



# HEGGIES

REPORT 10-4309-R21

Revision 0

## **White Bay Berth 4 Bulk Liquids Handling Golden Crest Ship Noise Monitoring Report**

PREPARED FOR

Sydney Ports Corporation  
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SYDNEY NSW 2000

24 APRIL 2008

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*Incorporating*

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# White Bay Berth 4 Bulk Liquids Handling Golden Crest Ship Noise Monitoring Report

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DOCUMENT CONTROL

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|             |            |               |               |              |              |



## EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the Golden Crest (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 at nearby residential receivers during Golden Crest vessel cargo handling operations during the evening 3 April 2008.

The measured noise levels were found to be potentially influenced by local traffic and domestic activity as well as from noise from wind on occasion. A reference noise measurement was therefore carried out in close proximity to the Golden Crest vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers, in the absence of local traffic and domestic activity related noise.

It was found that  $L_{Aeq(15\text{minute})}$  measured and predicted noise levels exceed the Licence imposed noise goals at representative locations in both Balmain and Pyrmont by 3 dBA and 2 dBA respectively. An  $L_{Aeq(\text{night})}$  exceedance of 11 dBA occurs in Balmain.

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.

Subject to feasibility, practicality and reasonability, the potential noise control measures that may be considered in order to meet the Licence imposed noise goals (as required by Condition R4.1) and ensure noise amenity remains unchanged in the area would be implementation of an on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Revised Noise Impact Mitigation and Management Strategy (Report 10-4309-R10 Revision 1), 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 Pty Ltd (Heggies) has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the “Golden Crest” (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 have been conducted during cargo handling operations (ship auxillary power unit (APU), ventilation fans, pumps and truck activity on the wharf) at two locations considered representative of the potentially most exposed residential receivers. The locations are at Balmain to the west and Pyrmont to the east of WB-4. Measurements at both representative locations have been conducted during the loading of bulk liquids from road tanker trucks to the ship via pumps on the wharf. The measurements were conducted after the ship arrived between 5.30 pm and 11 pm on 03 April 2008, with the weather conditions a west to south-westerly wind. During the measurement period the sky was generally clear.

An additional “reference” noise measurement was carried out in close proximity to the Golden Crest vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers for comparison with the attended measurements.

The predicted noise levels correlated well with the measured levels, and were 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 occupies approximately 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:

- Five multiple-use berths spread along the northern side of White Bay;
- Storage warehouse situated to the northeast 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.

The Glebe Island facility which includes two multiple-use berths and two car terminal berths is located adjacent to the White Bay Port on a neighbouring peninsula south of White Bay.

Berth 4 is located approximately in the middle of the northern side of White Bay, as shown in **Figure 1**. To the north and northwest 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 northeast of WB-4 is about 20 m at the highest point and provides significant acoustic shielding to the residential properties directly behind. To the southeast 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 southeast 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 10-4309-R1 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 only 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 loading 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 the relative absence of traffic noise. Giba Park is considered to be equivalent to level 5, 2 Point Street.

