$ measurements were however considered to be affected by background noise unrelated to the bulk liquids unloading (ports-related) activity, as discussed in **Section 6**.

An assessment of the measured noise levels against goals listed in the Licence Conditions are presented in **Table 8**, **Table 9** and **Table 10**. Please note that in **Table 8** and **Table 9**, the assessment only takes into account measurements carried out between 1:00 am and 3:00 am (during which unloading was taking place), as these were found to be least influenced by transient noise sources unrelated to the port operations.

Table 6 Summary of Attended LAmax Noise Levels at 13 Donnelly Street, Balmain

LAmax Source	LAmax Range	Notes
Pressure Release Valve (ship based	63 dBA	High pitched pressure release valve could be heard coming from the rear of the ship. The event lasted for approximately 1 second
Pressure release Valve (truck based)	69 dBA	Truck based pressure release valve (compressor?) could be heard coming from the rear of the ship. The event lasted for approximately 1 second
Clunks from restraining and / or unloading equipment (chains and hose ends)	50 dBA – 57 dBA	Included chain like "clunks" on other metallic surfaces (possibly the ships hull) and metal dropping and being dragged across the concrete (possibly manifold pipe (hose) connection
Truck activity on site	48 dBA - 53 dBA	Trucks accelerating as they leave the site resulted in a 53 dBA Lmax level, while trucks manoeuvring into position were generally below 50 dBA.
Winch motor used to lower the ship's gangplank	64 dBA	"Drill like noise" that seemed to be caused by metal to metal friction. The event lasted for approximately 5 seconds
Car passby on Donnelly Street	65 dBA – 72 dBA	Car passby noise levels ranged from 65 dBA and 66 dBA for cars rolling downhill to 69 dBA and 72 dBA for cars engaged in gear going uphill

NOTE: Car Passby on Donnelly Street unrelated to bulk liquids unloading operation at White Bay berth 4.

Table 7 Summary of Attended LAmax Noise Levels at 2 Point Street, Pyrmont

LAmax Source	LAmax Range	Notes
Winch motor used to lower the ship's gangplank	46 dBA	Distant "drill like noise" (seemed to be caused by metal to metal friction). The event lasted for approximately 5 seconds.
Miniature motorbike exhaust at Pyrmont Point Park (about 15 metres below and across Pirrama Road.	47 dBA - 68 dBA	A miniature motorbike was ridden around Pyrmont Point Park for about 15 minutes between approximately 12:45 am and 1:00 am. Idling produced noise levels up to 48 dBA. However, riding the bike around the park resulted in relatively constant noise levels of between 61 dBA and 68 dBA
Bus engine	56 dBA	The engine could be heard revving in the distance (> 100 m). Most likely caused by a public transport bus from either Pirrama Road or Harris Street
Truck noise from Anzac Bridge	49 dBA - 50 dBA	Truck revving uphill in the distance (on Anzac Bridge approximately 1km away))
Car passby on Pirrama Road (noise level meter shielded by edge of building)	51 dBA – 57 dBA	Car pass-by noise levels ranged from 51 dBA for cars rolling past to 57 dBA for a car with a loud "sports" exhaust.

NOTE: The winch motor used to lower the ship's gangplank was the only recorded LAmax event related to the bulk liquids unloading activities at WB-4. It should be noted that no pressure release valve events occurred while monitoring was undertaken on the Pyrmont / Glebe side.

Table 8 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	L_{A90} Exceedance of Licence Goals
	L_{Aeq}	L_{A90}			
13 Donnelly Street (Balmain / Rozelle)	48 dBA	46 dBA	47 dBA	1 dBA	No Exceedance
Level 5, 2 Point Street (Pyrmont / Glebe)	45 dBA	41 dBA	41 dBA	4 dBA	No Exceedance

Table 9 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	L_{A90} Exceedance of Licence Goals
	L_{Aeq}	L_{A90}			
13 Donnelly Street (Balmain / Rozelle)	48 dBA	46 dBA	41 dBA	7 dBA	5 dBA
Level 5, 2 Point Street (Pyrmont / Glebe)	45 dBA	41 dBA	N/A	N/A	N/A

Table 10 Assessment of (Port Related) Measured Noise Levels Against L_{Amax} Noise Goals

Measurement Location	Range of Maximum Measured Levels (LAmax Range)	L_{Amax} Noise Goals	Range of Recorded LAmax Exceedances of the Licence Noise Goals
13 Donnelly Street (Balmain / Rozelle)	63 dBA – 69[1] dBA	57dBA	6 dBA – 12 dBA
Level 5, 2 Point Street (Pyrmont / Glebe)	46 dBA[2]	51 dBA	No Exceedance

1 Three events registered during the 30 min monitoring period, 69 dBA due to truck compressor blow-off valve, 64 dBA caused by winch used to lower gangplank and 63 dBA due to ship based pressure blow-off valve.

2 Only one Lmax event distinctly due to port related activity registered during the monitoring periods. This event was caused by lowering (or raising) of the gangplank, which lasted for a maximum of 5 seconds. Noise from either ship or truck based pressure blow-off valve were not recorded during the monitoring period.

