

# Noise Monitoring Report

## Esperance Port September 2011

Prepared For




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## 1 INTRODUCTION

Esperance Ports Sea & Land (the Port) was granted a variation to the assigned noise levels under regulation 17 of the *Environmental Protection (Noise) Regulations 1997* (the Regulations). This variation was originally granted in July 2001 and has since been regranted being cited as the *Environmental Protection (Port of Esperance Operations Noise Emissions) Approval 2009* (the Approval). The new Approval is valid for a period of 10 years and requires that monitoring be undertaken. This report provides the results of monitoring undertaken during September 2011.

Monitoring was undertaken between 9.00pm on 21 September through to 5.00am on 22 September 2011.

During the monitoring sessions, the following activities occurred:

- Ikan Bilis (lump iron ore) located at Berth 3. This vessel was already in port, arriving at 2.45am on 21 September 2011 and departed 11.00am on 22 September 2011;
- During the monitoring, the following loading operations occurred:
  - From 8.40pm to 11.20pm, train unloaded direct to vessel;
  - From 11.20pm onwards, vessel was loaded from Shed 4, with three loaders operating inside the shed;
  - From 1.00am onwards, train unloaded to Shed 1.

Note that the unloading of trains to the sheds is currently occurring in order to stockpile sufficient ore for future works on the railway, that will restrict train access.

Weather conditions during the measurements were obtained from the Bureau of Meteorology's Esperance weather station as follows:

Time	Temperature (°C)	Relative Humidity (%)	Wind Direction	Wind Speed (km/hr)
9.00pm	12.5	76	NW	26
10.00pm	12.4	75	WNW	24
11.00pm	11.6	83	NW	22
0.00am	11.1	78	WNW	22
1.00am	10.3	89	WNW	22
2.00am	12.1	74	SW	20
3.00am	12	60	SW	26
4.00am	12.1	61	SSW	26
5.00am	12.2	55	SSW	24

As is evident above, wind speeds and particularly gusts were relatively high at more than 5m/s. There was also some reasonably heavy rain between midnight and 2.00am.

*Appendix B* contains a description of some of the terminology used throughout this report.

## 2 CRITERIA

The *Environmental Protection (Port of Esperance Operations Noise Emissions) Approval 2009* is derived from regulation 17 of the Regulations, and varies the assigned noise levels specified under regulation 8. The assigned noise levels of regulation 8 are shown below in *Table 2.1*.

**Table 2.1 – Assigned Noise Levels – Regulation 8**

Type of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L <sub>A10</sub>	L <sub>A1</sub>	L <sub>Amax</sub>
Noise Sensitive – within 15 metres of a noise sensitive building	0700 to 1900 hours Monday to Saturday	45 + I.F.	55 + I.F.	65 + I.F.
	0900 to 1900 hours Sunday and public holidays	40 + I.F.	50 + I.F.	65 + I.F.
	1900 to 2200 hours all days	40 + I.F.	50 + I.F.	55 + I.F.
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + I.F.	45 + I.F.	55 + I.F.
Noise Sensitive – further than 15 metres from a noise sensitive building	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial and Utility	All hours	65	80	90

The I.F. is calculated by the following equation:

$$\frac{1}{10} (\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20} (\% \text{ Type B}_{100} + \% \text{ Type B}_{450})$$

where :

% Type A<sub>100</sub> = the percentage of industrial land within a 100m radius of the premises receiving the noise

% Type A<sub>450</sub> = the percentage of industrial land within a 450m radius of the premises receiving the noise

% Type B<sub>100</sub> = the percentage of commercial land within a 100m radius of the premises receiving the noise

% Type B<sub>450</sub> = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

The Approval varies the assigned noise levels by + 5 dB during the night, over the assigned noise levels of regulation 8 (*Table 2.1*) as shown in *Table 2.2*.

**Table 2.2 – Assigned Noise Levels – Approval**

Type of Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L <sub>A10</sub>	L <sub>A1</sub>	L <sub>Amax</sub>
Noise Sensitive – within 15 metres of a noise sensitive building	0700 to 1900 hours Monday to Saturday	45 + I.F.	55 + I.F.	65 + I.F.
	0900 to 1900 hours Sunday and public holidays	40 + I.F.	50 + I.F.	65 + I.F.
	1900 to 2200 hours all days	40 + I.F.	50 + I.F.	55 + I.F.
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	40 + I.F.	50 + I.F.	55 + I.F.
Noise Sensitive – further than 15 metres from a noise sensitive building	All hours	60	75	80
Commercial	All hours	60	75	80
Industrial and Utility	All hours	65	80	90

The following are not required to meet the requirements of *Table 2.2*.

1. Trains, aircraft, emergency vehicles and safety warning devices needed to comply with occupational safety and health laws (these are exempt under regulation 3 of the Regulations).
2. Construction work.
3. Noise emissions from Cooperative Bulk Handling Ltd (CBH).
4. Noise received at the premises occupied by CBH.