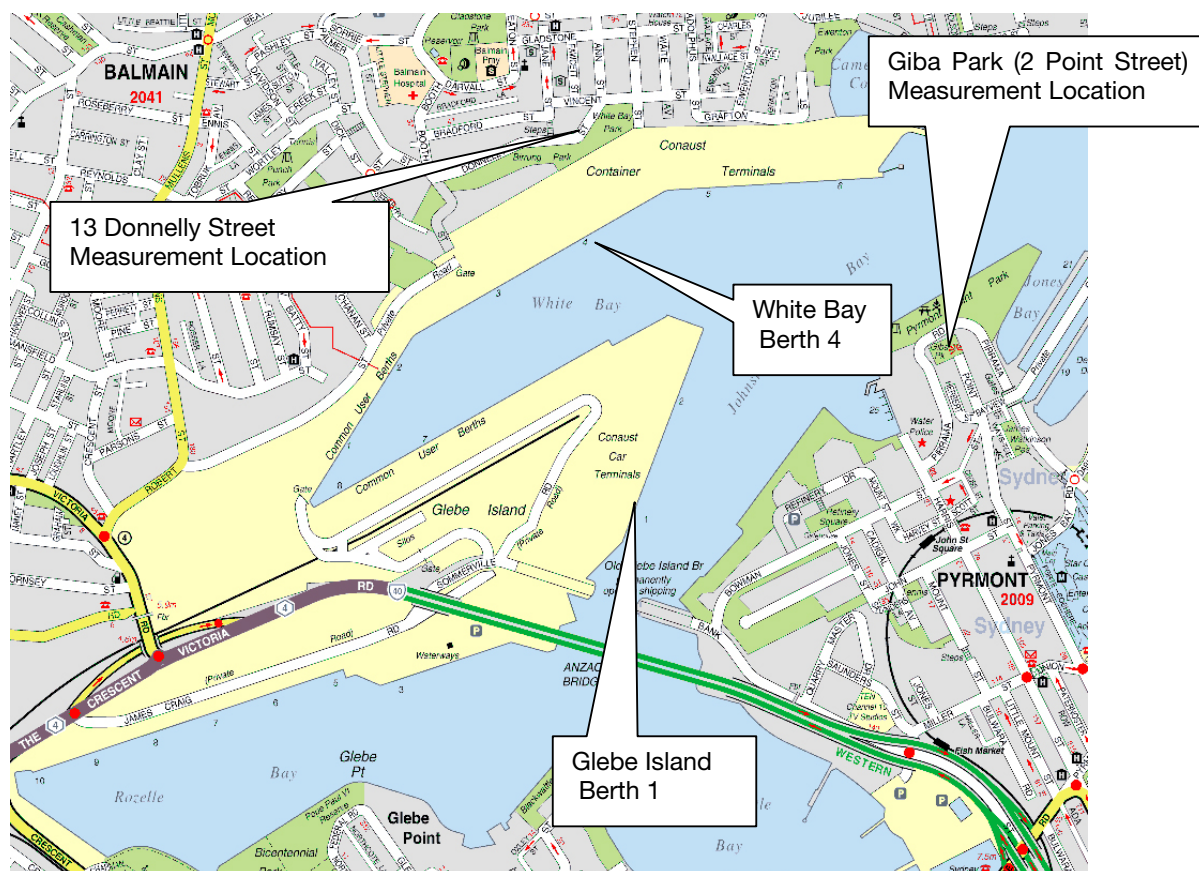


**Table 1** summarises the receiver locations where measurements were conducted in each area and gives a brief description of each location. A more detailed description and photos of the selected monitoring locations are presented in **Appendix B** and **Appendix C**.

**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 facade  |
| Pymont and Glebe      | 2 Point Street, Pymont           | At Giba Park, on top of a 4 storey building at 2 Point Street (ie height equivalent of a 5 storey building)   |
| Reference Measurement | White Bay Berth 4 Deck           | On deck of White Bay Berth 4, and approximately 50 m from the ship rear engine room/exhaust stack area, the main source of noise from the Golden Crest vessel.. |

**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**.

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

| Location            | Night          |                |        |
|---------------------|----------------|----------------|--------|
|                     | LAeq(15minute) | LAeq(Night)    | LAmx   |
| Balmain and Rozelle | 49 dBA         | 41 dBA         | 59 dBA |
| Pymont and Glebe    | 41 dBA         | Not Applicable | 51 dBA |

Explanatory notes:

1. LAmx 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(15minute) 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

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 (ie, waterfront) locations during periods of inactivity (eg, ship Auxiliary Power Units (APUs) operating) and during loading operations (eg, 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 loading inactivity exists immediately after the ship berths, while the loading 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 loading is continuous, with at least two road tankers filling the ship at any one time. Ship noise measurements during periods of activity can be measured at any time after loading commences.

The previous ship noise monitoring report prepared by Heggies (Report Number 10-4309-R2 Revision 1) concluded that measurements are best carried out at night (preferably after 1.00 am). Extraneous noise (not related to the subject activity) is generally at a minimum at this time and measurement results are consequently likely to be much more meaningful. For the noise monitoring of the Golden Crest monitoring was timed to co-incide with the ship arriving (at approximately 5.40 pm) which enabled residential noise measurements to be conducted during the setup phase and also during the ship loading phase.

Attended noise level 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.

A "reference" measurement was conducted in close proximity to the Golden Crest, where the noise environment was dominated by bulk liquids unloading related noise. The "reference" measurement was then used as a basis for the estimation of WB-4 activity related noise at the receivers of interest.

