WYUNA

Glebe Island Berth 8
Compliance Noise Monitoring Report

Prepared for:

Port Authority of New South Wales
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Port Authority of New South Wales (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.04309-R91-v1.0	24 March 2021	Nicholas Vanderberg	Aaron McKenzie	Aaron McKenzie

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR Consulting) were commissioned by the Port Authority of New South Wales (Port Authority of NSW) to conduct monitoring of noise emissions during the unloading of the "Wyuna" (a bulk cargo vessel) at Glebe Island Berth 8 (GI-8), as required by the Glebe Island and White Bay Port Noise Policy, *Port Authority of NSW (2020)* which came into effect in January 2021.

Noise measurements were conducted whilst the ship was berthed at GI-8 and unloading using the onboard blowers. A series of measurements were undertaken at a single location considered representative of the potentially most exposed residential receiver adjacent to Batty Street during night-time period.

The measurements were conducted during the night-time between 01:30 and 04:30 on the morning of Monday 22 February 2021.

2 Site description

The Glebe Island Port facility is located north of Anzac Bridge between Johnsons Bay and White Bay on Glebe Island. The facility occupies approximately 40 hectares of waterfront land and forms a crescent around Glebe Island, with a water frontage of about 1,400 m in length.

The facility layout comprises the following main elements:

- Two berths on the eastern side f Glebe Island designated GI-1 and GI-2, and two berths on the western side designated GI-7 and GI-8;
- Concrete/asphalt area previously used for vehicle storage; and
- Internal roads continuing from Sommerville Road providing truck access to the storage areas of Berths 1 to 2.
- The adjacent White Bay facility to the west of Glebe Island consists of 5 berths on the northern side of White Bay.

Berth 8 is located towards the western end Glebe Island, as shown in **Figure 1**.

Figure 1 also identifies the nearest receiver locations for each berth as identified in Appendix H – Noise Standard, which forms part of the Port Noise Policy and the measurement locations used.