Also, as part of the Approval, Item 6(2) encourages the Port to purchase properties where noise levels are above those of *Table 2.1*.

Furthermore, noise originating from the Port must be free from annoying characteristics (tonality, modulation and impulsiveness) for at least 99% of any 4-hour period.

Previous assessments have identified 13 locations used to determine the noise compliance status of the Port. These locations are listed below and shown in *Appendix A*.

*Location 1 – End of Bostock Street (Lot 16):*

The Port has purchased the majority of properties on the north side of Bostock Street (and some on the south side). Lot 16 is not owned by the Port and has a dwelling on the property. It is understood by the Port that the resident does not consider noise to be an issue. A conversation, at the time of previous measurements, between the resident and the author verified this. The silos of CBH typically shield noise from the Port to this residence and CBH noise emissions would be more dominant at this location.

*Location 2 - Lot 10 Bostock Street:*

This is a vacant lot owned by the Port, has line of sight to a number of the Port operations and is a location where Port and CBH noise is dominant above background noise. It is considered that this location is representative of Lot 14, which is a vacant lot not owned by the Port. As there is no dwelling on this Lot, it is the 'further than 15 metres' criteria that currently applies (i.e. 60 dB(A)  $L_{A10}$ ). However, the Port should be aware that the criteria would change to the 'within 15 metres' assigned levels should a dwelling be constructed on this lot.

*Location 3 - Lot 40 Panorama Place:*

This lot is currently vacant and is representative of a number of lots with dwellings that are not owned by the Port (both on the south side of Bostock Street and on Panorama Place).

*Location 4 - Lot 34 Panorama Place:*

This is a vacant lot not owned by the Port but again, representative of dwellings located in this area. A new residence has been constructed immediately east of this lot.

*Location 5 – Lot 4 Bostock Street:*

This is a vacant lot owned by the Port, but can be used for guidance as to the type of noises that may be heard at non-port owned houses further away.

*Location 6 - Lot 8 Bostock Street:*

This house is now owned by the Port and occupied by one of their employees. The measurement location is no longer used as an Air Quality Station has been installed at this property and dominates the noise levels in the immediate area.

*Location 7 - Southeast corner of Hardy Street and The Esplanade:*

Measurements were recorded closer to the Port than the dwellings, which are located further south, up a hill. For the scenario where loaders are working in Sheds 1 and 2, the noise reduction between the measurement location and houses is expected to be 3 – 5 dB.

*Location 8 - Caravan Park:*

Located on the corner of Harbour Road and The Esplanade, a fence has been constructed around the park, by the Port, to minimise any impact from road traffic (particularly grain trucks). Measurements are recorded on the Port side of the fence and thus any attenuation of Port noise provided by the fence (considered minimal) has not been taken into account.

*Location 9 – Corner of Taylor Street and The Esplanade:*

There are some noise sensitive properties in this area and some commercial properties. Noise from the ocean (wave noise) can influence measurements at this location.

*Location 10 - Tea Rooms:*

A commercial property located towards the jetty opposite Taylor Street. Esperance Bay separates the Tea Rooms from the Port. Ocean noise is generally the dominant source at this location.

*Location 11 - Lot 8 Bostock Street (House):*

As per Location 6, except further north to represent the closest part of the house to the Port. This was used in the noise modelling as an assessment location, rather than a measurement location.

*Location 12 - Corner of Corry and Hardy Streets:*

To the west of the Port at a location where the I.F. is at a minimum.

*Location 13 - Lot 6 The Esplanade:*

Located between William Street and Andrew Street, again a location where the influencing factor I.F. was low.

Note that only the most relevant locations were utilised as measurement locations in this instance.

Table 2.3 shows the I.F. and night-time assigned noise levels for each of the above locations.

**Table 2.3 – Night-Time Assigned Noise Levels**

Location	I.F., dB	Assigned Level (dB)		
		L <sub>A10</sub>	L <sub>A1</sub>	L <sub>Amax</sub>
1 <sup>#</sup>	13	53	63	68
2 <sup>*</sup>	N/A (9)	60 (49)	75 (59)	80 (64)
3	9	49	59	64
4	8	48	58	63
5 <sup>#</sup>	8	48	58	63
6 <sup>#</sup>	8	48	58	63
7	5	45	55	60
8	4	44	54	59
9	2	42	52	57
10	N/A	60	75	80
11	8	48	58	63
12	0	40	50	55
13	1	41	51	56

\* The levels shown are for those of a vacant lot not owned by the Port (i.e. further than 15 metres from building directly associated with a noise sensitive use). Those shown in brackets are for the scenario of a building being constructed on the vacant lot (not owned by the Port).