An equivalent ship sound power level was therefore calculated based on the "reference" measurement and noise contributions related to the bulk liquids cargo handling were estimated at each noise sensitive location.

All items of acoustic instrumentation employed during the noise monitoring surveys were designed to comply with the requirements of AS IEC 61672.1 2004: "*Electroacoustics-Sound level meters-Specifications*" and carried appropriate and current NATA (or manufacturer) calibration certificates. 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 | 2414702       | Brüel & Kjær Modular Precision Sound Level Meter       |
| 4189 | 2378026       | Brüel & Kjær 12.5 mm Prepolarised Condenser Microphone |
| 4231 | 1730711       | Brüel & Kjær Calibrator                                |



Environmental noise measurements were carried out with reference to the guidelines contained within the NSW Industrial Noise Policy 2000 (INP). In circumstances where it was not practical to carry out measurements at the potentially most 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 (of 15 minute duration) are usually considered to be sufficient to provide sufficient information to enable an estimate of the  $L_{Aeq(night)}$  noise levels at the selected residential receivers. On this occasion however, the ambient noise environment was influenced by another source and the  $L_{Aeq(15minute)}$  and  $L_{Aeq(night)}$  noise levels were predicted based on “reference” measurements.

A brief description of acoustic terminology used in this report is presented in **Appendix A**.

Attended measurements during periods of setup and unloading activities were carried out during the evening of 3 April 2008, commencing at approximately 5.30 pm.

Two separate 15 minute measurements were carried out at the representative Balmain location during cargo handling operations at WB-4, at 7.10 pm and 9.20 pm. At this location, during both surveys, noise from local traffic and domestic activity was influencing the ambient noise environment, as well as wind on occasion.

One 15 minute noise measurement was also carried out at the representative receiver at the Pyrmont site, at 8.15 pm. At this location, the measurement was on occasion influenced by local traffic noise and domestic activity.



## 5 RESULTS AND ANALYSIS

The results of the 15 minute duration attended noise measurements are summarised in **Table 5**. Discussion of the results is presented in **Section 6** of this report. It should be noted that the measured noise levels presented below include noise from the bulk liquids cargo handling facility at WB-4 as well as ambient noise unrelated to the facility.

**Table 4 Measured Noise Levels - Setup Activity with Pumps not Operating**

| Address                                  | Start Time | LAeq (15min) | LA90 (15min) | WB-4 Related LAmax Range | Comments  |
|--|------------|--------------|--------------|--------------------------|---|
| 13 Donnelly Street (Balmain / Rozelle)   | 7.11 pm    | 54 dBA       | 51 dBA       | 55 dBA                   | LAeq influenced by WB-4 noise as well as birds.             |
| Level 5, 2 Point Street (Pymont / Glebe) | 8.15 pm    | 53 dBA       | 50 dBA       | Non observed             | Golden Crest not audible, ambient from general urban noise. |

**Table 5 Measured Noise Levels - Loading Activity with Pumps Operating**

| Address                                | Start Time | LAeq (15min) | LA90 (15min) | WB-4 Related LAmax Range | Comments  |
|--|------------|--------------|--------------|--------------------------|---|
| 13 Donnelly Street (Balmain / Rozelle) | 9.20 pm    | 52 dBA       | 50 dBA       | 56 dBA to 59 dBA         | LAeq influenced by WB-4 noise as well as noise from wind. |

During the first and second measurements at 13 Donnelly Street (at approximately 7.11 pm and 9.20 pm) noise from the ship APU was audible. Pumps that were operational during the second (loading) survey were audible but not measureable above the ship APU noise. LAeq noise levels of 54 dBA and 52 dBA were recorded for the 7.11 pm and 9.20 pm surveys respectively.

During the measurements at Point Street, the ambient noise resulted from distant city noise, local traffic and Anzac Bridge traffic, with seagulls also influencing the LAeq level. A LAeq noise level of 53 dBA was recorded for the 8.20 pm survey.

Noise from trucks was audible at Balmain with a summary of the LAmax events at the site presented in **Table 6**. WB 4 related LAmax noise events were not observed at the Pymont monitoring location.