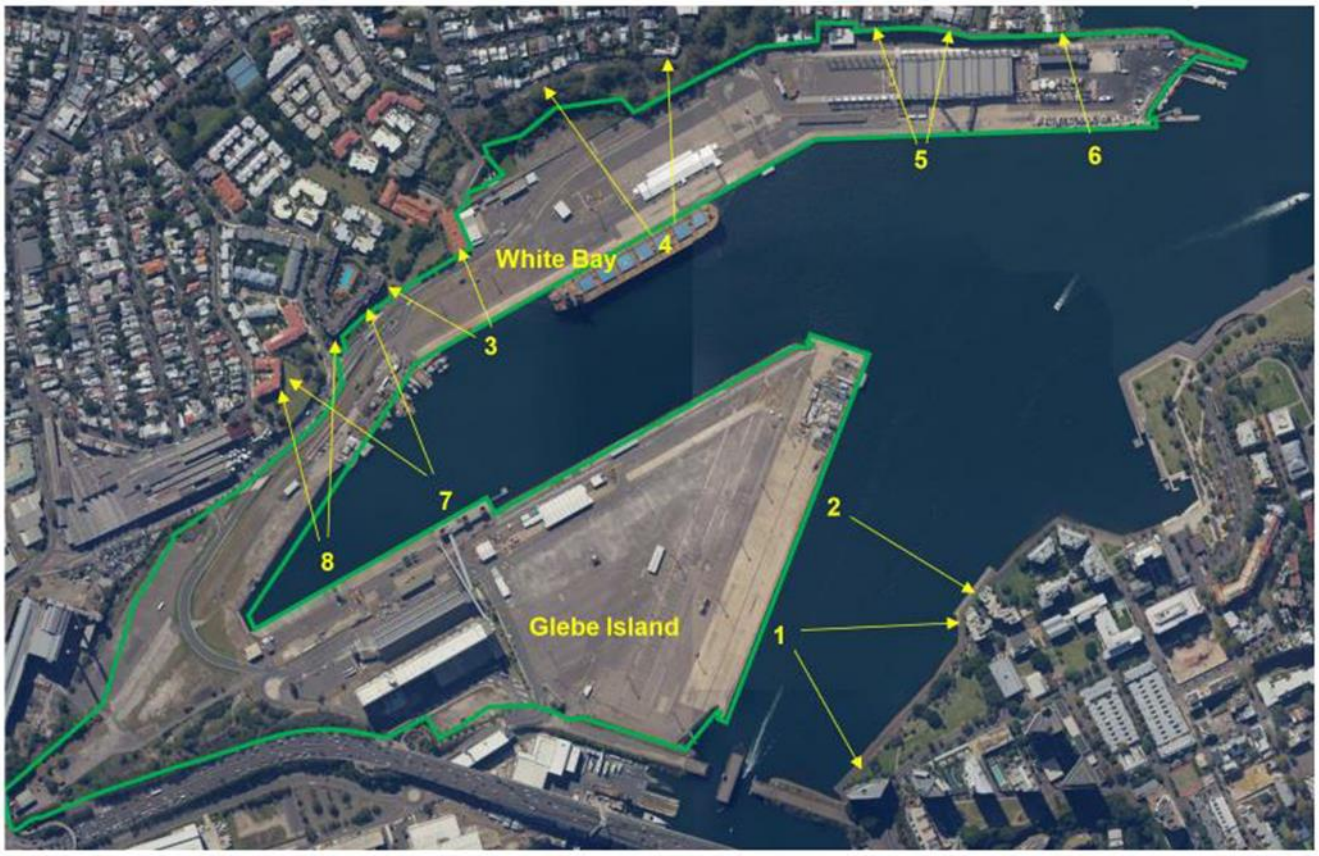


Figure 1 Location of berths and nearest receivers to each berth

Note: Figure referenced from Appendix H of the Port Noise Policy

2.1 Noise Trigger Levels and Criteria

The noise trigger levels applicable at the worst affected sensitive receiver as outlined in the Port Noise Policy is reproduced in **Table 1**.

Table 1 Vessel Trigger Noise Level (external)

Environmental trigger applied to vessels at berth	Assessment Location	Day LAeq (15 hour) 7am – 10pm	Night LAeq (1 hour) 10pm - 7am	Night LAmax 10pm – 7am
Glebe Island 1 and 2	All sensitive receivers near the port	60 dBA	55 dBA	65 dBA
Glebe Island 7 and 8		60 dBA	55 dBA	65 dBA
White Bay 3		60 dBA	55 dBA	65 dBA
White Bay 4 (non-cruise)		60 dBA	55 dBA	65 dBA

Note 1: This includes a 5dBA allowance in the short term for vessels that cannot meet the night time vessel trigger noise level without restrictions to unloading speeds. The 24/7 goal is the median unloading noise level for vessels which is applied as the night time vessel trigger noise level

3 Measurement Methodology and Instrumentation

In accordance with the Port Noise Policy, compliance with the Noise Trigger Levels is required at all sensitive receivers to the port. The nearest receivers to each berth have been identified and measurements have been subsequently undertaken at the closest receiver to assess compliance as identified in the Port Noise Policy and shown in **Figure 1**. The noise measurements were undertaken during unloading operations that consisted of blowers as well as auxiliary engines and associated ventilation systems.

As these measurements were undertaken to a gain an understanding on the different operating conditions, only one 15 minute measurement was undertaken for each scenario once the ship confirmed everything was operating for that scenario.

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2013 *Electroacoustics—Sound level meters - Specifications* and carries current National Association of Testing Authorities (NATA) or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

Noise measurements and assessments in this report have been prepared in accordance with Australian Standard AS 1055-2018 "Acoustics - *Description and Measurement of Environmental Noise"* and with reference to the Noise Policy for Industry (NPfI).

The survey instrumentation used during the studies is set out in **Table 2**.

Table 2 Noise Survey Instrumentation

Type	Serial Number	Instrumentation Description
2270	3027586	Brüel & Kjær Modular Precision Sound Level Meter
4189	3232163	Brüel & Kjær 12.5 mm Pre-polarised Condenser Microphone
SVAN	24604	Svantek Sound Level Calibrator

4 Results and Analysis

The results of the attended noise measurements are summarised in **Table 3**. The measured noise levels presented include noise from the ship unloading activity as well as ambient noise unrelated to GI-8.

Table 3 Summary of Measurement Results – 22 February 2021

Location	Period/Weather	Scenario	Start Time	LAeq	LCeq	LCeq LAeq	LA10	LA90	GI-8 Related LAmax	Comments
1	Night time Calm weather conditions 20 degrees C	1 – Baseline testing basic ships plant running with only accommodation load running from 1 x Aux Generator	1:30	44.1	58	14	45	44	46	Tones – up to 63 dBA Air release up to 60 dBA General ship noise – approx. 52 dBA **Wyuna** **Estimated contribution LAeq(1hour) <55 dBA[11]** **LAmax 63 dBA** *Other noise events:* Car – 55 to 59 dBA Beep – 59 dBA Truck in marshalling yard faintly audible at times Bats – <53 to 55 dBA
			1.34	49.6	65	15	50	49	51	
		2 – Two lines (small compressor mode) Ships Line #2 + Line #1 X 4 Blowers + x4 Vacuum Pumps + x4 Compressors (VM45 only)	2:01	51.4	61	10	52	51	60	
		3 – Two lines Ships Line #2 + Line #1 x4 Blowers + x4 Vacuum Pumps + x4 Compressors (VM45 x2 & VM75 x2)	2:29	53.2	61	8	55	52	60	
		4 – Three lines Ships Line #2 + Line #1 + Line #4 x6 Blowers + x6 Vacuum Pumps + x6 Compressors	2:57	54.3	62	8	56	52	63	
		5 – Three lines (reduced noise) Ships Line #2 + Line #1 + Line #4 x3 Blowers + x3 Vacuum Pumps + x6 Compressors	3:17	54.7	62	7	57	52	63	
		6 – Four lines (max noise) Ships Line #2 + Line #1 + Line #4 + Line #3 Purging Only via Cross-Over Valve X8 Blowers + x8 Vacuum Pumps + x7 Compressors	3:39	54.4	63	8	56	53	60.6	
		7 - As above but hatches open	4:02	53.1	64		55	51	60.9	

Note 1: Overall LAeq(15minute) for an individual scenario went up to 55dBA.

