



46.5125.R2A:MSC

27th January, 2016

Solotel
Level 2, 429 New South Head Road
DOUBLE BAY NSW 2028

Attention: Mr A Osterballe

Dear Sirs,

ACOUSTIC ASSESSMENT - PROPOSED AMENDMENTS TO THE OPERA BAR
LOWER CONCOURSE RESTAURANT AREA
SYDNEY OPERA HOUSE

The purpose of this report is to present the results and findings of an acoustic assessment in relation to the provision of larger umbrellas over the outdoor area and a roll down blind at the rear of the stage area of the Opera Bar, which is located on the lower concourse to the Sydney Opera House on the eastern side of Circular Quay.

The Opera Bar is part of the overall licensed area of the Opera House and is adjacent to other entities that use the lower concourse area under a single liquor licence.

In 2014 the Opera Bar was the subject of an acoustic assessment concerning the emission of music from the premises with respect to an occupant of 1 Macquarie Street, Sydney (commonly identified as the Toaster Building) being the nearest residential accommodation to the Opera House.

As the Toaster Building is subject to a variety of different noise sources that influence the acoustic environment of the area, in undertaking an assessment of the Opera Bar it is necessary to differentiate between the different noise sources and the subject site.

It is noted that the group of buildings from 1 to 7 Macquarie Street were subject to a requirement for attenuation of the building to address the relatively high ambient noise level of the area and as such does not fall under general acoustic criteria utilised by Council or the Office of Liquor, Gaming and Racing.

The previous investigation related to an Apartment on level 5 of 1 Macquarie Street, being the most northern apartment on the eastern side of the building that has a clear line of sight to the lower concourse area, the Opera House, the Harbour Bridge and the northern part of the open water identified as Circular Quay.

The previous investigations involved unattended logger measurements on an external balcony for a 7-day period.

Attended testing was carried out on the night of Thursday 24th April, 2014 where measurements were conducted simultaneously on the balcony and inside the apartment.

The previous testing identified the acoustic environment of the area and the performance of the building façade of the apartment. There is no basis to assume the ambient noise environment in 2016 will be different to that of 2014. The use of the 2014 data is of assistance in this assessment.

From the outset, notwithstanding the current operations comply with the relevant acoustic conditions applicable to the site and the nearest residential receivers, it was envisaged the proposed amendments to the Opera Bar will provide a slight reduction in noise emission by reason of the larger area of umbrellas and attenuation by reason of the roll down blind to the stage area. This investigation involved the conduct of measurements on the Opera Bar on the night of Thursday 7th January 2016, taken from the upper concourse to provide noise source data for use in this assessment.

The Site

Both the Toaster Building and the Opera House are iconic items prominent in Sydney. As can be seen by the aerial photo in Appendix A, the Toaster Building is on the eastern side of Circular Quay and is subject to noise from ferries utilising Circular Quay and traffic on the Harbour Bridge.

Appendix A2 identifies the measurement locations used in the previous assessment in relation to the concourse area with the relative location of the logger positioned on the external balcony to the apartment on level 5.

Appendix A3 identifies the locations used in the current investigation.



Appendix B1 identifies the concourse in the general nature of the available restaurant/licensed areas on the concourse, of which the Opera Bar is one of those entities.

Appendix B2 identifies the changes in the area of the umbrellas and Appendix B3 provides a graphical presentation of the proposed umbrellas.

Macquarie Street is a no through road at the northern end of the street and involves a turning circle for northbound traffic to revert back in a southerly direction if not proceeding into the Opera House underground car park.

Both during the day and night there is a significant volume of traffic utilising Macquarie Street and a stream of pedestrian traffic along the concourse area being associated with tourists and patrons of the Opera House and ancillary licensed areas.

It is noted that on the western side of Circular Quay in part of the former overseas terminal building is a licensed venue identified as Cruise Bar that provides recorded (DJ) music that on previous occasions in relation to monitoring outside of 1 Macquarie Street (not associated with this assignment) music from the Cruise Bar was found to be clearly audible and give rise to measurable increases above the ambient background level.

Due to the Opera Bar being on the lower concourse there is acoustic shielding to the ground floor (street) level of the Toaster Building that presents difficulty in obtaining a measurement of the Opera Bar in the public domain.

Therefore, in considering the subject complaint as identified above there is a need for identification and separation of noise sources.

Measurement Techniques

Measurements were taken in accordance with the Australian Standard AS1055 “*Acoustics - Description and Measurement of Environmental Noise*” and the background measurement procedures set out in Appendix B of the EPA’s *Industrial Noise Policy*.



The attended sound level measurements in 2014 were recorded using a Brüel & Kjær 2250 Sound Level Meter (serial No. 3004338) and a Bruel & Kjaer 2260 Sound Level Meter (serial No.1824813). The reference calibration level of each meter was checked prior to and after measurements using a Brüel & Kjær Sound Level Calibrator Type 4231 and exhibited no drift. The calibration of the sound level meters to manufacturer's requirements is current.

Unattended sound level measurements in 2014 were recorded using a Svan Type 957 Sound Level Meter (serial No. 23806). The reference calibration level of the sound level meter (logger) was checked prior to and after measurements using a Brüel & Kjær sound level calibrator Type 4230 and exhibited no drift. The calibration of the sound level meter (logger) to manufacturer's requirements is current.

The attended sound level measurements in 2016 were recorded using a Brüel & Kjær 2250 Sound Level Meter (serial No. 3004338). The reference calibration level of each meter was checked prior to and after measurements using a Brüel & Kjær Sound Level Calibrator Type 4231 and exhibited no drift. The sound level meter holds a current calibration certificate to the manufacturer's requirements.

Measurement Results – 2014 Testing

On the night of the attended survey the weather conditions were mild (22°C), clear sky and a light, north easterly wind at the site.

The subject apartment has the main living area on the north eastern quadrant with a view out towards the Opera House, with a kitchen and ancillary service areas on the western side of the apartment (adjacent an internal wall to another apartment).

Between the kitchen and the balcony access is a small dining area at which the internal measurements were undertaken (using the B & K 2250 Sound Level Meter). Simultaneously measurements were conducted on the balcony using the B & K 2260 meter where the microphone was located in the centre of the balcony and approximately 1 m from the external facade.

The subject apartment we are advised is to undertake refurbishment and therefore there was a little furniture in the living area of the apartment.



Monitoring occurred with the door open to reveal a general ambient background level in the dining room in the order of 49 to 50 dB(A), whilst on the balcony the corresponding background level of 59 to 60 dB(A) was obtained.

Music occurring at the Opera Bar by way of a drummer, pianist, bass player and female vocalist was audible at times inside the apartment but did not give rise to any measurable increase above the background level. Towards the end of the first 2 samples set out in Appendix C the music ceased for a short break where there was a slight decrease in the ambient noise levels but not directly attributable to the subject music.

The second sample of tests that appears in Appendix C2 relates to internal noise measurements conducted with the balcony door closed for the first 12 minutes of testing and then with a door open where there is an increase in the internal noise levels as a result of the balcony door being open.

During the first 6 minutes of the second sample there was no music occurring at the Opera Bar and revealed for the balcony position a general ambient noise level around 60 dB(A) whilst inside the apartment the ambient level was in the order of 32 dB(A).

At about 8:35 PM the band commenced and was faintly audible inside the apartment and indicates a slight increase in the ambient noise levels both internal and externally.

The ambient background level in the apartment with the doors closed was determined by way of a ventilation exhaust system in the kitchen that serves the entire building. An inspection of the living room revealed a number of small vertical windows in the external facade and a side door to the balcony of which the seals for the door and the vertical windows were leaking giving rise to some intrusion of music that could be detected at the dining room area but no transmission of music via the balcony door.

After obtaining attended measurements of observations of the deflections in the apartment with the doors closed, the balcony door was opened to give rise to an increase in both the ambient and the music noise levels set out in the upper graph of Appendix C2 (in that we understood the music of the Opera Bar was to cease by 9 PM).



In addition to the graphs showing the variation in the A-weighted level over time Appendix C also includes a table of statistical noise level measurements associated with the ambient noise and also the average maximum (L10) levels observed on the sound level meter in relation to the music as detected.

Appendix D provides the results of the unattended logging (in 2014) that reveals similar background levels to that observed during the attended measurements.

Measurement Results – 2014 Testing

As identified above the provision of umbrellas over a greater area of the Opera Bar would introduce a greater degree of acoustic attenuation of patrons under the umbrellas which could lead to a marginal reduction in noise emission from the Opera Bar, whilst the provision of a roll down blind behind the stage area (as a result of the 2014 testing) would reduce the contribution of music to the Toaster Building from that determined in 2014.

Furthermore, due to the topography of the area that has the Opera Bar on the lower concourse then there is a degree of acoustic shielding provided by the upper concourse with respect to any ground-level monitoring positions at the Toaster Building.

To permit the prediction of noise levels from the Opera Bar as a result of the proposed amendments for the current operation a series of short term measurements were conducted at the western edge of the upper concourse overlooking the Opera Bar.

Appendix A3 identifies three locations along the edge of the upper concourse with location 1 being opposite the set of stairs on the lower concourse, location 2 opposite the stage and location 3 north-east of the stage above an open area. An additional location 4 was at the front boundary of the Toaster Building.

Measurements were first conducted without the band occurring so as to determine the ambient noise with location 1 producing a 15-minute time splice graph as the upper figure in Appendix E1. This graph identifies the variation in noise in the A-weighted noise level over time that resulted in a background level of 68 dB(A) with a statistical L 10 level of 72 dB(A). Whilst the actual stairs were cleared at the location it would appear that there were potentially 60 people, assumed to be patrons of the Opera Bar, in the immediate proximity that could influence the results.



The higher peak levels appearing in the upper graph in Appendix E1 relate to pedestrian traffic on the upper concourse which is not part of the Opera Bar.

The second graph in Appendix E1 provides measurements at locations 2 & 3, commencing at location 2 for the first portion of the time splice, being adjacent to the stage but no performers occurring only background music. By way of extracting that section of the graph from the Bruel & Kjaer Evaluator program one determines an average maximum level of 76 dB(A) primarily as a result of the Opera Bar noting that patrons were closer to the microphone than in location 1, and were under umbrellas.

The middle portion of the second time splice in Appendix E1 covers a short sample at the northern end of the Opera Bar test area with an average maximum level of 80 dB(A) from patrons.

The latter part of the second graph in Appendix E1 is a measurement back at location 2 (opposite the stage) with the band in operation to provide an average maximum level of 85 dB(A).

By way of the second graph in Appendix E, the music obtained at location 2 was in the order of 8 to 9 dB above that of the general patron noise.

A short sample was then obtained at location 1 with the band performing and found whilst the music was audible, it did not produce any significant increases above the ambient noise level such that the statistical results on A-weighted basis are similar to that without the band. This would indicate the effectiveness of the current acoustic shielding at the rear of the stage area.

Attendance then occurred to the Toaster Building boundary where some vocal component of the band could be detected from time to time again but did not give rise to any measurable increase above the ambient background level of 58 dB(A). It is noted that the average maximum level of 64 dB(A) as a result of pedestrian traffic primarily on the connection between East Circular Quay and the upper concourse.



Acoustic Criteria

In assessing noise from licensed premises there are generally two noise components to be considered, mechanical plant noise and noise from activities (music/people) associated with licensed premises. These two different noise sources are assessed under different criteria.

There is no issue in relation to mechanical plant associated with the Opera Bar in that no mechanical plant could be detected from the assessment location.

With respect to mechanical plant the Council normally applies the general Environment Protection Authority (EPA) (previously Department of Environment, Climate Change and Water – then part of the Office of Environment & Heritage in the Department of Premier and Cabinet, and re-established as a separate body in February 2012) noise criteria of background + 5 dB (A), measured as a Leq over 15 minutes and described in the *Industrial Noise Policy INP* as the *intrusive noise* target. The assessment point is at residential boundaries.

In relation to noise emission from Licensed Premises the former NSW Liquor Administration Board (“LAB”) imposed a more stringent set of noise criteria to that normally imposed by the EPA.

The same noise criteria (as the LAB) have been adopted by the Office of Liquor, Gaming and Racing, being the government department replacing the LAB.

For consistency with the general description of noise criteria for licensed premises we refer to the LAB/OLGR noise criteria for the licensed premise as the “OLGR” criteria.

For the purposes of conducting an OLGR compliance assessment, measurements are in the form of an average maximum level compared to the background level in octave bands, rather than the Leq approach adopted by the EPA/DECC for industrial noise sources.



In OLGR assessments there is a requirement to break up the analysis into frequency components called octave bands with centre frequencies from 31.5 Hz to 8 kHz. Musically speaking, low frequency is typical of the bass guitar and bass drum whilst high frequency is like a cymbal or a triangle. The octave bands measured encompass most of the audible spectrum and the OLGR analysis requires the music to be assessed in individual octave bands.

The OLGR criteria are in two parts according to different times of day being the pre midnight criteria (7.00 am to midnight) and the post-midnight criteria (after midnight to 7.00 am). The OLGR pre midnight criteria allows noise emissions from a licensed premise to exceed the background noise level by 5 dB in any octave band with centre frequencies between 31.5 Hz and 8 kHz at any residential boundary.

As the background level is defined as the level that is exceeded 90% of the time and therefore is measured on a statistical basis, the impact of the acoustic environment of the area on a statistical L10 level does not permit one to determine the noise level attributed to the licensed premises.

