KOIKAS ACOUSTICS PTY LTD
CONSULTANTS IN NOISE & VIBRATION
ABN 12 058 524 771
Commercial 1 (Unit 27)
637 - 645 Forest Road
BEXLEY NSW 2207
Ph: (02) 9587 9702
Fax: (02) 9587 5337
E-mail: Office@KoikasAcoustics.com

ACOUSTIC ASSESSMENT

MECHANICAL PLANT & OPERATIONAL NOISE IMPACT

SERVICE STATION AT
NO. 370-372 CARRINGTON ROAD,
LONDONDERRY NSW 2753

Date: Monday, 5 August 2019

File Reference: 3334R20180322jt370-372CarringtonRdLondonderryV4.docx

DOCUMENT CONTROL SHEET	
Project Title	Acoustic Assessment Mechanical Plant & Operational Noise Impact Service Station at No. 370-372 Carrington Road, Londonderry NSW 2753
Our Project Number	3334
Our File Number	3334R20180322jt370-372CarringtonRdLondonderryV4.docx
File Link	G:\Shared drives\KA Acoustics 2019\REPORT\Service Stations\3334R20180322jt370-372CarringtonRdLondonderryV4.docx
Revision	V1 Thursday, 21 June 2018
	V2 Wednesday, 27 June 2018
	V3 Monday, 3 June 2019
	V4 Monday, 5 August 2019
Prepared By	James Tsevrementzis
Checked By	Nick Koikas 
Prepared For	Maria Galas
Care Of	R.J. Sinclair Pty Ltd Attention: Dick Sinclair Mobile: 0418 240 940 Phone: (02) 8883 0999 Email: dick@rjsinclair.com.au

ACOUSTIC ASSESSMENT

MECHANICAL PLANT & OPERATIONAL NOISE IMPACT

SERVICE STATION AT

NO. 370-372 CARRINGTON ROAD, LONDONDERRY NSW 2753

ACOUSTIC ASSESSMENT
MECHANICAL PLANT & OPERATIONAL NOISE IMPACT
SERVICE STATION AT
NO. 370-372 CARRINGTON ROAD, LONDONDERRY NSW 2753

1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was requested to undertake an acoustic assessment for the proposed service stations at No. 370-372 Carrington Road, Londonderry NSW 2753.

An unattended ambient noise survey was conducted over a one-week period at the development site to obtain background noise levels of the surrounding area.

A noise impact assessment of mechanical plant and operational noise impact was carried out in accordance with relevant Australian Standards and the ***EPA's Noise Policy for Industry (NPI)***.

All noise sources associated with the subject assessment site were quantified and assessed to both the amenity and intrusive noise criterion of the ***NPI***.

The aim of this assessment was to ascertain the type and extent of noise mitigation measures required to achieve the nominated noise criteria.

This assessment considers the following:

- a discussion of the noise criteria applying to the subject site and surrounding premises;
- computer modelling using software program Cadna/A so as to predict mechanical plant and operational noise impact to surrounding premises, and
- details of the noise mitigation measures to comply with the nominated noise criteria.

2.0 SITE DESCRIPTION

2.1 SITE LOCATION

The proposed service station is located at No. 370-372 Carrington Road, Londonderry NSW 2753. An aerial photograph showing the assessment site, surrounding premises and monitoring location is shown below in Figure 1.

Figure 1. Aerial photo of subject site and surrounds (Image is taken from Six Maps)

2.2 SURROUNDING PREMISES

Surrounding the assessment site is:

- Commercial premise to the North-West and East, and
- Residential premises in all directions (most noise affected are residents to south at 523 Londonderry Road and to the east on the first-floor at 12 Muscharry Rd).

2.3 DESCRIPTION OF THE SITE

The existing service station is to be demolished and replaced with the proposed new service station. The land at this site is on relatively flat ground.

2.4 HOURS OF OPERATION

The proposed hours of operation of the service station are 24 hours a day, 7 days a week.

2.5 AMBIENT NOISE PROFILE OF THE SITE

In this neighbourhood, the general ambient noise is dominated by road traffic. During the night-time period, the ambient noise is generally dominated by environmental factors such as wind, rustling leaves insect noise and sporadic road traffic.

2.6 NOISE SOURCES

This acoustic assessment addresses the cumulative noise impact from the use of:

- Vehicles traversing on the subject premises;
- Two (2) outdoor AC condenser units (Actron Air - SCA290C) located inside an enclosure on the ground floor to the north side of the sales building;
- One (1) toilet exhaust fan (Fantech - CHD 356) located inside an enclosure on the ground floor to the north side of the sales building;
- One (1) island chiller condenser unit (ACPAC - APS8.3ML2-1) located inside an enclosure on the ground floor to the north side of the sales building;
- One (1) coolroom condenser unit (ACPAC - APS11.7ML3-1) located inside an enclosure on the ground floor to the north side of the sales building, and
- One (1) freezer condenser unit (ACPAC - APB15.8ML3-4) located inside an enclosure on the ground floor to the north side of the sales building.

Based upon the traffic count survey conducted by R.O.A.R. Data for Winning Traffic Solutions (Dated: Wednesday 4th April 2018), the maximum vehicle counts for one 15-minute period are shown below in Table 1 for each period of the day.

Table 1. Maximum vehicle counts for one 15-minute period

Period of the day	Light Vehicles	Heavy Vehicles	Total
Daytime	21	0	21
Evening	8	0	8
Night-time	4	0	4

Although no heavy vehicles were traversing onsite during the peak periods, one (1) heavy vehicle was counted during other periods and therefore as a worst-case scenario one (1) heavy vehicle will be considered in the acoustic assessment for each period of the day.

If any of the assumptions made in this assessment are incorrect, there will likely be a need for further

calculation to determine the noise effect of the vehicular noise and mechanical plant noise impact to surrounding residential premises.

2.7 ARCHITECTURAL DRAWINGS PROVIDED

The following architectural drawings provided by R.J. Sinclair Pty Ltd (Project No.: 16-096), mechanical services schedule by RM Design (Project No.: 16-095) and details provided in the email from Vaughn (R.J. Sinclair Pty Ltd) sent 26th June 2018 were used for this assessment:

Architectural Drawings

Drawing Title	Drawing No.	Revision	Date
Existing Site Plan and Demolition Plan	A-01	P2	25.06.2019
Proposed Site Plan	A-02	P3	25.06.2019
Dimensioned Plan	A-03	P2	25.06.2019
Roof Plan	A-04	P2	25.06.2019
Sales Building Elevations and Sections	A-05	P2	25.06.2019
Refuelling Canopy Elevations and Sections	A-06	P2	25.06.2019

Mechanical Services Schedules

Drawing Title	Drawing No.	Revision	Date
Mechanical & Refrigeration Equipment Schedule & Details Plan	M 202	A	31/01/2018

3.0 NOISE CRITERIA

3.1 MECHANICAL PLANT & OPERATIONAL NOISE CRITERIA

3.1.1 BACKGROUND NOISE

The mechanical plant noise impact assessment was based on undertaking an unattended ambient noise survey at a representative site. The background noise level was determined over consecutive 15 minutes consecutive intervals for a period of one week.

From this data of $L_{A90,15\ minutes}$ noise levels, the 10th percentile lowest background noise levels were determined for each of the days. The *rating background level* was then determined by calculating the median value of the daily background noise levels during each of the three specific time periods, i.e. daytime, evening and night-time.

The rating background level result was used to determine the noise criteria applicable for the surrounding residential properties in accordance with the ***NPI*** assessment procedures.

The background noise level $L_{A90,\ 15\ minutes}$ is normally determined in the absence of extraneous noise such as traffic, wind, rain, conversation, birds chirping, insect noise and unnatural increases in noise from distant sources due to local air movement. The EPA defines such sources as *incidental noise* which can cause the masking of offensive noise from a specific source. Where traffic or other incidental noise cannot be excluded, then it is considered that these noise sources are part of the background noise.

Generally, when the noise criteria prescribed in the ***NPI*** complies, offensive noise will also be achieved. In some cases, when the amenity criterion is lower, this does not mean that it is a more stringent criterion compared to the intrusive noise criterion.

3.1.2 OFFENSIVE NOISE

In the definitions of the POEO Act, "offensive noise" means noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

3.1.3 NSW EPA's NOISE GUIDE FOR LOCAL GOVERNMENT (MAY 2013)

Section 2 of the NGLG provides guidance on how to examine the nature and characteristics of a noise.

- the location of the noise source
- its audibility at certain locations
- the time the noise is made and its duration
- its characteristics
- the reported effect it has on people.

In Section 2.1.4 Offensive noise test, the EPA considers a range of factors to determine whether the noise is offensive.

The above check list was proposed for use for Council officers and authorised persons making a systematic judgement about whether a particular noise is offensive. The DECCW goes on to say that "*Not all questions need to be answered 'yes' before a noise is deemed to be offensive*".

Offensive noise test: Checklist of considerations

Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?

This establishes that the noise is likely to be heard by neighbours. Its volume alone may be annoying. An example would be music being played at a very high volume in a residence so it can be heard over very noisy activity outside, such as construction work. The noise may also be loud relative to the background noise. An example would be loud fireworks set off late at night. Noise measurements using a sound level meter would help to determine how loud the noise is relative to the background noise level in the area.

Q2: Does the noise include characteristics that make it particularly irritating?

The presence of tones, impulses or fluctuations in volume can make people more likely to react to the noise. These can be judged subjectively but noise measurements will help to quantify the extent of these characteristics. Examples might be screeching sounds from poorly maintained equipment or a 'beeper' alarm that uses a pulsed sound made up of one or two alternating frequency tones, usually higher pitched, that are louder than the background noise in the area.

Q3: Does the noise occur at times when people expect to enjoy peace and quiet?

People usually expect their surroundings to be quieter during the evening and at night. Talk to the complainants about how the noise affects them to see if it is interfering unreasonably with their comfort at home. Is it regularly disturbing their sleep, making it difficult to have a conversation, study, read or hear

the TV? Noise that regularly disturbs sleep is likely to be considered offensive by complainants and this should be taken into account in your assessment.

Q4: Is the noise atypical for the area?

Where noise from an activity that is causing nuisance is new or unusual for an area, people are more likely to react. Look at the typical uses of the area and determine whether the activity is consistent with the local environmental plan. An example might be a community event with amplified music affecting a residential area that has not traditionally been affected by such events.

Q5: Does the noise occur often?

Noise can be more annoying when it occurs frequently. Examples might be a leaf blower used every morning or a band that practises frequently without regard to the impact on neighbours.

Q6: Are a number of people affected by the noise?

Only one person needs to be affected by the noise for it to be deemed offensive. However, talking to other neighbours likely to be exposed to the same noise about how it affects them may assist in deciding what action to take. Some councils have a policy of requiring a minimum number of complaints from different individuals before taking formal action.

The EPA also state in Section 2.2.1 Intrusive noise:

Noise is identified as 'intrusive' if it is noticeably louder than the background noise and considered likely to disturb or interfere with those who can hear it. Councils may have local policies about what they consider constitutes intrusive noise from specified activities in particular situations or locations. In these circumstances, it may be council policy that a particular intrusive noise is treated as offensive. It is expected that such a policy would take into account the factors in the offensive noise checklist when setting local intrusive noise levels and descriptors.

In the absence of a council policy, intrusive noise would not automatically be considered offensive. Where council policy determines that a particular noise level is intrusive, the subject noise will need to be measured to determine if it complies with the policy.

This type of policy may assist councils in determining appropriate noise limits for development approvals or notices such as Noise Control Notices or Prevention Notices, as well as when considering the second part of Q1 in the offensive noise checklist about whether the noise is loud relative to other noise in the area.

In many situations L_{Aeq} will be the most suitable descriptor for describing the noise under investigation. This should be measured at the most affected point on or within the residential property boundary or, if this

is more than 30 metres from the residence, at the most affected point within 30 metres of the residence. Note, however, that other descriptors may be more appropriate:

The background level is the LA90 measurement of all noise in the area of the complaint without the subject noise operating or affecting the measurement results.

3.1.4 EPA's NOISE POLICY FOR INDUSTRY (NPI)

In summary, the following steps and notes applying for the EPA's Noise Policy for Industry (NPI):

- determine the magnitude and nature of all relevant noise sources;
- measure the existing background and ambient noise levels;
- determine the Project Noise Trigger Level (PNTL). The PNTL is a level that, if exceeded, would indicate a potential noise impact on the community, and so, 'trigger' a management response – noise treatment. Assessing a proposal to the NPI requires consideration of the defined Project Noise Trigger Levels, the reasonableness and feasibility of noise treatment options, and any residual noise impacts (exceeding noise levels after all reasonable and feasible noise controls have been applied). As with the INP, the Project Noise Trigger Level is maintained as the lower of the intrusive and amenity noise goals, however, it is only referred to as a $L_{Aeq\ 15\ minutes}$. This means that the amenity noise levels are adjusted from $L_{Aeq\ Period}$ to $L_{Aeq\ 15\ minutes}$. The policy assumes the $L_{Aeq\ 15\ minutes}$ is equal to the $L_{Aeq\ Period}$ + 3dB. An alternate adjustment may be used provided significant evidence is provided as justification.
- Project intrusiveness noise level/limit is maintained as background + 5dB. It is noted that any excursions (breaches) of noise above the intrusiveness level during the daytime would not have the same negative impact as would be the case during the evening and night periods, where more noise-sensitive activities are typically occurring.
- The Minimum RBL's have changed slightly. They are now 35dB(A) daytime, and 30dB(A) evening and night.
- Furthermore, unless reasonably justified, the intrusive noise trigger level for the evening will not be greater than for daytime, and the night-time intrusive noise level will not be greater than for evening.
- Recommended amenity noise levels in Table 2.2 represent the objective for **total** industrial noise, whereas the 'project amenity noise level' applies to each individual source of the industrial noise. The project amenity noise level is represented by the recommended amenity noise level (from Table 2.2) minus 5dB. This assumes that local receivers are impacted by 3 to 4 industrial developments/sources.

Table 2.2: Amenity noise levels.

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
(see Table 2.3 to determine which residential receiver category applies)			**Recommended amenity noise level**
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Hospital ward internal external	 All All	 Noisiest 1-hour Noisiest 1-hour	 35 50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB(A) to recommended noise amenity area

- Some exceptions can apply when deriving the project amenity noise level, such as:
  - Assessment in areas of high traffic.
  - For proposed development in major industrial clusters.
  - Where the resultant project amenity noise level is 10dB or lower than the existing industrial noise.
  - Where cumulative industrial noise is not an issue as there are no other industrial premises in the area.
- The trigger point for conducting a detailed maximum noise level assessment is where night-time industrial noise at a residential location exceeds:
  - $L_{Aeq,\ 15\ mins}$ 40dB(A) or the RBL + 5dB, whichever is greater, and/or
  - L_{AFmax} 52dB(A) or the RBL + 15dB, whichever is greater.

A detailed maximum noise level assessment is to cover the maximum noise level, the extent to which this exceeds the background noise level, and the number of occurrences during the night-time period.

An extract from *Fact Sheet C: Corrections for annoying noise characteristics* of the ***EPA's NPI*** is shown.

Correction for duration: this is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is shown in Table C3 for the duration of the event. This adjustment is designed to account for unusual and one-off events, and does not apply to regular and/or routine high-noise level events.

Table C3: Adjustment for duration.

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15min}$ equivalent project noise trigger level at receptor for the period of the noise event, dB(A)	
	Daytime and evening (7 am–10 pm)	Night-time (10 pm–7 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

Note: Where the duration of the noise event is smaller than the duration of the project noise trigger level (that is, less than 15 minutes) the allowable adjusted project noise trigger level becomes:

$$10Log_{10}\left(\left(10^{\frac{PNTL}{10}} x \left(\frac{900 - duration}{900}\right)\right) + \left(10^{\frac{PNTL+allowable\ exceedance\ (Table\ C3)}{10}} x\ duration\right)\right)$$

3.2 SLEEP DISTURBANCE

For activities that occur on a commercial or industrial site that are intermittent in nature, the noise criterion that has been used for such events for periods between 10 pm and 7 am (night time) is the EPA's sleep arousal noise criterion.

The EPA's Sleep Arousal Criterion is described in the following documents, however the conclusions in each document sheds an element of uncertainty on account that social surveys have not been undertaken to validate the guidelines:

- EPA's Environmental Criteria for Road Traffic Noise,
- EPA's Environmental Noise Control Manual 1994, nor the
- EPA's Industrial Noise Policy/Noise Policy for Industry.

In the DECCW's NGLG, Sleep Disturbance is defined as "*Awakening and disturbance to sleep stages*". Koikas Acoustics has been advised by the EPA that the sleep arousal criterion is ***only*** a recommended assessment procedure and is ***not*** a legislated Act or Regulation as for example in the Protection of the Environment Operations Act 1997 (POEO Act 1997).

The EPA considered that the $L_{A1,\ 1\ minute}$ *of any specific noise source should not exceed the background noise level* ($L_{A90,\ 15\ minutes}$) *by more than 15 dB when measured outside the bedroom window.*

A letter dated 14 December 1992 was distributed to all Regional Staff of the EPA and stated that the measurement period for quantifying the L_{A1} is 1 minute, the time weighting of the sound level meter be set on "Fast", and that the sound measurements be taken outside and 1 metre from the closest noise sensitive bedroom window.

Australian Standard 1055.3-1984 *"Description and Measurement of Environmental Noise Part 3 Acquisition of Data Pertinent to Land Use"* considers the acquisition of data pertinent to land use, i.e. *"the measurement technique used, e.g. instrumentation, number of microphone positions, nature of the sound sources and the receivers and the significance of the results for land use."* Noise should therefore, be addressed in a manner pertinent to the environment in which it occurs and the noise metrics used, are an important measure of the noise.

In this case, there are other noise sources in the neighbourhood that may be louder and would exceed the EPA's sleep arousal/disturbance criterion of $L_{A1,\ 1\ minute}$ compared to that of car doors opening and closing, engines idling and plant operating on the subject service station.

The rated background level (RBL) for the nearest residential premise was found to be 45 dB. The $L_{A1,\ 1\ minute}$ noise criterion for this residential premise is therefore 60 dB. Typical $L_{A1,\ 15\ minutes}$ measured traffic noise levels were found to be over 60 dB. The sleep disturbance criterion is therefore not considered appropriate for use in the current environment.

In addition, it is noted, the EPA's ECRTN, Appendix B, page 29 states:

- *"Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions", and*
- *"One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and well-being significantly".*

The EPA also state that a noise event with maximum internal levels of 65 to 70 dB(A) occurring once or twice per night would not likely affect health and well-being significantly. If the EPA states that a level over 55 dB(A) could cause awakening, then this would imply that it would also interrupt sleep and therefore on a regular basis could affect the well-being of a person significantly. It would appear that these statements are therefore contradictory and the relevance of the sleep disturbance criterion is therefore questionable.

The EPA also conclude (Page 30 of the EPA's ECRTN), that *"until more definitive information becomes*

available, it will not be possible to develop noise level criteria for sleep disturbance that would have the equivalent level of confidence as those noise criteria used for annoyance reactions."

In Section 2.2.4 Assessment of Sleep Disturbance of the DECCW's NGLG (August 2009) document also states "*Currently, there is no definitive guideline to indicate a noise level that causes sleep disturbance and more research is needed to better define this relationship."*

In conclusion and based on the above, the EPA's sleep disturbance criterion cannot be considered for such assessments on account of the low level of confidence asserted by the EPA in relation to the current correlation between noise levels and sleep disturbance/awakening, and the L_{A1} noise of existing traffic in the neighbourhood during the night time is currently well over the criterion of RBL + 15 dB.

4.0 NOISE SURVEYS

4.1 NOISE MONITORING PROCEDURES

All noise methodologies and equipment used comply with the following Australian Standards:

- *AS1259.2-1990 "Acoustics - Sound Level Meters - Integrating - Averaging", and*
- *ISO 1996-2007 "Acoustics – Description, measurement and assessment of environmental noise" Part 2: Determination of environmental noise levels*

4.2 SITE LOCATION OF UNATTENDED NOISE MONITORING

The unattended noise logger was placed on the roof of the existing building at No. 370-372 Carrington Road, Londonderry. The microphone was placed at 1.5 meters above the building roof. This location was used to determine the background noise levels used to determine the noise criteria. Refer to Section 2.1 for an aerial photo showing the unattended noise monitoring location.

4.3 NOISE SURVEY PERIOD, DATE AND DURATION

The survey was conducted between Wednesday 13th to Tuesday 19th December 2017 for a duration of seven consecutive days.

4.4 METEOROLOGICAL CONDITIONS PERTAINING DURING UNATTENDED SURVEY

Analysis of the meteorological records and ambient noise trends in the logger graphs suggests that the meteorological conditions over the monitoring period did not adversely impact the noise survey results.

4.5 NOISE MONITORING INSTRUMENTATION

The unattended noise survey was conducted with Type 1 precision Svan 949 octave band sound level meter data loggers S/N 6027. The sound level meter data logger was field calibrated with a NATA certified field pistonphone.

5.0 NOISE SURVEY RESULTS

5.1 UNATTENDED NOISE SURVEY RESULTS

The measured noise levels obtained from the unattended noise surveys are as follow

Table 2. Summary of Unattended Noise Survey Results (13th – 19th December 2017)		
NOISE METRICS	**PERIOD [hhmm-hhmm]**	**Noise Level [dB]**
$L_{A90,\ daytime}$	0700-1800 0800-1800 (Sunday/Public Holiday)	50
$L_{A90,\ evening}$	1800-2200	45
$L_{A90,\ night\text{-}time}$	2200-0700 2200-0800 (Sunday/Public Holiday)	36
$L_{Aeq,\ daytime}$	0700-1800 0800-1800 (Sunday/Public Holiday)	66
$L_{Aeq,\ evening}$	1800-2200	64
$L_{Aeq,\ night\text{-}time}$	2200-0700 2200-0800 (Sunday/Public Holiday)	60
$L_{Aeq,\ 15\ hours}$	0700-2200	66
$L_{Aeq,\ 9\ hours}$	2200-0700 2200-0800 (Sunday/Public Holiday)	60

The above RBLs have been calculated as per the EPA's ***NPI***. Attached as **Appendix A** are the complete noise logger graphs for the entire measurement period including the summary sheets.

6.0 NOMINATED NOISE CRITERIA

6.1 MECHANICAL PLANT AND OPERATIONAL NOISE CRITERIA

The project noise trigger levels are dependent on the background noise levels of the subject site. The calculated project noise trigger levels that are to be achieved to surrounding residential receivers from the use of mechanical plant and operational noise, are presented in Table 3.

Table 3. Summary of Noise Survey Results and the Calculated Mechanical Plant Noise Criteria [dB]

PERIOD	Existing Background Noise Levels $L_{A90, Period}$	Intrusive Noise Criteria $L_{A90} + 5$	Existing Ambient Equivalent Continuous Noise Level $L_{Aeq, Period}$	Recommended Amenity Criteria $L_{Aeq, Period}$	Adopted Amenity Criteria $L_{Aeq, Period}$	**Project Noise Trigger Level**
Daytime (1800 to 2200 hours)	50	**55**	66	55	**56**[1]	**55 Intrusive**
Evening (1800 to 2200 hours)	45	**50**	64	45	**54**[1]	**50 Intrusive**
Night time (2200 to 0700 hours)	36	**41**	60	40	**50**[1]	**41 Intrusive**

1. *As the "Existing Ambient Equivalent Continuous Noise Level" ($L_{Aeq,Period}$) is more than 10 dB above the recommended "amenity criterion" level. Therefore, as per the assessment procedure of section 2.2.3 of NSW EPA's INP, the adopted amenity criterion becomes the "Existing Ambient Equivalent Continuous Noise Level" minus 10 dB.*

Therefore, the project noise trigger levels adopted for this assessment is:

- $L_{Aeq, 15\ min}$ ≤ **55 dB** for surrounding residential premises during the daytime (0700-1800);
- $L_{Aeq, 15\ min}$ ≤ **50 dB** for surrounding residential premises during the evening (1800-2200);
- $L_{Aeq, 15\ min}$ ≤ **41 dB** for surrounding residential premises during the night-time (2200-0700), and
- $L_{Aeq, 15\ min}$ ≤ **65 dB** for surrounding commercial premises.

The above mechanical plant and vehicular movement noise criteria applies at the boundary or as per the EPA's *NPI* recommendations:

For a residence, the project noise trigger level and maximum noise levels are to be assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most-affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level.

7.0 SOURCE SOUND POWER LEVELS

7.1 SITE LOCATIONS OF SOUND SOURCES AND DESCRIPTIONS

This acoustic assessment addresses the cumulative noise impact from the use of:

- Vehicles traversing on the subject premises, with doors opening/closing and engines starting. Refer to Table 4 for the number of light/heavy vehicles considered for each period of the day;
- Two (2) outdoor AC condenser units (Actron Air - SCA290C) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*;
- One (1) toilet exhaust fan (Fantech - CHD 356) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*;
- One (1) island chiller condenser unit (ACPAC - APS8.3ML2-1) located inside an enclosure on the ground floor to the north side of the sales building;
- One (1) cool room condenser unit (ACPAC - APS11.7ML3-1 located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*, and
- One (1) freezer condenser unit (ACPAC - APB15.8ML3-4) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*.

Table 4. Vehicles considered in acoustic assessment for one 15-minute period

Period of the day	Light Vehicles	Heavy Vehicles	Total
Daytime	21	1	22
Evening	8	1	9
Night-time	4	1	5

7.2 SOURCE SOUND POWER LEVELS

All sound sources were quantified by measurements taken by Koikas Acoustics or data provided by the manufacturers of the plant and equipment proposed for use. Sound power levels derived for this assessment are summarised in Table 5 below.

Table 5. Mechanical Plant and Vehicle Sound Power Levels

Noise Source	Noise Metric	*Frequency Band [Hz]*									
		31.5	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*Total*
Outdoor AC Condenser Unit (continuous operation) