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technical report

CLEARY BROS. (BOMBO) PTY LTD
GERROA SAND RESOURCE
EXTENSION OF NORTHERN EXTRACTION AREA

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

TC059-01F02 (REV2) NOISE ASSESSMENT REPORT.DOC

September 2005

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SUMMARY

Renzo Tonin & Associates has conducted an environmental noise impact assessment of the proposed expansion to sand dredging activities at Gerroa by Cleary Bros (Bombo) Pty Ltd. The findings of this assessment are summarised below:

- Noise impact from the proposed extension upon the potentially most affected noise sensitive residential and recreational receivers, is expected to comply with the noise guidelines set by the DEC for industrial noise. Compliance with the guidelines is expected under both calm isothermal and adverse wind conditions.

- No noise mitigation measures for on site activities were deemed necessary for the proposed expansion.

- Noise levels to residences from truck traffic from the development on public roads are expected to be within 1dB(A) of existing traffic levels and therefore comply with the traffic noise criteria stipulated in the NSW ECRTN.

- No noise mitigation measures for traffic noise were deemed necessary for the proposed expansion.

1. INTRODUCTION

Renzo Tonin & Associates were engaged to conduct an environmental noise impact assessment of the proposed expansion of the existing sand dredging activities at Gerroa operated by Cleary Bros (Bombo) Pty Ltd. The key activities assessed in this study are extraction plant and activity noise from the site, as well as transportation truck noise whilst trucks are on site and whilst travelling on public roads.

This report summarises the results of noise monitoring undertaken over 7 days near potentially affected residential premises near the site, and short term attended measurements carried out at a number of representative locations to determine existing background and ambient noise and existing road traffic noise levels.

Noise emissions from the proposed extended operations of the Gerroa sand mine are calculated at the potentially most affected neighbouring residences. Noise emission calculations are then assessed against the relevant noise criteria, in accordance with the requirements of the NSW Department of Environment and Conservation (DEC, ex Environment Protection Authority), including:

- NSW Industrial Noise Policy (INP);
- NSW Environmental Criteria for Road Traffic Noise (ECRTN); and

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2. PROJECT DESCRIPTION

2.1. BACKGROUND INFORMATION

In 1990 the Land & Environment Court issued Development Consent for the extraction of sand to be extended to the north. However, this approval had expired in December 2003 and the approved area was not fully extracted when the approval expired. A further consent was issued in September 2003 for a limited area of extraction.

An extension to the sand extraction area at Gerroa is proposed as the sand resource at the existing extraction facility is almost exhausted. It is proposed to continue the recent rate of extraction, whereby the company extracts sand from the Gerroa resource at a sufficient rate to maintain its stockpiles to satisfy variable market demand. There is no change proposed to the method of operation.

2.2. PROPOSAL

It is proposed to essentially continue the same extraction operations, with the exception of the following minor changes:

- Extend the sand quarry in a northerly direction within the company's property
- Construct earth mounds as required to create a visual barrier along the roadside and to prevent inundation along the creek side and stabilise with vegetation
- Extend vehicle access along the western edge of the extraction area, utilising the flood barrier.

2.3. SITE DESCRIPTION

The sand extraction operation is located approximately four (4) kilometres south of Gerroa along Gerroa Road, with access to the site off Beach Road (see Figure 1).

The site is split into two local government jurisdictions – City of Shoalhaven to the south and the Municipality of Kiama to the north. Whilst the proposed extraction operation is contained within the Kiama Municipality area, there are associated operations such as screening, stockpiling, administration and transportation which are undertaken within the City of Shoalhaven Council area.

Rural-residential lots largely occupy land to the south, south west and north west of the site. The Seven Mile Beach Holiday Park is located to the north of the site, while recreational areas (bbq and picnic) are located to the east as part of the Seven Mile Beach National Park.

The nearest affected residential locations were identified as:

- **R1** **670 Beach Road**
  Rural residential property located approx. 500 metres south of the quarry and directly opposite the access road to the quarry. This location is representative of the most affected residences along Beach Road directly to the south of the quarry.
- **R2** **11 Banggarai Street**
  Rural residential property located approx. 750 metres south west of the quarry. This location is representative of the most affected residences on Banggarai Street, Coollaroo Place and Beach Road to the south west of the quarry.

- **R3** **Seven Mile Beach Holiday Park**
  Caravan park located approx. 1500 metres north of the quarry. This location is representative of the most affected residences to the north of the quarry.

- **R4** **Coralea Property**
  Rural residential property located approx. 850 metres north west of the quarry. This location is representative of the most affected residences to the north west of the quarry.

Sensitive receivers identified as being potentially affected by the operation of the quarry include:

- **R5** **Picnic Area 1**
  Recreational area located within the Seven Mile Beach National Park approx. 780 metres north east of the quarry.

- **R6** **Picnic Area 2**
  Recreational area located within the Seven Mile Beach National Park approx. 710 metres south east of the quarry.

Trucks and other vehicles will access the site via a private sealed road located off Beach Road, on the southern side of the site and approximately 300m west of the intersection of Beach Road and Gerroa Road. The sealed access road is two lanes in width and leads directly into the quarry operations area from Beach Road. All vehicles must enter and leave the site via this access.

The route followed by north-bound trucks is north along Gerroa Road, across the Crooked River Bridge onto Fern Street via Gerroa and travel up a steep hill to the nearby town of Gerringong. At Gerringong the trucks will turn off Fern Street into Belinda Street to reach the Princes Highway and then generally head north towards Kiama.

The route followed by trucks that are south-bound is along Beach Road which leads to the Princes Highway. Once at the highway, the trucks will generally turn south and head for either Berry or Nowra.

Figure 1 provides details of the site, critical receivers and measurement locations.

2.4. HOURS OF OPERATION

The proposed hours of operation are identical to those of the current approved operation. That is, from 7am to 6pm Monday to Friday and 7am to 1pm Saturdays.

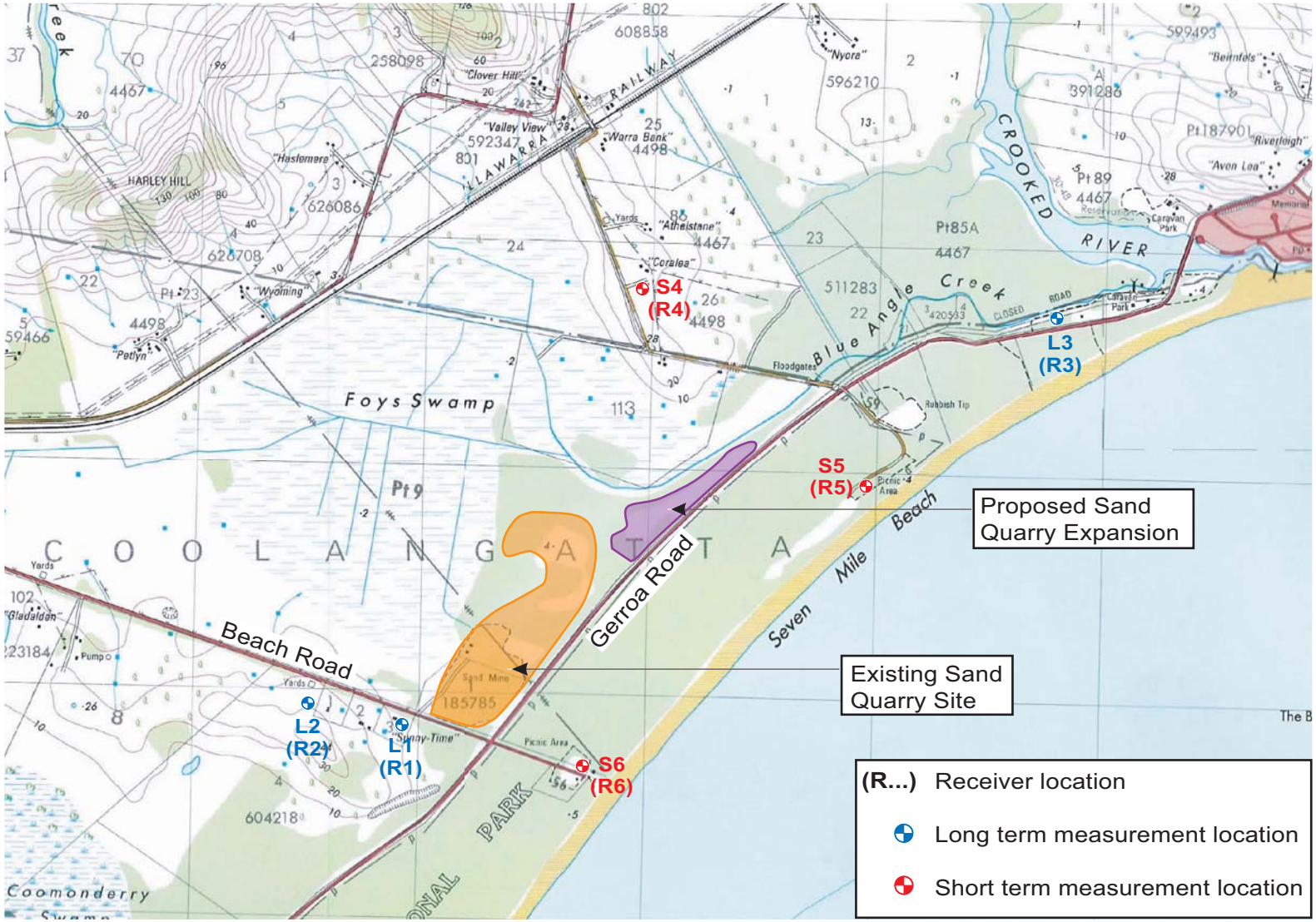
The site is closed on Sundays, public holidays and for an extended period over the Christmas to New Year break.

2.5. NOISE ISSUES

It is anticipated that noise from the proposed extension will essentially emanate from the two main sources, outlined below.

- *Operational noise* from general operations at the site, including:
  - Intermittent noise from vehicle movement (trucks and cars) on site;
  - Intermittent noise from extraction activities including loading, dredging, sorting and excavating.

- *Road traffic noise* from truck movements associated with the development on site and on public roads. Trucks will enter and exit the site from the sealed access road, which intersects Beach Road.



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Title : Figure 1 - Site Layout and Measurement Locations

Date : 23/08/05

Scale: NTS

Project: Cleary Bros EIS

Ref : TC059-01P01 (rev 0)

3. EXISTING ACOUSTIC ENVIRONMENT

Background noise varies over the course of any 24 hour period, typically from a minimum at 3am in the morning to a maximum during morning and afternoon traffic peak hours. Thus, the NSW INP requires that the level of background and ambient noise be assessed separately for the daytime, evening and night-time periods. The INP defines these periods as follows:

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Traffic noise levels are assessed separately for daytime and night time periods, defined by the NSW ECRTN as follows:

- **Day** is defined as 7:00am to 10:00pm;
- **Night** is defined as 10:00pm to 7:00am.

Given that operation of the quarry is to take place during daytime hours only, then daytime background and ambient noise levels are required for the purpose of this assessment.

3.1. NOISE MONITORING LOCATIONS

Long term unattended and short term attended noise measurements were taken at the nearest or potentially most affected residential and sensitive locations. Measurement locations are shown in Figure 1 and were as follows:

- **Location L1** **670 Beach Road**
  Long term unattended noise monitoring. Noise monitor located on northern side of property facing Beach Road. Noise environment dominated by intermittent traffic noise from Beach Road, natural sounds and distant wave noise from Seven Mile Beach. Same location as Receiver R1.
- **Location L2** **11 Banggarai Street**
  Long term unattended noise monitoring. Noise monitor located on northern side of property facing Beach Road. Noise environment dominated by intermittent traffic noise from Beach Road, natural sounds and distant wave noise from Seven Mile Beach. Same location as Receiver R2.
- **Location L3** **Seven Mile Beach Holiday Park**
  Long term unattended noise monitoring. Noise monitor located on southern side of property adjacent to Gerroa Road. Noise environment dominated by intermittent traffic noise from Gerroa Road, natural sounds and distant wave noise from Seven Mile Beach. Same location as Receiver R3.
- **Location S4** **Coralea Property**
  Short term measurements taken on the southern side of the property in front of the driveway entrance. Noise environment dominated by natural sounds. Same location as Receiver R4.

- **Location S5** **Picnic Area 1**
  Short term attended measurements taken at the centre of the picnic area. Noise environment dominated by natural sounds and wave noise from Seven Mile Beach. Same location as Receiver R5.

- **Location S6** **Picnic Area 2**
  Short term attended measurements taken at the centre of the picnic area. Noise environment dominated by natural sounds and wave noise from Seven Mile Beach. Same location as Receiver R6.

To quantify the existing ambient noise environment, long-term (unattended) noise monitoring was conducted over eight (8) days, between Friday 5th to Friday 12th August, 2005. Short term attended noise measurements were conducted on Friday 5th and Friday 12th August 2005. Figure 1 shows the long term and short term monitoring locations.

Appendix B of this report details the noise monitoring methodology. The graphical recorded output from long term noise monitoring is included in Appendix C. The graphs in Appendix C were analysed to determine a single assessment background level (ABL) for each day, evening and night period, in accordance with the NSW DEC's 'Industrial Noise Policy'.

In order to assess existing traffic noise, $L_{Aeq(15hr)}$ and $L_{Aeq(9hr)}$ traffic noise descriptors were measured as suited for arterial roads and $L_{Aeq(1hr)}$ were measured as suited for collector and local roads.

3.2. EXISTING BACKGROUND & AMBIENT NOISE LEVELS

Existing background and ambient noise levels are presented in Table 3.1 below.

The noise measurements were conducted outdoors in the free-field (ie away from building facades) at all locations. Table 3.1 presents a summary of representative daytime L_{A90} background and L_{Aeq} ambient noise levels for each of the locations listed above. Operational noise from plant and equipment should be assessed away from the facade at the potentially most affected residential boundary and therefore the representative noise levels listed in Table 3.1 are directly applicable.

The representative noise levels presented for the short term locations S4, S5 and S6 are levels measured over a 15 minute period during the daytime period.

Table 3.1 – Measured Daytime Rating Background Level (RBL) & Ambient (L_{eq}) Noise Levels, dB(A)

Noise Monitoring Location	Day L_{A90} Background	Day L_{Aeq} Ambient
L1 670 Beach Road	39	51
L2 11 Banggarai Street	36	54
L3 Seven Mile Beach Holiday Park	43	59
S4 Coralea Property	39	41
S5 Picnic Area 1	48	49
S6 Picnic Area 2	46	48

During the short term unattended measurements at Locations S5 and S6 it was observed that the noise environment was dominated by wave noise from Seven Mile Beach. Existing noise from plant and equipment at the sand quarry was inaudible at both locations.

Locations L1, L2 and L3 were also observed to be the most affected receivers to traffic noise levels. Therefore, existing traffic noise levels were measured at these locations and presented in Table 3.2. The NSW ECRTN stipulates that traffic noise is assessed over the day and night periods. The day period is defined as the period from 7am to 10pm and the night period is defined as the period from 10pm to 7am. However, given that the operation of the quarry will only occur during the day period as stipulated in the NSW ECRTN, only noise levels for the day period are presented and assessed.

Table 3.2 – Measured Existing Daytime Road Traffic ($L_{eq,15hr}$) Noise Levels

Receiver Location	Road Traffic Noise Source	Distance from Road	$L_{eq,15hr}$ Traffic Noise Levels, dB(A)
L1 – 670 Beach Rd	Beach Road	Approx. 50m	53
L2 – 11 Banggarai St		Approx. 50m	56
L3 – Seven Mile Beach Holiday Park	Gerroa Road	Approx. 30m	62

4. ACOUSTIC CRITERIA

4.1 SITE NOISE

Noise impact from the general operation of the quarry is assessed against the NSW Industrial Noise Policy (INP). The assessment procedure in terms of the INP has two components:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for particular land uses for residences and other land uses.

In accordance with the INP, noise impact should be assessed in terms of both intrusiveness and amenity.

4.1.1 Intrusiveness Criteria

According to the NSW INP, the intrusiveness of a mechanical noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level measured in the absence of the source by more than 5dB(A). It is noted that this is applicable to residential properties only.

Therefore, the intrusiveness criterion for residential noise receptors as summarised in the INP is as follows:

$L_{Aeq,\ 15\ minute}$ ≤ Rating Background Level (L_{A90}) + 5 dB(A)

The intrusiveness criteria for the potentially most affected locations are presented below:

Table 4.1 – Intrusiveness Noise Criteria, dB(A)

Receiver	Intrusiveness Criteria $L_{Aeq,15min}$
R1 – 670 Beach Rd	39 + 5 = **44**
R2 – 11 Banggarai St	36 + 5 = **41**
R3 – Seven Mile Beach Holiday Park	43 + 5 = **48**
R4 – Coralea Property	39 + 5 = **44**

4.1.2 Amenity Criteria

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the NSW INP, the applicable parts of which are reproduced below.

Nearby critical receivers consists of residential properties situated in a rural area and recreational areas. Based on the nature of these receivers, the amenity criteria (L_{Aeq}) for rural residential properties and recreational areas will be applied.

Table 4.2 – Amenity Noise Criteria

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Maximum
Residence	Rural	Day	50	55
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55

Notes: 1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. Only the day period is assessed as operating hours for the site only occur during the day.

Since the aim of the project is for the expansion of the quarry, the existing measured noise levels at nearby residential properties were affected from current operations of the site. As previously mentioned, noise due to the current operations of the site was inaudible at the recreational areas (Receivers R5 and R6). By applying Table 2.2 of the NSW INP for modification to the acceptable noise level to account for existing levels of industrial noise, the applicable amenity criteria are:

Table 4.3 – Modified Amenity Noise Criteria based on Table 2.2 of NSW INP

Receiver	Modified L_{Aeq} Amenity Criteria, dB(A)
R1 – 670 Beach Road	$\leq$ 50 – 8 = **42**
R2 – 11 Banggarai Street	$\leq$ 54 – 10 = **44**
R3 – Seven Mile Beach Holiday Park	$\leq$ 59 – 10 = **49**
R4 – Coralea Property	**50**

4.1.3 Summary

In assessing noise impact of industrial noise sources, both components must be taken into account for residential receivers. In most cases, only one will become the limiting criterion and form the **project specific noise levels** (PSNLs) for the noise source.

The applicable PSNLs (including intrusive and amenity criteria) are presented in the table below. The day period is only considered as the hours of operation only occur during this period.

Table 4.4 – INP Project Specific Noise Levels, dB(A)

Receiver	Intrusiveness Criteria $L_{Aeq,15min}$	Amenity Criteria $L_{Aeq,period}$
R1 – 670 Beach Road	44	**42**
R2 – 11 Banggarai Street	**41**	44
R3 – Seven Mile Beach Holiday Park	**48**	49
R4 – Coralea Property	**44**	50
R5 – Picnic Area 1	-	**50**
R6 – Picnic Area 2	-	**50**

*Note: 1. PSNLs are in **bold**. Intrusiveness criteria not applicable for R5 and R6 as these are not residential receivers.*

The above table shows that the limiting criterion is the intrusiveness criterion for Receivers R2, R3 and R4, while the Amenity criterion is applicable for the other receivers.

4.2 TRAFFIC NOISE

The NSW Environmental Criteria for Road Traffic Noise (ECRTN) policy is used to assess the potential traffic noise impact from the site. Table 1 of the ECRTN – 'Road Traffic Noise Criteria for Proposed Road or Residential Land Use Developments' divides land use developments into different categories and lists the respective criteria for each case.

Gerroa Road is categorised as a 'collector' road as it collects local traffic leaving nearby local areas and connects to a major arterial road (Princes Highway), while Beach Road is categorised as a 'local' road as it is situated in a rural area and handles local traffic with characteristically intermittent traffic flows.

Table 4.5 – Road Traffic Noise Criteria

Type of Development	Day 7am – 10pm	Night 10pm – 7am
8. Land use developments with potential to create additional traffic on collector road	$L_{Aeq(1hr)}$60	$L_{Aeq(1hr)}$55
13. Land use developments with potential to create additional traffic on local roads	$L_{Aeq(1hr)}$55	$L_{Aeq(1hr)}$50

According to the guidelines, where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB(A).

We consider it is not feasible or practicable to implement noise mitigation measures such as noise barriers or other road-side treatments to reduce traffic noise to residences along Gerroa Road and along Beach Road. This is because:

- the areas along these two roads are already developed in parts, restricting the possibility for either moving the roads further from dwellings and/or changing the land-use of the area, especially as such measures are not in the applicant's control,
- the construction of noise barriers would cause access difficulties to driveways for local residences located along the roads,
- traffic calming devices (ie roundabouts, chicanes, speed humps etc) would affect total noise levels, but are not in the applicant's control, and
- no alternative routes exist for sand to be transported from the site without driving by residential dwellings.

Therefore, for assessment purposes, traffic arising from the quarry should be limited to an increase in existing noise levels of no more than 2dB(A) in any hour during the quarry's normal operation.

5. NOISE SOURCES

5.1 EXTRACTION OPERATION SOURCES

A bulldozer (CAT D6), an excavator (CAT 235C) and a rubber tyred loader (CAT 966C) is to be used for the sand extraction process. The bulldozer will also be used to from time to time to clear vegetation or when the edge of the pond needs to be shaped for revegetation.

The proposal is to continue to use the same wet extraction or dredging method as is currently being used on site.

Wet extraction is carried out below the water table using a suction dredge to draw sand to a maximum depth of 8m. The dredge is connected via a pipeline to a wet sorter, which acts as a screen, sorting the sand from other coarser materials. This pipe line may be up to 1km long and it is usual that the wet sorter remains at one location throughout the entire extraction operation within an area.

The extracted sand and material is stockpiled at the process area, screened and transported. The stockpiles are maintained with a bulldozer (CAT D6) and a water cart, as necessary, for dust suppression.

A dry sorter is located on the site; however, this plant equipment has been decommissioned and will not be used as part of the proposed extension.

The following table lists plant and equipment likely to be used during the operation of the quarry. The sound power levels presented are based on noise tests conducted on site as part of an earlier noise study. Given that the noise data used in the earlier noise study were in terms of L_{A10} noise levels, as was required by noise guidelines of that time, the data is corrected here to represent typical L_{Aeq} noise levels in accordance with the NSW INP. Based on experience with measurements conducted on similar plant and equipment, and consistent with conducting a conservative noise impact assessment, a conservatively low correction factor of –3dB(A) is applied to the L_{A10} noise levels to convert these to L_{Aeq} noise levels.

Table 5.1 – Sound Power Levels of Plant and Equipment on Site

Plant Item	Sound Power Level [dB(A) re 1pW]	
	L_{A10}	L_{Aeq}*
Bulldozer	109	106
Rubber Tyred Loader	110	107
Excavator (hydraulic)	104	101
Sand Dredge	109	106
Wet Sorter	102	99
Trucks	108	105

*Note: * Determined by applying a -3dB(A) correction to the L_{A10} noise data*

It is noted that there are only one of each plant equipment listed in the above table (except for trucks). Therefore, due to the limited amount of equipment and personnel available, operating scenarios occurring at any one time varies depending on what operation is being used. The operating scenarios that are considered to cause the highest noise emissions and which are to be used for the assessment are as follows:

Table 5.2 – Plant and Equipment used for Different Scenarios

Area	Plant & Equipment Used
Scenario 1 – loading trucks and extraction	
Loading Area	loader & truck
Dredge Pond	sand dredge, wet sorter, excavator & truck
Scenario 2 – clearing and/or pond shaping	
Loading Area	loader & truck
Dredge Pond	sand dredge, wet sorter, bulldozer & truck
Scenario 3 – loading trucks at dredge pond area & extraction	
Loading Area	truck
Dredge Pond	sand dredge, wet sorter, loader & truck

5.2 TRAFFIC SOURCES

The previous impact assessment work on the Gerroa Sand Resource was based on an output of approximately 70,000 tonnes per annum, with an anticipated 2% annual growth rate. Whilst there have been significant fluctuations in yearly output over the last ten years, total site production is shown to be currently at 75,000 tonnes per annum, which is markedly less than expected. This production output is based on an average annual growth rate of just less than 2%, with initial market downturn taken into consideration.

Based on yearly sales for the financial year 1998-99, Table 5.3 has been produced which summarises the transport truck movements associated with the site operations and the truck types.

Table 5.3 – Transport Truck Types, Movements and Destination for 1998-99

Truck Type	Direction			Total	
	North	South	Ex-Bin*	Number	%
Tri-Axle (avg. 28 tonnes)	732	83	358	1173	35
Eight Wheeler (avg. 26 tonnes)	83	12	-	95	3
Six Wheeler and Dog (avg. 28 tonnes)	163	33	-	196	6
Six Wheeler (avg. 15 tonnes)	434	770	106	1310	39
Small Trucks (1-9 tonnes)	-	-	274	274	8
Other (Utes / Box Trailers)	2	-	316	318	9
Total Numbers	**1414**	**898**	**1054**	**3366**	
Total %	**42**	**27**	**31**		**100**

*Note: * the destination direction of ex-bin sales is not known accurately*

Further to the above table, by analysing the available truck movement information for the financial year of 1999-00 and comparing it to the information provided above, it is shown that

approximately 70% of trucks leaving the site are north-bound and the remaining 30% are south-bound.

Based on the number of days in 1998-99 when sales were recorded and the total number of truck movements indicated in the table above, this equates to the average number of truck movements being just under 28 per day, with approximately 20 truck movements being north-bound and 8 truck movements being south-bound.

It is seen from the available data that there is generally only a small number of trucks used that make several trips per day to and from the site. Given this and the fact that there is only one loader on site used to load vehicles, the rate at which trucks can be loaded depends on the operation of the loader. Therefore, the number of trucks leaving the site per hour when sales occur is relatively small.

Past records held on site indicate that the normal maximum number of sales in an hour (or trucks per hour) is between three and four. Therefore, should the trucks arrive and depart the site within the same hour, residential receivers living along the routes used by trucks would experience twice the number of movements indicated above. Based on the information provided above, the maximum number of truck entries plus exits to and from the site is generally six to eight per hour. For a conservative assessment, the number of truck passbys used in this noise assessment for the north-bound route along Gerroa Road is eight and the south-bound route along Beach Road is six.

The 1990 noise study also used eight truck movements per hour in its assessment, however it assumed four movements per hour in each direction.

Under exceptional circumstances (approx. three to four times per year), if a Cleary Bros. concrete plant is running low in sand, six trucks may be deployed to the site to replenish the plant's stockpiles. These would all be loaded within an hour, meaning that on these few occasions in a year, up to twelve truck movements may occur in either direction, and this could occur twice within one day.

6. PREDICTED NOISE LEVELS

6.1 SITE NOISE

Noise emissions from the operation of the quarry for each scenario were modelled to the nominated nearby receivers using the ENM (Environmental Noise Model) computer program. The noise model accounted for the noise sources; receiver locations; distance and topographical features between source and receiver. ENM calculates the contribution of each noise source at nominated receivers and allows for the prediction of the total noise from a site. The computer program is endorsed by the DEC and its environmental noise predictions have been verified on many past occasions in the field.

Potential increase in noise levels resulting from adverse meteorological conditions have been considered and computed as per the requirements of the NSW INP.

The meteorological conditions used for the noise model were obtained from the Bureau of Meteorology for the weather station located at Kiama Bowling Club. These conditions were as follows:

- Average temperature approximately 17.7°C
- Average humidity approximately 67%

Noise predictions were prepared for each of the following meteorological scenarios:

1. Calm & isothermal conditions (acoustically neutral) – no wind and no temperature inversion

2. Slight to gentle breeze – 3m/s wind velocity at 10m from ground level between each noise source and each noise receiver (as per INP default wind conditions). Wind direction was based on wind travelling from the source to the receiver.

3. Temperature inversions were not considered as Section 5.2 of the NSW INP states that temperature inversions are only considered for the period between 6pm and 7am. Hours of operation are outside this period.

Table 6.1 and Table 6.2 below presents the predicted operational noise levels at each residence for the Scenarios 1 to 3 during calm isothermal and slight source to receiver wind conditions, respectively.

Table 6.1 – Predicted Noise Levels – Calm Isothermal Conditions, dB(A)

Location		PSNL	Predicted $L_{Aeq(15min)}$ noise levels, dB(A)		
			Scenario 1	Scenario 2	Scenario 3
R1	670 Beach Rd	42	32	32	33
R2	11 Bangarrai St	41	31	31	32
R3	Seven Mile Beach Holiday Park	48	31	31	31
R4	Coralea Property	44	32	32	33
R5	Picnic Area 1	50	39	40	41
R6	Picnic Area 2	50	33	33	33

Notes: 1. As activities remain fairly continuous throughout the operational hours of the facility, the $L_{Aeq,15min}$ noise level has been assessed as equivalent to the $L_{Aeq,day}$, in line with a conservative assessment.

2. **Bold** font indicates exceedance with the NSW INP's Intrusiveness criteria

Table 6.2 – Predicted Noise Levels – Slight Source to Receiver Wind

Location		PSNL	Predicted $L_{Aeq(15min)}$ noise levels, dB(A)		
			Scenario 1	Scenario 2	Scenario 3
R1	670 Beach Rd	42	40	40	41
R2	11 Bangarrai St	41	40	40	40
R3	Seven Mile Beach Holiday Park	48	35	35	36
R4	Coralea Property	44	42	42	43
R5	Picnic Area 1	50	44	46	46
R6	Picnic Area 2	50	43	43	43

Notes: 1. As activities remain fairly continuous throughout the operational hours of the facility, the $L_{Aeq,15min}$ noise level has been assessed as equivalent to the $L_{Aeq,day}$, in line with a conservative assessment.

2. **Bold** font indicates exceedance with the NSW INP's Intrusiveness criteria

The results show that noise levels will comply with the project specific noise levels (PSNL) for both calm isothermal and source to receiver wind conditions.

Therefore, additional noise mitigation will not be necessary to reduce noise emission from the site.

It should be noted that the modelled noise levels at residential receivers were tested for characteristics including tonality and dominant low frequency as noise emission containing these characteristics can cause greater annoyance than other noise at the same level. The test, based on Table 4.1 of the NSW INP found that that tonal and low frequency characteristics were not present in predicted noise emissions from the site to residential receivers. Therefore, no modifying factor correction has been applied.

6.2 TRAFFIC NOISE

A previous noise study conducted by Renzo Tonin & Associates for the quarry [ref. S770-02F01 (rev2) dated March 2001] presented traffic volumes along the routes that traffic to and from the quarry will use, namely Beach Road and Gerroa Road. The traffic volumes for 2001 were as follows:

Table 6.3 – 2001 Traffic Volumes Along Expected Routes

Route	Minimum traffic volumes		Maximum Traffic Volume	
	vehicles/hr	% Heavy vehicles	vehicles/hr	% Heavy vehicles
Northern (Gerroa Road)	414	4.9	585	4.9
Southern (Beach Road)	30	18.9	55	18.9

Based on natural traffic growth of approximately 2% per year, the existing 2005 traffic volumes are predicted to be as follows:

Table 6.4 – 2005 Traffic Volumes Along Expected Routes

Route	Minimum traffic volumes		Maximum Traffic Volume	
	vehicles/hr	% Heavy vehicles	vehicles/hr	% Heavy vehicles
Northern (Gerroa Road)	448	4.9	633	4.9
Southern (Beach Road)	32	18.9	60	18.9

Based on the traffic volumes in Table 6.4 and the proposed truck movement from the site to be eight along the northern route (Gerroa Road) and six along the southern route (Beach Road), the predicted traffic noise levels were modelled and assessed against the NSW ECRTN.

The United States Federal Highways Administration's (US FHWA) road traffic noise prediction model was used to predict noise at the facade of the nearest affected residences, taken to be a conservative ten (10) metres from the road kerb. Like other prediction models, the FHWA method arrives at a predicted noise level through a series of adjustments to a reference sound level. This model is commonly used in rural situations where other models are not suited due to low volumes of traffic and intermittent or non-free flowing traffic conditions.

Table 6.5 – Calculated $L_{Aeq(1hr)}$ Traffic Noise Levels at 1m from Most Affected Residential Dwelling Facade , dB(A)

Route	Existing $L_{eq(1hr)}$ Traffic Noise Levels (7am to 6pm)	Total Criteria	Predicted $L_{eq(1hr)}$ Traffic Noise Contribution from Proposal at 60km/h	Total Traffic Noise Along Route	Complies?
Northern (Gerroa Road)	min = 69	69 + 2 = **71**	61	70	Yes
	max = 71	71 + 2 = **73**		71	Yes
Southern (Beach Road)	min = 63	63 + 2 = **65**	60	64	Yes
	max = 66	66 + 2 = **68**		66	Yes

From the results of Table 6.2, it can therefore be expected that maximum traffic noise generated from the site will comply with the specified daytime traffic noise level criteria as set out in the NSW ECRTN.

7. CONCLUSION

Renzo Tonin & Associates have completed an assessment of environmental noise impact from the proposed extension of the existing sand dredging activities at Gerroa operated by Cleary Bros (Bombo) Pty Ltd.

Noise impact from the proposed extension upon the potentially most affected noise sensitive residential and recreational receivers, has been quantified and compared to the noise guidelines set by the DEC. Compliance with the criteria has been determined for calm isothermal and adverse wind conditions. Therefore, no noise mitigation measures were considered necessary for the proposed extension.

Noise impact from quarry traffic travelling along the northern route and the southern route will vary depending on the actual volume of traffic arriving and departing from the site. However, even though it will be noticeable by residents living along these routes during busy periods, there will also be many hours in a day when no quarry trucks will drive by residences. In summary, according to traffic noise calculations, noise from quarry truck movements on public roads will comply with the traffic noise criteria stipulated in the NSW ECRTN.

APPENDIX A - GLOSSARY OF ENVIRONMENTAL NOISE TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather — Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient Noise — The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period — The period in a day over which assessments are made.

Assessment Point — A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.

Background Noise — Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $\mathbf{L_{90}}$ noise level (see below).

Decibel [dB] — The units that sound is measured in. The following are examples of the decibel readings of every day sounds:

0dB	The faintest sound we can hear
30dB	A quiet library or in a quiet location in the country
45dB	Typical office space. Ambience in the city at night
60dB	Martin Place at lunch time
70dB	The sound of a car passing on the street
80dB	Loud music played at home
90dB	The sound of a truck passing on the street
100dB	The sound of a rock band
115dB	Limit of sound permitted in industry
120dB	Deafening

dB(A): — A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the “A” filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.

Frequency — Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound

	of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_{1}	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B - NOISE MONITORING METHODOLOGY

NOISE MONITORING EQUIPMENT

All long term noise monitoring was conducted using RTA Technology noise loggers. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters” and is designated as a Type 2 instrument suitable for field use.

A noise monitor consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

METEOROLOGY DURING MONITORING

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the INP. The Bureau of Meteorology provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period.

NOISE VS TIME GRAPHS

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the $\mathbf{L_{10}}$, $\mathbf{L_{90}}$, and $\mathbf{L_{eq}}$ levels. The statistical descriptors $\mathbf{L_{10}}$ and $\mathbf{L_{90}}$ measure the noise level exceeded for 10% and 90% of the sample measurement time. The $\mathbf{L_{eq}}$ level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs representing measured noise levels at the two noise monitoring locations in Appendix C illustrate these concepts.

Noise levels are commonly measured in units of A-weighted decibels or dB(A). The "A-weighting" refers to a standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low pitch sound than it is to high pitch sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

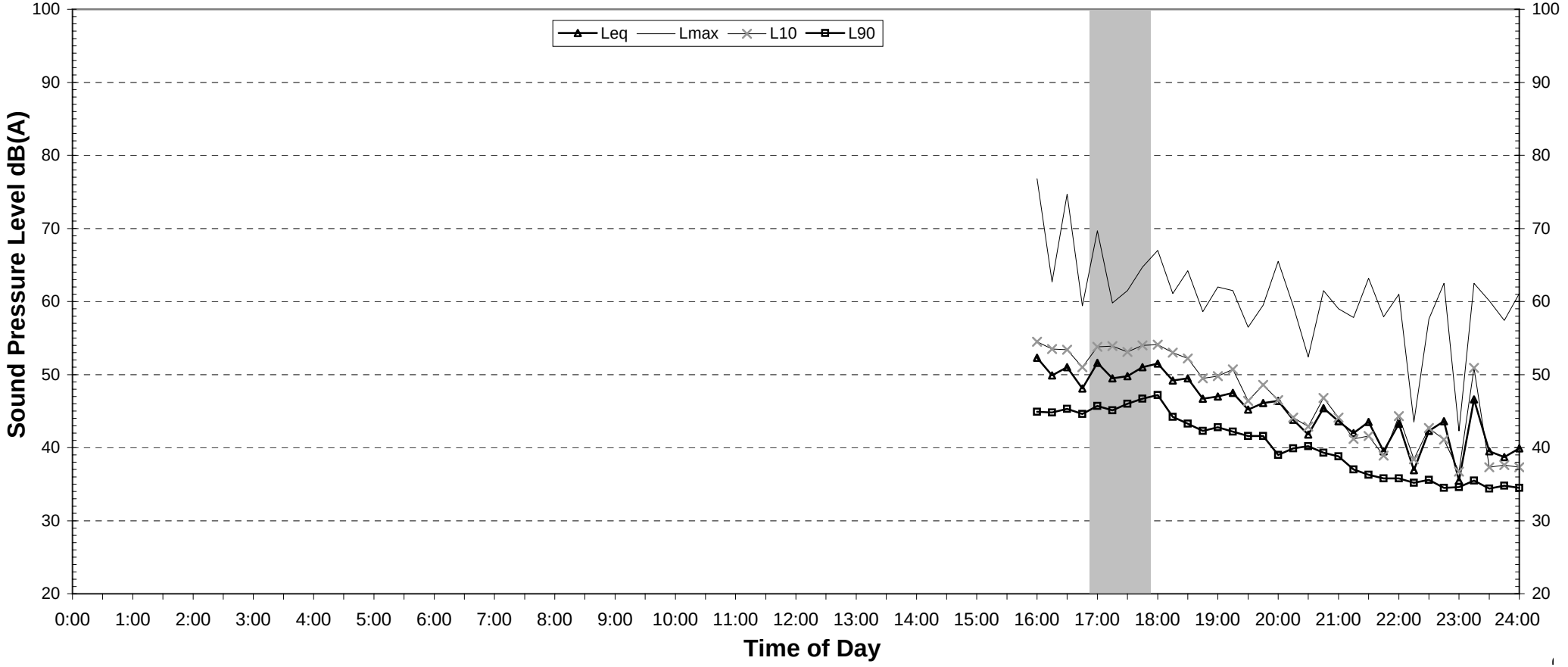
Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample time period. This is represented as the $\mathbf{L_{90}}$ noise level.

APPENDIX C – LONG TERM NOISE MONITORING RESULTS

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Friday, 5 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	44.6	35.8	34.3
Leq	50.8	45.8	40.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

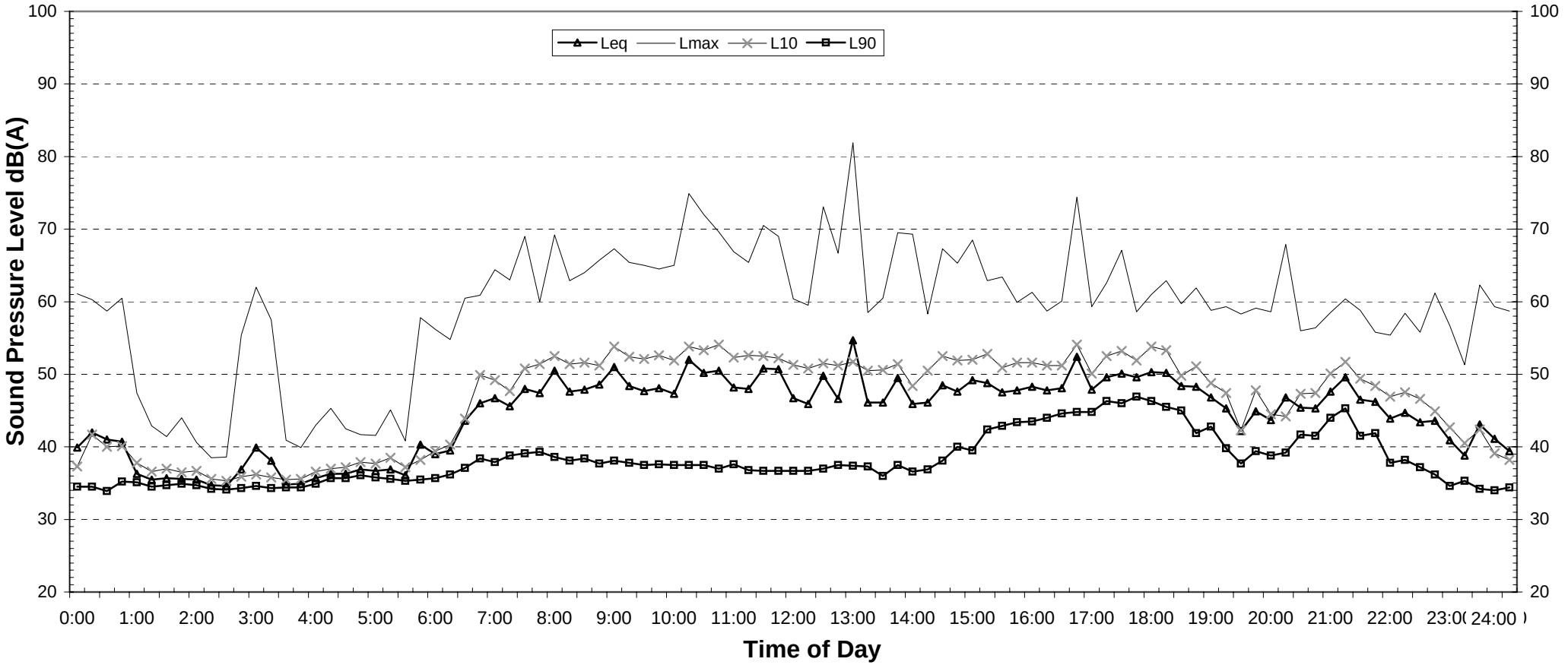
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	50.1	42.7
Leq 1hr upper 10 percentile	54.8	47.2
Leq 1hr lower 10 percentile	44.8	38.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	19.4	to	24.9

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Saturday, 6 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	36.7	37.8	34.1
Leq	49.1	46.8	45.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

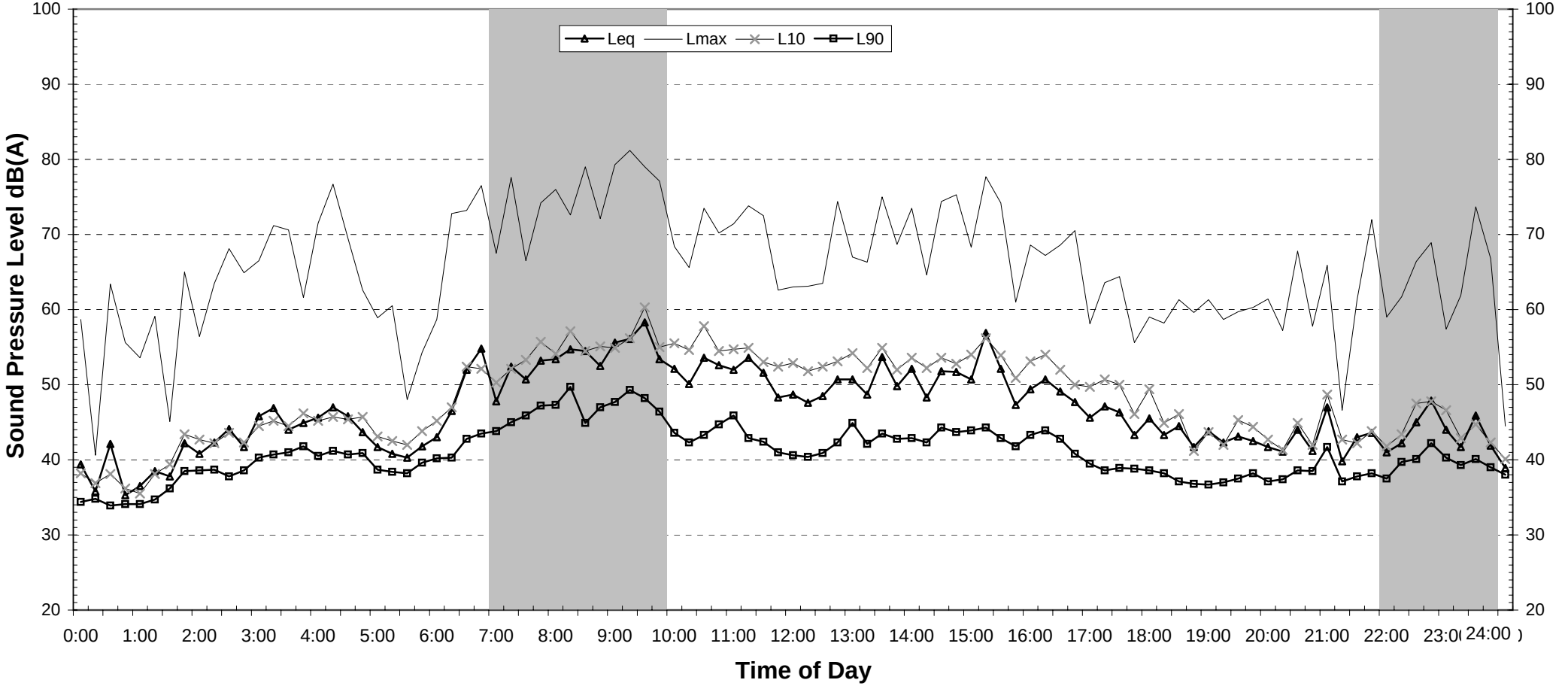
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	51.1	47.6
Leq 1hr upper 10 percentile	53.1	54.8
Leq 1hr lower 10 percentile	47.9	40.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.0	to	76.7
Lmax - Leq (Range)	17.8	to	31.7

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Sunday, 7 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	38.9	36.8	37.5
Leq	50.8	43.2	43.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

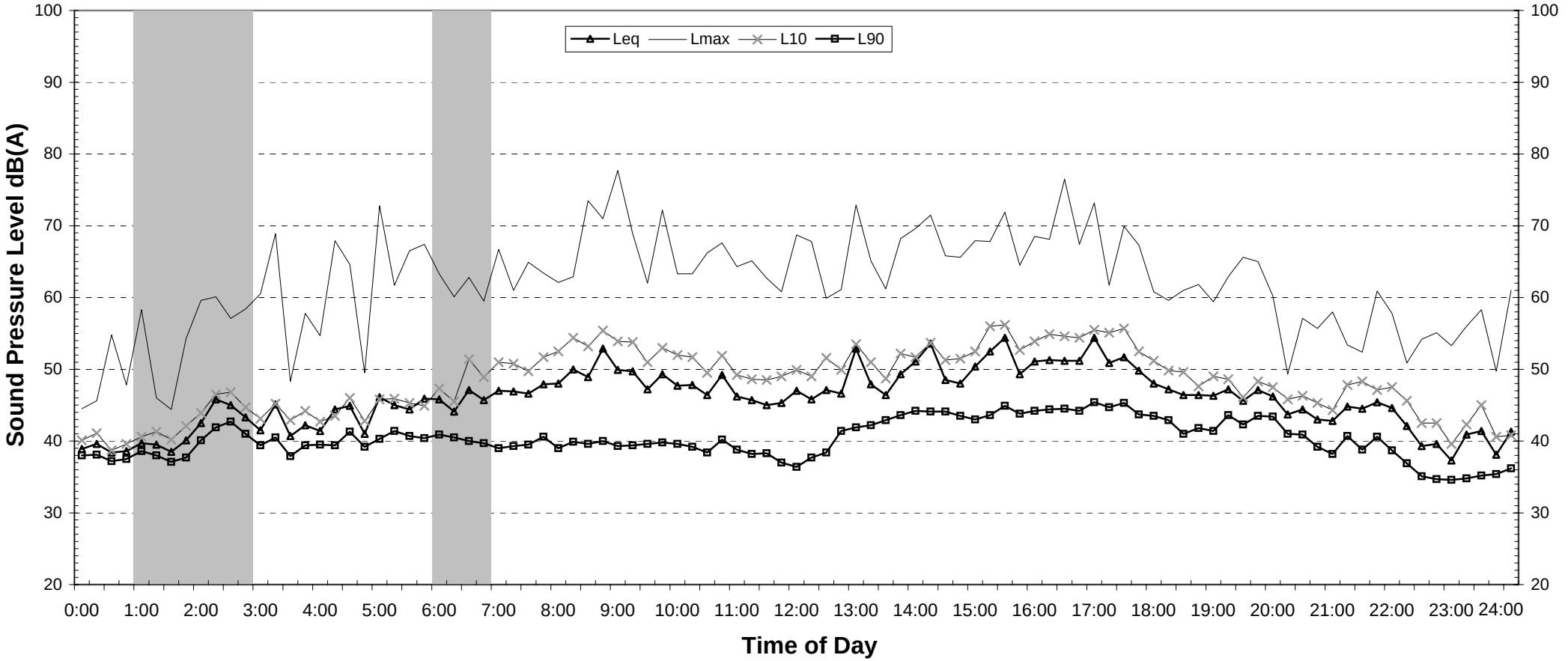
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	52.0	46.0
Leq 1hr upper 10 percentile	55.3	49.5
Leq 1hr lower 10 percentile	44.9	41.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	66.7	to	72.8
Lmax - Leq (Range)	15.9	to	28.3

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Monday, 8 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	38.3	38.7	34.0
Leq	49.9	45.6	42.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

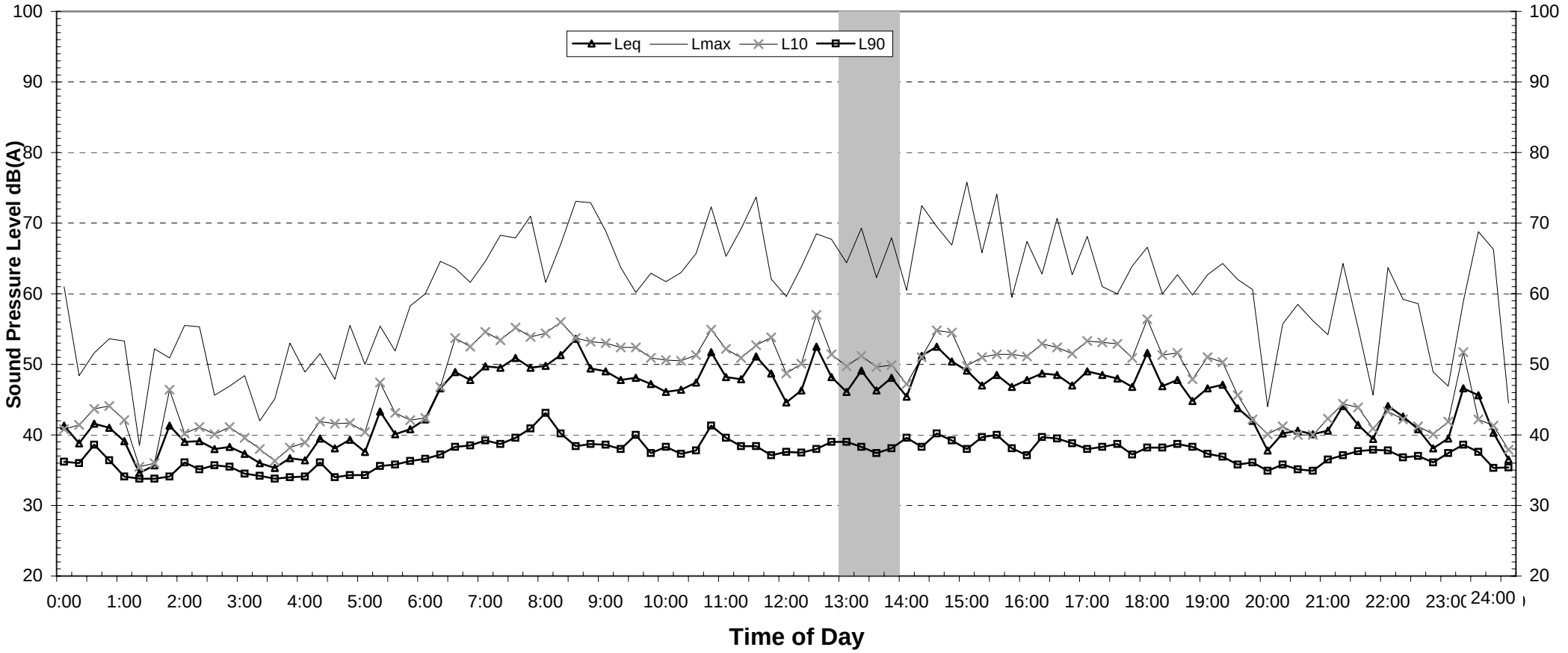
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	51.6	44.6
Leq 1hr upper 10 percentile	54.7	50.9
Leq 1hr lower 10 percentile	46.7	38.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	15.2	to	20.4

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Tuesday, 9 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	37.5	34.9	34.5
Leq	49.3	44.0	44.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

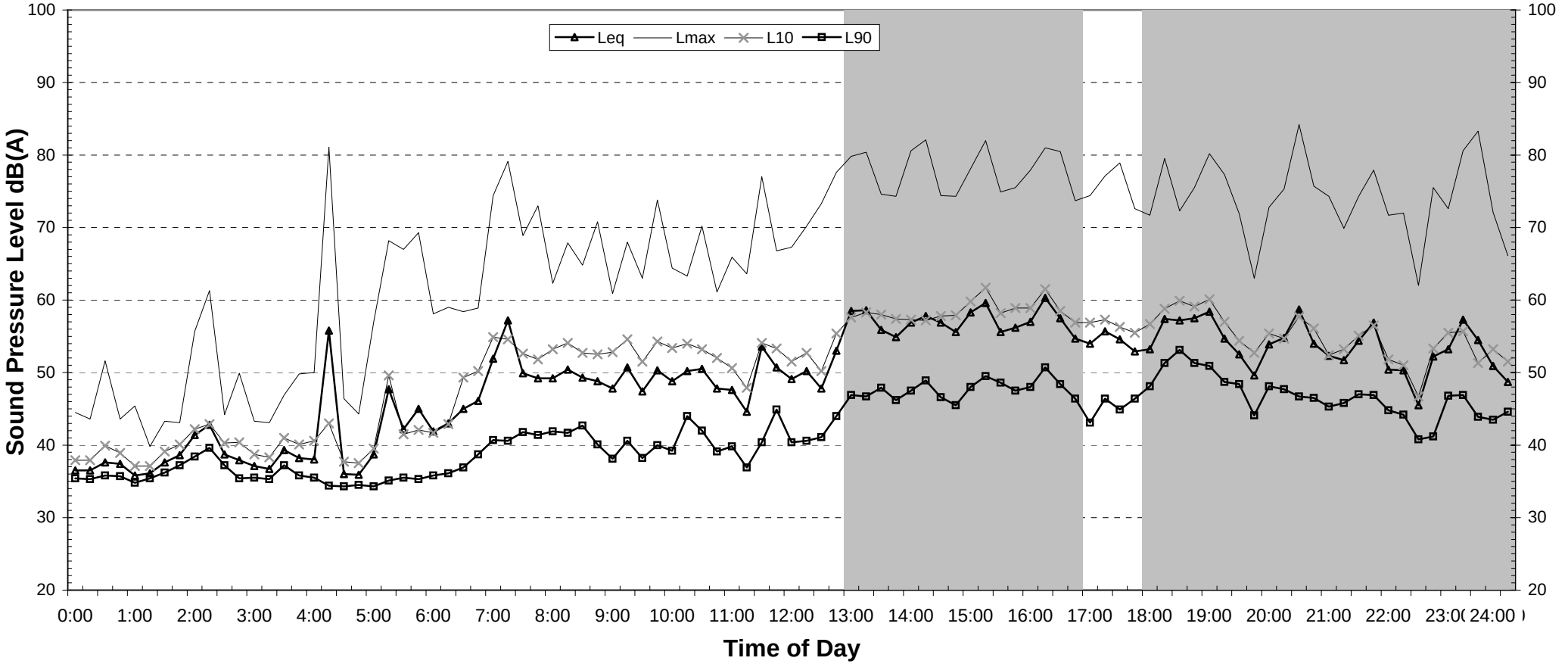
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	50.8	47.0
Leq 1hr upper 10 percentile	53.6	52.5
Leq 1hr lower 10 percentile	44.2	39.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	68.8	to	81.1
Lmax - Leq (Range)	16.8	to	31.1

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Wednesday, 10 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	38.2	-	36.0
Leq	51.4	-	43.7

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

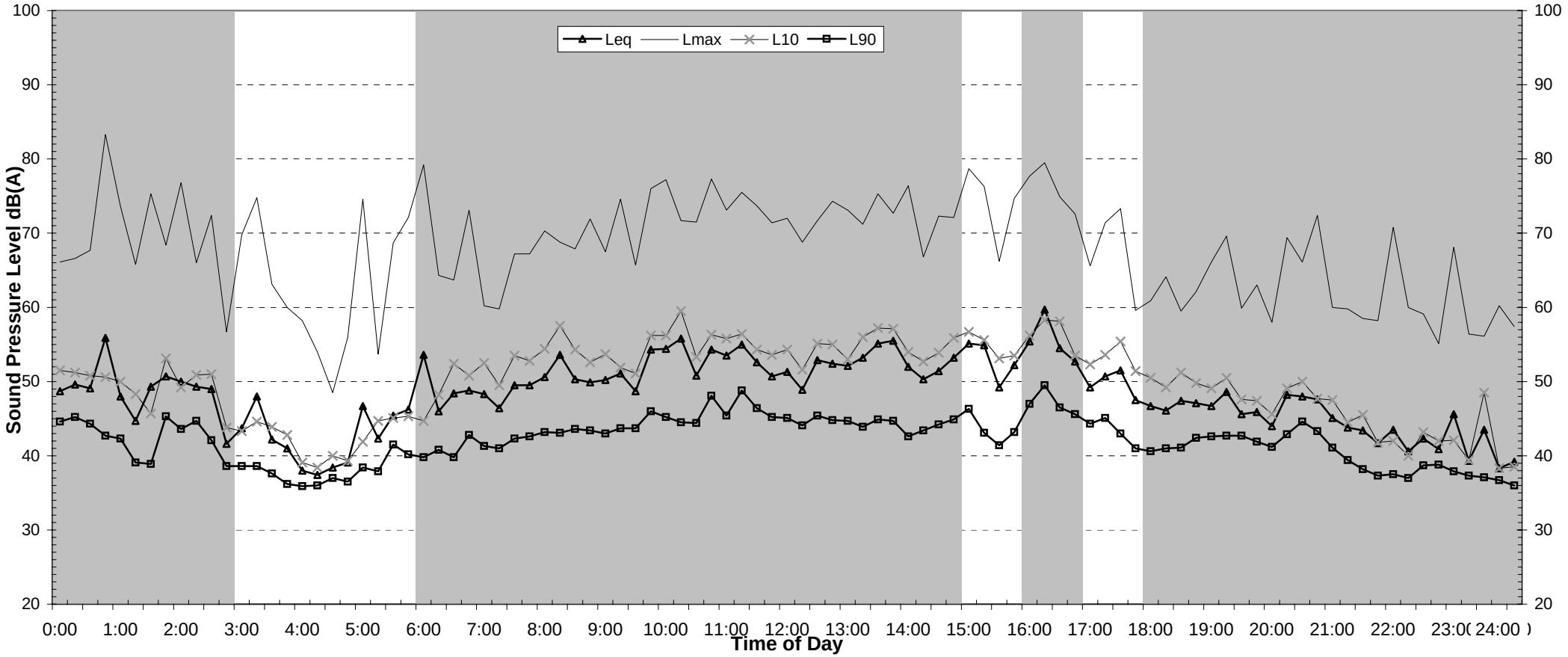
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	53.9	46.2
Leq 1hr upper 10 percentile	57.0	47.4
Leq 1hr lower 10 percentile	51.7	44.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	69.8	to	74.8
Lmax - Leq (Range)	26.1	to	32.3

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Thursday, 11 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.0	-	36.1
Leq	52.0	-	42.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

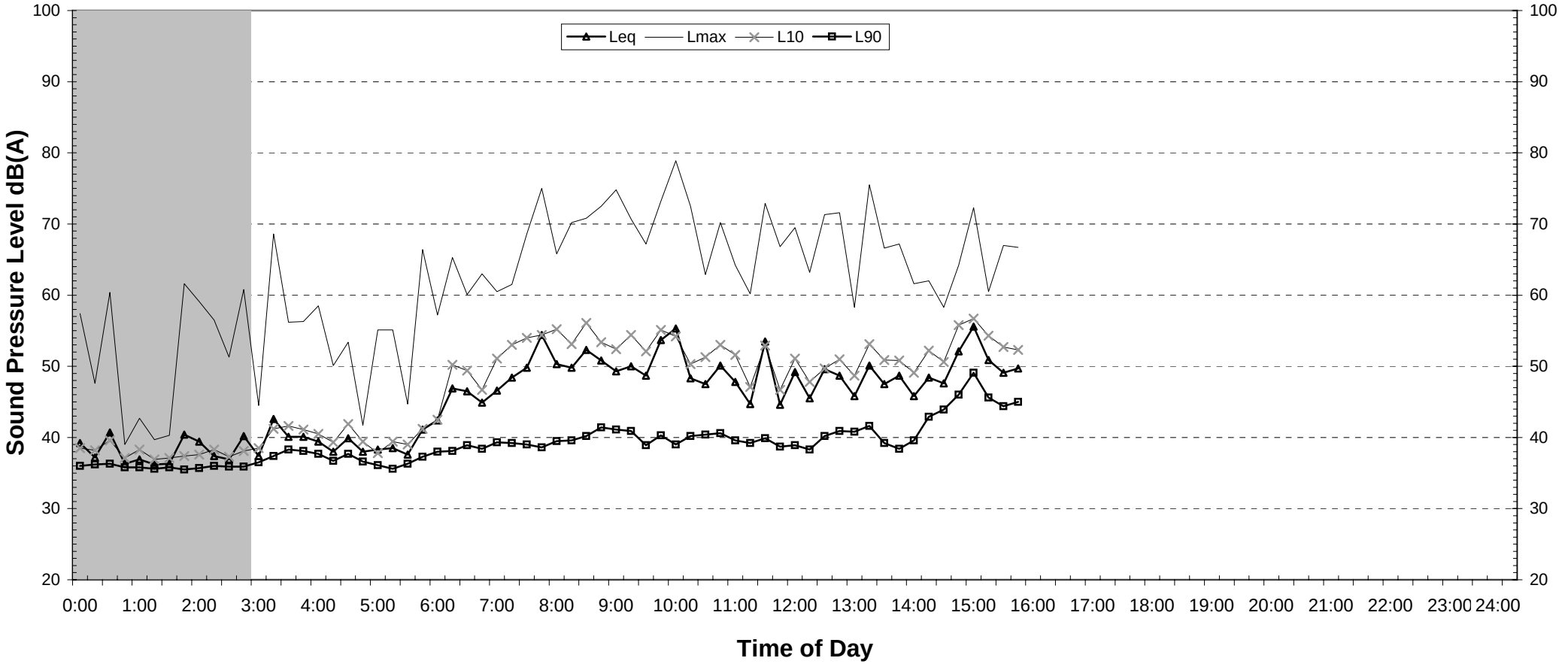
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	54.5	44.9
Leq 1hr upper 10 percentile	57.6	48.8
Leq 1hr lower 10 percentile	51.7	39.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.3	to	68.6
Lmax - Leq (Range)	16.5	to	27.9

EXISTING AMBIENT NOISE LEVELS

Frontyard of 670 Beach Rd

Friday, 12 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	38.7	-	-
Leq	50.4	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

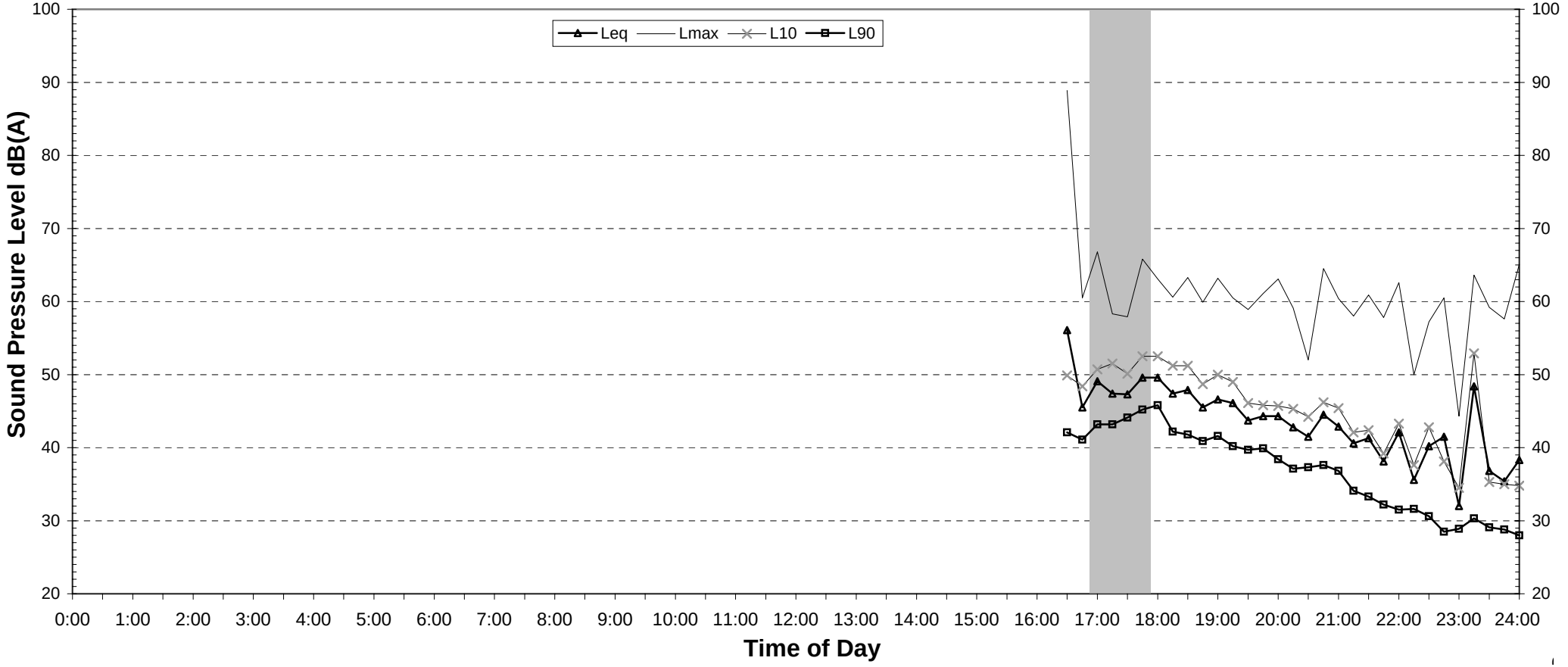
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	52.9	-
Leq 1hr upper 10 percentile	55.2	-
Leq 1hr lower 10 percentile	50.3	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Friday, 5 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.1	32.2	28.5
Leq	52.5	44.4	39.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

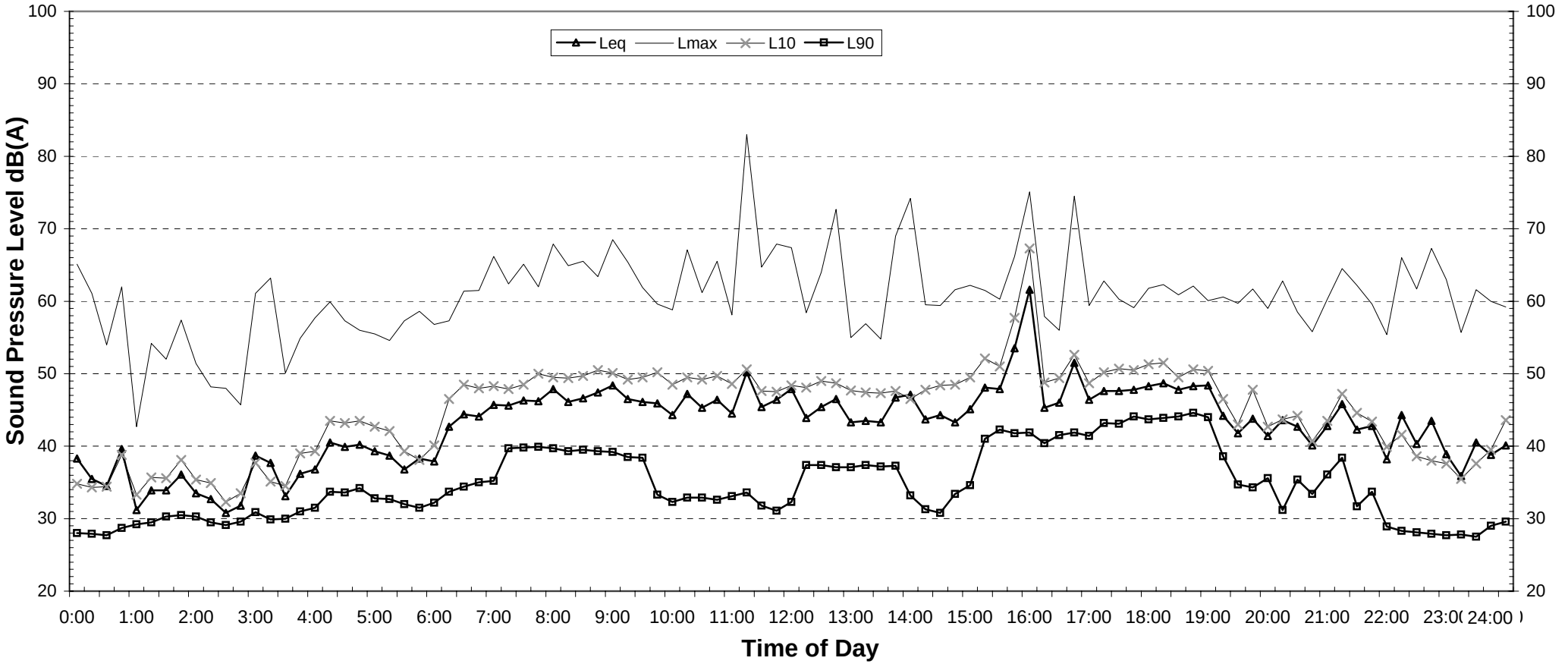
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	49.6	42.3
Leq 1hr upper 10 percentile	56.0	46.9
Leq 1hr lower 10 percentile	43.3	37.0

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.1	to	66.2
Lmax - Leq (Range)	19.9	to	26.9

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Saturday, 6 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	32.3	31.2	27.9
Leq	49.1	45.0	53.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

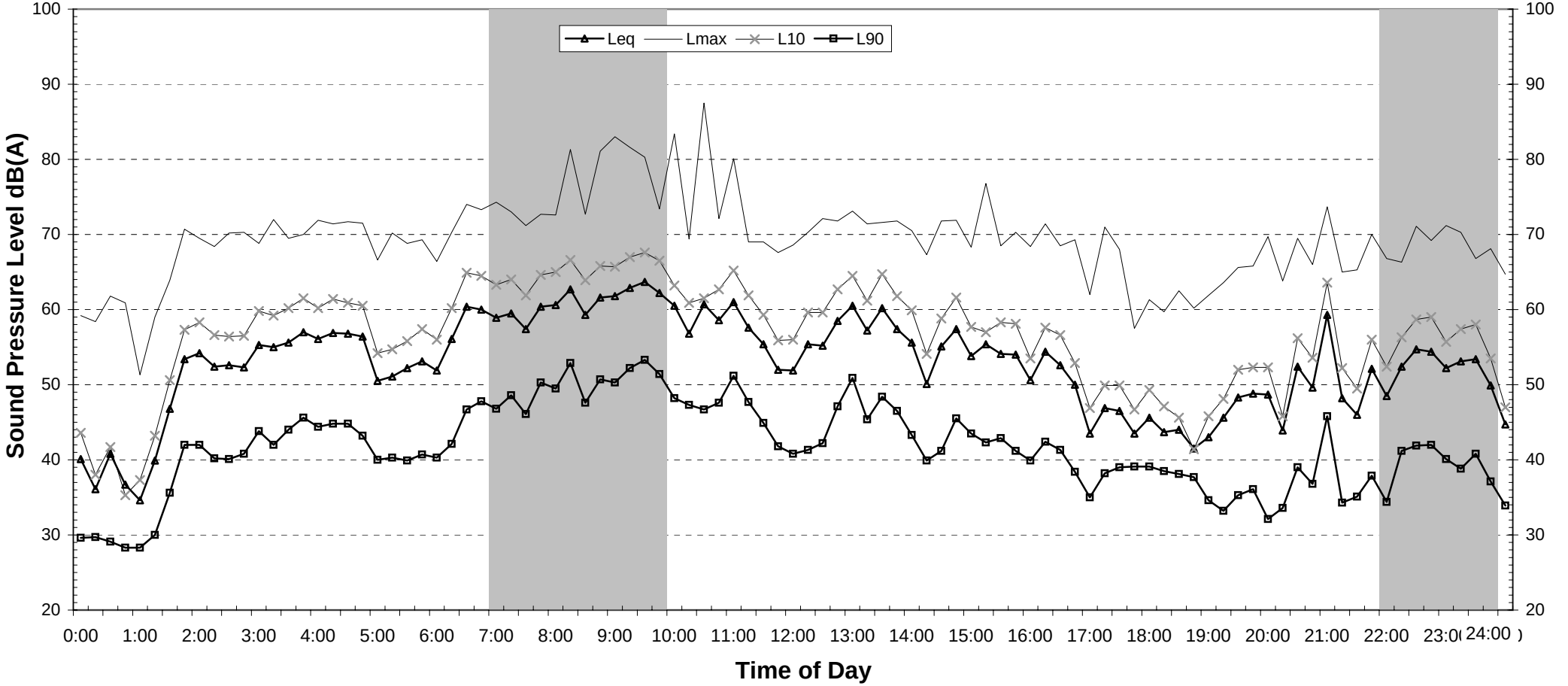
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	50.9	56.0
Leq 1hr upper 10 percentile	56.6	61.7
Leq 1hr lower 10 percentile	45.2	40.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	67.3	to	72.0
Lmax - Leq (Range)	15.9	to	25.0

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Sunday, 7 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	39.0	33.2	33.0
Leq	56.2	50.7	52.6

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

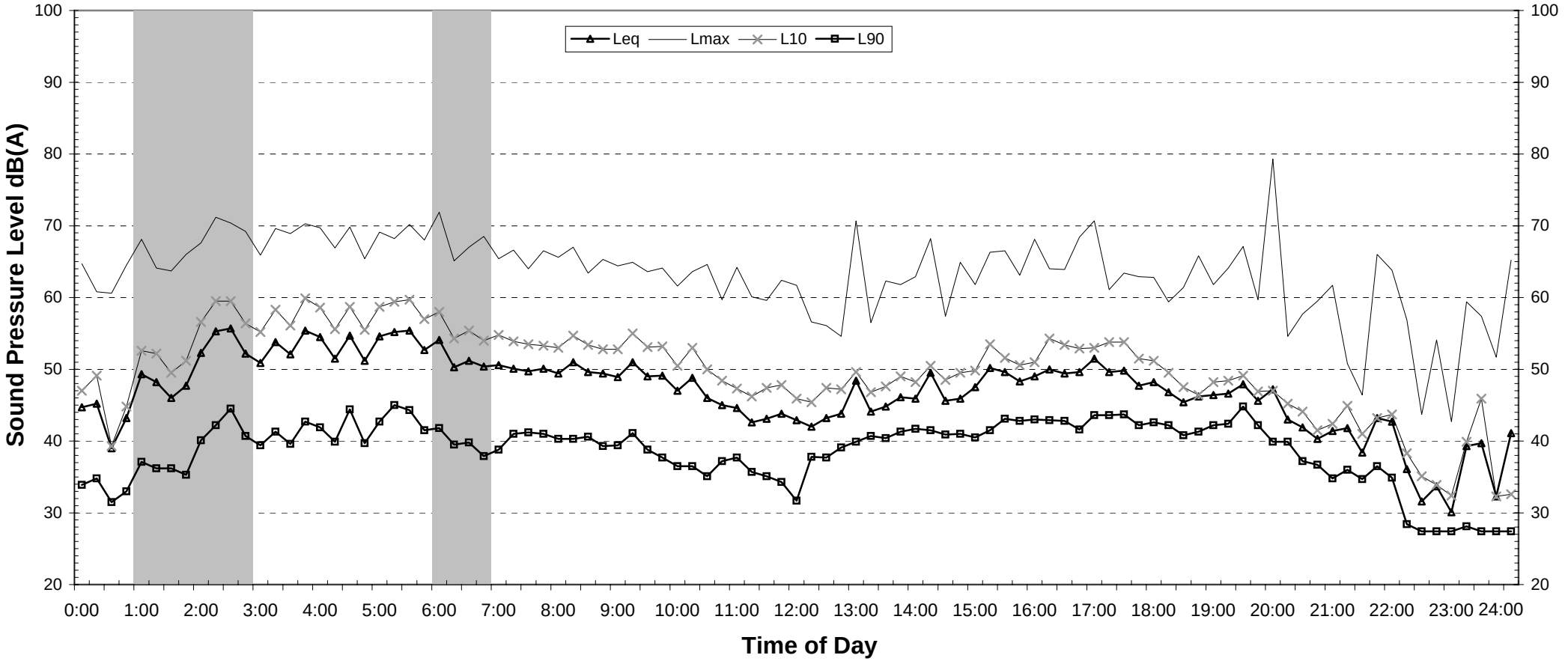
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	57.6	55.1
Leq 1hr upper 10 percentile	62.7	57.1
Leq 1hr lower 10 percentile	46.6	45.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.9	to	70.3
Lmax - Leq (Range)	15.0	to	21.4

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Monday, 8 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	35.7	34.8	27.4
Leq	48.2	44.8	40.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

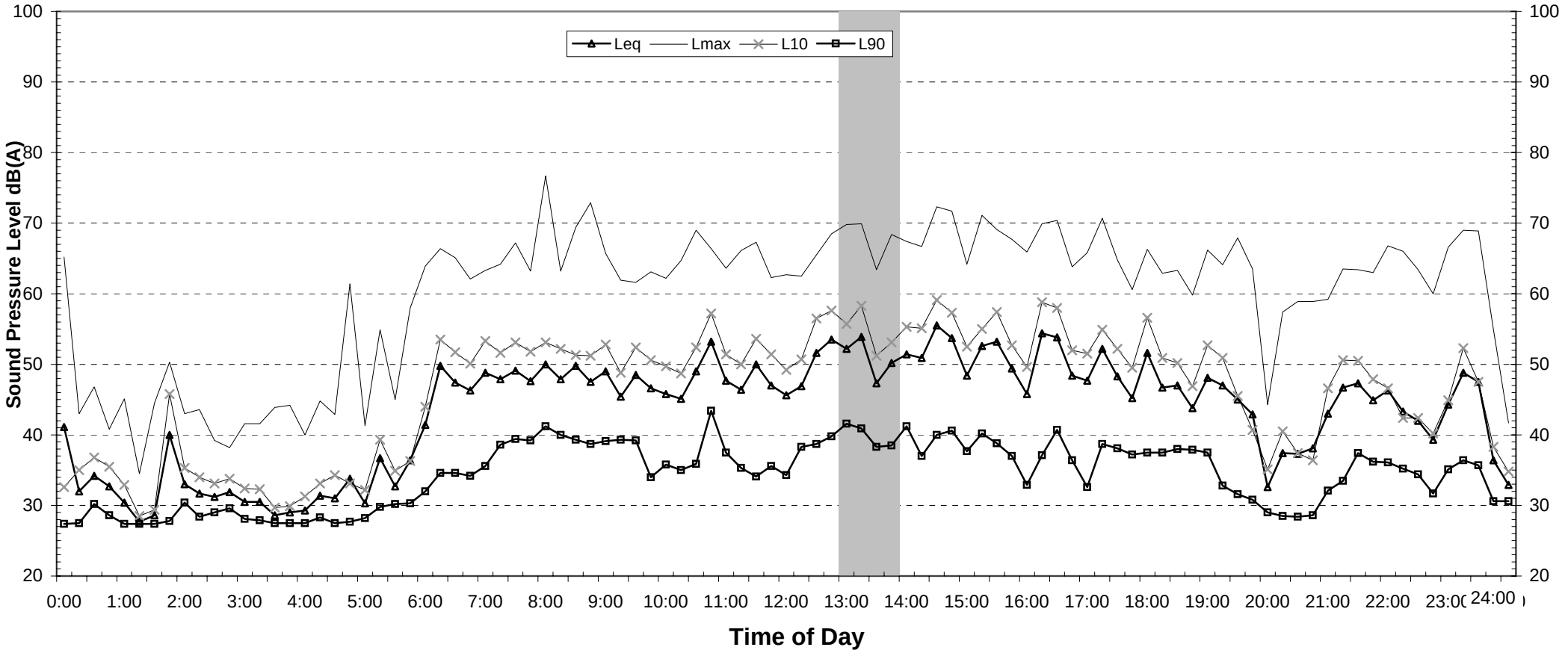
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	50.0	42.7
Leq 1hr upper 10 percentile	52.5	50.8
Leq 1hr lower 10 percentile	44.3	31.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.2	to	66.4
Lmax - Leq (Range)	15.1	to	29.6

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Tuesday, 9 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	34.7	28.5	28.4
Leq	50.3	44.9	44.7

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

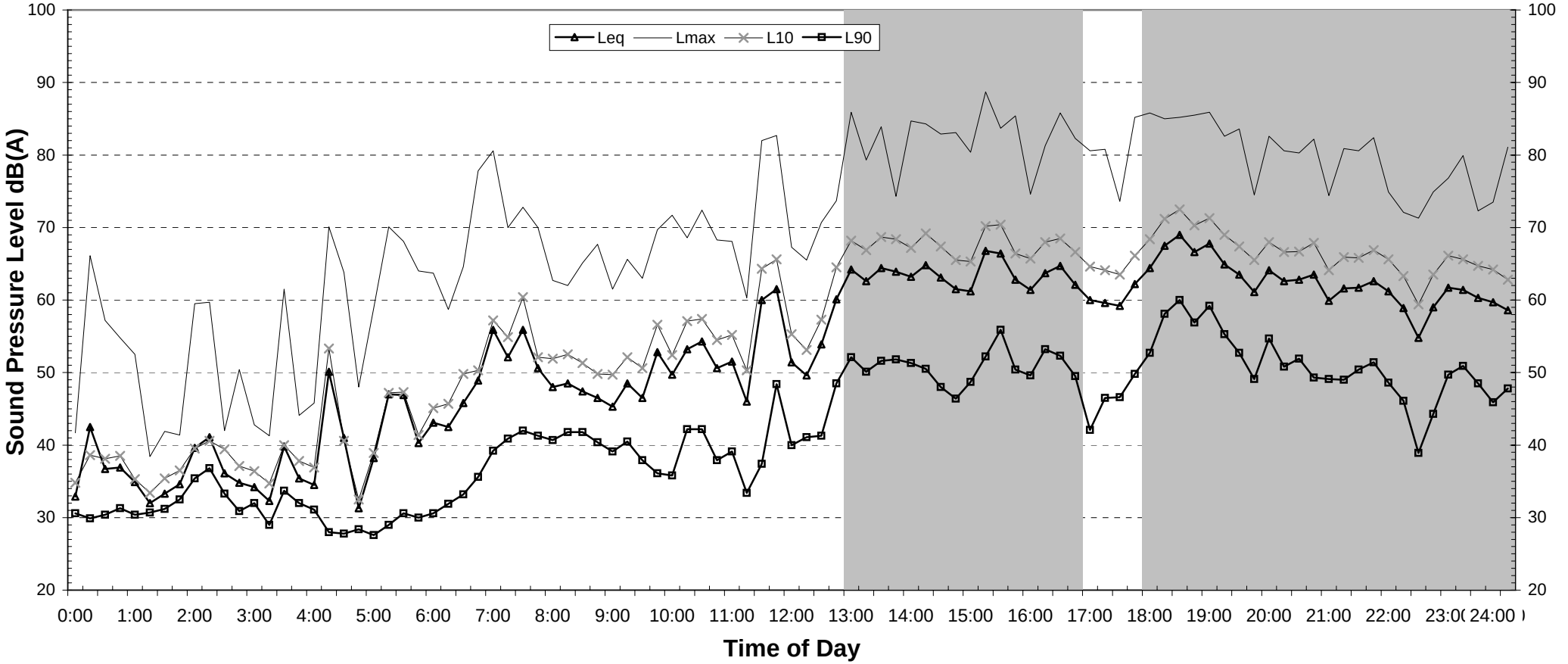
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	51.8	47.2
Leq 1hr upper 10 percentile	55.0	53.7
Leq 1hr lower 10 percentile	44.9	38.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	66.1	to	80.6
Lmax - Leq (Range)	22.2	to	29.4

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Wednesday, 10 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	36.1	-	30.7
Leq	55.9	-	50.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

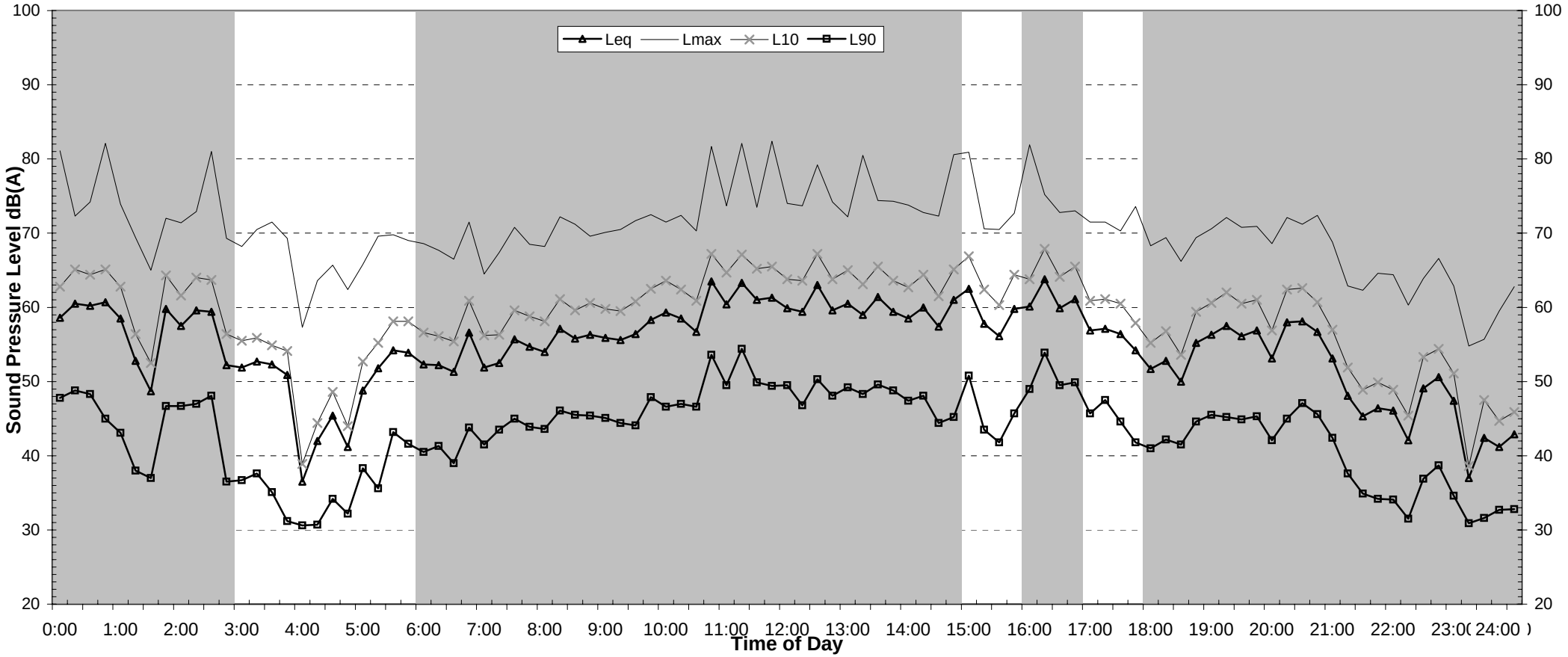
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	58.4	53.3
Leq 1hr upper 10 percentile	63.0	55.9
Leq 1hr lower 10 percentile	49.6	47.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.8	to	71.5
Lmax - Leq (Range)	16.3	to	20.7

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Thursday, 11 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.8	-	32.5
Leq	58.3	-	46.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

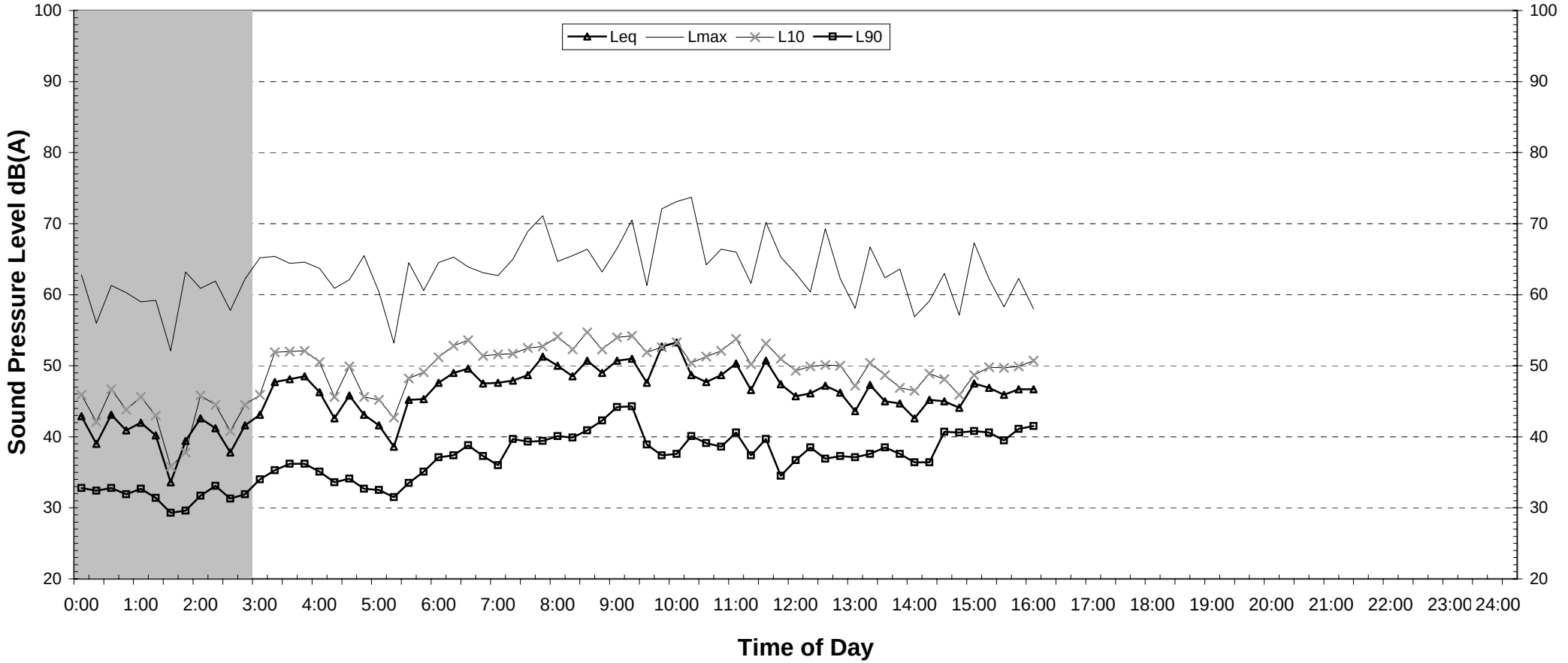
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	60.8	49.0
Leq 1hr upper 10 percentile	65.0	51.0
Leq 1hr lower 10 percentile	58.6	45.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.2	to	65.5
Lmax - Leq (Range)	16.8	to	22.1

EXISTING AMBIENT NOISE LEVELS

Frontyard of 11 Banggarai St

Friday, 12 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	36.7	-	-
Leq	48.5	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

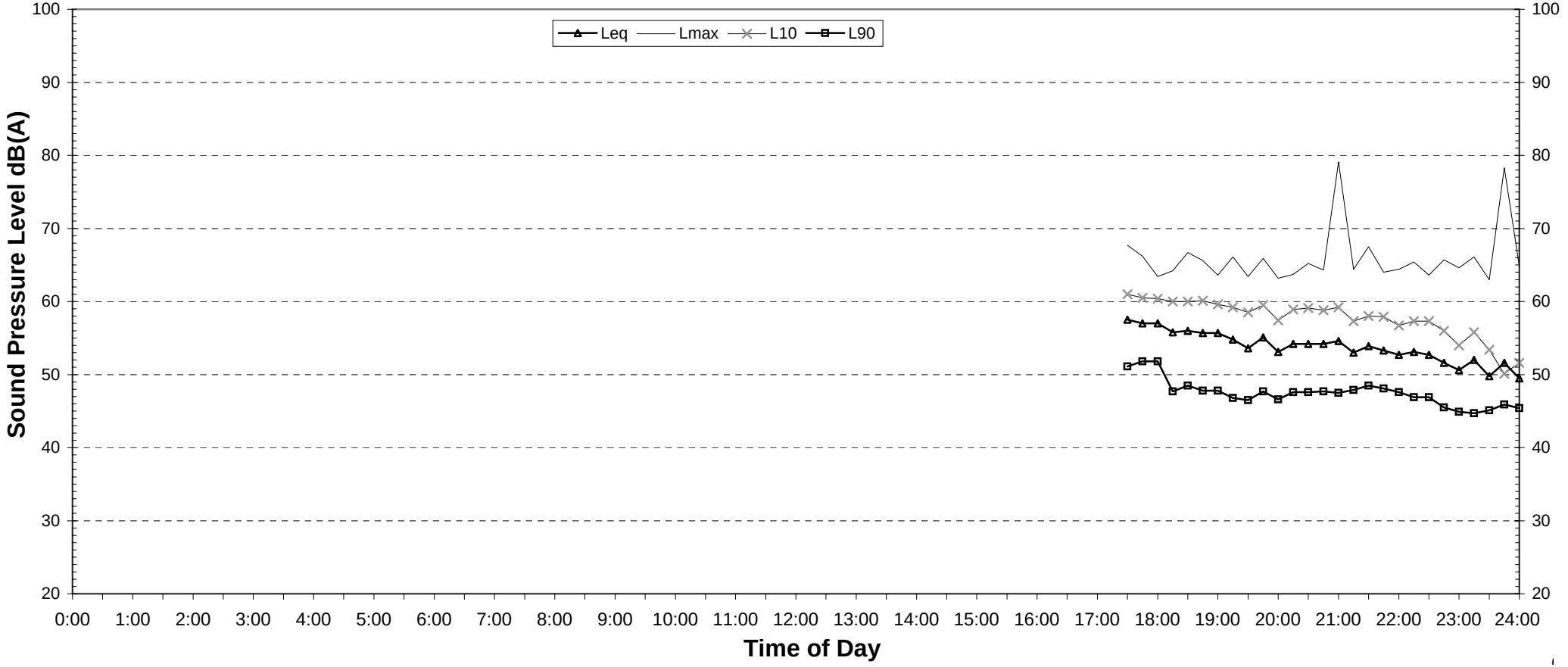
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	51.0	-
Leq 1hr upper 10 percentile	54.1	-
Leq 1hr lower 10 percentile	47.7	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Friday, 5 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	51.1	46.6	43.3
Leq	57.2	54.5	49.7

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

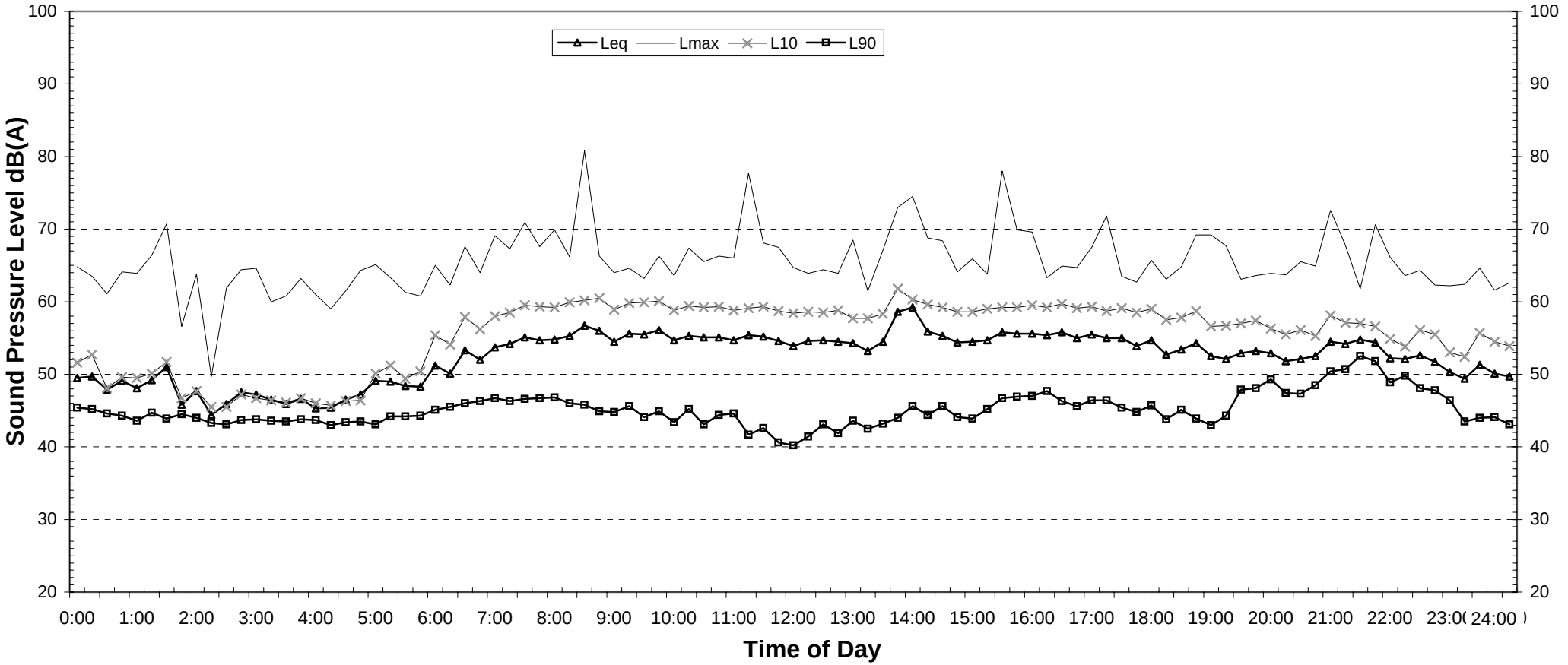
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	57.5	52.2
Leq 1hr upper 10 percentile	59.7	55.0
Leq 1hr lower 10 percentile	55.7	48.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.0	to	78.3
Lmax - Leq (Range)	15.3	to	27.4

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Saturday, 6 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.9	43.8	40.1
Leq	55.3	53.3	48.6

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

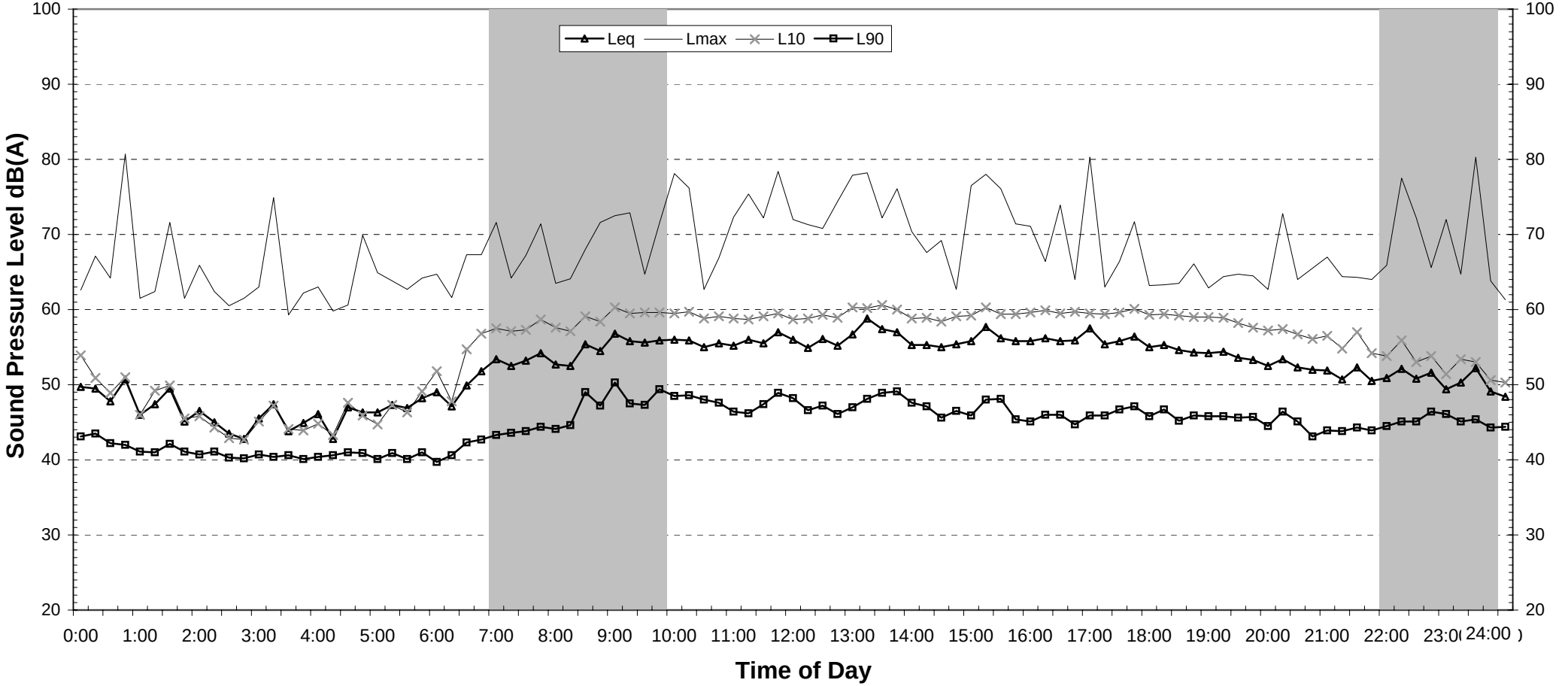
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	57.4	51.1
Leq 1hr upper 10 percentile	59.0	54.3
Leq 1hr lower 10 percentile	55.3	46.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	67.3	to	80.7
Lmax - Leq (Range)	16.8	to	31.9

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Sunday, 7 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	45.6	43.8	42.6
Leq	56.1	53.2	49.6

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

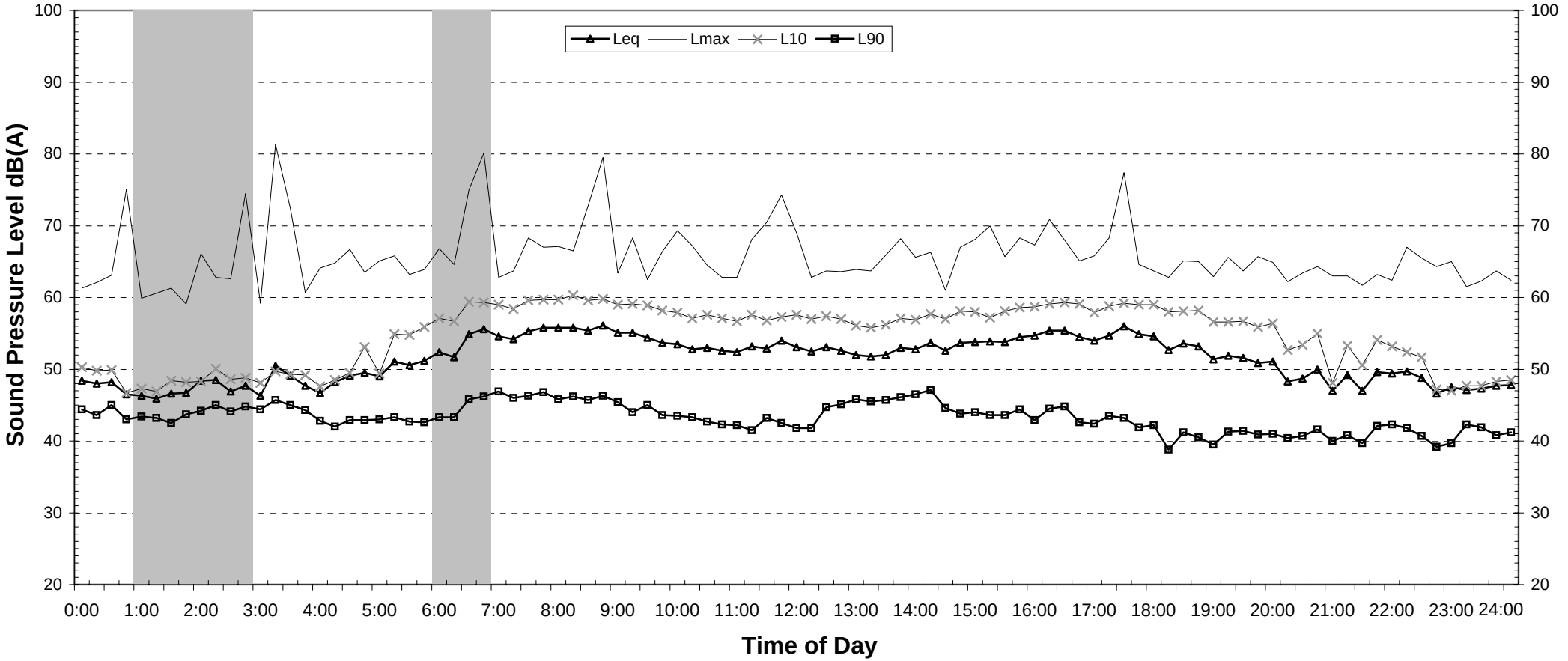
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	57.9	52.1
Leq 1hr upper 10 percentile	59.6	57.1
Leq 1hr lower 10 percentile	54.1	48.8

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	66.7	to	81.3
Lmax - Leq (Range)	17.7	to	32.6

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Monday, 8 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	42.2	39.5	40.0
Leq	54.1	50.8	49.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

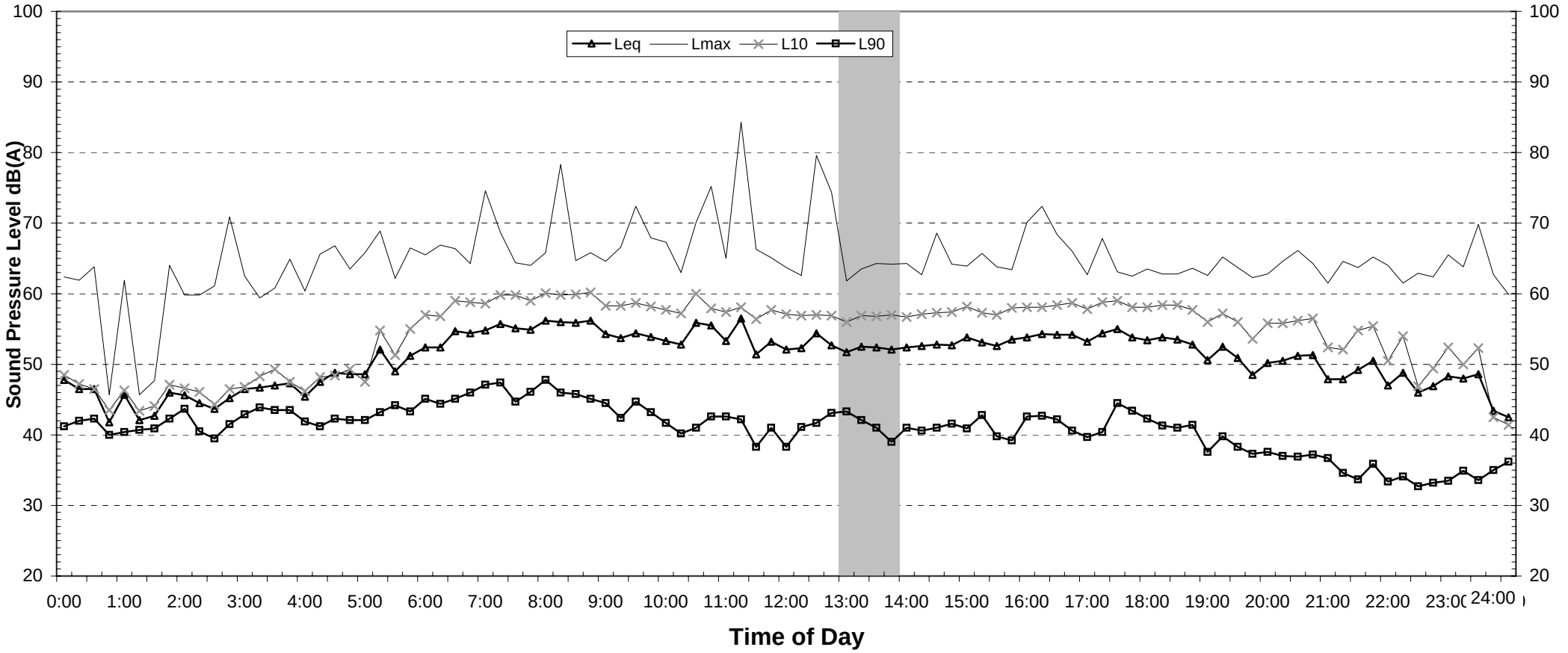
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	56.0	51.6
Leq 1hr upper 10 percentile	58.0	56.7
Leq 1hr lower 10 percentile	51.3	46.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	66.8	to	74.6
Lmax - Leq (Range)	16.2	to	25.8

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Tuesday, 9 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	40.0	33.7	33.2
Leq	54.2	51.0	47.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

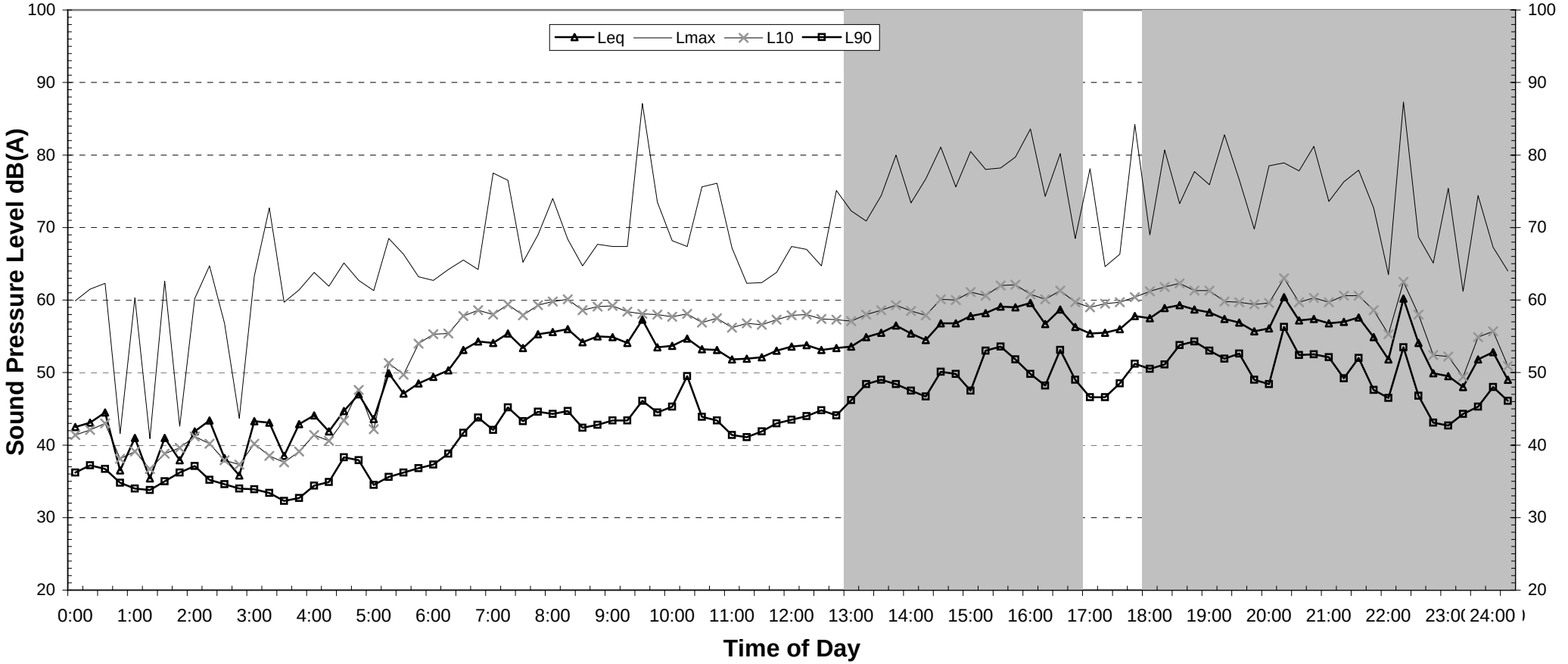
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	56.0	49.7
Leq 1hr upper 10 percentile	58.1	55.7
Leq 1hr lower 10 percentile	52.2	42.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.1	to	77.5
Lmax - Leq (Range)	17.9	to	30.1

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Wednesday, 10 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.9	-	39.3
Leq	54.6	-	49.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

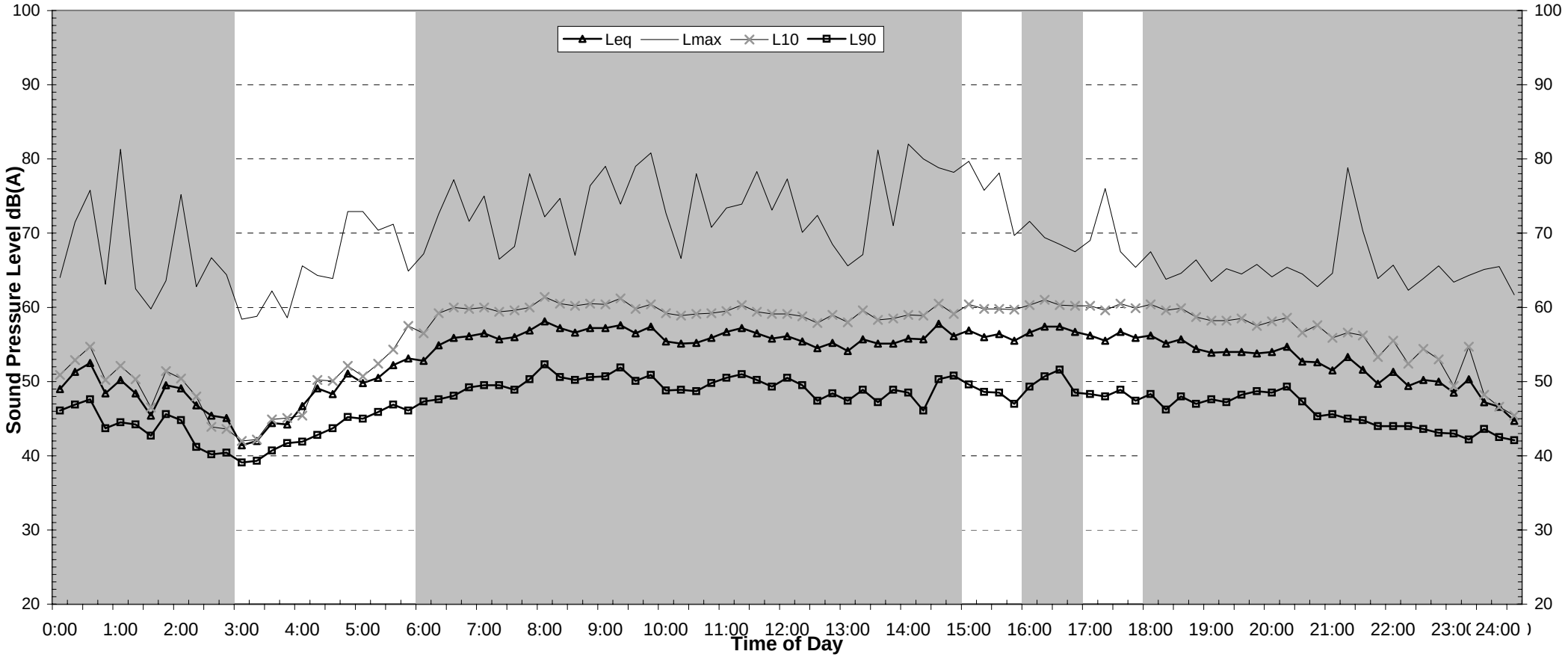
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	57.1	51.6
Leq 1hr upper 10 percentile	59.0	54.6
Leq 1hr lower 10 percentile	55.2	43.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.6	to	72.9
Lmax - Leq (Range)	17.0	to	23.2

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Thursday, 11 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	47.0	-	42.2
Leq	56.2	-	50.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

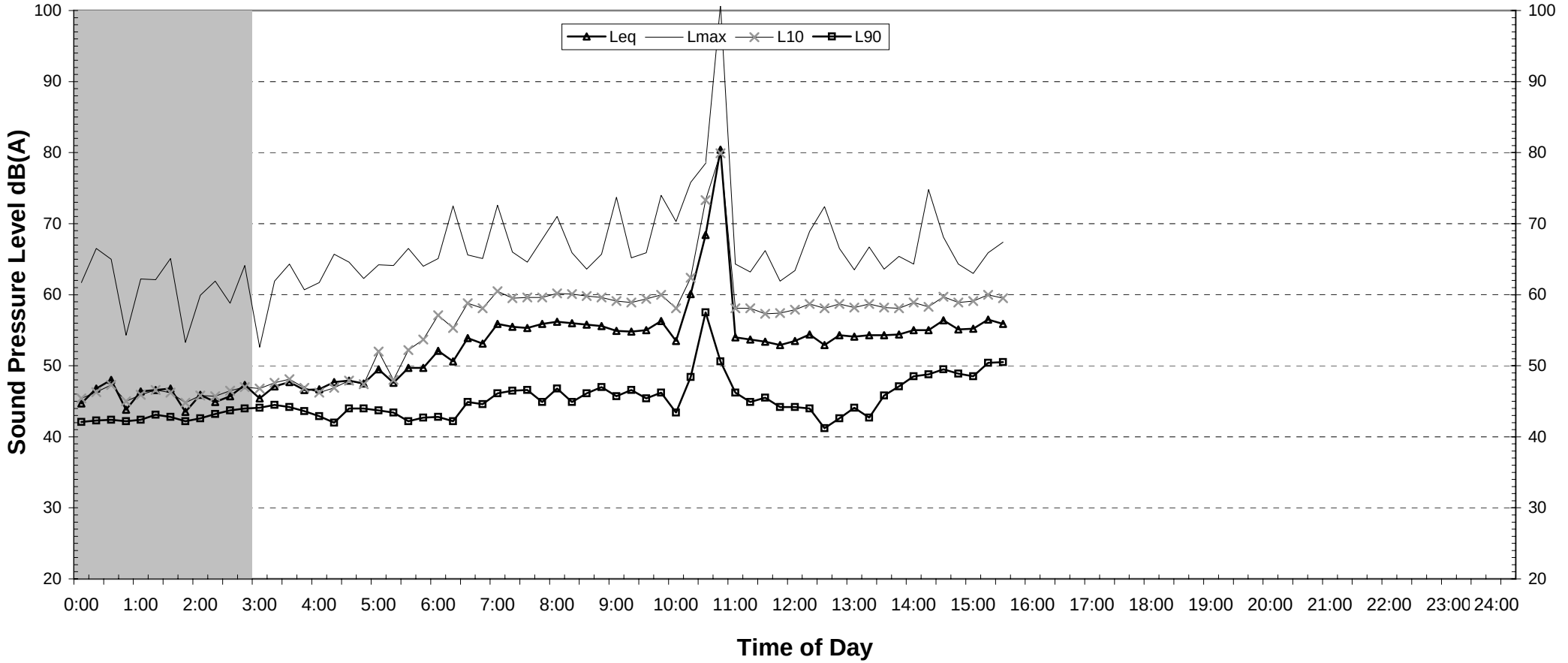
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	58.7	52.9
Leq 1hr upper 10 percentile	59.4	56.3
Leq 1hr lower 10 percentile	58.5	47.9

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.7	to	72.6
Lmax - Leq (Range)	16.4	to	18.8

EXISTING AMBIENT NOISE LEVELS

Seven Mile Beach Holiday Park

Friday, 12 August 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	43.4	-	-
Leq	65.7	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	68.2	-
Leq 1hr upper 10 percentile	77.2	-
Leq 1hr lower 10 percentile	55.9	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

APPENDIX D – INP DEFAULT METEOROLOGICAL CONDITIONS

Default values for inversion strength and wind have been specified for use in the noise assessment to avoid the need for potentially costly on-site monitoring. The DEC selected the default values based on the analysis of available field data.

DEFAULT TEMPERATURE INVERSION CONDITIONS

Given the site is located in a '*non-arid area (annual rainfall greater than 500mm)'*, the default inversion parameters specified in Appendix D of the DEC's INP for this type of area assumes the temperature inversion strength for all receivers is 3°C/100m. Drainage flow wind is not applicable as the site is generally below receiver level.

Table D1 in Appendix D of the INP gives an estimate of the decibel difference in noise levels predicted with and without inversion conditions representing an increase in noise levels as a result of the inversion. The potential increases in noise level due to the default temperature inversion condition are summarised in **Table D1**.

Table D1 – Increase in Noise Level Due to INP Default Inversion Condition 3°C/100m

Distance, m	100	200	400	500	1000	2000
Increase in noise level, dB(A)	1.0	1.0	1.5	1.5	1.5	1.5

DEFAULT WIND CONDITIONS

As done in Appendix D of the INP for 'temperature inversion' effects, the table below may be used as a rough guide for predicting 'wind' effects at a site at the initial screening test stage of an assessment.

The table gives an estimate of the decibel difference in noise levels predicted with and without the default wind condition of 3m/s at 10m height, representing an increase in noise levels as a result of wind. The levels are based on calculations performed using ENM ver.3.06, assuming the following:

- single point source calculations – as per Appendix D
- flat ground (rural ground type) with no barriers – as per Appendix D
- temperature = 20^0C (daytime)
- relative humidity = 85% – as per Appendix D
- worst-case wind direction from source (left) to receiver (right) – as per Appendix D
- Worst case scenario: source height = 3m; receiver height = 2m – as per Appendix D

Table D2 – Estimated Increase in Noise Level Under INP Default 3 m/s Wind

Distance, m	100	200	400	500	1000	2000
Increase in noise level, dB(A)	1.5	2.0	2.5	2.7	3.7	4.5