To identify the difference between the existing ambient L10 and the noise to be assessed from a licensed premises the OLGR before midnight residential boundary criterion be described as:

The LA10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz – 8k Hz inclusive) by more than 5 dB between 07:00 am and 12:00 midnight at the boundary of any affected residence.*

For the purpose of the OLGR jurisdiction the LA10* means the average maximum deflection on a sound level meter – not a statistical L10 level.

The OLGR post-midnight criteria are more stringent and require that the noise emission from any licenced premises is not to exceed the background noise level within the same octave bands used in the pre-midnight criteria at any residential boundary. The post-midnight criteria also stipulate that noise emissions from licenced premises are to be inaudible in any habitable room of any residential premises.



It is noted that the City Council in their current standard conditions of consent adopt the OLGR criteria for the purpose of licensed premises and also include an internal noise target with doors and windows closed in residential premises (but mechanical and air conditioning operating) of ambient background +3 dB when measured in the relevant octave bands.

However, it was identified above the subject building itself was granted development consent in September, 1994 that required the entire building to have specific noise control measures incorporated into the building and any assessment of noise to occur with those doors and windows closed (similar to the current standard conditions).

In the matter of Minus 5 Pty Ltd V City of Sydney Council [2008] NSW LEC1137, the decision of Commissioner Hussey (in proceedings No. 11226 of 2007) identifies the application of development consent No. 94/00279 for the Bennelong Apartments and acknowledgement by the Liquor Administration Board of that consent and noise issues where documentation from the Liquor Administration Board (with respect to Minus 5) stated:

“In doing so, and having regard to the terms of the City of Sydney Councils Development Consent No 94/00279 for the Bennelong Apartments, which specifically address noise attenuation for the apartments, the Board is giving consideration to amending its noise condition on the Hotel licence by adding a provision to the effect that in respect of the building known as the Bennelong Apartments/Opera Quays, at 2 Macquarie St Sydney, the condition will apply in any habitable room of any residential lot with doors and windows to the residence closed and mechanical ventilation as required by conditions 119 and 120 of Development Consent 94/00279 operating, and background noise level measured in the absence of noise emitted from the use.”

Therefore, in terms of the Opera Bar and its impact upon the Bennelong Apartments the application of the LAB/OLGR condition would occur inside the apartment with doors and windows closed and mechanical ventilation in operation.

Notwithstanding that consent I have also been requested to consider the general conditions of consent from the *Protection of the Environment Operations Act* with respect to offensive noise being a noise that may interfere with the rest and repose of persons.



However, offensive noise as a subjective assessment would not be applied in this case by reason of the consent for the Toaster Building. Section 2.2.1 of the EPA's *Noise Guide for Local Government* (version 2 issued after the 2014 investigation) provided the basis of this change by the EPA as shown in the following extract that also cites a decision from the Land & Environment Court of NSW:

Any existing regulatory instruments (for example, consents, approvals, notices etc) that apply directly to the premises or any relevant guidelines, policies or regulatory instruments that apply to that type of activity should also be considered when making a determination about offensive noise. An activity that complies with noise limits determined in the light of relevant noise policies or guidelines is unlikely to be regarded as offensive.

'Offensive noise' has been considered by the Land and Environment Court in Meriden v Pedavoli (2009), NSW Land and Environment Court judgement 183 (22 October 2009).

Acoustic Assessment

With respect to the standard criteria issued by the OLGR at residential boundaries the observations during the attended measurements (2014 and 2016) as a result of music revealed compliance with background +5 dB(A) noting that the ambient background level without music occurring is the basis of assessment at the time of our measurements.

By reference to the 2014 ambient logger charts recorded on the balcony there is no basis to consider any significant difference in the ambient background level on other nights of the week to that observed during the attended measurements.

If one considers the LAB's decision in relation to the subject building having regard to the Council's development consent No. 94/00279 then the 2014 measurements that were undertaken found full compliance with the OLGR criteria applied inside the apartment with doors and windows closed. It is noted that at the time of the testing the mechanical ventilation that was operating was only the kitchen and we assume automatically from the bathrooms by way of an exhaust system being extraction of air, but not necessarily any supply air as required under Australian Standard 1668.2. Furthermore, it is noted that air conditioning for the apartment was not in operation at the time of our internal testing.



If one considers potential noise from air conditioning to give rise to a marginal increase in the background level in the apartment, then the resultant music emissions from the Opera Bar in 2014 would fully comply with the OLGR limits.

As noted during our previous assessment we did find some sound leakage by way of seals to the side door to the balcony and narrow vertical windows positioned in the facade which were primarily letting high-frequency noise into the living room that would suggest the seals need renewing in light of the sound leakage resulting in non-compliance for general ambient noise with the internal criteria contained in the development consent for the building.

Under the Council's assessment criteria, the internal noise levels set out in Appendix C being the L10 levels as the average maximum levels observed on a sound level meter would automatically be lower when assessed as a statistical L10/Leq noise level which could not be done at the time in view of the existing ambient noise for the general area.

Based on the audible assessment in 2014 with the balcony doors open and an audible assessment with the balcony doors closed it was not considered that noise emission from the Opera Bar would be deemed to be offensive noise as defined in the *Protection of the Environment Operations Act*. In light of the consent to the Toaster Building and the revised version of the EPA 's *Noise Guide for Local Government*, offensive noise would not apply to the Opera Bar at the nearest residential receiver.

Our 2014 assessment recommended that the RMS limiting be provided on the sound system for the Opera Bar (as required by Council's current standard conditions of consent for licensed premises) is maintained.

The 2014 assessment suggested a practical solution to further reduce the vocal component of the entertainment would be to use a clear transparent roll down plastic blind at the southern end of the entertainment area that would provide additional shielding from the music occurring under the covered stage and back towards the complainant's premises.

The Opera Bar Architectural Design Statement identifies the following change in the covered areas, being approximately a 50% increase for the two areas closest to the Toaster Building:



TABLE 1: Umbrella Areas

Area	Plan Area Existing	Plan Area Proposed
Opera Bar South	59m ²	126m ²
Opera Bar North	133m ²	169m ²

As a consequence of more of the outdoor area being covered (including the stage) there would automatically be a reduction in noise emitted from the Opera Bar outdoor area.

In dealing with noise emission from outdoor areas the normal approach is to consider the noise source as a sound power level for the number of people, with 50% of the patrons talking simultaneously. The noise emission for areas where drinking and smoking can occur is normally considered as patrons speaking in 'raised' voices. Where smoking only occurs the analysis uses "normal" voice.

Appendix F considers the distribution of patrons and music based upon the latest measurements, the current layout and the proposed layout. From the plans for the umbrellas the lower concourse has been broken into the following areas that have been used in our analysis:

- The area south of the southern umbrellas, being basically a triangle opposite location 1.
- The area designated Opera Bar South (the current and proposed umbrellas)
- The area designated Opera Bar North (the current and proposed umbrellas)
- The open area north of Opera Bar North Umbrellas (south of the Kitchen umbrella area) that remains open

For the covered areas (that have tables and chairs) the patrons have been allocated 1m² where is the open areas 0.5m². In all cases we have used raised voices. For the attenuation of the umbrellas we have used the insertion loss (sound reduction) reduction of the Ferrari Tint 1.5mm vinyl obtained from measurements of the operable blinds at the Manly Wharf Hotel and the Mill Hotel.



Appendix F provides the following contribution from patrons when assessed at level 5 of the Toaster Building to be below the background level.

Music Contribution		A-Weighted Octave Band Centre Frequency (Hz)								
	dB(A)	31	63	125	250	500	1k	2k	4k	8k
Current	56	9	30	42	54	50	46	40	32	29
Proposed	51	9	30	41	50	43	37	27	17	8
Balcony Ambient Background L90	59	20	34	41	44	53	55	52	44	30

Patron Contribution		A-Weighted Octave Band Centre Frequency (Hz)								
	dB(A)	31	63	125	250	500	1k	2k	4k	8k
Current	52	-6	8	28	40	49	47	43	38	30
Proposed	51	-7	7	27	39	48	47	42	37	28
Balcony Ambient Background L90	59	20	34	41	44	53	55	52	44	30

A similar exercise for the music is provided in Appendix F that identifies the attenuation from the umbrellas over the stage and a similar material at the back of the stage shows the contribution to be below the A weighted background level.

Conclusion

Compliance testing carried out on the night of Thursday 24th April, 2014 found music to be audible from the entertainment in the Opera Bar to be fully compliant with the standard OLGR criteria measured at residential boundaries and fully compliant with the OLGR criteria that applies to the subject building by way of development consent No. 94/00279 that covers the entire development, as addressed by both the Land and Environment Court and the Liquor Administration Board with respect to a licensed premises at the southern end of that building being Minus 5.



In terms of the ambient noise it is noted that noise from patrons in the concourse area and general pedestrian traffic outside the Toaster Building add to a general mixture of the environmental noise that provides masking of activities from the various licensed premises on the forecourt.

We note that the acoustic environment in the area also has an added component from ferry traffic into and out of Circular Quay and a general background roar from traffic using the Harbour Bridge.

In 2014 we formed the view that that the operation of the Opera Bar in its (then) current configuration and noise limitation did not present an acoustic issue with respect to the Toaster Building but as requested by management recommended the provision of a roll down blind on the southern side of the entertainment area that would provide further attenuation and the necessity of having an rms limiter on the sound system to control the music output.

The sound system incorporates the rms limiter and limits the overall level of music.

With the increase in the size of the umbrellas and the provision of a roll down blind (to the rear of the stage area) there would be a marginal reduction in noise emission from the Opera Bar. More importantly the proposed change in umbrellas will not cause any increase in noise emitted from the Opera Bar.