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

| LAmax Source                         | LAmax Range      | Notes   |
|--------------------------------------|------------------|---|
| Truck air brakes                     | 57 dBA           | Truck air brake noise (parking break engagement) could be heard from trucks arriving at the site. The events lasted for approximately 1 second. |
| Trucks arriving and leaving the site | 56 dBA to 59 dBA | Truck engine noise.   |

In order to confirm the contribution to the ambient by bulk liquids related noise, noise levels were predicted based on the reference measurements taken in close proximity of the Golden Crest, where the noise environment was dominated by bulk liquids loading related noise.



**Table 7** presents the “reference” noise measurements carried out 50 m away from the bulk liquids vessel Golden Crest, and also 6 m from the pumping units located on the wharf, where the noise environment was dominated by bulk liquids cargo handling related noise. The first measurement was taken 50 m from the rear of the ship in the direction towards 13 Donnelly Street, Balmain, where ship noise dominated the ambient. .

The second, third and fourth “reference” noise measurements are of pump units that were on the wharf. In typical bulk liquids handling two silenced pumps are used, however in the ultimate configuration up to three silenced pumps (the third for up to 50 percent of the time) may be in operation.

**Table 7 Golden Crest “Reference” Noise Level**

| Reference | Location | Distance from Source | Height of Source | LAeq   |
|-----------|----------|----------------------|------------------|--------|
| 1         | WB-4     | 50 m                 | 15 m             | 70 dBA |
| 2         | WB-4     | 6m                   | 1.5 m            | 72 dBA |
| 3         | WB-4     | 6 m                  | 1.5 m            | 73 dBA |
| 4         | WB-4     | 6 m                  | 1.5 m            | 73 dBA |

Calculations were performed with the reference measurements (assuming 3 silenced pumps operational, two shielded by tankers, and one shielded and operational for 50 percent of the time) taken in close proximity of the Golden Crest vessel. Predictions indicate bulk liquids loading related LAeq noise levels at the representative receivers at 13 Donnelly Street and 2 Point Street of 54 dBA and 43 dBA respectively.

The calculated LAeq(15minute) noise level of 54 dBA is similar to the measured noise levels of 52 dBA to 54 dBA at 13 Donnelly Street. The calculated LAeq(15minute) noise level at 2 Point Street is significantly below the ambient noise level at this location and is consistent with WB-4 related noise being not audible

A comparison of the predicted noise levels with the noise goals listed in the Licence Conditions are presented in **Table 8** **Table 9**, and **Table 10**.

**Table 8 Assessment of Measured/Predicted Noise Levels Against LAeq(15minute) Noise Goals**

| Prediction Location                       | Measured/Predicted LAeq Noise Levels <sup>1</sup> | LAeq(15 minute) Noise Goals | LAeq (15 minute) Exceedance of Licence Goals |
|---|---|-----------------------------|--|
| 13 Donnelly Street (Balmain / Rozelle)    | 52/54 dBA   | 49 dBA                      | 3 dBA exceedance                             |
| Level 5, 2 Point Street (Pyrmont / Glebe) | 53/43 dBA   | 41 dBA                      | 2 dBA exceedance                             |

Notes : 1. The measured noise level presented corresponds to the ship loading period.

**Table 9 Assessment of Predicted Noise Levels Against LAeq(night) Noise Goals**

| Prediction Location                       | Measured / Predicted LAeq Noise Levels <sup>1</sup> | LAeq(night) Noise Goals | LAeq Exceedance of Licence Goals |
|---|---|-------------------------|----------------------------------|
| 13 Donnelly Street Balmain / Rozelle)     | 52/54 dBA   | 41 dBA                  | 11 dBA exceedance                |
| Level 5, 2 Point Street (Pyrmont / Glebe) | 53/43 dBA   | N/A                     | N/A                              |

Notes : 1. The measured noise level presented corresponds to the ship loading period



**Table 10 Assessment of (WB-4 Related) Measured Noise Levels Against L<sub>Amax</sub> Noise Goals**

| <b>Measurement Location</b>                 | <b>Range of Maximum Measured Levels (L<sub>Amax</sub> Range)</b> | <b>L<sub>Amax</sub> Noise Goals</b> | <b>Range of Recorded L<sub>Amax</sub> Exceedances of the Licence Noise Goals</b> |
|---|--|-------------------------------------|--|
| 13 Donnelly Street<br>(Balmain / Rozelle)   | 56 dBA to 59 dBA   | 59 dBA                              | No exceedance  |
| Level 5, 2 Point Street<br>(Pymont / Glebe) | N/A <sup>1</sup>   | 51 dBA                              | No exceedance  |

Note 1 No L<sub>Amax</sub> events associated with the bulk liquids unloading activity at WB-4 were recorded during the monitoring periods at 2 Point Street, Pymont.



## 6 DISCUSSION

Predicted and measured  $L_{Aeq}(15 \text{ min})$  noise levels exceed the Licence imposed noise goals at the representative locations at both Balmain and Pyrmont by 3 dBA and 2 dBA respectively. An  $L_{Aeq}(\text{night})$  exceedance of 11 dBA was predicted at the Balmain representative receiver.

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.

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 in-concept noise control measures are discussed below for the sources identified.

A Revised Noise Impact Mitigation and Management Strategy (Report No 10-4309-R10 Revision1) 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 Revised 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 the Golden Crest cargo handling operations during the evening of 03 April 2008. A reference noise measurement was carried out in close proximity of the Golden Crest vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference level was then used to predict noise levels at the representative receivers in the absence of other surrounding activity related noise.

It was found that  $L_{Aeq(15\text{minute})}$  measured and predicted noise levels exceed the Licence imposed noise goals at representative locations in both Balmain and Pyrmont by 3 dBA and 2 dBA respectively. An  $L_{Aeq(\text{night})}$  exceedance of 11 dBA occurs in Balmain.

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.

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 trucks and an on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Revised Noise Impact Mitigation and Management Strategy (Report 10-4309-R10 Revision 1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.

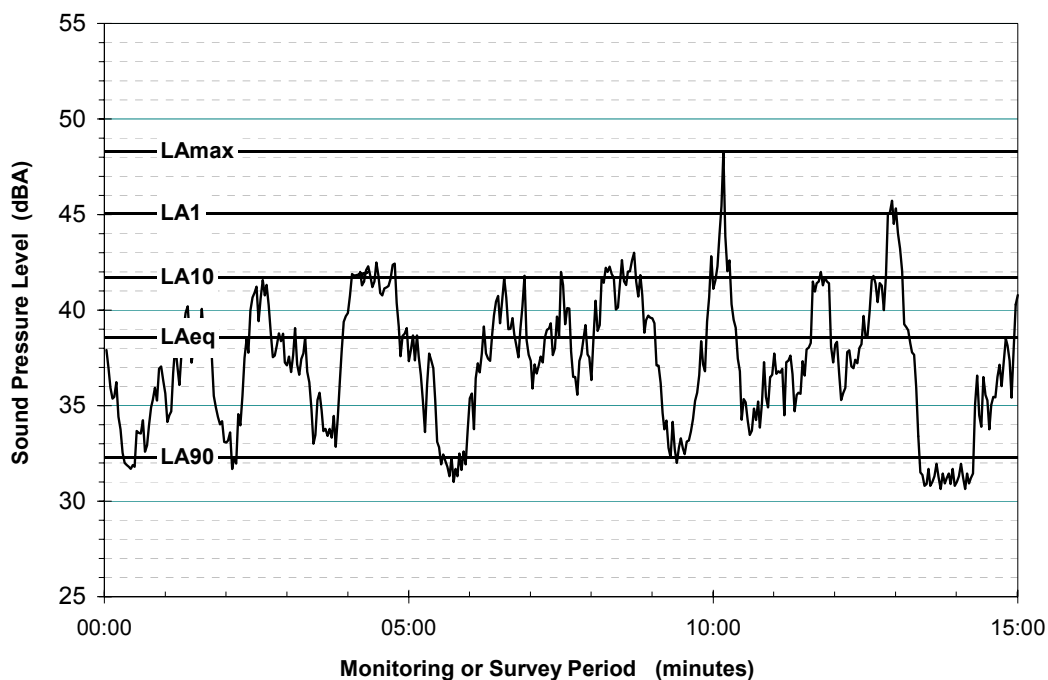
## ACOUSTIC TERMINOLOGY USED IN THE REPORT

### 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 Quiet     |
| 50                         | General Office                             |                       |
| 40                         | Inside private office                      | Quiet to Very quiet   |
| 30                         | Inside bedroom                             |                       |
| 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

## Appendix B

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13 DONNELLY STREET, BALMAIN

### 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 the 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 the bulk liquids ship berthed at WB-4