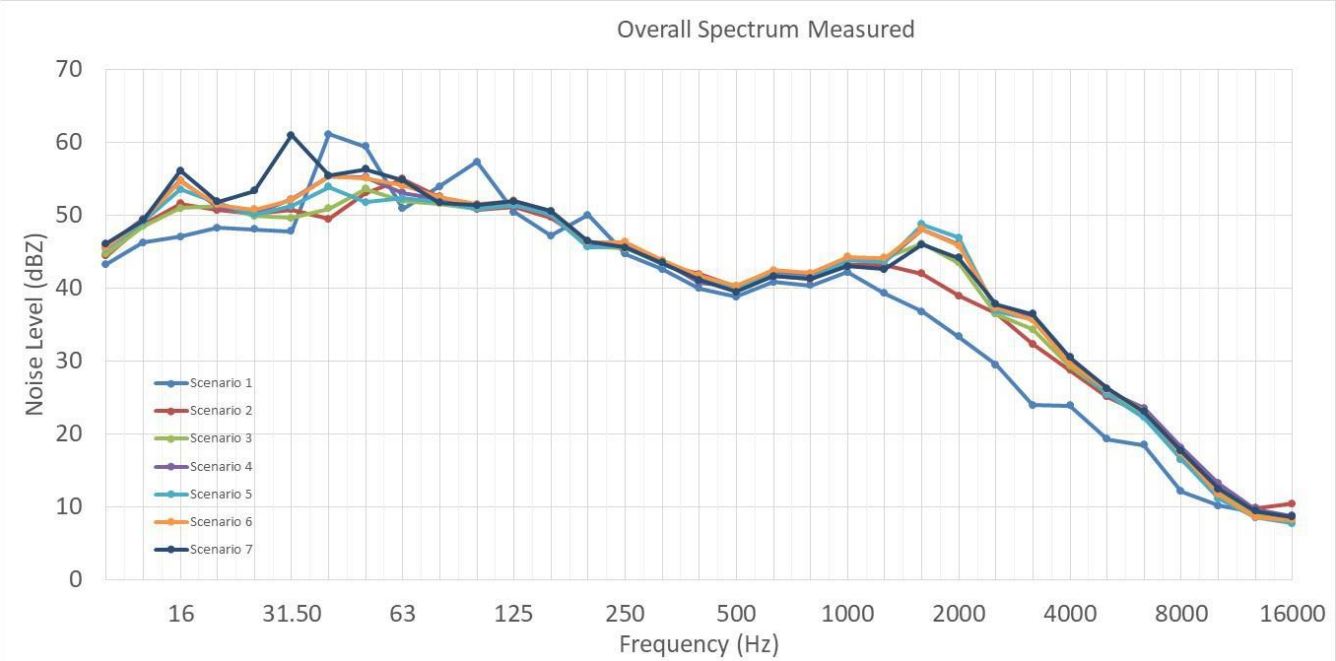
4.1 Modifying Factors

The Port Noise Policy (Appendix F, Vessel Noise Guideline) makes reference to the NSW Environment Protection Authority NPfI (EPA 2017) for the assessment of annoying characteristics such as tonal noise.

The noise level measured at Location 1 during the night-time had a noticeable tone that influenced both the 1.6kHz and 2kHz third octave frequency band during scenario 3 to 7 as indicated in **Figure 2**. As the 1.6kHz and 2kHz adjacent 1/3 octave bands are elevated, they do not directly trigger a tonal penalty when assessed against Table C1 of the NPfI. However, the NPfI further states that

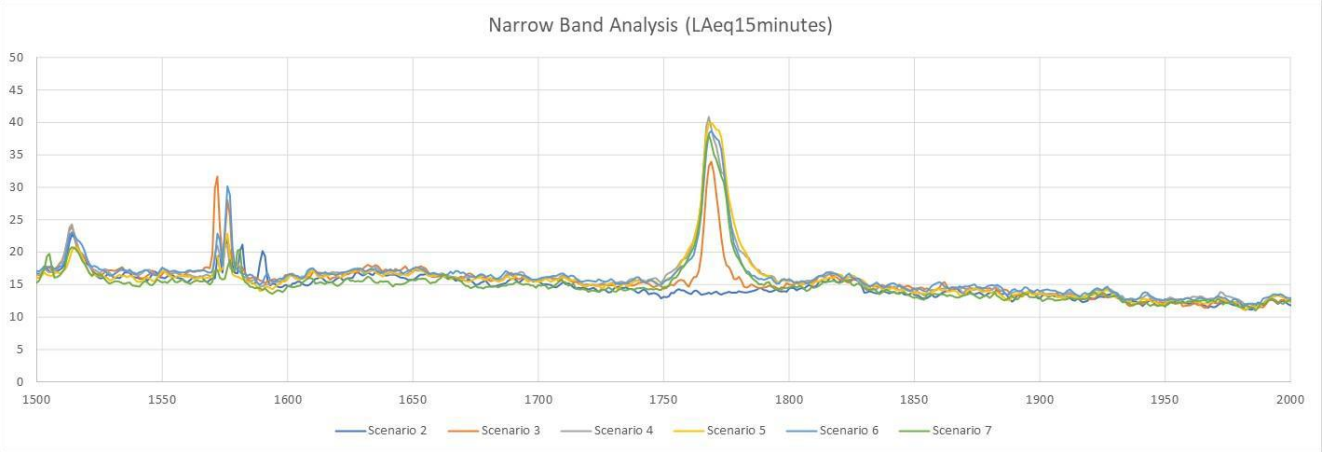
> *'narrow band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands'.*

Figure 2 Location 1 – Night-time Spectrum for each scenario



To assist in understanding whether the noise emissions were tonal, a narrow band analysis was undertaken of the recorded audio data. This showed that the centre of the tone is approximately 1.77kHz which corresponds with the cross over frequency between 1.6kHz and 2kHz third octave bands. This is illustrated in **Figure 3**. This corresponds to the observation on site of a distinct tone that was phasing in and out during the various scenarios.

Figure 3 Narrow band analysis of the $L_{Aeq(15minute)}$ for Scenario 2 to Scenario 7



Note: the y axis is not to scale, as it is not 100% calibrated.

Based off this analysis, it is recommended that a 5dB penalty be applied for tonality as per Table C1 of the NPfI.

No modification factors for low frequency as defined in the NPfI were triggered for the measurements undertaken.