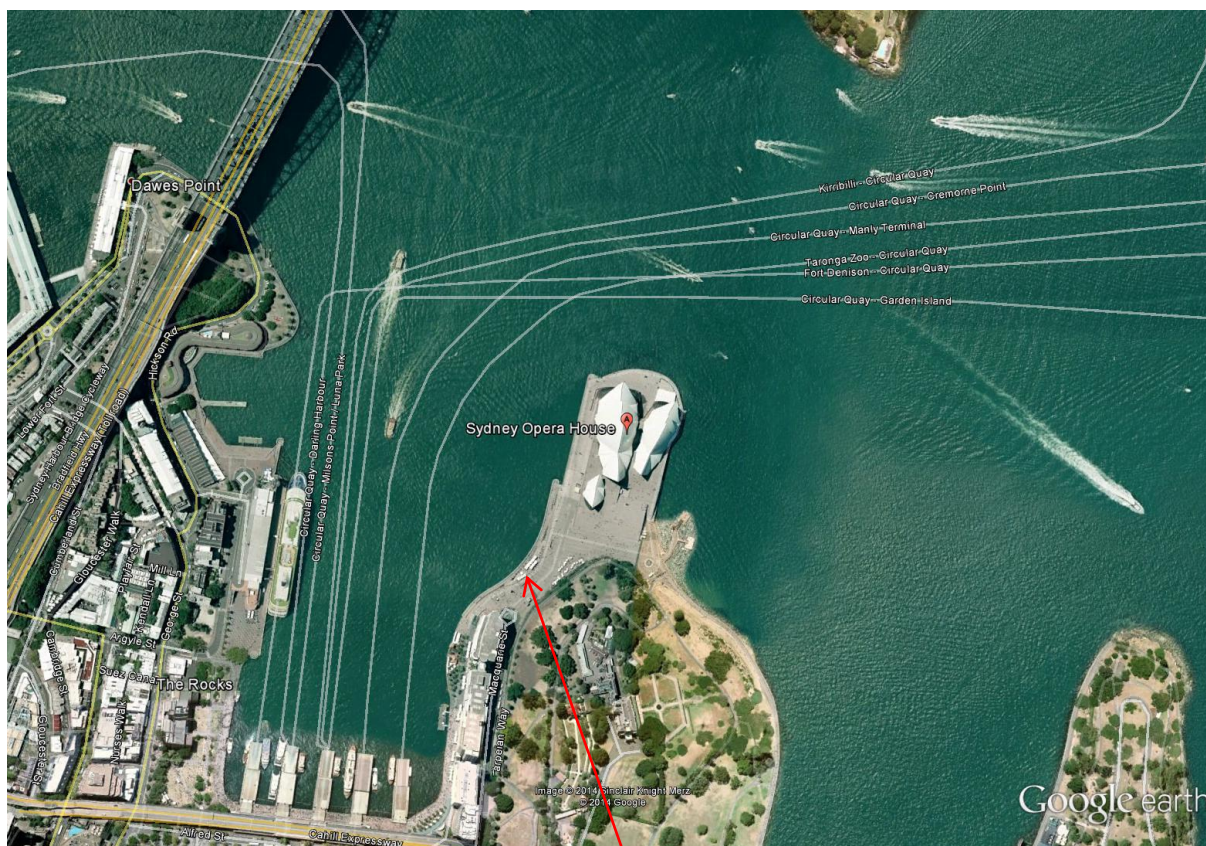
Yours faithfully,

THE ACOUSTIC GROUP PTY LTD


STEVEN E COOPER

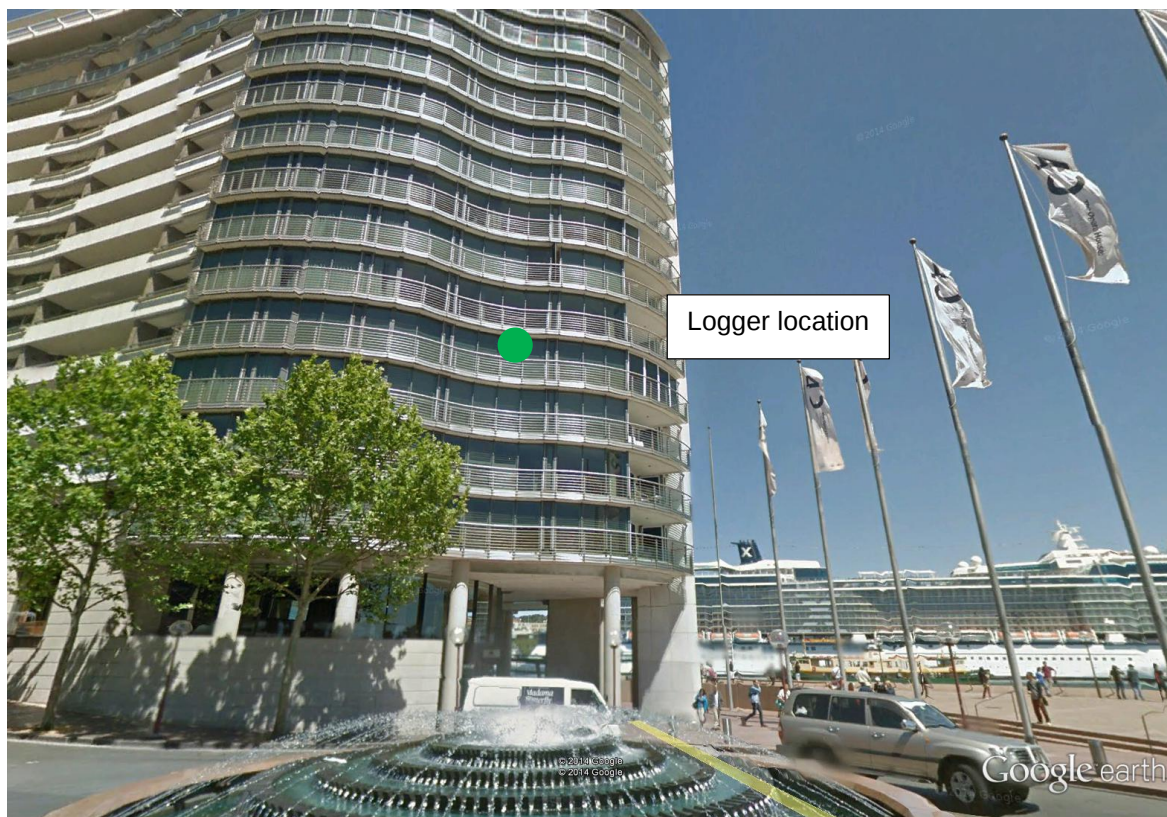


APPENDIX A: **Site and Measurement Locations**



Site



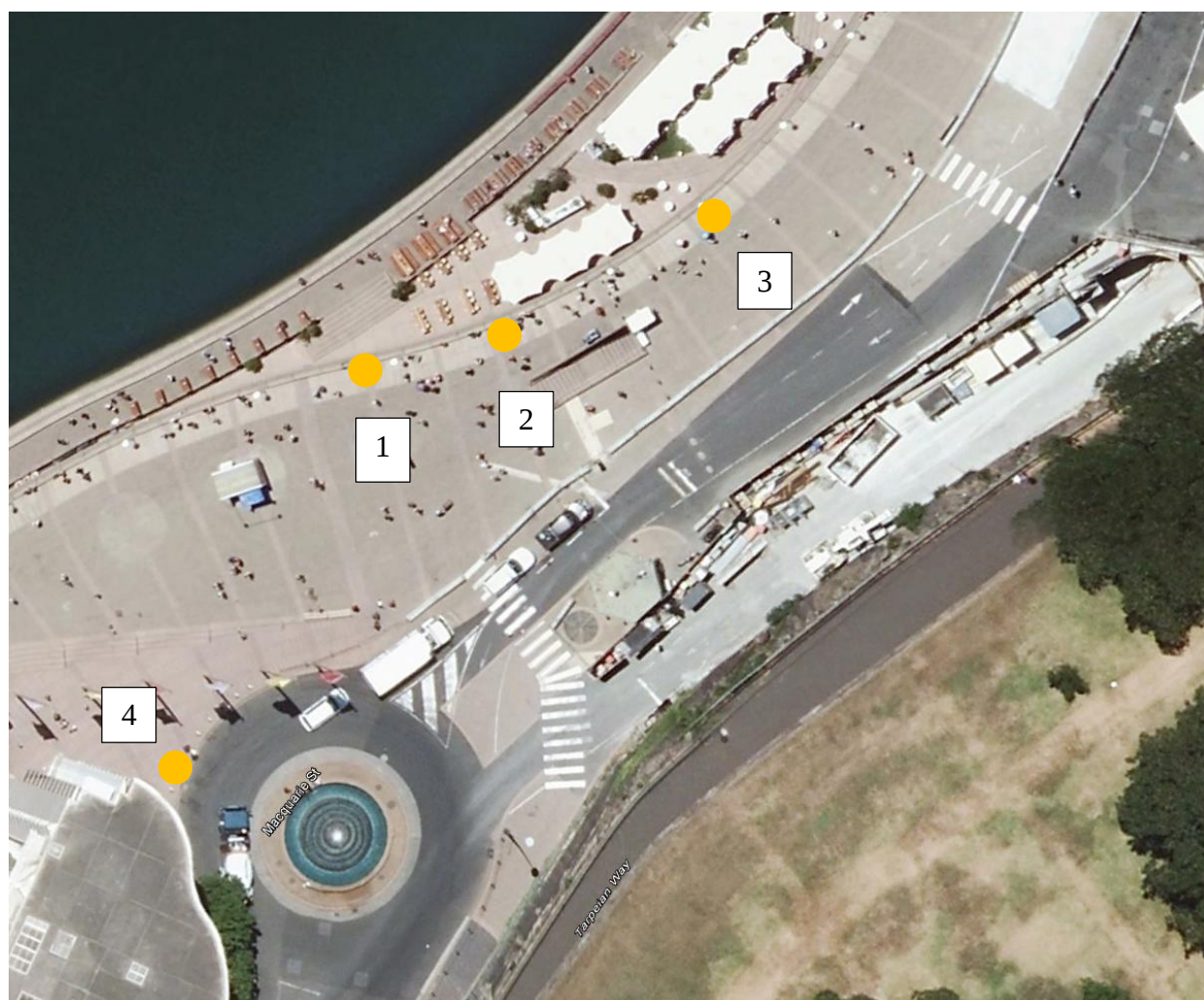


● Attended External Measurement Location

● Logger Location

● Attended Internal Measurement Location

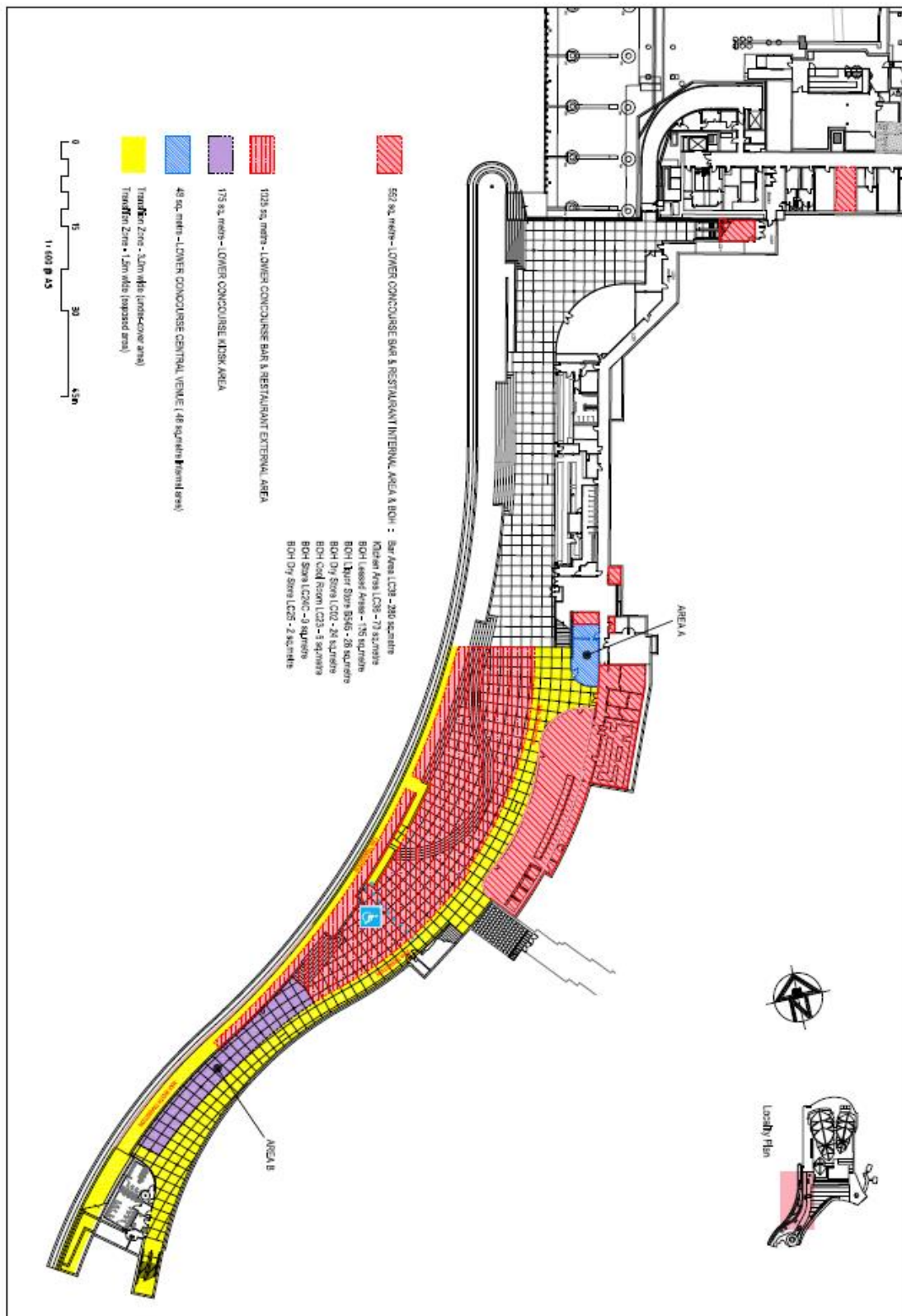


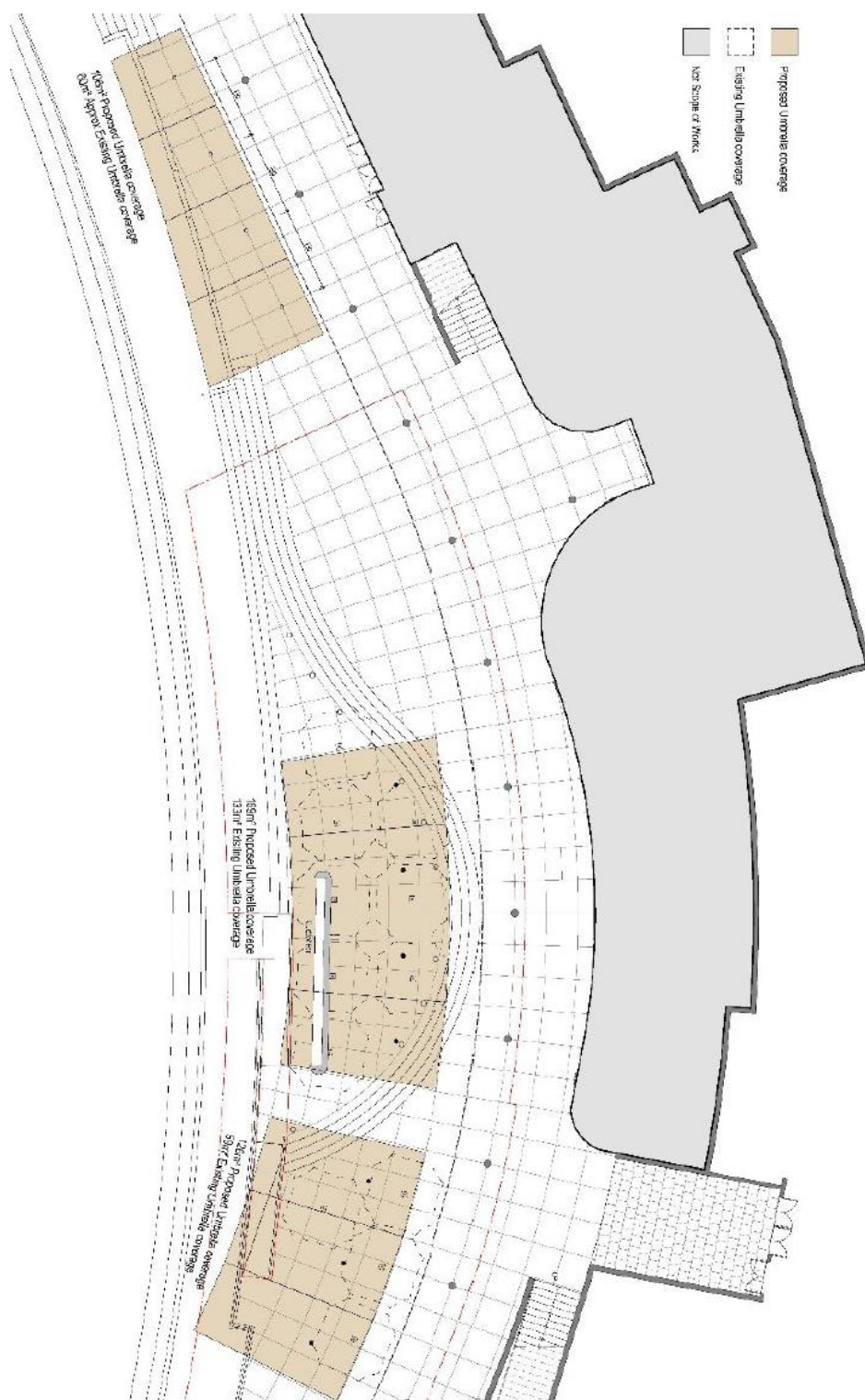


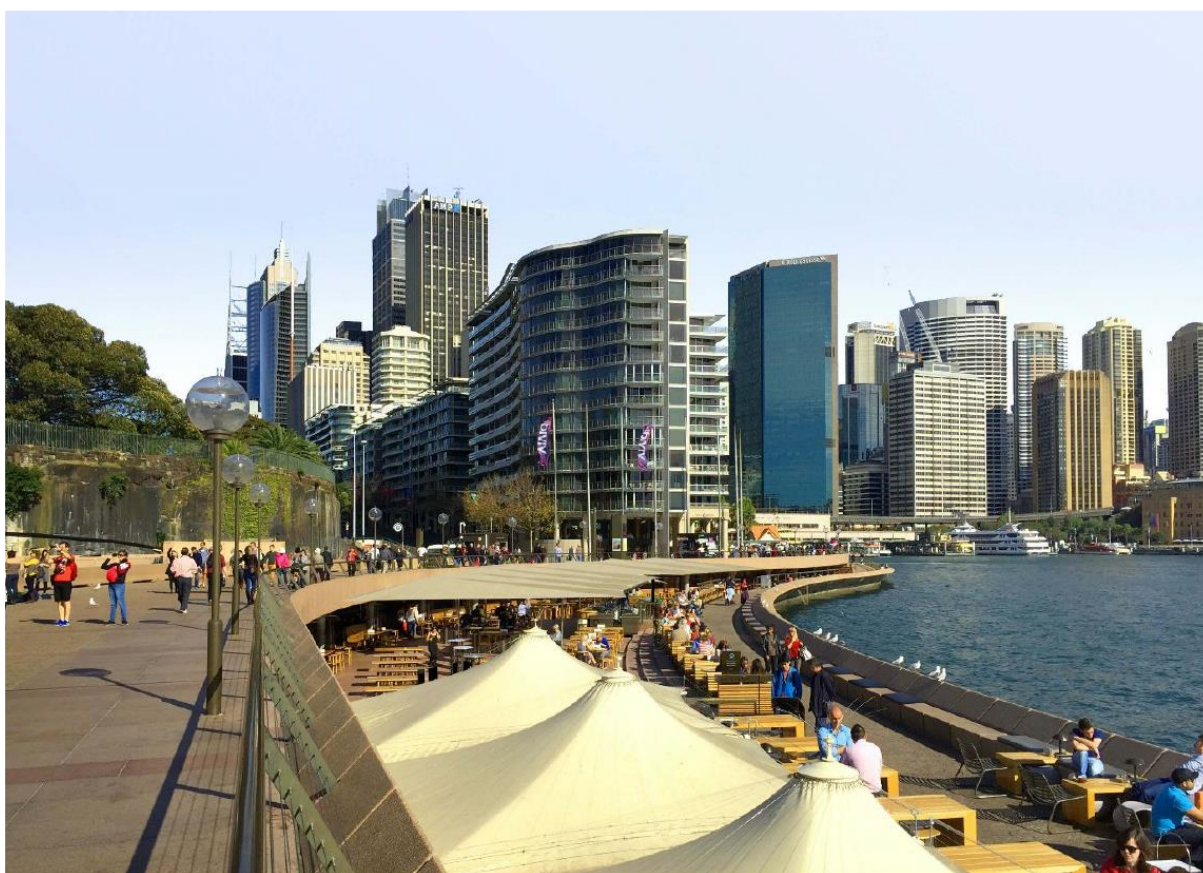
● Attended Monitoring Locations in 2016



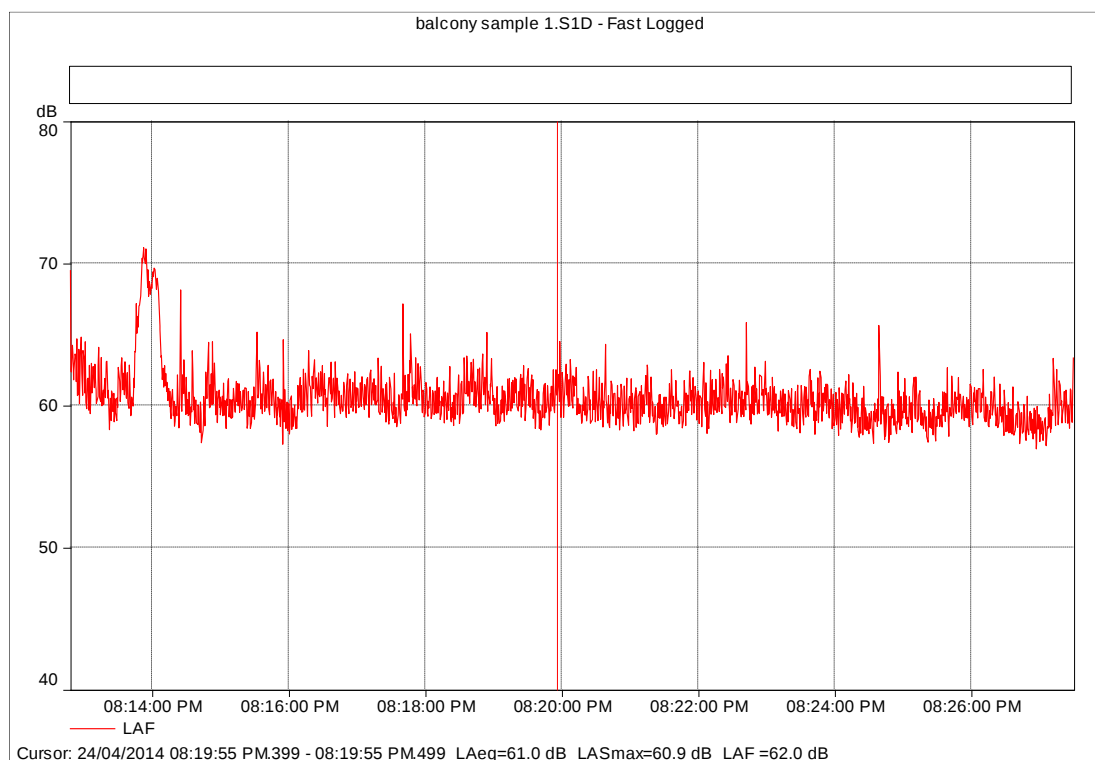
APPENDIX B: Concourse Layout

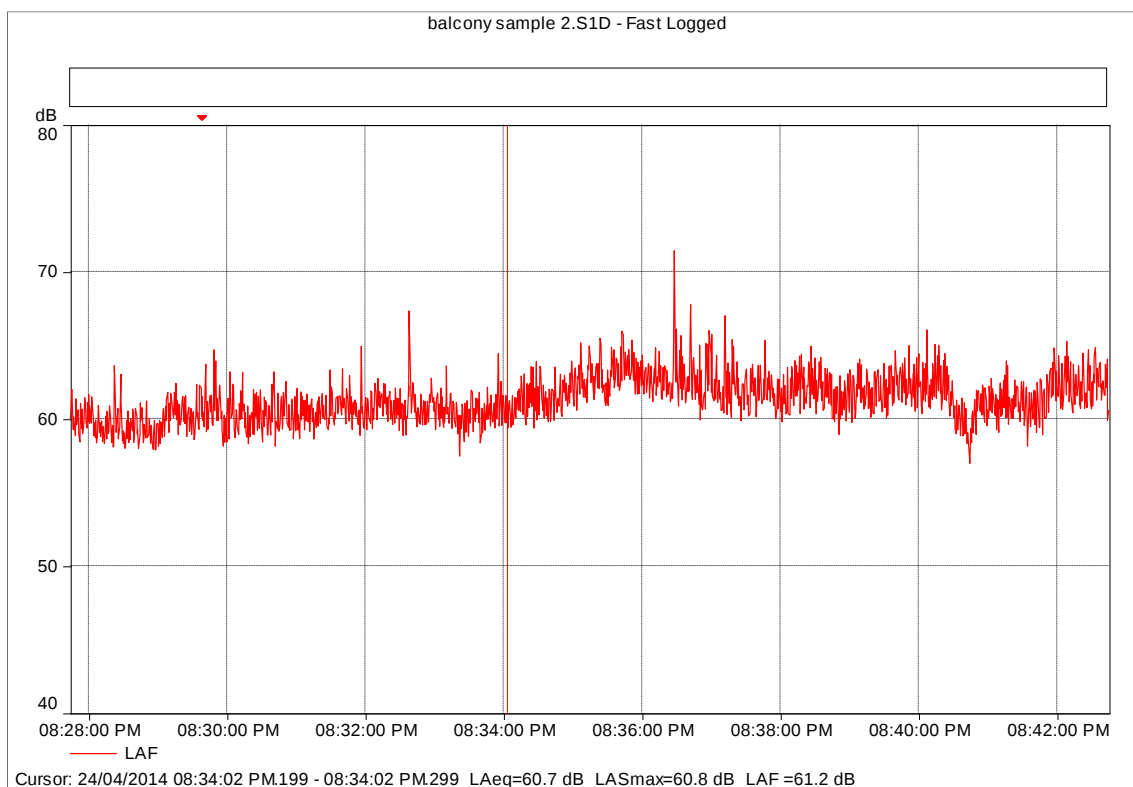
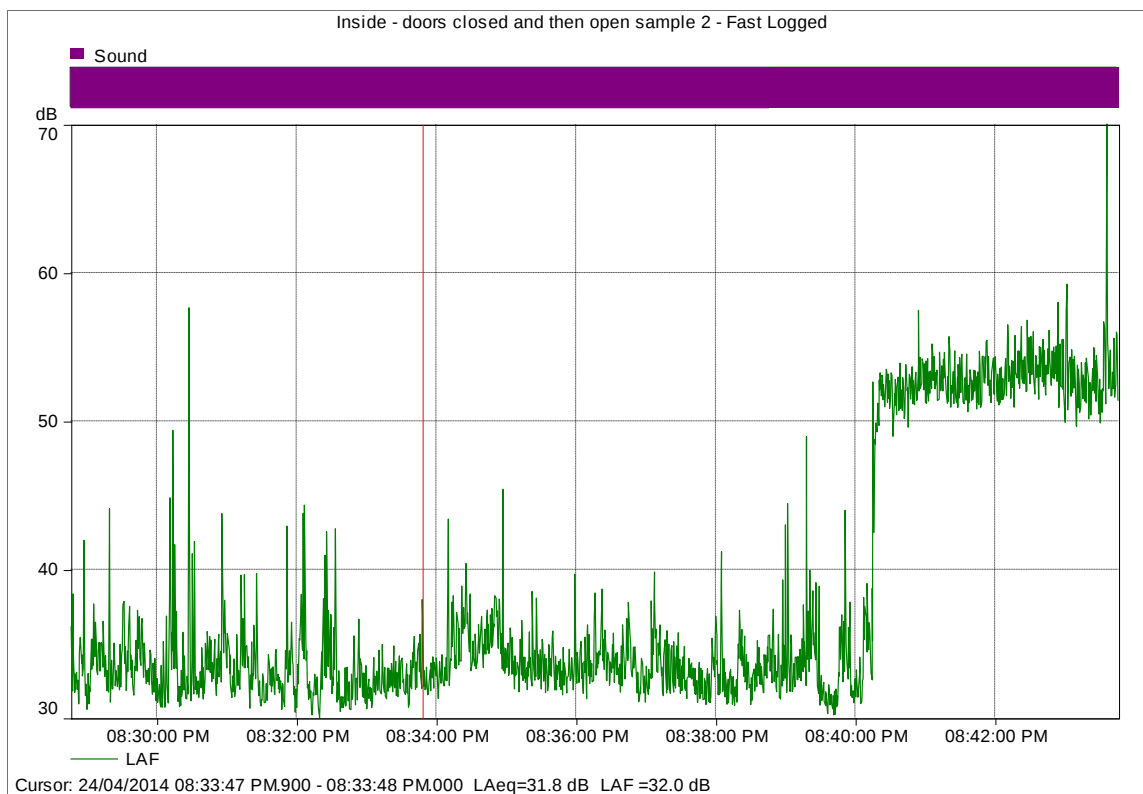






APPENDIX C: Measurement Results - 2014





Location	Parameter		A-weighted Octave Band Centre Frequency (Hz)								
		dB(A)	31	63	125	250	500	1k	2k	4k	8k
Inside sample 1 doors open	L10	53	29	34	39	37	47	49	46	40	27
	Leq	51	26	31	36	35	45	48	44	38	25
	L90	50	18	25	31	33	44	45	41	35	21
Balcony Sample 1	L10	62	30	41	48	48	56	58	55	47	34
	Leq	61	26	39	46	47	55	57	55	46	33
	L90	59	20	34	41	44	53	55	52	44	30
Inside Sample 2 (all)	L10 Music (door closed)	-	18	20	22	23	27	26	20	16	-
	L10	53	26	32	36	40	48	49	45	39	25
	Leq	47	22	27	30	35	42	43	39	35	26
	L90	32	14	16	20	22	27	25	19	13	11
Balcony Sample 2	L10	63	31	45	48	53	58	59	56	48	34
	Leq	62	28	42	46	50	56	57	54	46	32
	L90	60	21	35	42	45	54	55	52	44	30



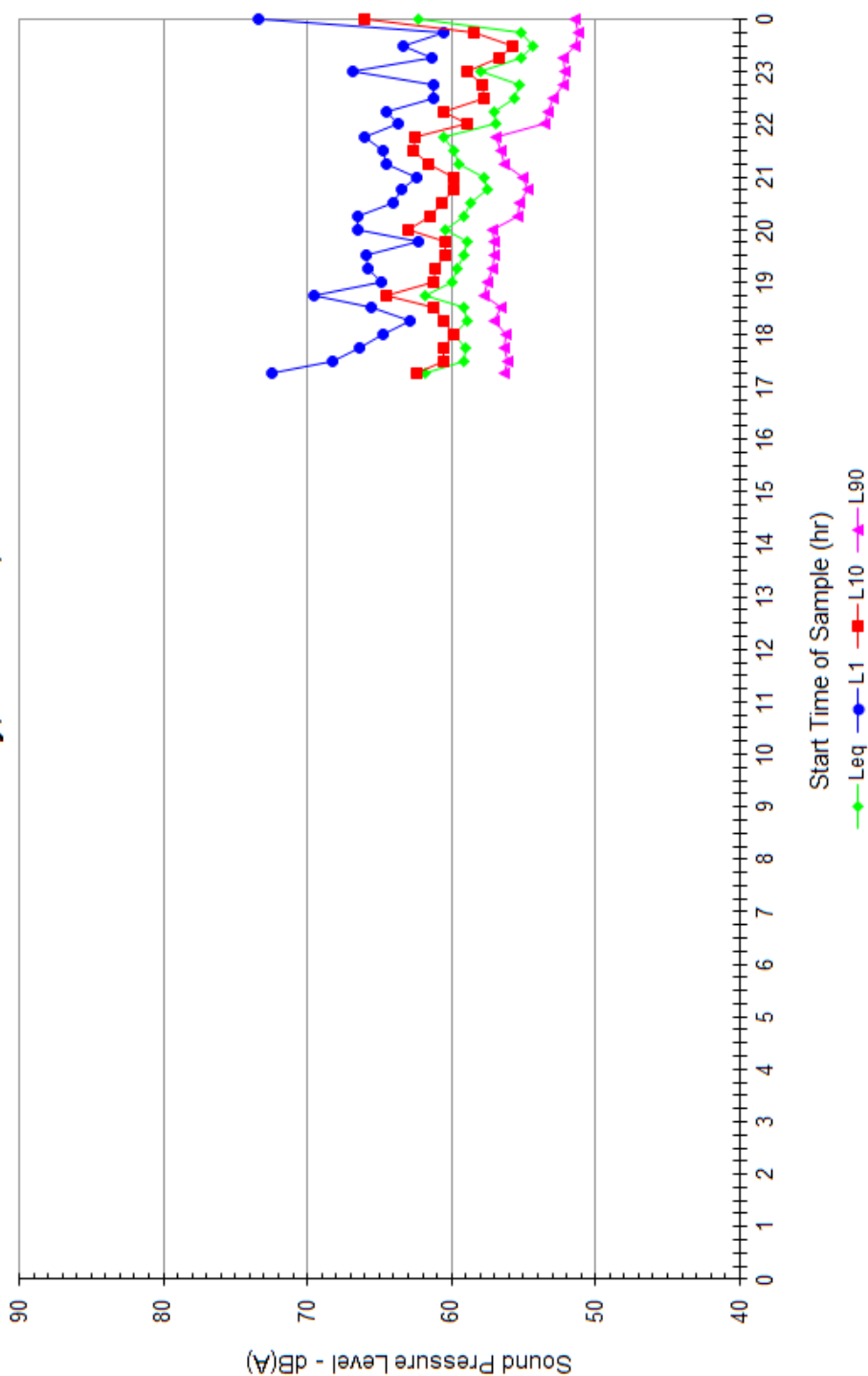
APPENDIX D: Logger Results

Opera Bar						
Job Number:	44.5125.R1					
Instrumentation:	SVAN 957 Logger 23806					
Logger Location:	Balcony of Apartment on Level 5 of the Toaster Building					
Free Field:	yes					
Monitoring Period:	Monday 31 March 2014		to		Monday 7 April 2014	
BACKGROUND AND AMBIENT NOISE MONITORING RESULTS						
NSW EPA's INDUSTRIAL NOISE POLICY , 2000						
Day	L90 Background Noise Levels			Leq Ambient Noise Levels		
	Day 7am - 6pm	Evening 6pm - 10pm	Night 10pm - 7am	Day 7am - 6pm	Evening 6pm -	Night 10pm - 7am
Monday 31 March 2014	*	53.5	48.1	*	59.1	58.4
Tuesday 1 April 2014	55.9	55.8	48.9	63.2	62.0	57.8
Wednesday 2 April 2014	55.9	57.3	49.4	63.3	65.2	57.5
Thursday 3 April 2014	54.3	57.2	48.1	60.5	62.0	57.2
Friday 4 April 2014	56.1	57.8	48.3	62.4	63.3	57.0
Saturday 5 April 2014	54.8	62.8	43.9	66.1	69.7	55.0
Sunday 6 April 2014	48.4	51.4	45.6	58.7	60.5	53.7
RBL Median	55.4	57.2	48.1	-	-	-
Log Average	-	-	-	63.0	63.4	55.8
TRAFFIC NOISE MONITORING RESULTS						
DECCW's NSW Road Noise Policy 2011						
Day	Leq Ambient Noise Levels		Leq 1 Hr Noise Levels			
	Day 7am - 10pm	Night 10pm - 7am	Day - Max	Day - Min	Night - Max	Night - Min
Monday 31 March 2014	*	60.9	62.6	*	65.4	54.9
Tuesday 1 April 2014	65.4	60.3	68.6	59.8	64.8	55.1
Wednesday 2 April 2014	66.4	60.0	72.8	58.9	62.6	56.8
Thursday 3 April 2014	63.5	59.7	67.8	59.4	65.5	53.3
Friday 4 April 2014	65.2	59.5	68.8	62.0	64.1	54.1
Saturday 5 April 2014	69.9	57.4	73.3	65.0	63.4	51.3
Sunday 6 April 2014	61.7	56.2	66.9	57.2	57.6	54.4
Log Average	65.2	58.3	69.8	61.2	63.9	54.5
* indicates an incomplete set of data for a given time period						
# Nighttime for a given day continues through to the following morning						



Ambient Measurements

Monday, March 31, 2014



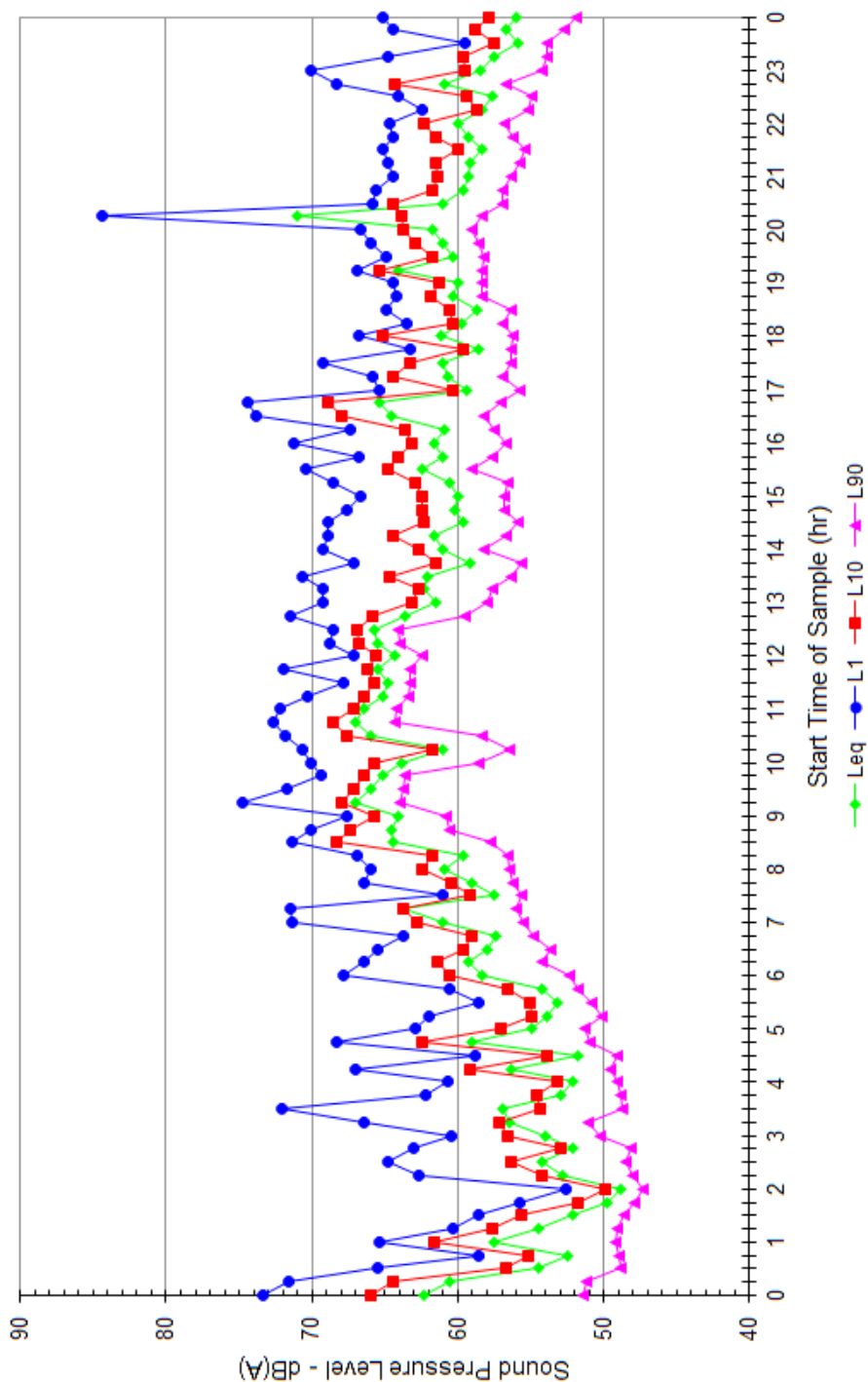
Opera Bar
SVAN 957 Logger 23806

Balcony of Apartment on Level 5 of the Toaster Building
44.5125.R1



Ambient Measurements

Tuesday, April 1, 2014



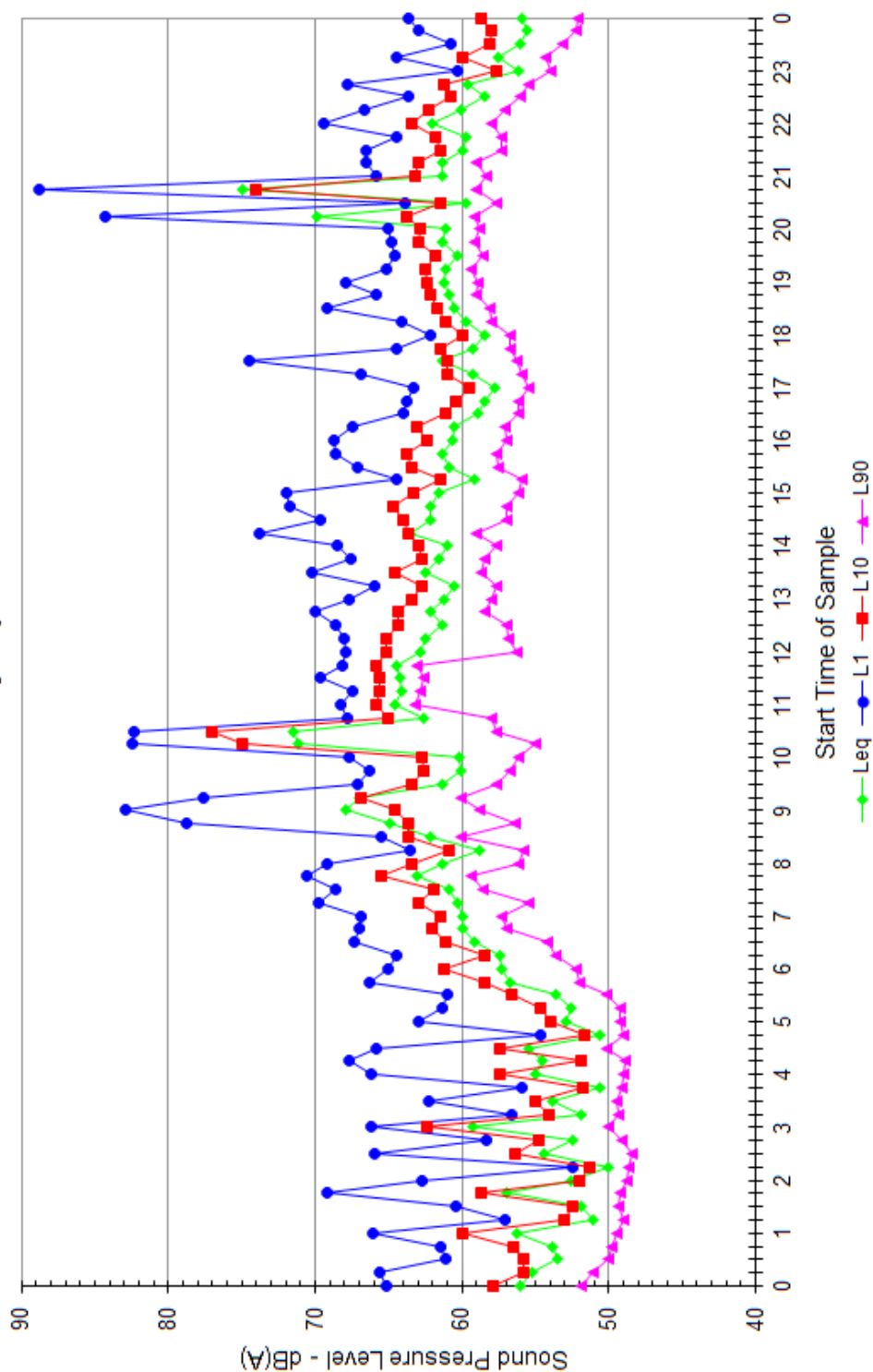
Opera Bar
SVAN 957 Logger 23806

44.5125.R1
Balcony of Apartment on Level 5 of the Toaster Building



Ambient Measurements

Wednesday, April 2, 2014



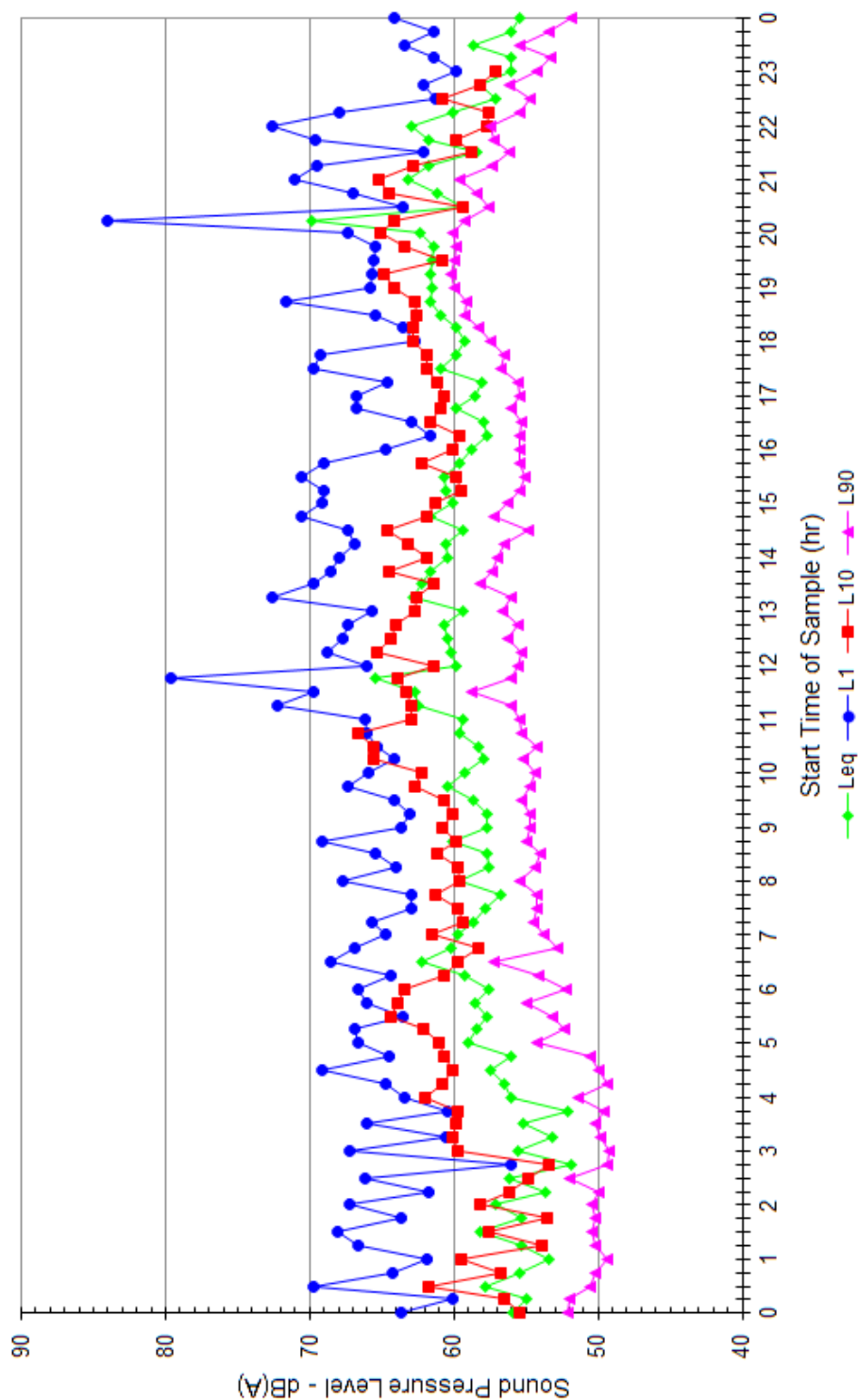
Opera Bar
SVAN 957 Logger 23806

44.5125.R1
Balcony of Apartment on Level 5 of the Toaster Building



Ambient Measurements

Thursday, April 3, 2014



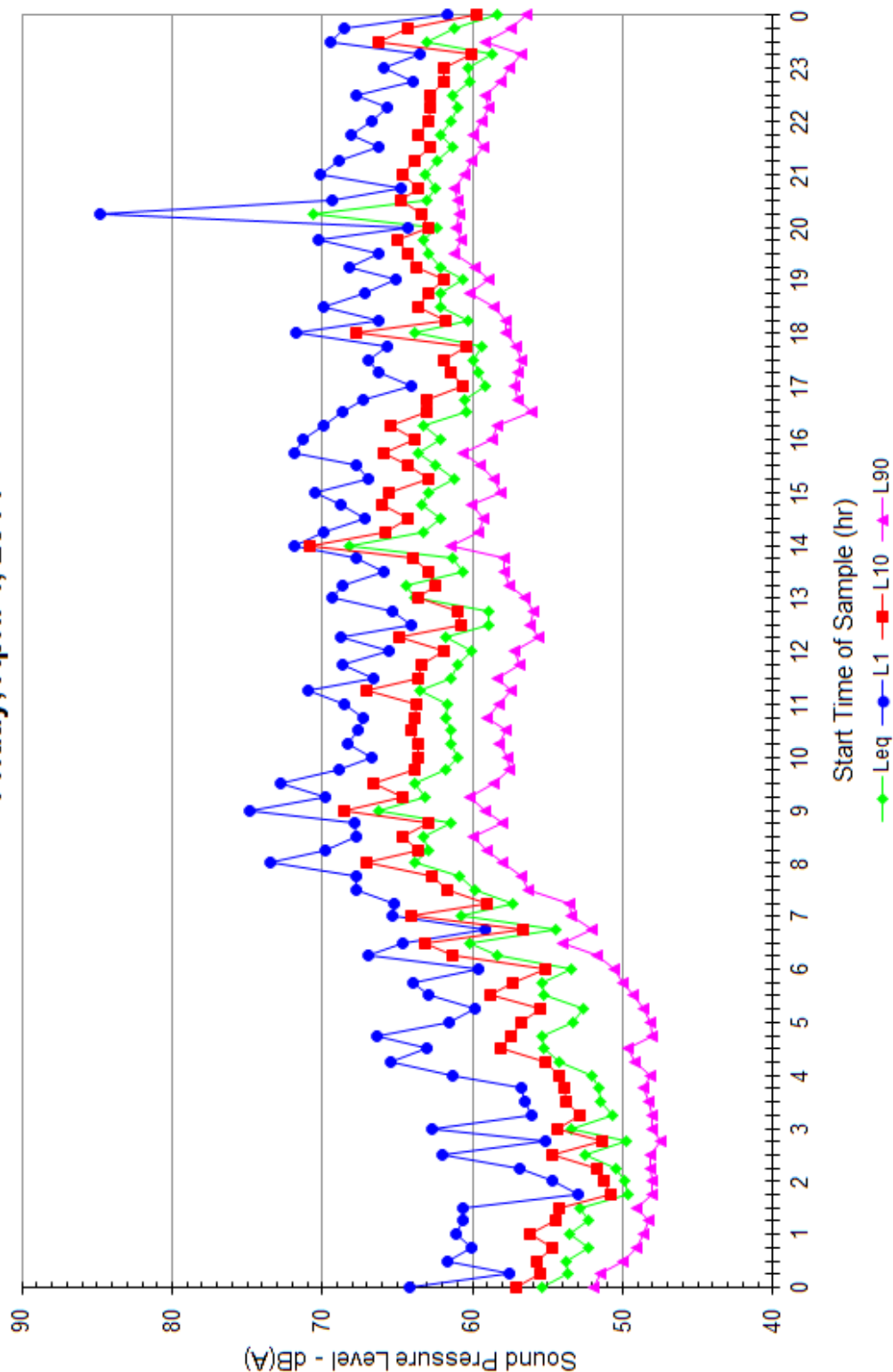
44.5125.R1
Balcony of Apartment on Level 5 of the Toaster Building

Opera Bar
SVAN 957 Logger 23806



Ambient Measurements

Friday, April 4, 2014

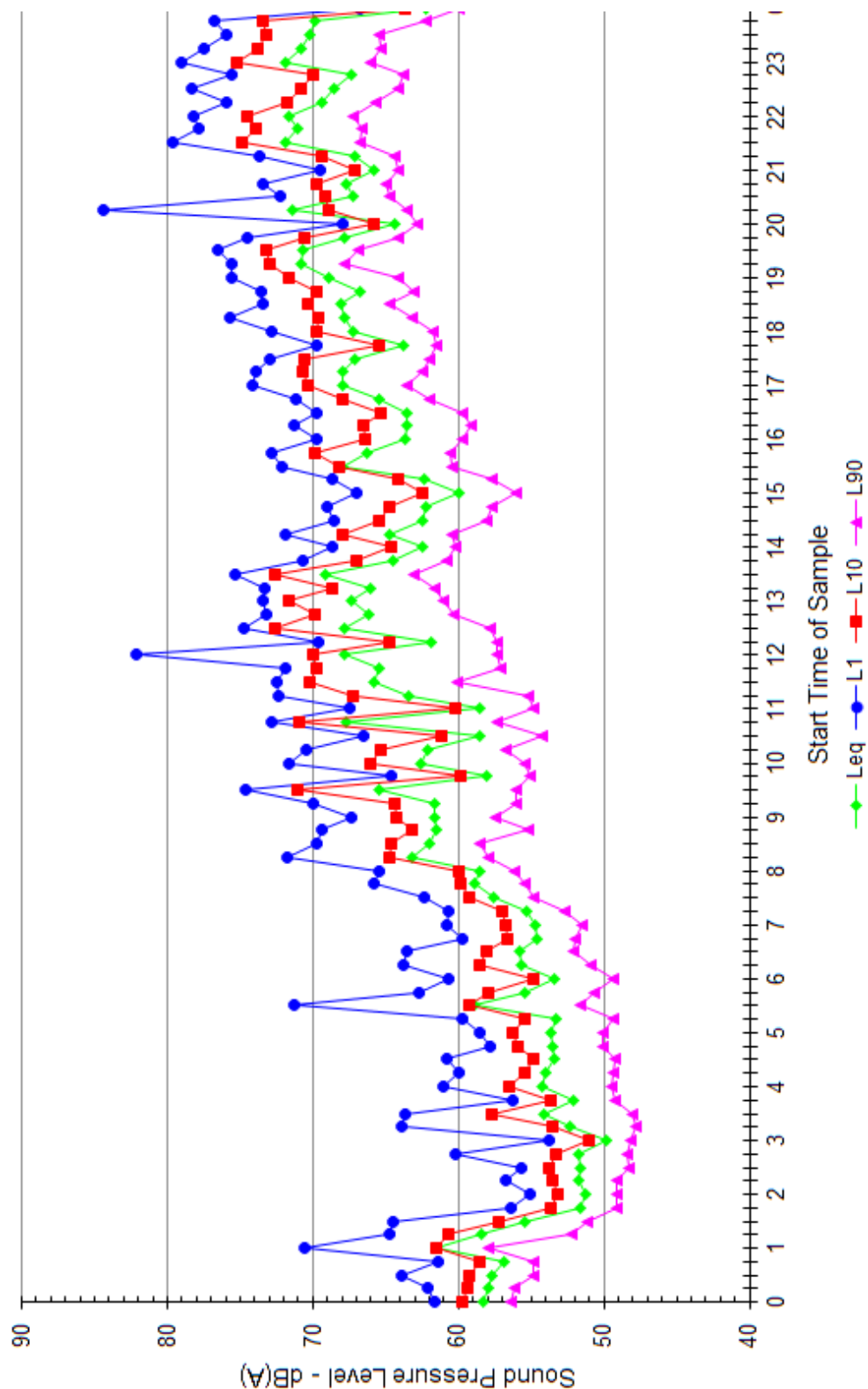


Opera Bar
SVAN 957 Logger 23806



Ambient Measurements

Saturday, April 5, 2014



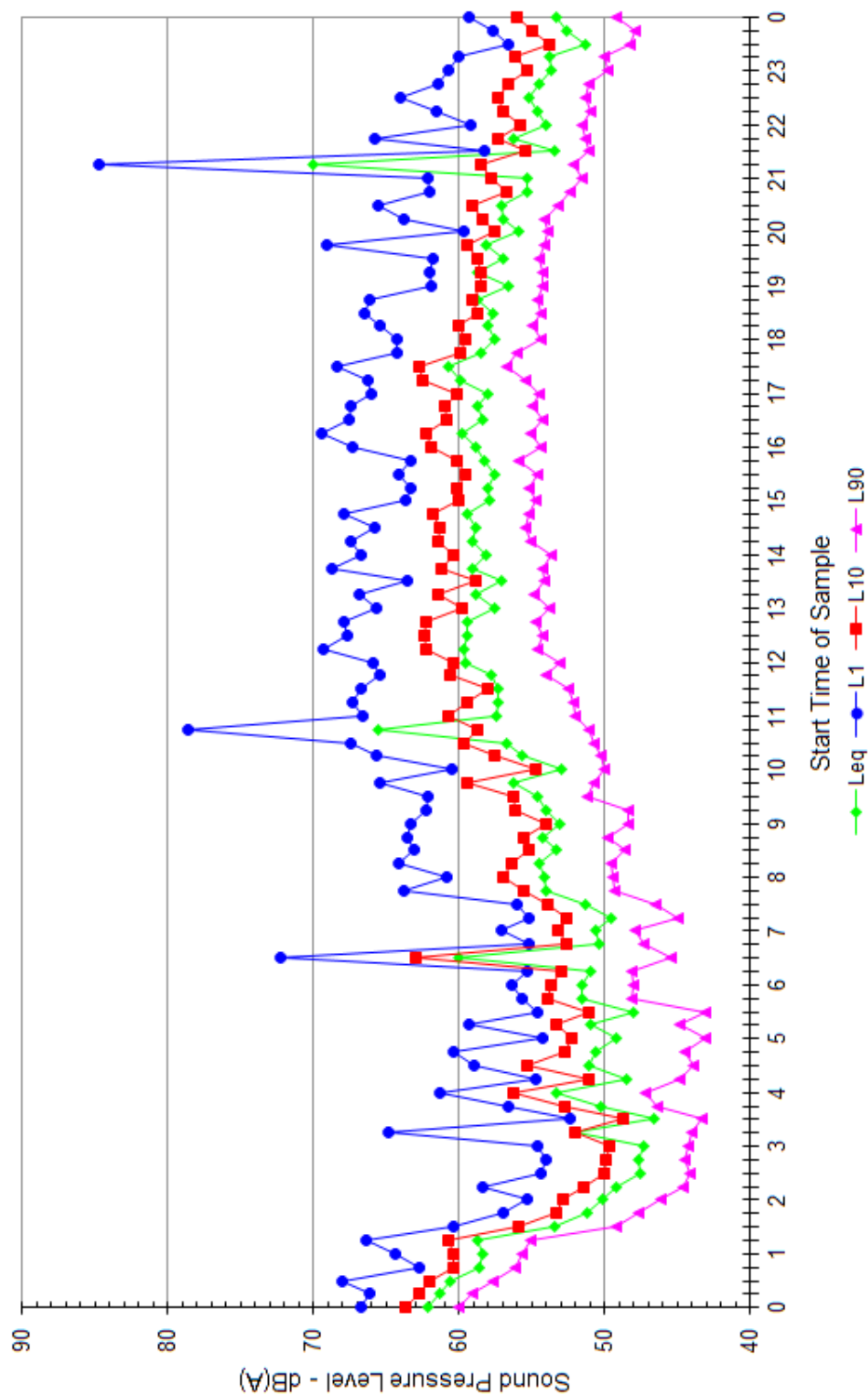
Opera Bar
SVAN 957 Logger 23806

44.5125.R1
Balcony of Apartment on Level 5 of the Toaster Building



Ambient Measurements

Sunday, April 6, 2014



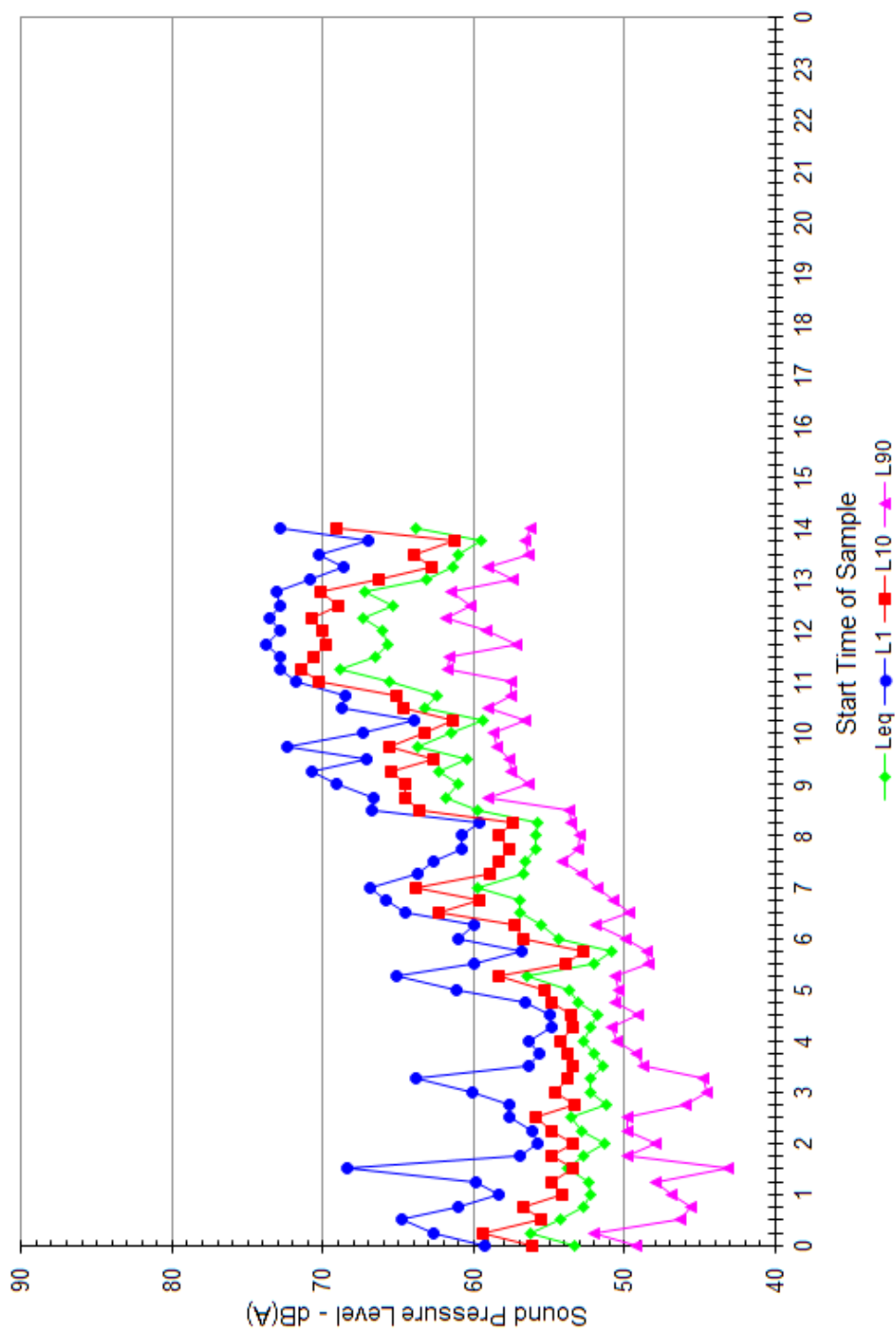
Opera Bar
SVAN 957 Logger 23806

44.5125.R1
Balcony of Apartment on Level 5 of the Toaster Building



Ambient Measurements

Monday, April 7, 2014

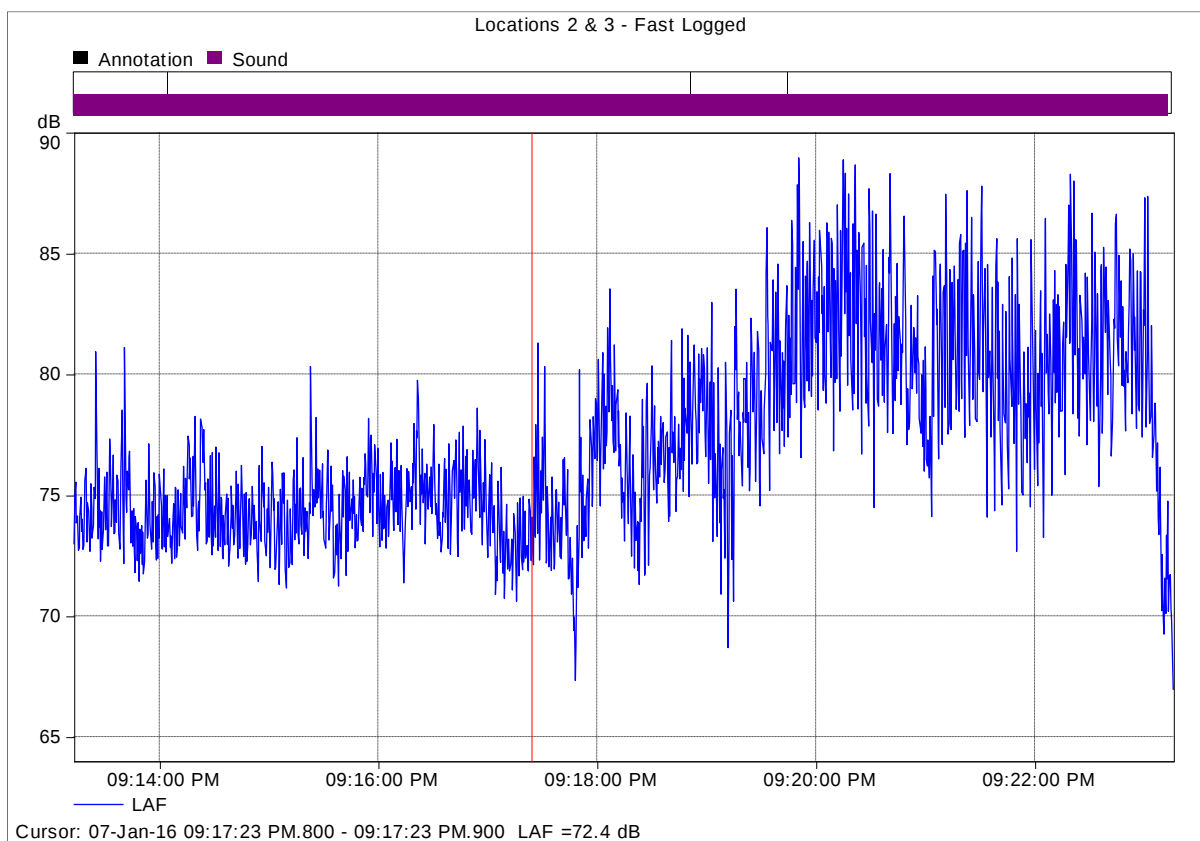
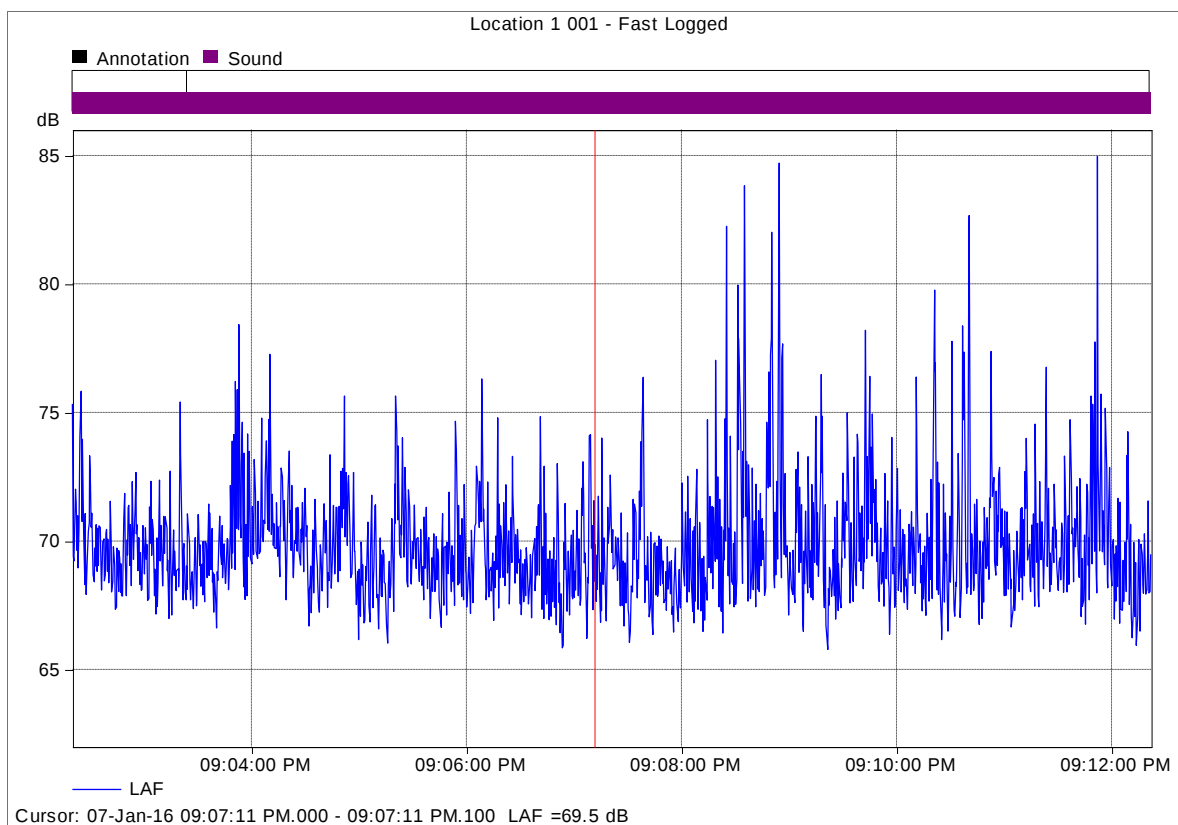


Opera Bar
SVAN 957 Logger 23806

Balcony of Apartment on Level 5 of the Toaster Building



APPENDIX E: Measurement Results – 2016



Location	Parameter		A-weighted Octave Band Centre Frequency (Hz)								
		dB(A)	31	63	125	250	500	1k	2k	4k	8k
1 (no band)	L10	72	33	47	50	58	67	69	65	58	46
	Leq	71	31	44	49	56	65	67	63	57	44
	L90	68	28	38	46	54	63	63	60	53	40
2 (no band)	L10	76	35	50	57	66	71	72	70	63	55
	Leq	75	32	47	54	63	70	70	68	61	53
	L90	73	27	41	50	59	67	67	65	58	46
3 (no band)	L10	80	34	53	64	75	75	76	72	67	53
	Leq	78	32	50	60	72	73	73	69	63	51
	L90	75	29	43	52	63	69	67	62	55	44
2 (with band)	L10	85	34	57	70	83	80	77	71	64	61
	Leq	82	32	54	66	79	76	74	68	62	56
	L90	78	29	48	60	73	71	70	66	59	48
1 (with band)	L10	73	35	44	52	60	68	69	65	58	46
	Leq	71	32	42	50	58	67	67	62	55	43
	L90	68	28	39	48	55	63	63	60	52	39
4 (with band)	L10	64	34	45	47	53	59	59	55	49	40
	Leq	62	31	42	47	52	57	57	53	47	38
	L90	58	27	38	45	49	53	52	48	41	32



APPENDIX F: Calculations

To Toaster Building 5th Floor Balcony

A: Current Situation

Line			A-Weighted Octave Band Centre Frequency (Hz)								
			dB(A)	31	63	125	250	500	1k	2k	4k
Southern Open Area											
a.	200 Patrons(50% raised voices)	92	32	46	66	79	88	87	83	78	70
b.	Attenuation from Upper Concourse		-5	-5	-5	-5	-6	-7	-8	-10	-12
c.	Distance attenuation + Lw to SPL		-41	-41	-41	-41	-41	-41	-41	-41	-41
d.	Contribution	44	-14	0	20	32	41	39	34	27	17
Opera Bar South – Open Area											
e.	400 Patrons (50% raised voice)	95	35	49	69	82	91	90	86	81	73
f.	Attenuation from Upper Concourse		-5	-5	-5	-5	-5	-5	-5	-5	-5
g.	Distance attenuation + Lw to SPL		-43	-43	-43	-43	-43	-43	-43	-43	-43
h.	Contribution	47	-13	1	21	34	43	42	38	33	25
Opera Bar South Covered Area											
i.	60 Patrons (50% raised voice)	87	27	41	61	74	83	82	78	73	65
J	Umbrellas Insertion Loss		0	0	0	-2	-5	-6	-9	-11	-16
k.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0
l.	Distance attenuation + Lw to SPL		-43	-43	-43	-43	-43	-43	-43	-43	-43



Line			A-Weighted Octave Band Centre Frequency (Hz)								
			dB(A)	31	63	125	250	500	1k	2k	4k
m.	Contribution	38	-16	-2	18	29	34	33	26	19	6
Opera Bar North Open Area											
n.	130 Patrons (50% raised voice)	90	30	44	64	77	86	85	81	76	68
o.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0
p.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45
q.	Contribution	45	-15	-1	19	32	41	40	36	31	23
Opera Bar North Covered Area											
r.	135 Patrons (50% raised voice)	90	30	44	64	77	86	85	81	76	68
s.	Umbrellas Insertion Loss		0	0	0	-2	-5	-6	-9	-11	-16
t.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0
u.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45
v.	Contribution	39	-15	-1	19	30	36	34	27	20	7
Open Area North of Umbrellas											
w.	400 Patrons (50% raised voice)	95	35	49	69	82	91	90	86	81	73
x.	Attenuation from Upper Concourse		-5	-5	-5	-5	-5	-5	-5	-5	-5
y.	Distance attenuation + Lw to SPL		-48	-48	-48	-48	-48	-48	-48	-48	-48
z.	Contribution	47	-13	1	21	34	43	42	38	33	25



Line			A-Weighted Octave Band Centre Frequency (Hz)								
		dB(A)	31	63	125	250	500	1k	2k	4k	8k

Cumulative Contribution											
aa.	Southern Open Area	44	-14	0	20	32	41	39	34	27	17
ab.	Opera Bar South – Open Area	47	-13	1	21	34	43	42	38	33	25
ac.	Opera Bar South Covered Area	38	-16	-2	18	29	34	33	26	19	6
ad.	Opera Bar North Open Area	45	-15	-1	19	32	41	40	36	31	23
ae.	Opera Bar North Covered Area	39	-15	-1	19	30	36	34	27	20	7
af.	Open Area North of Umbrellas	47	-13	1	21	34	43	42	38	33	25
ag.	Cumulative Contribution of Patrons	52	-6	8	28	40	49	47	43	38	30
ah.	Balcony L90	59	20	34	41	44	53	55	52	44	30

B Music - Current Situation

Line			A-Weighted Octave Band Centre Frequency (Hz)								
			dB(A)	31	63	125	250	500	1k	2k	4k
Opera Bar North Open Area											
ai.	Band (front)	108	56	79	92	105	102	99	93	86	83
aj.	Directivity		-2	-4	-5	-6	-7	-8	-8	-9	-9
ak.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45
al.	Contribution	56	9	30	42	54	50	46	40	32	29



C: Proposed Umbrellas

Line			A-Weighted Octave Band Centre Frequency (Hz)								
			dB(A)	31	63	125	250	500	1k	2k	4k
Southern Open Area											
am.	200 Patrons(50% raised voices)	92	32	46	66	79	88	87	83	78	70
an.	Attenuation from Upper Concourse		-5	-5	-5	-5	-6	-7	-8	-10	-12
ao.	Distance attenuation + Lw to SPL		-41	-41	-41	-41	-41	-41	-41	-41	-41
ap.	Contribution	44	-14	0	20	32	41	39	34	27	17
Opera Bar South – Open Area											
aq.	268 Patrons (50% raised voice)	93	33	47	67	80	89	88	84	79	71
ar.	Attenuation from Upper Concourse		-5	-5	-5	-5	-5	-5	-5	-5	-5
as.	Distance attenuation + Lw to SPL		-43	-43	-43	-43	-43	-43	-43	-43	-43
at.	Contribution	45	-14	0	20	33	42	41	37	31	23
Opera Bar South Covered Area											
au.	126 Patrons (50% raised voice)	89	30	44	64	77	86	85	81	76	68
av	Umbrellas Insertion Loss		0	0	0	-2	-5	-6	-9	-11	-16
aw.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0
ax.	Distance attenuation + Lw to SPL		-43	-43	-43	-43	-43	-43	-43	-43	-43
ay.	Contribution	36	-18	-4	16	27	33	31	24	17	4



Line			A-Weighted Octave Band Centre Frequency (Hz)								
		dB(A)	31	63	125	250	500	1k	2k	4k	8k

Opera Bar North Open Area												
az.	60 Patrons (50% raised voice)	87	27	41	61	74	83	82	78	73	65	
ba.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0	
bb.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45	
bc.	Contribution	41	-18	-4	16	29	38	37	33	28	20	
Opera Bar North Covered Area												
bd.	170 Patrons (50% raised voice)	91	31	45	65	78	87	86	82	77	69	
be.	Umbrellas Insertion Loss		0	0	0	-2	-5	-6	-9	-11	-16	
bf.	Attenuation from Upper Concourse		0	0	0	0	0	0	0	0	0	
bg.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45	
bh.	Contribution	40	-14	0	20	31	37	35	28	21	8	
Open Area North of Umbrellas												
bi.	400 Patrons (50% raised voice)	95	35	49	69	82	91	90	86	81	73	
bj.	Attenuation from Upper Concourse		-5	-5	-5	-5	-5	-5	-5	-5	-5	
bk.	Distance attenuation + Lw to SPL		-48	-48	-48	-48	-48	-48	-48	-48	-48	
bl.	Contribution	47	-13	1	21	34	43	42	38	33	25	



Line			A-Weighted Octave Band Centre Frequency (Hz)								
			dB(A)	31	63	125	250	500	1k	2k	4k
Cumulative Contribution											
bm.	Southern Open Area	44	-14	0	20	32	41	39	34	27	17
bn.	Opera Bar South – Open Area	45	-14	0	20	33	42	41	37	31	23
bo.	Opera Bar South Covered Area	36	-18	-4	16	27	33	31	24	17	4
bp.	Opera Bar North Open Area	41	-18	-4	16	29	38	37	33	28	20
bq.	Opera Bar North Covered Area	40	-14	0	20	31	37	35	28	21	8
br.	Open Area North of Umbrellas	47	-13	1	21	34	43	42	38	33	25
bs.	Cumulative Contribution of Patrons	51	-7	7	27	39	48	47	42	37	28
bt.	Balcony L90	59	20	34	41	44	53	55	52	44	30

D Music - Proposed Umbrellas

Line		dB(A)	A-Weighted Octave Band Centre Frequency (Hz)								
			31	63	125	250	500	1k	2k	4k	8k
Opera Bar North Open Area											
bu.	Band (front)	108	56	79	92	105	102	99	93	86	83
bv.	Directivity		-2	-4	-5	-6	-7	-8	-8	-9	-9
	Umbrellas Insertion Loss		0	0	0	-2	-5	-6	-9	-11	-16
bw.	Distance attenuation + Lw to SPL		-45	-45	-45	-45	-45	-45	-45	-45	-45
bx.	Contribution	51	9	30	41	50	43	37	27	17	8



APPENDIX G: Instrumentation

Sound level measurements conducted in relation to the subject investigation utilised precision sound level meters that under International Standard IEC 61672 – 1 are identified as Class 1. The Standard sets out frequency weighting and tolerance limits for sound level meters.

The Bruel and Kjaer 2250 sound level meter utilises Enhanced Sound Analysis Software to permit the recording of statistical parameters in the overall A-weighted level and in octave bands over the sampling period. The time constant used for measurements is FAST response to accord with the relevant standard utilising sampling based upon 100 ms samples for both statistical analysis and logging of the LAF (Inst) to provide a time splice graph of the variation of the instantaneous A-weighted level over time.

In dealing with licensed premises the criteria are relative to A-weighted results and therefore the instrument is set up to record A-weighted octave band whereas in general environmental assessments the octave band information is recorded in linear mode (i.e. no A-weighting filter).

In accordance with the manufacturer's specification and relevant standards the reference calibration of the sound level meter is checked prior to and after measurements using a reference calibrator that generates a constant signal of 1 kHz (normally a Bruel and Kjaer Type 4230/4231 calibrator).

Logging measurements utilised an SVAN Type 957 sound level meter set to continuously log the noise level in 15 minute increments utilising fast response exponential averaging to determine the statistical results in each sample period.

The logger is set to operate as a free field situation with no compensation filters.

The A-weighted logger results are processed in accordance with Appendix B of the EPA's *Industrial Noise Policy* to determine the lowest 10 percentile of the individual L90 results for the day, evening and night periods for each of individual day (identified as the ABL) from which the Rating Background Level (RBL) is determined as the median of the individual daily results.

The Leq level for each of the individual day, evening and night periods per day are the energy average of the measured levels from which the individual daily results are energy averaged to provide the Leq for those periods.

The analysis of the logger results also assessed in terms of standard EPA time periods and classifications for traffic noise that requires a correction to obtain a facade corrected level being the index used for assessment of road traffic noise.

