JONES BAY WHARF MARINA EXPANSION

NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 10087
VERSION B

WILKINSON MURRAY

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SEPTEMBER 2010

PREPARED FOR

PELOTON GROUP
SUITE 11, 2-4 KINGS LANE
DARLINGHURST NSW 2010

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1 INTRODUCTION

This report has been prepared for Peloton Group and presents an assessment of the potential noise impacts associated with the proposed expansion of the marina at Jones Bay Wharf, Pyrmont, NSW.

Assessment has been made in accordance with the Director General's Requirements for Application Number MP 09_0205. The assessment considers the noise impacts from wharf operations and construction.

2 SITE AND PROJECT DESCRIPTION

Jones Bay Wharf is located in Pyrmont to the northwest of Darling Island as shown in Figure 2-1. The Wharf is occupied by commercial properties. The surrounding area is occupied by offices, residential properties and entertainment premises.

The nearest residential receivers have been identified as:

- 3, Darling Island Road; and
- 'Macarthur Building' 25, Pirrama Road.

Figure 2-1 Site Layout

Jones Bay Wharf currently has 12 boats moored on the west side and seven boats moored on the east side. The nearest noise sensitive receivers are apartment buildings located east and southwest of the wharf, indicated in Figure 2-1.

The west side of the wharf currently has 19 moorings which will be increased to 21 moorings. The proposed type and use of vessel is not expected to change. This minor increase is expected to provide negligible noise impact on the residential receivers. Therefore only the activities at the east wharf have been considered in the operational noise assessment.

The current watercraft activity on the eastern side is summarised below in Table 2-1.

Table 2-1 Current watercraft activity

Number Off	Size	Movements(1)	Operation	Hours of Operations
2	30m	two per day during peak season	Commercial Charter	Evening and night
1	40m	Leaves every Friday and returns Monday	Private commercial	Evening Friday and Morning Monday
1	30m	None	Commercial Berthing	-
3	25m	4 per week during peak season	Private Commercial	Daytime

Note: (1) One movement is taken to be the watercraft either leaving or returning to the wharf.

The boats require minor maintenance in the wharf which includes sewage pumping, victualling, cleaning inside and occasional exterior cleaning. No fuelling or passenger embarkation takes place at the wharf.

The expansion of the wharf is expected to include the following changes in layout as shown in Figure 2-2. On the eastern side, the number of berths will increase from 7 to 51 which includes:

- Nine Large vessel berths (28-45m)
- 42 Small vessels berths (12-18m)

The changes for the new development are summarised below.

- The usage of the wharf berths is expected to include charter boat operators, boat broker storage and large private charter vessels.
- Boats will be moored to floating structures that extend into the bay.
- Sewage waste will be evacuated via an onshore pump inside an enclosure.
- Mains power will be provided to all berths.
- Occasional use of hand tools for maintenance.
- Periodic pressure washing of boat exteriors.
- Routine interior cleaning of commercial charter vessels.
- Daily tradesmen access to larger boats.
- Daily victualling for larger boats during summer peak.
- Weekly victualling for larger boats in off peak periods.
- Weekly truck apron access for large boat victualling.

A summary of the proposed usage of the expanded wharf is presented in Table 2-2.

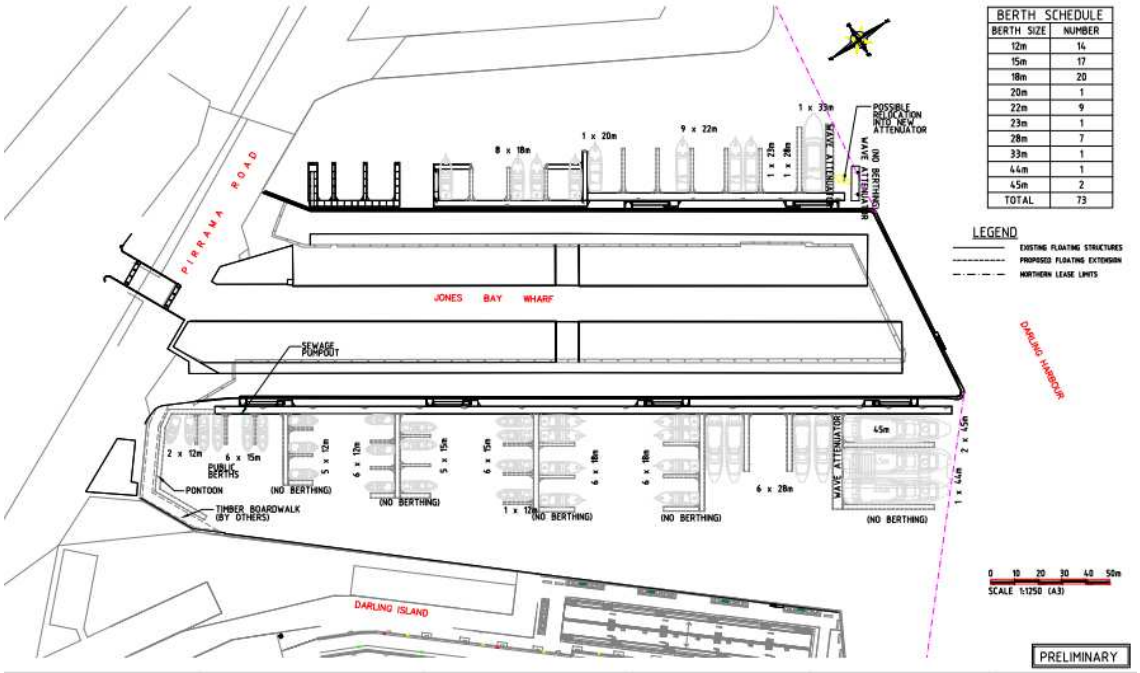
Table 2-2 Proposed Expanded Wharf Operation

Number Off	Size	Movements[2]	Operation	Hours of Operations
2	30m	two per day during peak season	Commercial Charter	Evening and night
1	40m	Leaves every Friday and returns Monday	Private commercial	Evening Friday and Morning Monday
1	30m	None	Commercial Berthing	-
3	25m	4 per week during peak season	Private Commercial	Daytime
2	28-45m	Once a week	Private Commercial	Daytime/Evening
~21[1]	12-18m	Daily	private commercial	Daytime/Evening
~21[1]	12-18m	None	Broker Berthing	-

Note: (1) At the time of writing the exact figure was not known. Based on current operations and advice from the client, the smaller berths have been assigned accordingly.
(2) One movement is taken to be the watercraft either leaving or returning to the wharf.

The construction stage of the project is expected to include amongst other general construction activities, bored piling in the bay.

Figure 2-2 Proposed Layout of Jones Bay Wharf



3 NOISE MEASUREMENTS

The existing noise environment was measured using unattended noise loggers and attended measurements were used to establish existing operational noise levels.

3.1 Background Noise

The existing background noise was measured using a noise logger placed at the REVY building adjacent to the residential properties at 3 Darling Island Road. The logger was placed at a height equivalent to the first floor apartments in the adjacent residential building, as shown in Figure 3-1. The background noise levels measured at this location are considered representative of the residences at 3, Darling Island Road. They are considered conservatively low for the residences at 25, Pirrama Road as there is a local road in front of the building.

Figure 3-1 Noise Monitoring Location

The noise monitoring equipment used for these measurements consisted of an environmental noise logger set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period.

The results of the noise logger are presented in Table 3-1 below and in Appendix B.

Table 3-1 Background Noise Levels

Location	Time Period	Ambient $L_{Aeq,Period}$ (dBA)	Rating Background Level (dBA)
REVY building	Daytime (7.00am-6.00pm)	54	48
	Evening (6.00pm-10.00pm)	51	46
	Night time (10.00pm-7.00am)	49	41

Observations at the site indicated that the only existing industrial noise in the area is from the existing wharf activities. Since these activities are intermittent in nature with no noise being generated most of the time, the day, evening and night $L_{Aeq, Period}$ levels of industrial noise are negligible.

3.2 Noise Source Levels

The operational noise was measured using attended measurement techniques. Daytime activities were simulated by high engine revs equivalent to manoeuvring engine activity. Typical evening and night operation measurements were based on a commercial charter boat preparing to leave, leaving and returning to the bay, then being internally cleaned and the crew leaving. The additional attended measurement position is indicated in Figure 3-1.

Noise levels were measured with a Bruel and Kjaer Type 2250 Sound Level Meter. This sound level meter conforms to Australian Standard 1259 Acoustics – Sound Level Meters, as a Type 1 Precision Sound Level Meter which has an accuracy suitable for field or laboratory use. The sound level meter calibration was checked before and after the measurement period with a Bruel and Kjaer Type 4231 sound level calibrator and no significant drift was noted.

Measurements were carried out on Tuesday 15th June between 12.00pm and 1.00pm with two boats moored towards the end of Jones Bay Wharf simulating manoeuvring engine activity by revving their engines. The measurement location was approximately 175m from the boats.

Measurements were also carried out on Saturday 19th June 2010 between 5.30pm and 11.30pm when the boat 'Blue Room' was performing typical night and evening operations. The boat left the wharf at 6.00pm and returned at 9.50 pm where it moored and the crew cleaned for approximately 40 minutes. When the boat returned, Café Morso, a licensed premises located to the southern end of the wharf, was open and patrons outside it were audible. The measurement location was approximately 140m from the location of the boats

A summary of the attended measurement levels are shown in Table 3-2.

Table 3-2 Noise Measurements during Day and Night Operations

Location	Date	Time	Duration (Minutes)	Distance from Source (m)	Activity	Noise Sources	Noise Descriptor	Noise Level (dBA)
REVY building	15 June 2010	12.30-12.40pm	10	175	Blue Room and Olympic Storm revving engines	Boat engines, traffic noise	L_{Aeq}	52.0
			-	175	Blue Room and Olympic Storm revving engines	Boat engines, traffic noise	L_{Amax}	62.3
		1.00-1.15pm	15	-	Background	Traffic noise	L_{A90}	48.0
In front of 3 Darling Island Road	19 June 2010	5.50-6.00pm	10	140	Blue Room leaving wharf	Boat engines, distant traffic	L_{Aeq}	54.0
		5.55pm	-	140	Blue Room leaving wharf	Boat movement	L_{Amax}	63.6
		9.50-10.10pm	20	140	Boat returns, then idles whilst cleaning	Boat engines, traffic, Café Morso	L_{Aeq}	54.0
		10.08pm	-	140		Café Morso	L_{Amax}	70.7[2]
		10.23-10.38pm	15	140	Crew leaves boat and exits along wharf	Café Morso, distant traffic	L_{Aeq}	51.0

Note: (1) Café Morso denotes the noise source was audible music and loud talking and laughing from these premises.
(2) Maximum level from Café Morso.

4 OPERATIONAL NOISE CRITERIA

4.1 Types of Noise Criteria

The *NSW Industrial Noise Policy (INP)* recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent than the other and dominates the noise assessment. The criteria are based on the L_{Aeq} descriptor, which is explained in Appendix A.

4.1.1 Intrusiveness Criterion

An intrusiveness criterion applies for residential receivers only.

The intrusiveness criterion requires that the L_{Aeq} noise level from the source being assessed, when measured over 15-minutes, should not exceed the Rating Background Noise Level (RBL) by more than 5dBA. The RBL represents the 'background' noise in the area, and is determined from measurement of L_{A90} noise levels, in the absence of noise from the source. The definition of L_{A90} and the procedure for calculating the RBL is given in Appendix A.

Where the noise level from the source varies over time due to changes in operating conditions, meteorological conditions or other factors, the upper 10^{th} percentile of 15-minute L_{Aeq} noise levels can be used for comparison with the criterion.

4.1.2 Amenity Criterion

The amenity criterion sets a limit on the total noise level from *all industrial noise sources* affecting a receiver. Different criteria apply for different types of receiver (e.g. residence, school classroom); different areas (e.g. rural, suburban); and different time periods, namely daytime (7.00am-6.00pm), evening (6.00pm-10.00pm) and night time (10.00pm-7.00am). In this case the residential receivers are located in an urban setting.

The noise level to be compared with this criterion is the L_{Aeq} noise level, measured over the time period in question, due to all industrial noise sources, but excluding non-industrial sources such as transportation.

Where a new noise source is proposed in an area with negligible existing industrial noise, the amenity criterion for that source may be taken as being equal to the overall amenity criterion. However, if there is significant existing industrial noise, the criterion for any new source must be set at a lower value. If existing industrial noise already exceeds the relevant amenity criterion, noise from any new source must be set well below the overall criterion to ensure that any increase in noise levels is negligible. Methods for determining a source-specific amenity criterion where there is existing industrial noise are set out in the *INP.*

4.1.3 Sleep Disturbance

Sleep disturbance is a complex issue and the potential for sleep disturbance depends on both the level of a noise event and the number of noise events. As a screening guideline, the DECCW recommends that the night time L_{A1} noise level should not exceed night time background noise level by more then 15 dBA. Where this screening criterion is exceeded, a more detailed analysis is required. In this case, some guidance on possible impacts is contained in the *DECCW's "Environmental Criteria for Road Traffic Noise"*.

4.2 Determination of Criteria

Table 4-1 and Table 4-2 show the relevant noise criteria for this project.

Table 4-1 Intrusiveness Criteria

Receiver	Time Period	RBL (dBA)	Intrusiveness Criterion $L_{Aeq,15min}$ (dBA)
3, Darling Island Rd	Daytime (7.00am–6.00pm)	48	53
	Evening (6.00–10.00pm)	46	51
	Night time (10.00pm–7.00am)	41	46
25, Pirrama Rd	Daytime (7.00am–6.00pm)	48	53
	Evening (6.00–10.00pm)	46	51
	Night time (10.00pm–7.00am)	41	46

Table 4-2 Amenity Criteria

Receiver	Time Period	Noise Level, $L_{Aeq,Period}$ (dBA)		
		Overall Amenity Criterion	Existing Industrial Noise	Project-Specific Amenity Criterion
3, Darling Island Rd (urban)	Daytime (7.00am–6.00pm)	60	Negligible	60
	Evening (6.00–10.00pm)	50	Negligible	42
	Night time (10.00pm–7.00am)	45	Negligible	35
25, Pirrama Rd (urban)	Daytime (7.00am–6.00pm)	60	Negligible	60
	Evening (6.00–10.00pm)	50	Negligible	42
	Night time (10.00pm–7.00am)	45	Negligible	35

4.3 Project Specific Noise Criteria

Typically, noise relating to the operation of Marinas primarily emanates from activities such as movements of watercraft at the wharf, low level maintenance works such as cleaning, small repairs and the use of the sewage pump out system. These activities are considered to be transient in nature and will have little impact on the existing amenity noise levels measured, nor influence the background noise levels. Therefore, it is appropriate to base the assessment of this development on intrusive noise criteria.

During the night time period, sleep disturbance is also assessed. Table 4-3 summarises the intrusiveness and sleep disturbance noise criteria for this development at the residences located at 3, Darling Island Road.

Table 4-3 Summary of Project Specific Noise Criteria

Location	Time Period	Intrusive Criteria $L_{Aeq,15min}$ (dBA)	Sleep Disturbance Criteria L_{Amax} (dBA)
3 Darling Island Rd	Daytime (7.00am-6.00pm)	53	-
	Evening (6.00pm-10.00pm)	51	-
	Night time (10.00pm-7.00am)	46	56
25 Pirrama Rd	Daytime (7.00am-6.00pm)	53	-
	Evening (6.00pm-10.00pm)	51	-
	Night time (10.00pm-7.00am)	46	56

5 OPERATIONAL NOISE ASSESSMENT

Wilkinson Murray has been advised of the likely activities at the expanded wharf, and our assessment has been based upon this advice.

5.1 Operational Activities

The noise sources associated with the marina operations have been identified as:

- marine vessels manoeuvring to and from the wharf;
- marine vessels engine idling for power generation;
- vehicle movements on the wharf apron;
- sewage pumping; and
- minor maintenance that includes cleaning using a gurney and the use of small hand tools.

Truck deliveries on the wharf apron for victualling of the commercial charter boats have not been included as they do not form part of the typical daily operations of the wharf.

Table 5-1 summarises the usage of the berths. At the time of writing, the exact number of broker storage berths was unknown and therefore it has been assumed that half of the smaller berths will be used by brokers for storage and the other half by private commercial vessels.

Table 5-1 Proposed Berth Usage in New Development

No. Off	Size	Function
9	28, 44, 45m	Large watercraft: Commercial Charter and Private Commercial
42	12, 15, 18m	Small watercraft: Private Commercial, Broker Storage

With the expansion of the marina it is expected that marine traffic in and out of the bay will increase. Where sufficient operational data is not available, a worst case scenario approach has been adopted. Table 5-2 shows a summary of expected operations. The different

scenarios represent typical operations during the assessment periods.

At the time of writing, the exact specifications of the sewage pump were not known. We have been advised that the pump will be encased in a concrete cell located under the wharf. In lieu of specific noise data, a worst case scenario has been considered using a typical noise level from Wilkinson Murray's database.

Sound power levels of operations with duration less than 15 minutes have been adjusted to take in account their contribution over a 15 minute period as follows.

- Small watercraft are expected to manoeuvre for ten minutes.
- Vehicle movement on the apron is expected to last three minutes.
- Use of hand tools, gurneys and sewage pumping is expected to last five minutes in every 15 minutes.

The $L_{Aeq,15minute}$ sound power levels of large watercraft have been calculated using measured sound pressure levels at the measurement locations. Sound power levels are adjusted for an average time of operation of 10 minutes per movement.

Table 5-2 Typical Operational Scenarios

Source	Duration of Occurrence / Movements in 15-min period	$L_{Aeq,15min}$ Sound Power Level, dBA	Maximum Sound Power Level L_{Amax}
Daytime Scenario 1			
Vehicle movement on apron	1 movement	65(1)	97(1)
Large Water craft docking/leaving Marina	1 movement	95(2)	112
Small Water craft docking/leaving Marina	2 movements	65(1) per movement	99(1)
Sewage pumping	Assumed continuous operation for 5 minutes in 15 minutes	60(1)	72(1)
Daytime Scenario 2			
Vehicle movement on apron	1 movement	65(1)	97(1)
Maintenance using small hand tool	Assumed continuous operation 5 minutes in 15 minutes	95(1)	107(1)
Sewage pumping	Assumed continuous operation for 5 minutes in 15 minutes	60(1)	72(1)
Large Water craft docking/leaving Marina	1 movement	95(2)	112
Small Water craft docking/leaving Marina	2 movements	65(1) per movement	99(1)
Gurney used to clean boat exterior	Assumed continuous operation for 5 minutes in 15 minutes	91(1)	103(1)
Typical Evening Scenario			
Large Water craft docking/leaving Marina	2 movements assumed	95(2) per movement	112
Small Water craft docking/leaving Marina	1 movement	65(1)	99(1)
Typical Night Time Scenario			
Large Water craft docking/leaving Marina	1 movement assumed	95(2)	112
Sewage Pumping	Assumed continuous operation for 5 minutes in 15 minutes	60(1)	72
Internal cleaning	Continuous	70(2)	86

Notes: (1) Typical levels from Wilkinson Murray's database have been used and adjusted for their duration over 15 minutes.
(2) Measurement data has been adjusted for distance and duration.

5.2 General Noise Assessment

Using the predicted noise levels in Table 5-2, overall noise levels were calculated at the receiver location based on worst case scenarios. Results are shown Table 5-3.

The predicted noise levels at the receiver have been calculated by summing the predicted sound power levels and then adjusting for distance to the receiver.

Noise source levels have been calculated using assumed distances to the receiver based upon the proposed wharf expansion plans. Operations which take place on the wharf apron such as vehicle movements, use of gurney, use of hand tools and sewage pumping are assumed to be 80m from 3, Darling Island Road and 160m from 25, Pirrama Road. Small watercraft are expected to operate at an average 30m from 3, Darling Island Road and 35m from 25, Pirrama Road. Large watercraft are expected to operate at an average of 70m from 3, Darling Island Road and 270m from 25, Pirrama Road. Commercial charter boats are expected to operate at an average of 110m from 3, Darling Island Road and 270m from 25, Pirrama Road.

Table 5-3 Predicted Noise Levels for Operations

Receiver	Scenario	Calculated $L_{Aeq,15min}$ Noise Level	Criterion $L_{Aeq,15min}$
3, Darling Island Rd	Day 1	50	53
	Day 2	53	53
	Evening	49	51
	Night	50	46
25, Pirrama Rd	Day 1	38	53
	Day 2	45	53
	Evening	41	51
	Night	38	46

The predicted levels comply with the criteria, except during the night time period at 3 Darling Island Road.