# These specific measurement locations are properties owned by the Port and hence the assigned noise levels are not applicable. However, the location may be used to assess noise levels to surrounding, non-port owned residences.

### 3 METHODOLOGY

Noise level measurements were undertaken using a Bruel & Kjaer Type 2260 Investigator, which satisfies regulation 22 of the Regulations. The microphone was extended so that it was at least 1.2 metres above the ground and was positioned at least 3 metres from reflecting facades, satisfying Regulation 20.

Monitoring was undertaken between 9.00pm on 21 September through to 5.00am on 22 September 2011.

Each of the assessment locations was attended, however, noise levels were not always recorded. Where measurements were undertaken, one-third-octave band information was obtained for the relevant parameters being the  $L_{A10}$ ,  $L_{A1}$ ,  $L_{Amax}$ ,  $L_{A90}$ , and  $L_{Aeq}$ . Obtaining these parameters allows assessment against the assigned noise levels as well as determining the presence of annoying characteristics.

Observations were made during the measurements including types of noise audible and the weather conditions.

### 4 MEASUREMENT RESULTS

Results of the measurements are shown graphically on *Charts 4.1 to 4.4* and discussed below.

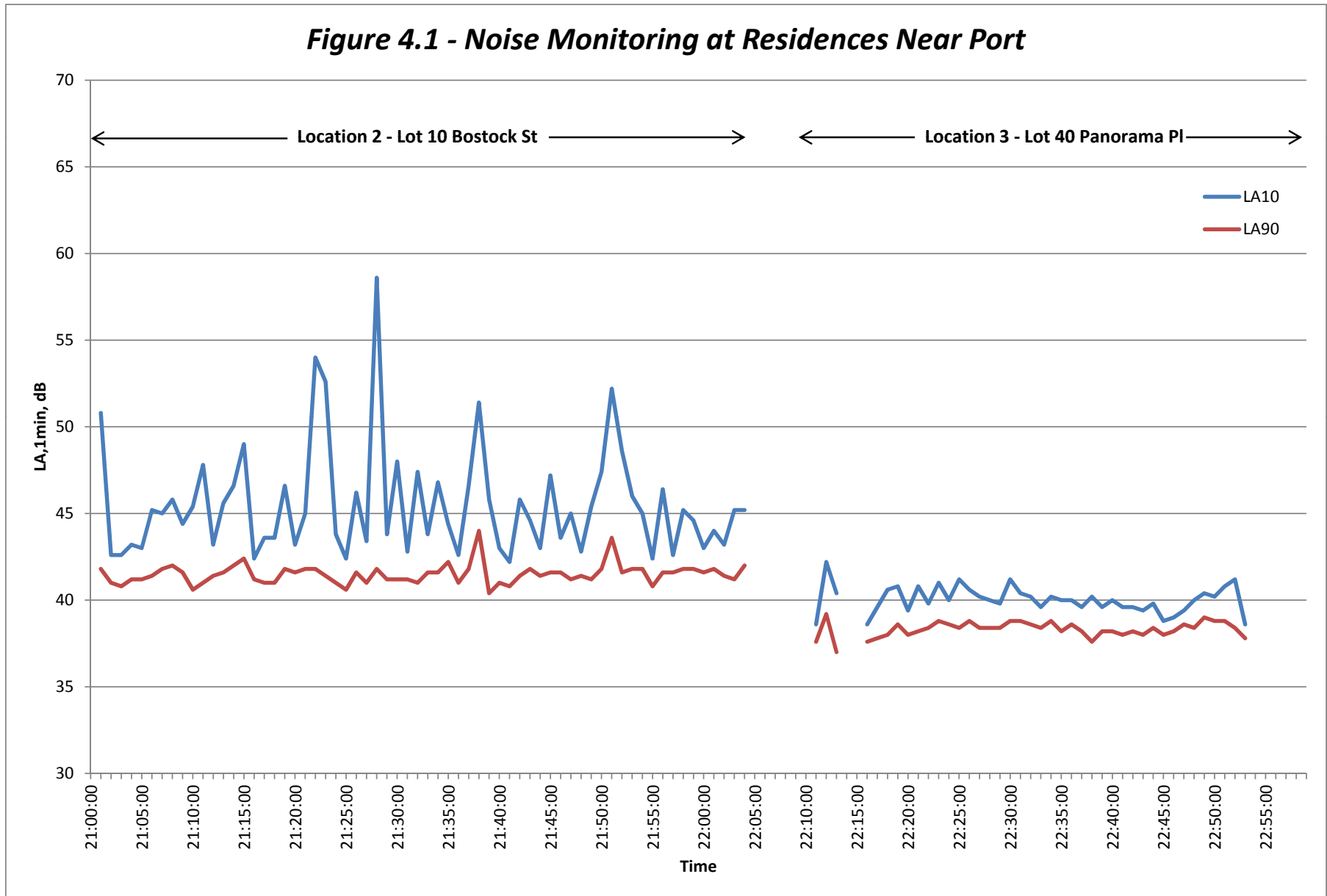
Location 2 was monitored for an extended period on two occasions, between 9.00pm and 10.00pm and 3.00am to 5.00am. During the first period, the vessel was being loaded direct from the train. The 1-minute peaks that are above the assigned noise level are due to train shunting and locomotive movement rather than Port noise. The  $L_{A90}$ , which is typically around 42 dB(A) is more representative of actual Port noise. During the second session, noise levels were noticeably higher. Again, the  $L_{A10}$  measured levels are affected by train noise and wind noise. The  $L_{A90}$  is considered to represent the noise from the Port at typically 47 dB(A). The increase in noise between the two sessions is a result of the Shed 1 conveyor system operating, which is closer to this measurement location. Noise levels therefore comply with those specified in the Approval.

Location 3 was monitored for just under a 1-hour period during the time when the vessel was loaded direct from the train. The shunting noise at this location was less of an issue, although the train was close to be completely unloaded at this time so may not have been fully exposed to this location. Noise levels were relatively low at typically less than 40 dB(A). Noise levels therefore comply with those specified in the Approval.

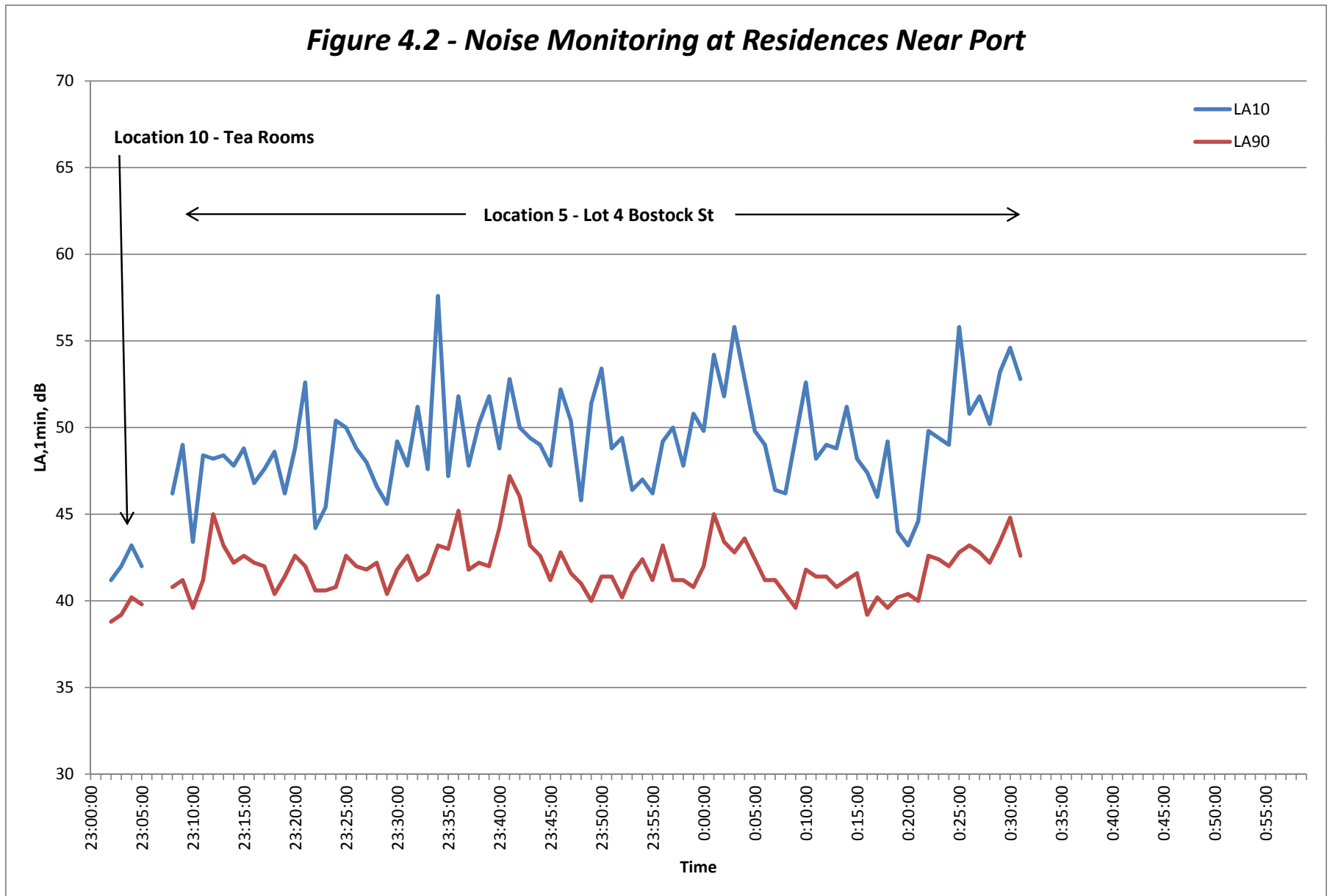
Noise from the Port at the Location 10 tea rooms was inaudible during the time when the vessel was being loaded from the train. Noise levels measured less than 45 dB(A), which is less than that permitted in the Approval and therefore compliant.

The  $L_{A10}$  noise level at Location 5 is affected again by wind and train movement as the train that was being unloaded left the Port during this time. The  $L_{A90}$  indicates noise levels were typically no more than 45 dB(A) with noise from the Port described as barely audible. For the majority of this monitoring period, the vessel was being loaded from Shed 4 which is some distance away. Port noise levels complied with the Approval.

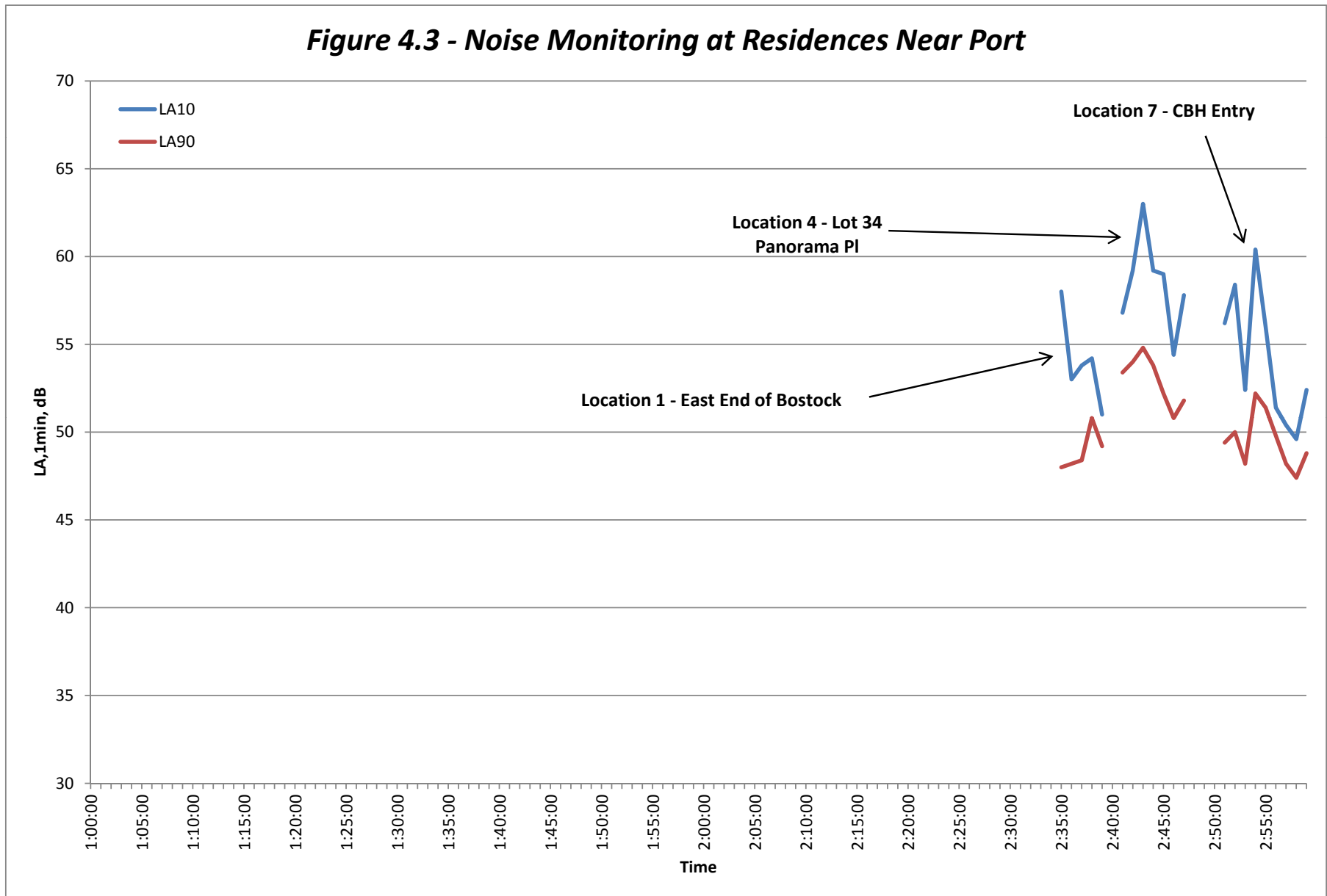
**Figure 4.1 - Noise Monitoring at Residences Near Port**



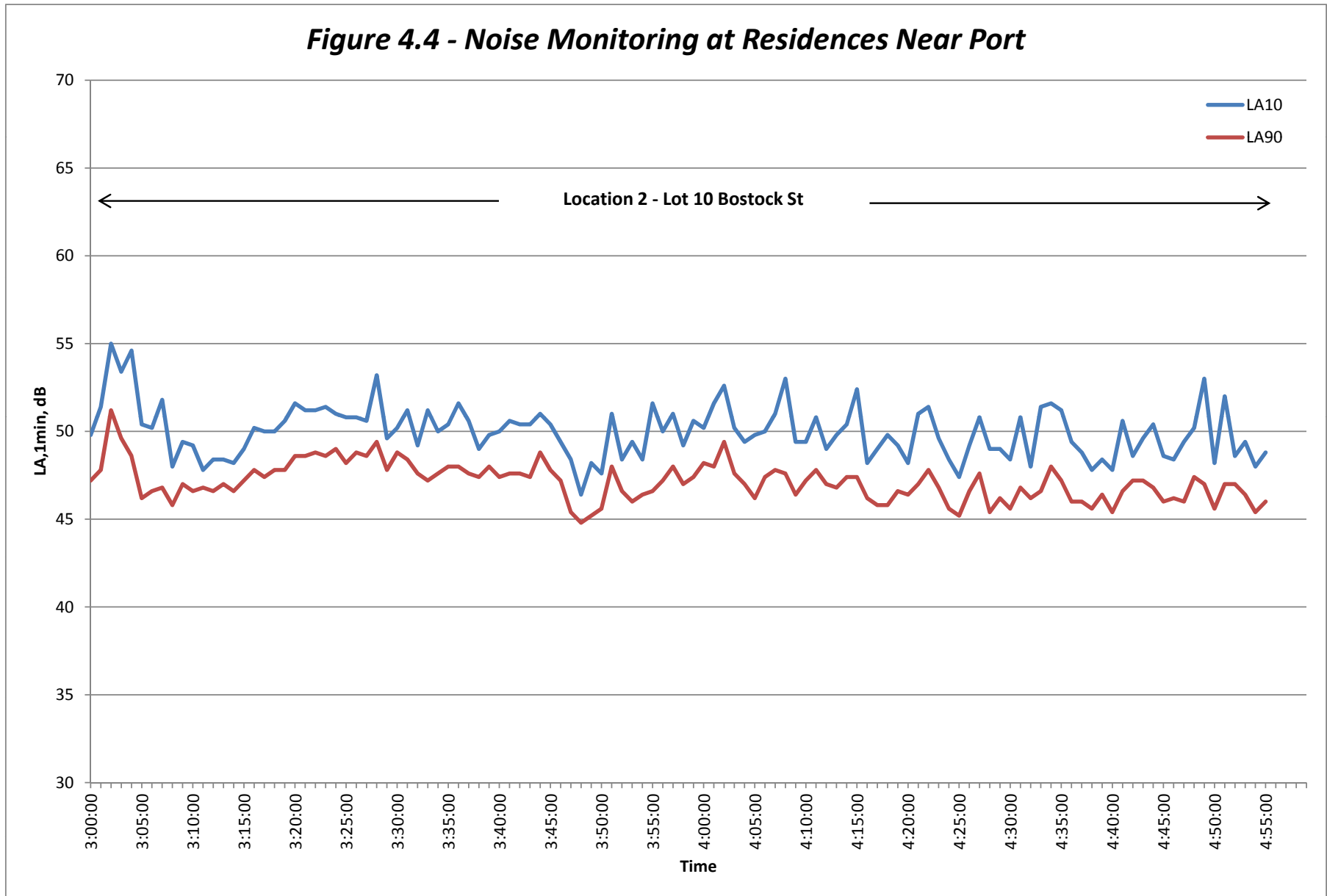
**Figure 4.2 - Noise Monitoring at Residences Near Port**



**Figure 4.3 - Noise Monitoring at Residences Near Port**



**Figure 4.4 - Noise Monitoring at Residences Near Port**



Up until around 2.30am, there was reasonably significant rainfall and therefore monitoring was not undertaken. From 2.30am to 3.00am, three short term measurements were undertaken, with wind noise significantly affecting the measured levels which are not representative of Port noise.

## **5 DISCUSSION & ASSESSMENT**

Winds were relatively high during the monitoring session and therefore affected the measured noise levels, being not representative of Port noise alone. Similarly, a train was being unloaded for all but around an hour of the measurement session and therefore locomotive noise and shunting noise also affected the measurements.

The location where Port noise was most audible above background wind noise is at Location 2 on Bostock Street, particularly when Shed 1 was loaded from the train. At all monitored times noise levels are considered to comply with the Approval and are therefore acceptable.

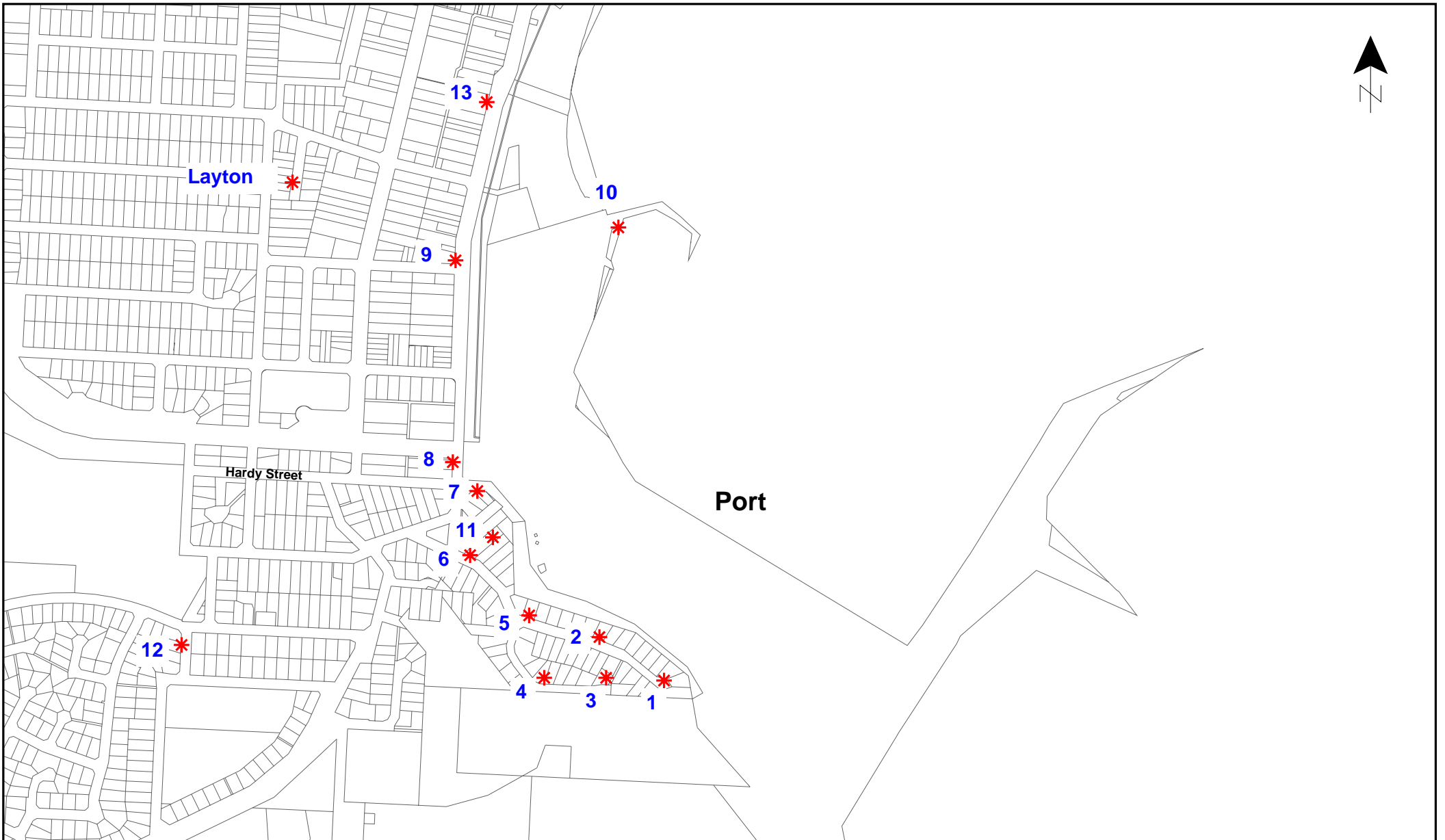
## **6 REMEDIAL ACTIONS**

From the results of this monitoring, no remedial action is required.

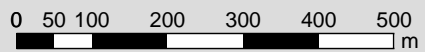
## **7 COMPLAINTS**

We are not aware of any noise related complaints since the previous June 2011 monitoring report.

**APPENDIX A**  
Measurement Locations

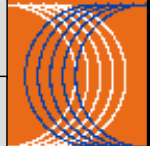


Length scale 1:10000



**ESPERANCE PORT AUTHORITY**  
**Locality Map**

Lloyd  
Acoustics



**FIGURE A01**

## **APPENDIX B**

### Terminology

The following is an explanation of the terminology used throughout this report.

### **Decibel (dB)**

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

### **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as  $L_A$  dB.

### **Sound Power Level ( $L_w$ )**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

### **Sound Pressure Level ( $L_p$ )**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

### **$L_{ASlow}$**

This is the noise level in decibels, obtained using the A frequency weighting and the S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.

### **$L_{AFast}$**

This is the noise level in decibels, obtained using the A frequency weighting and the F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

### **$L_{APeak}$**

This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

### **$L_{Amax}$**

An  $L_{Amax}$  level is the maximum A-weighted noise level during a particular measurement.

### **$L_{A1}$**

An  $L_{A1}$  level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

**$L_{A10}$**

An  $L_{A10}$  level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

**$L_{Aeq}$**

The equivalent steady state A-weighted sound level (“equal energy”) in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the “average” noise level.

**$L_{A90}$**

An  $L_{A90}$  level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the “background” noise level.

**One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

**$L_{Amax}$  assigned level**

Means an assigned level which, measured as a  $L_{A\ Slow}$  value, is not to be exceeded at any time.

**$L_{A1}$  assigned level**

Means an assigned level which, measured as a  $L_{A\ Slow}$  value, is not to be exceeded for more than 1% of the representative assessment period.

**$L_{A10}$  assigned level**

Means an assigned level which, measured as a  $L_{A\ Slow}$  value, is not to be exceeded for more than 10% of the representative assessment period.

**Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between —

- (a) the A-weighted sound pressure level in any one-third octave band; and
  - (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,
- is greater than 3 dB when the sound pressure levels are determined as  $L_{Aeq,T}$  levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as  $L_{A\ Slow}$  levels.

This is relatively common in most noise sources.

### **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of tonality is:

a variation in the emission of noise that —

- (a) is more than 3 dB  $L_{A \text{ Fast}}$  or is more than 3 dB  $L_{A \text{ Fast}}$  in any one-third octave band;
- (b) is present for at least 10% of the representative

### **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of tonality is:

a variation in the emission of a noise where the difference between  $L_{A \text{ peak}}$  and  $L_{A \text{ Max slow}}$  is more than 15 dB when determined for a single representative event;

### **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

### **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

### **Influencing factor**

$$= \frac{1}{10} (\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20} (\% \text{ Type B}_{100} + \% \text{ Type B}_{450})$$

where:

% Type A<sub>100</sub> = the percentage of industrial land within  
a 100m radius of the premises receiving the noise

% Type A<sub>450</sub> = the percentage of industrial land within  
a 450m radius of the premises receiving the noise

% Type B<sub>100</sub> = the percentage of commercial land within  
a 100m radius of the premises receiving the noise

% Type B<sub>450</sub> = the percentage of commercial land within  
a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

### **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

### **Background Noise**

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

### **Ambient Noise**

Means the level of noise from all sources, including background noise from near and far and the source of interest.

### **Specific Noise**

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

### **Satisfactory Design Sound Level**

The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

### **Maximum Design Sound Level**

The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

### **Reverberation Time**

Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.

### **RMS**

The root mean square level. This is used to represent the average level of a wave form such as vibration.

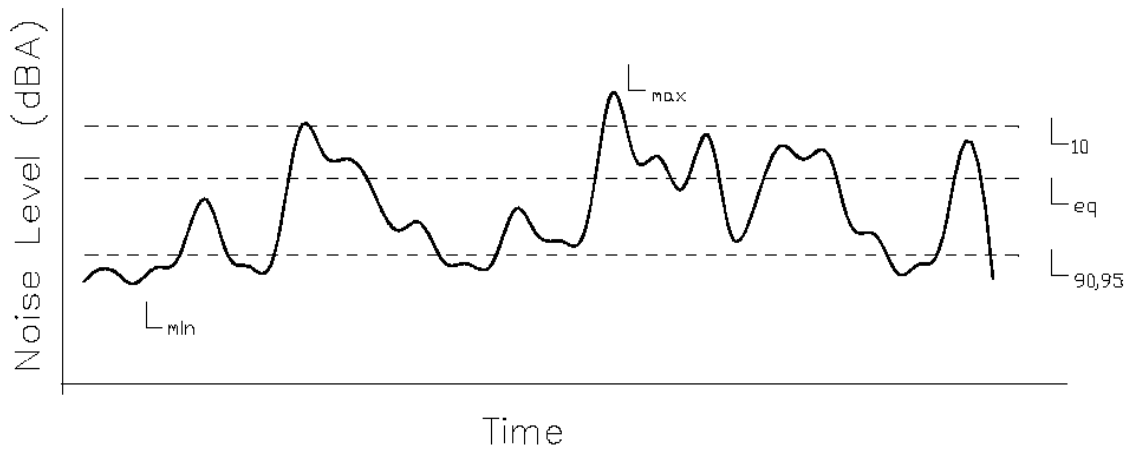
### **Vibration Velocity Level**

The RMS velocity of a vibration source over a specified time period. Units are mm/s.

### **Peak Velocity**

Level of vibration velocity measured as a non root mean square (r.m.s.) quantity in millimetres per second (mm/s).

**Chart of Noise Level Descriptors**



**Typical Noise Levels**