6 DISCUSSION

Higher noise levels were recorded between 10 pm and 12 midnight than between 1 am and 3 am, despite the fact that the intensity of port-related activities was greater between 1 am and 3 am.

The results therefore suggest that a higher level of background noise due to non port-related activities early in the night period (10 pm to 12 midnight) when compared with the later hours of the night (1 am to 3 am). The contribution of non port-related noise is found to be high enough to significantly affect the L_{A90} and L_{Aeq} measurements of ship noise levels. Measured L_{Aeq} and L_{A90} levels are assessed against the stated goals in **Table 8**, **Table 9** and **Table 10**. $L_{Aeq(15\ min)}$ exceedances of noise goals range from between 4 dBA in Pyrmont, to 1 dBA in Balmain. Similarly, an $L_{Aeq(night)}$ exceedance of 7 dBA occurs in Balmain. It should however be noted that the measured L_{Aeq} levels include contributions from non-port related (transient extraneous) noise sources that result in increased overall L_{Aeq} levels.

Due to the relatively high level of ambient noise and the generally constant nature of port-related noise, the measured L_{A90} levels are considered to better represent the true (port-related) L_{Aeq} levels as this descriptor is less sensitive to transient extraneous noise. On this basis, the noise levels from the licenced operations are found to comply with the criteria in Pyrmont and $L_{Aeq(15\ min)}$ criteria in Balmain, but exceed the Balmain $L_{Aeq(night)}$ and L_{Amax} criteria by 5 dBA and 12 dBA respectively.

Two sources of noise were identified as the only contributors to exceedances of L_{Amax} noise levels. These include the winch used to lower the ship's gangplank and either truck or ship based pressure release (blow-off) valves. Winch related noise was found to be "squeally" in nature, and typically lasted less than 5 seconds. The noise emission was found to exceed the L_{Amax} criteria by 7 dBA in Balmain. Pressure release valve related noise was much shorter in duration, typically not exceeding 1 second, but was significantly louder, exceeding the Balmain / Rozelle L_{Amax} criteria by up to 12 dBA. A pressure release valve event did not occur for the duration of monitoring at the representative Pyrmont / Glebe location.

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

Gangplank winch noise could potentially be mitigated by using a quietened drive motor (for example, acoustically enclosed). In addition, proper lubrication of all rubbing contact points would likely minimise the occurrence of metal to metal squeal. The extent of reduction achievable using the measures described above would depend on the specific nature of the noise source. In order to assess the extent of potential reduction, a detailed noise assessment of the source would be required. We estimate a noise reduction of up to 10 dBA could be achievable.

Noise from pressure release valves (resulting in L_{Amax} exceedance of 12 dBA) on the other hand could be managed through identifying the sources (both truck and ship based) and investigating the potential use of attenuator or mufflers, where this is feasible. As the truck fleet used to transport the cargo off-site is dependant on subcontractors, it may not be practical to fit all trucks with appropriate muffling or silencing devices. Identifying the offending vehicles however, will help minimise the occurrence of associated noise level events through the management of vehicles permitted on the site.

Based on subjective observation, ship based engine noise (potentially the APU) appeared to be emanating from approximately deck height. This indicates that a major source of noise was within the engine bay, and not the exhaust (approximated at 15 m above sea level). Further detailed investigation would be required to clearly identify the noise source and the appropriate at-source engineering noise reduction options available. These would likely involve sound proofing the engine bay and could potentially achieve a noise level reduction of up to 10 dBA. Based on the monitoring, a noise level reduction of 7 dBA would be required to comply with the Licence imposed noise goals.

In concept, the mitigation measures described above could enable compliance with Licence conditions O4.1 and O4.2 as their implementation could potentially meet the Licence imposed noise criteria. However, detailed investigation of ship based noise sources would be required to confirm subjective observations and to recommend the most effective mitigation measures.

7 CONCLUSION

In conclusion, noise measurements were carried out on the night between the 18th and the 19th of October 2005 during the unloading of Marine Pioneer, a bulk liquids delivery vessel. The measured levels (presented in **Table 8**, Table 9 and **Table 10)** were assessed against the noise goals imposed by the EPA licence conditions. It was found that $L_{Aeq(15\ min)}$ exceedances of noise goals range from between 1 dBA in Balmain, to 4 dBA in Pyrmont, while $L_{Aeq(night)}$ exceedance of 7 dBA occurred in Balmain. It should be noted that transient noise sources unrelated to the port activities contributed to the overall LAeq levels measured at the representative receiver locations.

Due to the relatively high level of ambient noise and taking into account the generally constant nature of port-related noise, the measured L_{A90} levels are considered to better represent the true (port-related) L_{Aeq} levels in absence of extraneous noise. On this basis, the noise levels from the licenced operations are found to comply with the criteria in Pyrmont and $L_{Aeq(15\ min)}$ criteria in Balmain, but exceed the Balmain $L_{Aeq(night)}$ and L_{Amax} criteria by 5 dBA and 12 dBA respectively.

Maximum (L_{Amax}) noise levels were found to be caused by a noisy winch used to lower the ship's gangplank, and both truck and ship based pressure release valves.

Potential noise control measures required to meet the Licence imposed noise goals that may be considered (as required by condition R4.1) subject to feasibility, practicality and reasonability include a combination of engineering noise controls and on-site noise management strategy.

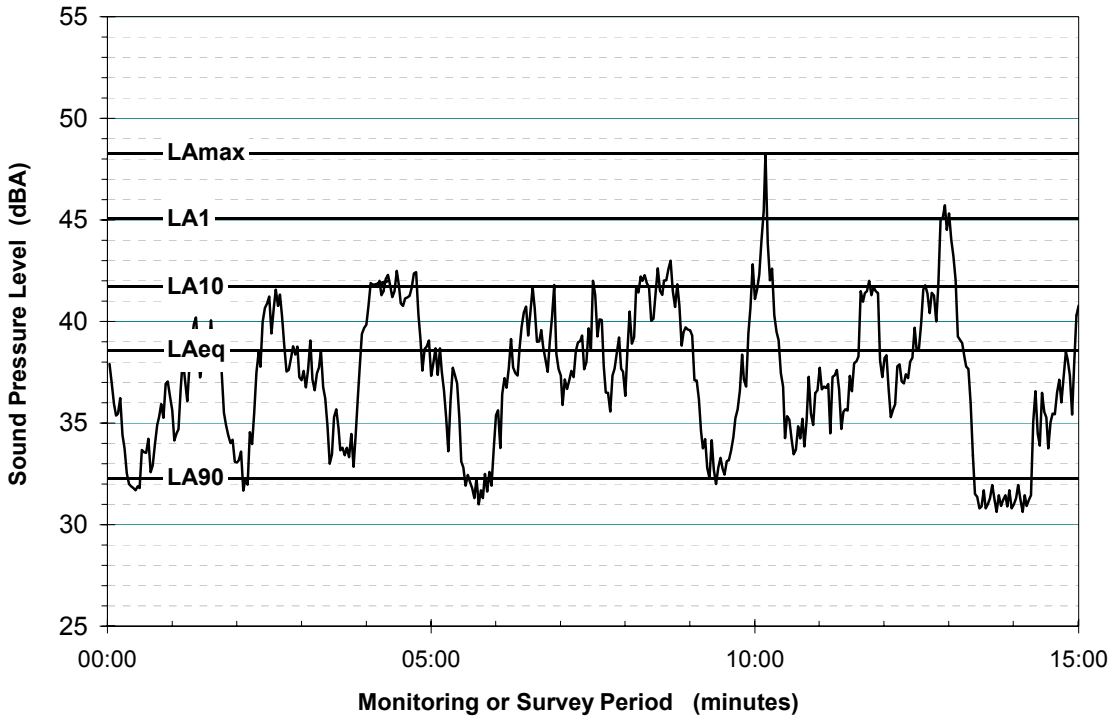
ACOUSTIC TERMINOLOGY USED IN THE REPORT

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the L_{A10}, L_{A90} and L_{Aeq} and L_{Amax} noise levels.

- The L_{A10} 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 L_{Aeq} 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 $L_{Aeq(15hour)}$ 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 $L_{Aeq(9hour)}$ 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 $L_{Aeq(1hour)}$ 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 L_{A90} 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 L_{Amax} 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
130 120 110	Threshold of pain Heavy rock concert Grinding on steel	Intolerable Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerb side of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to Quiet
40 30	Inside private office Inside bedroom	Quiet to 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).

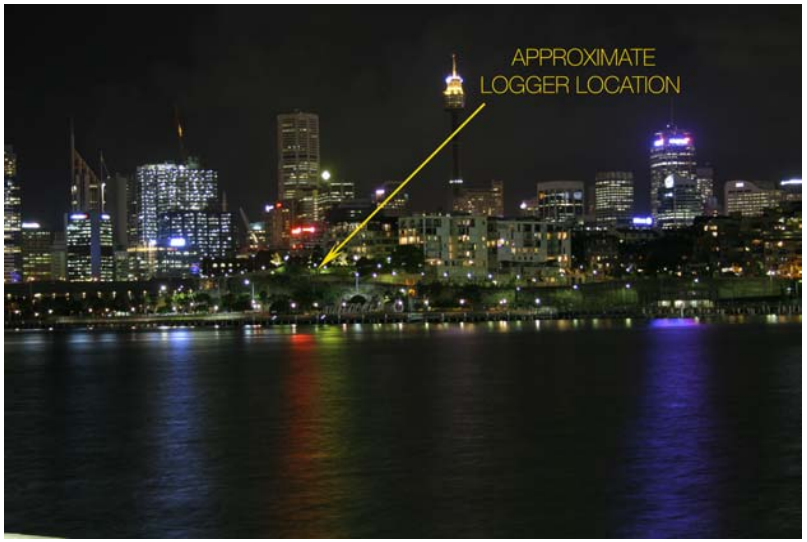
View from WB-4 deck towards 13 Donnelly Street

View from 13 Donnelly Street towards Marine Pioneer berthed at WB-4

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 Marine Pioneer berthed at WB-4