The dominating noise source during the night time is the movement of the large watercraft. This 15 minute night time scenario would occur typically two times over 15 minutes during the entire night time period (10.00pm-7.00am). During the rest of the assessment period no other wharf operations are expected. Therefore this scenario is not expected to cause a significant noise impact at the receiver.

5.3 Sleep Disturbance Assessment

Boat movements have been assessed against the screening sleep disturbance criterion, as summarised in Table 5-4. The criterion is exceeded by 7dBA at 3, Darling Island Road, and is not exceeded at 25, Pirrama Road. In this case, further analysis is required.

The *DECCW's "Environmental Criteria for Road Traffic Noise"* indicates that:

- *Maximum internal noise levels below 50-55dBA are unlikely to cause awakening reactions.*
- *One or two noise events per night, with maximum internal noise levels of 65-70dBA, are not likely to affect health and wellbeing significantly.*

If external windows are open, the difference between external and internal noise levels is approximately 10dBA, resulting in external levels below 60-65dBA being unlikely to cause awakening reactions. Hence, under the first of the points listed above, external maximum noise levels of 63dBA as indicated in Table 5-4 are considered unlikely to cause awakening reactions for residents. Given this, maximum night-time noise levels associated with this project are considered acceptable.

Table 5-4 Predicted Instantaneous Noise

Receiver	Scenario	Calculated Maximum Noise Level, L_{Amax}	Screening Criterion L_{Amax}
3, Darling Island Rd	Night	63	56
25, Pirrama Rd	Night	53	56

6 CONSTRUCTION NOISE

The applicable construction noise goals for this project are contained in the DECCW's *Interim Construction Noise Guideline*. For construction work during standard hours (Monday to Friday 7.00am-6.00pm and Saturdays 8.00am-1.00pm), a noise management level ($L_{Aeq,15minute}$) of RBL + 10dBA applies for residential receivers. This is aimed to represent the level above which there may be some community reaction to construction noise.

Wilkinson Murray has been advised of the following construction stages.

- Stage 1: Piles are either delivered by truck and then stored on the quayside or delivered by barge and tethered to the quayside
- Stage 2: Bored Piling by floating rig to last 10 weeks.
- Stage 3: The pontoons that have been fabricated off site are delivered by barge and floated into place using a crane.
- Stage 4: Connections are made to existing services for electricity, water and sewer pumping.
- Stage 5: Final fit out of service bollards on floating pontoons.

The construction is scheduled to take place on both the east and west side of the wharf. The construction noise from both sides of the wharf has been assessed at the residential receivers.

Construction is expected to take three months to complete, two months on the east side and one month on the west side. The piling is expected to last for ten weeks and the fit out and pontoon attachment will take the remaining two weeks. The construction work is expected to take place during standard hours on weekdays and Saturdays.

The assessment has been made for each stage over a 15 minute period. A worst case scenario has been assumed in order to make a conservative assessment. The construction stages are identical for both sides of the wharf.

The method of delivery of piles in Stage 1 is yet to be confirmed; therefore, two delivery options have been presented.

Stage 2 is assessed using a range of distances that the piling will take place from the residential receiver and a range of predicted noise levels have been calculated. As a worst case scenario the craning of the piles into place has been assumed to happen in the same assessment period as piling.

Stage 3 is assessed using a range of distances where the pontoons will be craned into the water and fixed to the piles. The pontoons will be bolted to the piles and use of a hand held drill or similar has been assumed for this process.

Stages 4 and 5 are expected to involve the use of a hand held drill or similar in order to make connections to services and fit out the pontoons.

Table 6-1 presents a summary of the equipment that will be used during construction and noise levels taken as typical levels from the Wilkinson Murray database.

Construction noise criteria and predicted levels are summarised in Table 6-2.

Table 6-1 Construction Equipment Noise Level Summary

Equipment	Sound Power Level, dBA
Bored Piles	117
Delivery Truck	109
Barge	110
Crane	112
Hand Held Drill	98

Table 6-2 Construction Noise Assessment

Construction Stage	Criteria $L_{Aeq,15min}$	Noise Level at Receiver $L_{Aeq,15min}$			
		East Wharf Construction		West Wharf Construction	
		3, Darling Island Rd	25, Pirrama Rd	3, Darling Island Road	25, Pirrama Rd
Stage 1, Option 1 – pile delivery	58	67	68	>20	56
Stage 1, Option 2 – pile delivery	58	73	61	>20	41
Stage 2 – piling & craning	58	83-69	80-60	>20	48-37
Stage 3 – pontoon placement	58	79-65	72-56	>20	38-33
Stage 4 – services	58	60	61	>20	21
Stage 5 – bollards	58	60	61	>20	21

Construction noise from the west wharf will comply with the criteria at the residential receivers at 25, Pirrama Road. The construction on the west wharf will have no significant noise impact on the receivers at 3, Darling Island Road.

Where the predicted construction noise levels exceed relevant criteria, the guidelines suggest the following:

- the proponent should apply all feasible and reasonable work practices to meet the noise affected level; and
- the proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

Where $L_{Aeq,15minute}$ construction noise levels are predicted to exceed 75dBA during Stages 2 and 3, the relevant authority (consent, determining or regulatory) may require respite periods to be observed. This may include restricting the hours that the very noisy activities can occur, taking into account:

- times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences); and

- if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Given that construction is expected to last only three months and will be limited to daytime, the impact on nearby residents is not expected to be substantial.

7 CONCLUSION

A noise assessment has been carried out to investigate the noise impacts of the proposed expansion of the marina at Jones Bay Wharf.

Operational noise criteria have been set and predicted operational noise levels were assessed against these criteria. The operational noise levels arising from the proposed development during the day and evening are expected to comply with the criteria. During the night time the exceedance of the criteria is not expected to cause a significant noise impact, given the frequency of occurrence is low.

Construction noise levels were predicted and assessed against the criteria. The predicted levels exceeded the criteria at 3, Darling Island Road for construction on the east side of the wharf. Action is required as prescribed by the relevant guidelines. The criteria were met for all other construction scenarios.

Version	Status	Date	Prepared by	Checked by
A	Draft	6 August 2010	Chris Marsh	Barry Murray
B	Final	13 September 2010	Chris Marsh	Rob Bullen