The average noise levels were observed to be generally constant over consecutive measurements, although fluctuations in the loudness of the audible tone were observed throughout each measurement and may be attributed to variations in operation or load of the ship mechanical plant. Fluctuation in loudness were not observed to be attributed to equipment cycling on and off.

Further measurements should be undertaken on the next occasion the ship is unloading at Glebe Island to confirm the presence of tonality.

5 Performance Assessment

5.1 Operations

Results of the operator attended noise measurements compared with the Vessel Noise Trigger Levels are given in **Table 5**.

Table 4 Compliance Assessment

Scenario	Estimated GI-8 Contribution (dBA)			Vessel Noise Trigger Levels (dBA)			Compliance	
	Day LAeq (15 hr)	Night LAeq (1 hr)	Night LA max	Day LAeq (15hr)	Night LA eq (1hr)	Night LAmax	Day	Night
Scenario 1	NA[1]	50	51	60 Dba	55 Dba	65 Dba	NA	Yes
Scenario 2	NA[1]	50	60				NA	Yes
Scenario 3	NA[1]	53	60				NA	Yes
Scenario 4	NA[1]	59[2]	63				NA	No
Scenario 5	NA[1]	60[2]	63				NA	No
Scenario 6	NA[1]	59[2]	61				NA	No
Scenario 7	NA[1]	58[2]	61				NA	NO

Note 1: No measurements were undertaken during the daytime period.

Note 2: Includes a 5dB penalty for tonality in accordance with the NPfI.as detailed in **Section 4.1**.

Table 5 indicates that compliance with the Vessel Noise Trigger Level was achieved at the nearest sensitive receiver location during the night-time period for Scenario 1, Scenario 2 and Scenario 3. It is however important to note that the tone was still present during Scenario 3 as identified in **Figure 2** and **Figure 3** however was not measured to be as prominent for as long of a duration as other scenarios.

Scenario 4 to Scenario 7 all contained tonal components at approximately 1.7kHz that has been identified in a narrow band analysis of each measurement. Based on these results, the measurements have incurred a penalty resulting in contributions up to 60dBA and a 5dB exceedance of the Vessel Noise Trigger Levels during the night-time period.

6 Conclusion

Noise measurements were carried out at GI-8 during the night-time period on the 22 February 2021 whilst the Wyuna was undertaking various unloading operational scenarios.

Noise measurements undertaken at Location 1 indicate that compliance with the Vessel Noise Trigger Levels have been achieved during scenario 1, scenario 2 and scenario 3 during the night-time period with up to 2 discharge lines running. The measured noise levels during scenario 4 to scenario 7 when discharging with either 3 and/or 4 lines were measured to be less the 55dBA, however incur a penalty for a tone identified during narrow band analysis, resulting in an exceedance of up to 5dB above the Vessel Noise Trigger Level during the night-time.

No exceedances of the L_{Amax} criterion were recorded for the measurement period.

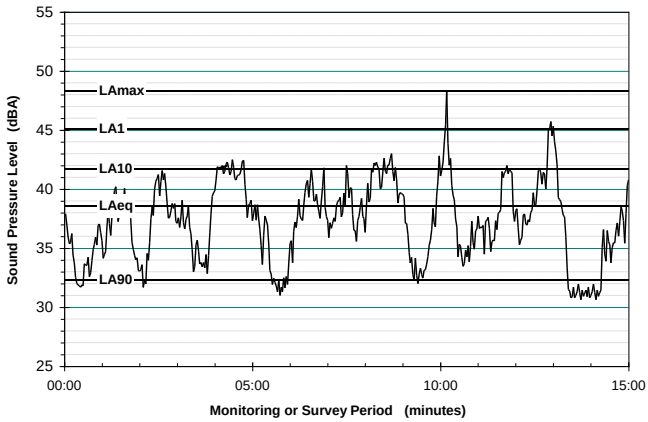
APPENDIX A
ACOUSTIC TERMINOLOGY

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 $L_{Aeq(period)}$ is the measurement parameter used to describe the average sound level over the period. For daytime the period is 7 am to 6 pm, for evening 6 pm to 10 pm, and for night-time 10 pm to 7 am.
- 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} is simply the maximum noise level and is often represented by the $L_{A1(1min)}$, being the level exceeded 1% of 1 minute, ie the noise level exceeded for 0.6 of a second.

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.

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