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

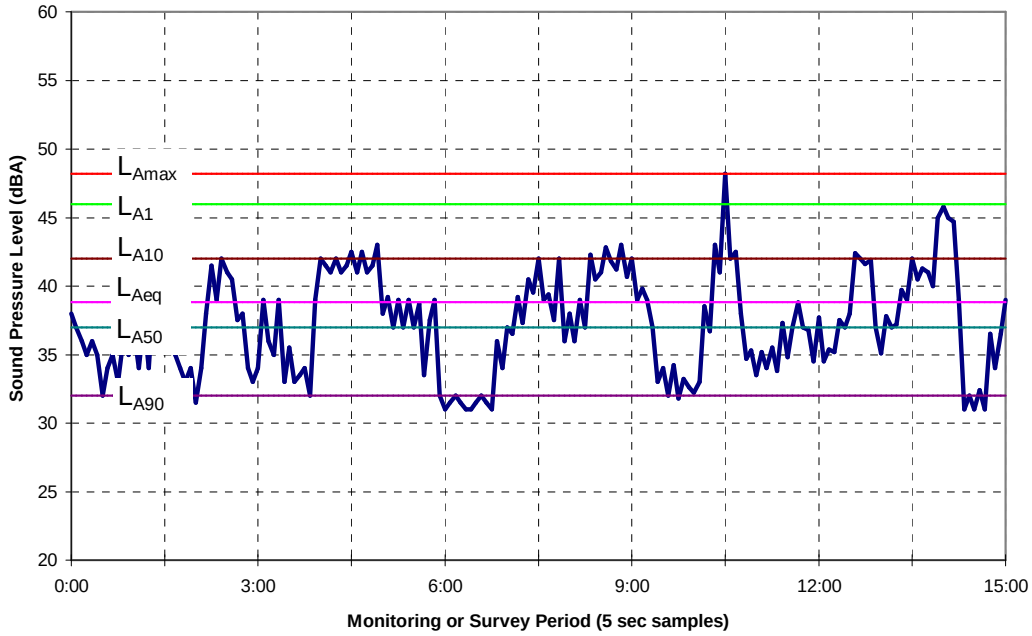
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

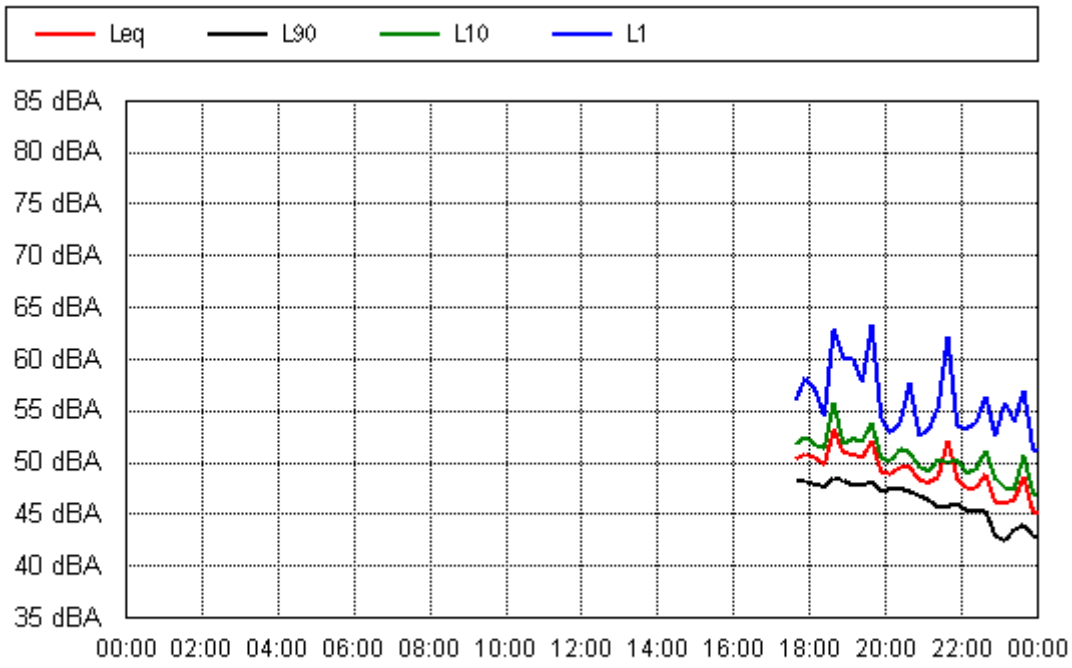
RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

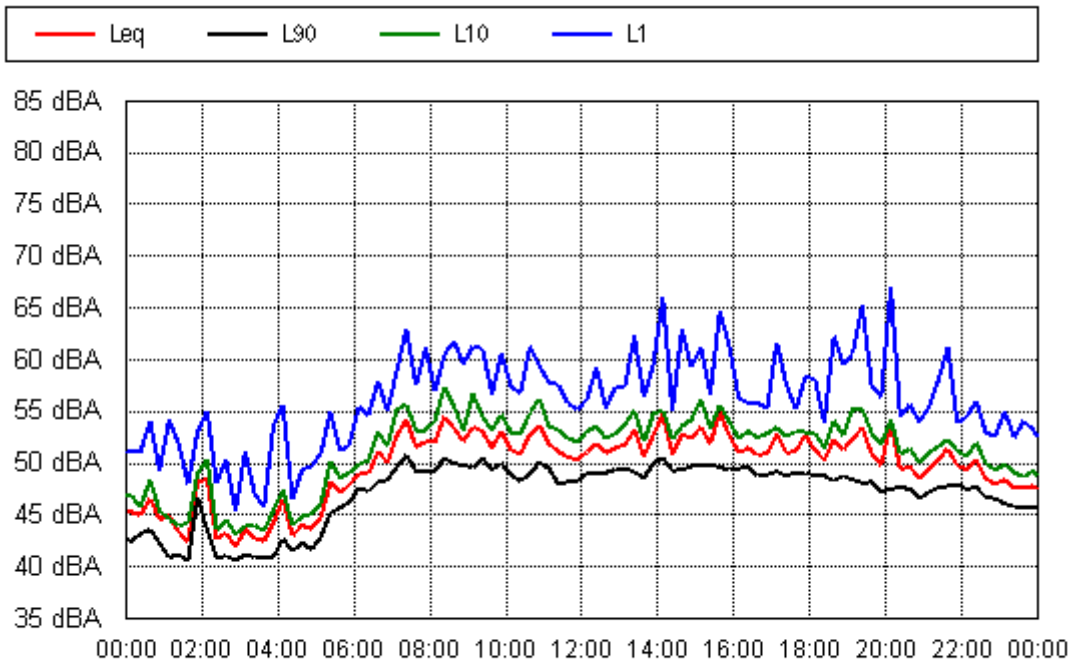
APPENDIX B

NOISE MEASUREMENT RESULTS

Project: Jones Bay
Location: REVY Building
Filter: A

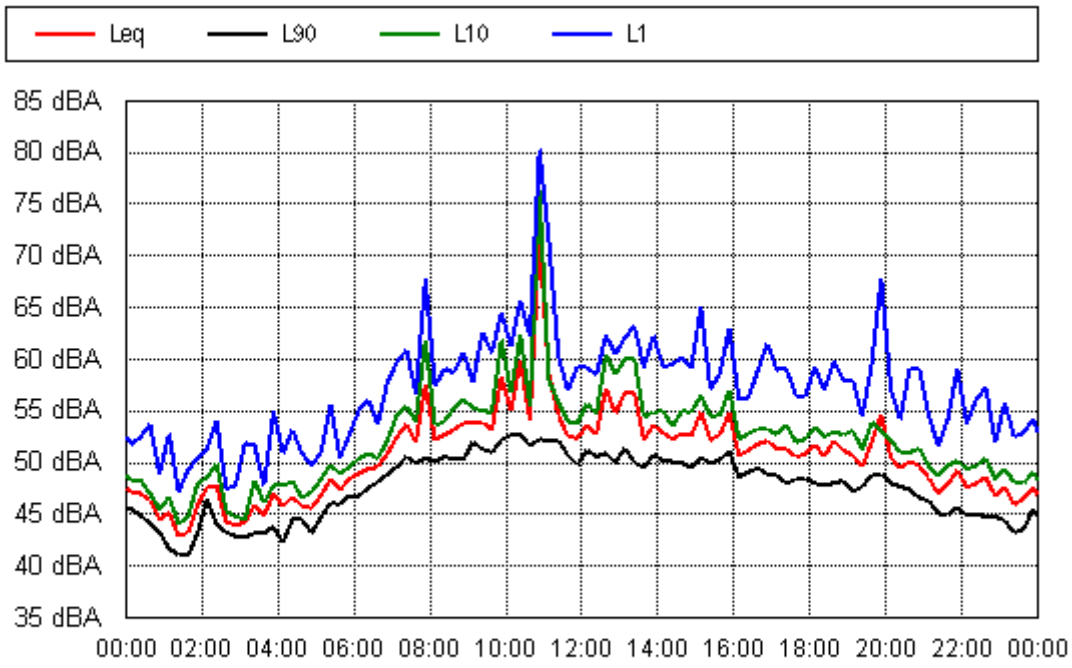


Tue 15 Jun 2010

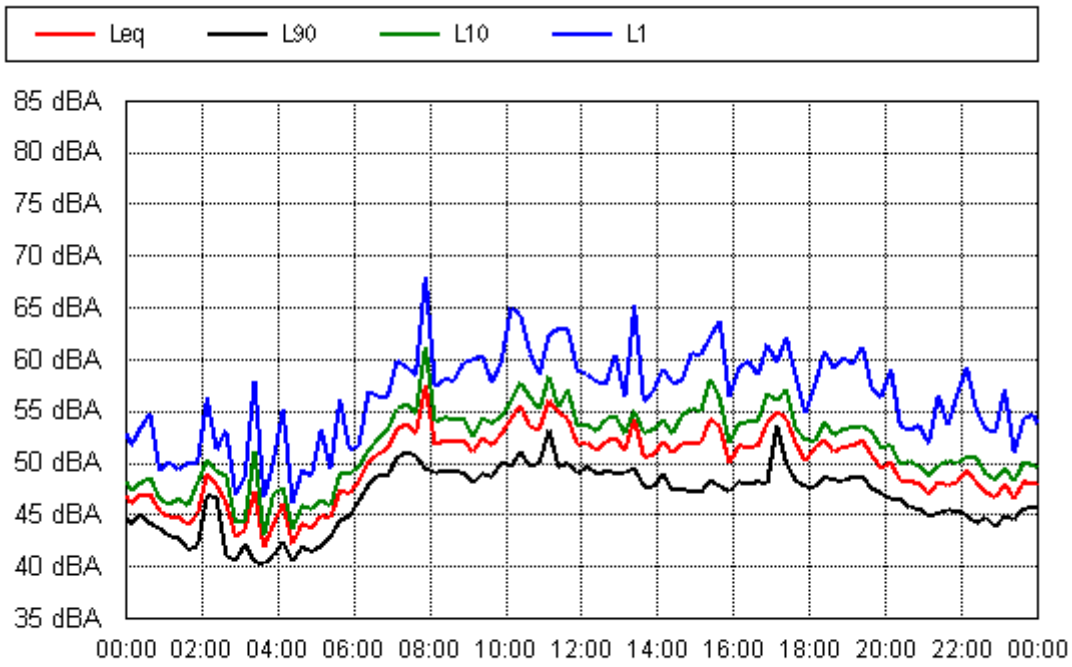


Wed 16 Jun 2010

Project: Jones Bay
Location: REVY Building
Filter: A

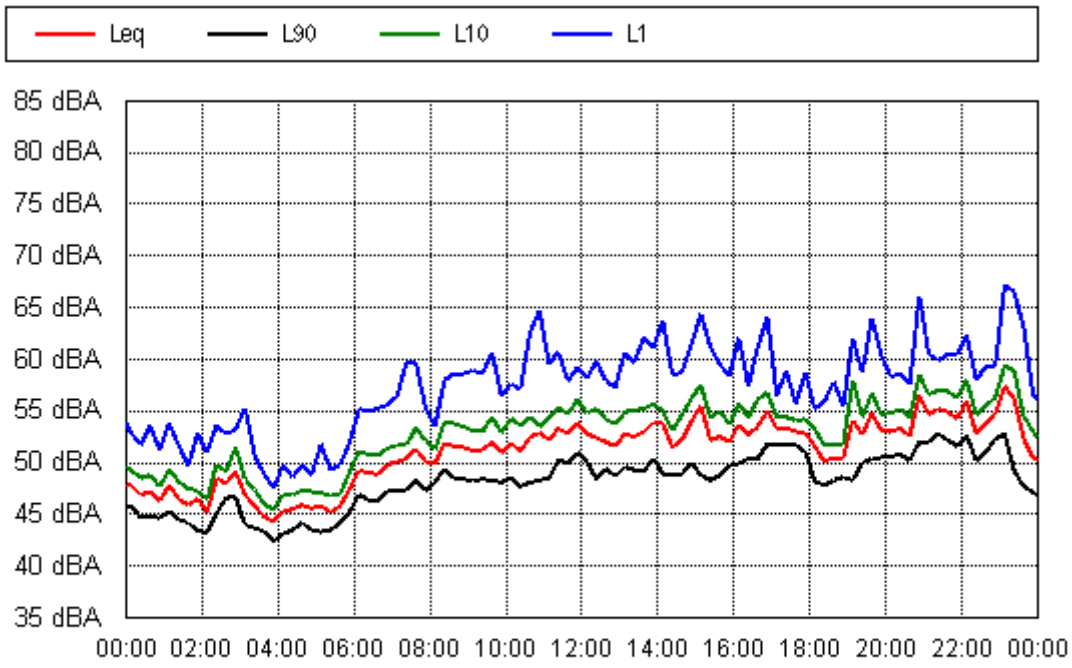


Thu 17 Jun 2010

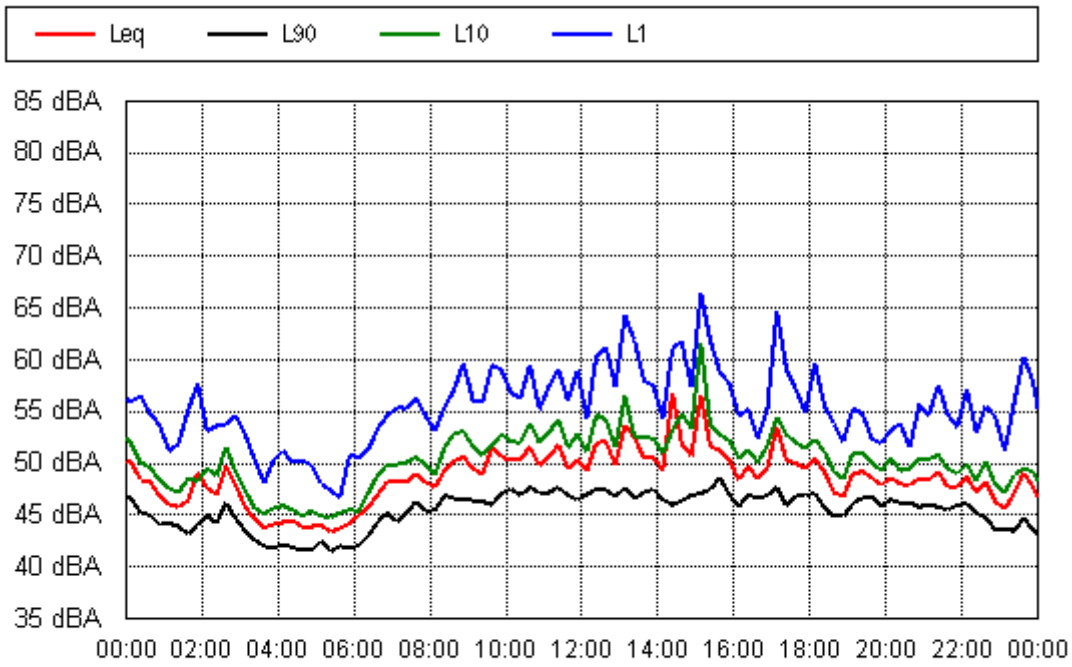


Fri 18 Jun 2010

Project: Jones Bay
Location: REVY Building
Filter: A

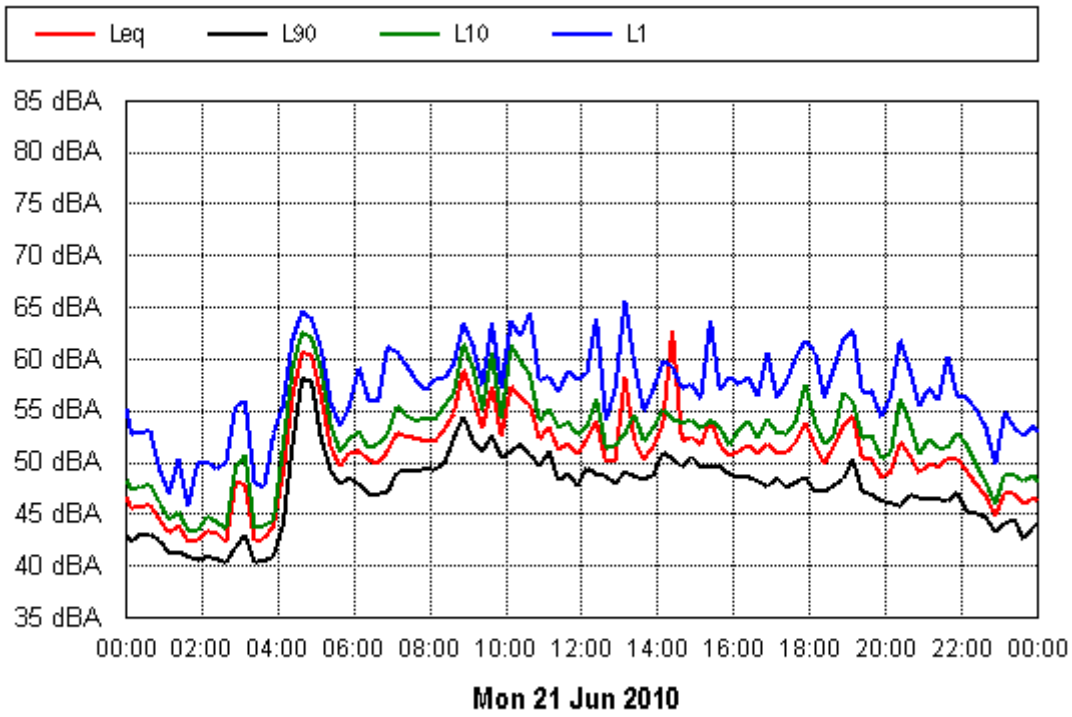


Sat 19 Jun 2010

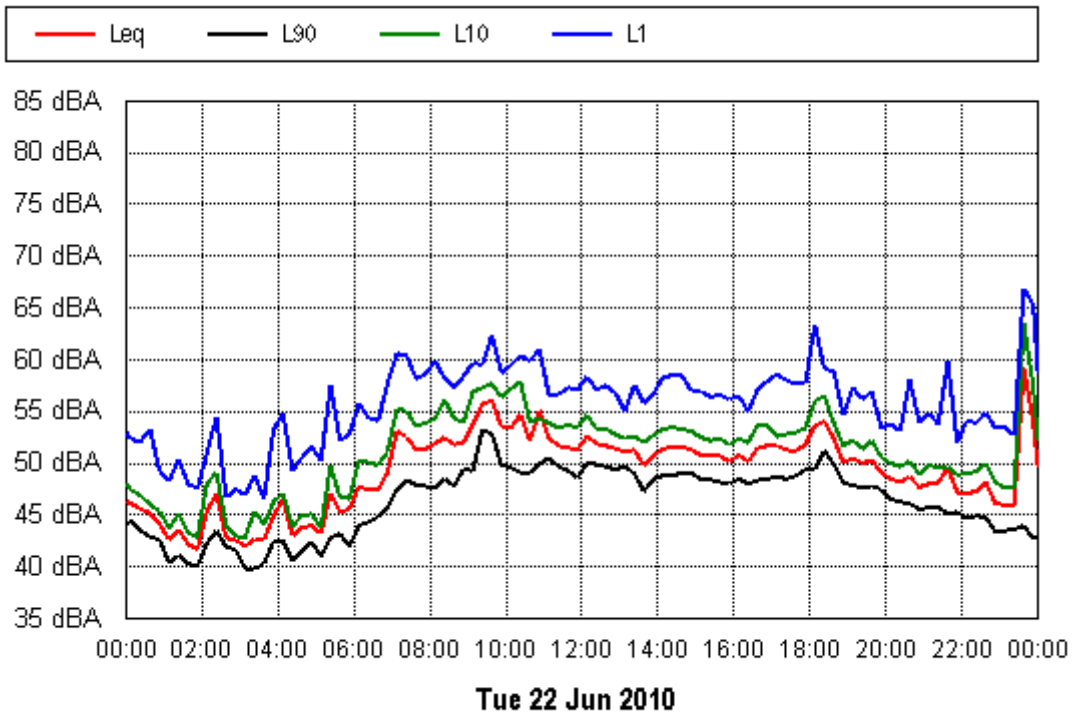


Sun 20 Jun 2010

Project: Jones Bay
Location: REVY Building
Filter: A

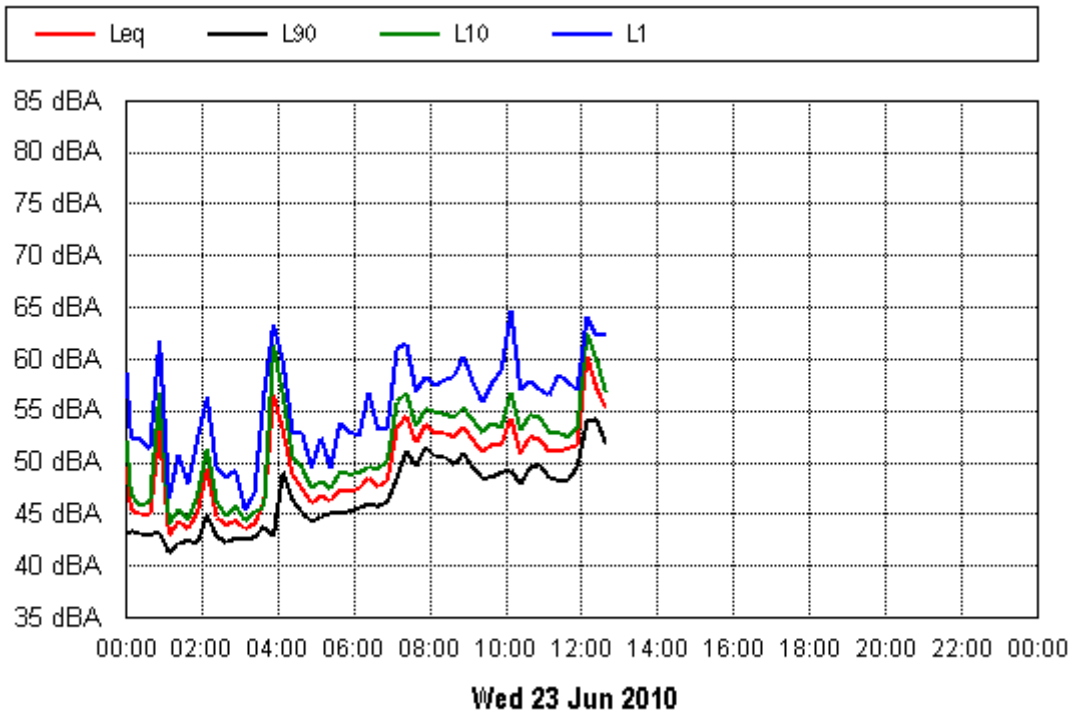


Mon 21 Jun 2010



Tue 22 Jun 2010

Project: Jones Bay
Location: REVY Building
Filter: A



Project: Jones Bay
Location: REVY Building
Filter: A

Noise Descriptor	Calculation Method	Date	Period		
			Day	Evening	Night
L_{eq}	**10% Exceedance**	14 Jun 2010			
		15 Jun 2010	50.8	52.1	49.1
		16 Jun 2010	53.6	52.9	49.5
		17 Jun 2010	57.5	52.1	49.6
		18 Jun 2010	54.7	52.0	49.1
		19 Jun 2010	53.9	55.6	53.3
		20 Jun 2010	52.4	49.2	54.7
		21 Jun 2010	57.1	52.8	47.6
		22 Jun 2010	53.7	51.5	53.4
		23 Jun 2010	54.5		
		All	54.8	53.5	50.6
	L_{eq} Period	14 Jun 2010			
		15 Jun 2010	50.6	50.2	46.9
		16 Jun 2010	52.4	51.1	47.6
		17 Jun 2010	58.0	50.5	47.3
		18 Jun 2010	53.0	50.0	47.3
		19 Jun 2010	52.6	53.9	49.6
		20 Jun 2010	51.1	48.3	51.5
		21 Jun 2010	54.3	50.9	46.1
		22 Jun 2010	52.2	49.8	49.9
		23 Jun 2010	53.7		
		All	54.0	50.9	48.6
L_{90}	**ABL/RBL**	14 Jun 2010			
		15 Jun 2010	48.2	45.8	40.9
		16 Jun 2010	48.7	47.3	42.6
		17 Jun 2010	48.8	45.0	40.9
		18 Jun 2010	47.6	45.1	43.4
		19 Jun 2010	48.1	48.3	41.8
		20 Jun 2010	45.8	45.2	40.7
		21 Jun 2010	48.1	46.0	40.3
		22 Jun 2010	47.8	45.2	42.4
		23 Jun 2010	48.3		
		RBL	48.1	45.5	41.4
	90% Exceedance	14 Jun 2010			
		15 Jun 2010	48.2	45.8	40.9
		16 Jun 2010	48.7	47.3	42.6
		17 Jun 2010	48.8	45.0	40.9
		18 Jun 2010	47.6	45.1	43.4
		19 Jun 2010	48.1	48.3	41.8
		20 Jun 2010	45.8	45.2	40.7
		21 Jun 2010	48.1	46.0	40.3
		22 Jun 2010	47.8	45.2	42.4
		23 Jun 2010	48.3		
		All	47.1	45.4	41.1
L_1	**10% Exceedance**	14 Jun 2010			
		15 Jun 2010	58.0	62.6	56.1
		16 Jun 2010	62.2	63.8	55.8
		17 Jun 2010	64.9	59.7	56.7
		18 Jun 2010	63.6	60.5	55.3
		19 Jun 2010	62.5	63.2	59.3
		20 Jun 2010	61.8	56.5	61.2
		21 Jun 2010	63.6	61.9	55.5

Noise Descriptor	Calculation Method	Date	Period		
			Day	Evening	Night
		22 Jun 2010	60.3	59.0	61.5
		23 Jun 2010	62.2		
		10% of Days	64.2	63.3	61.3
	L_{eq} Period	14 Jun 2010			
		15 Jun 2010	57.2	58.5	53.5
		16 Jun 2010	59.8	60.3	53.4
		17 Jun 2010	66.0	59.5	53.9
		18 Jun 2010	60.9	57.9	53.1
		19 Jun 2010	60.0	60.8	57.5
		20 Jun 2010	59.1	54.6	57.2
		21 Jun 2010	60.1	58.7	53.3
		22 Jun 2010	58.3	56.3	57.4
		23 Jun 2010	59.6		
		Leq of Days	61.2	58.7	55.4
L_1	10% Exceedance	14 Jun 2010			
		15 Jun 2010	52.4	53.1	51.0
		16 Jun 2010	55.7	54.7	50.7
		17 Jun 2010	60.3	53.1	51.3
		18 Jun 2010	57.1	53.6	51.0
		19 Jun 2010	56.0	58.0	55.1
		20 Jun 2010	54.4	51.0	57.3
		21 Jun 2010	59.0	56.1	50.0
		22 Jun 2010	56.8	53.1	56.7
		23 Jun 2010	56.8		
		All	56.8	55.5	52.2
	L_{eq} Period	14 Jun 2010			
		15 Jun 2010	52.2	51.5	48.5
		16 Jun 2010	54.1	52.6	49.0
		17 Jun 2010	61.5	51.7	49.0
		18 Jun 2010	55.3	51.7	48.9
		19 Jun 2010	54.5	55.9	51.5
		20 Jun 2010	53.2	50.0	53.5
		21 Jun 2010	55.7	53.2	47.9
		22 Jun 2010	54.2	51.5	53.1
		23 Jun 2010	55.8		
		All	56.5	52.6	50.7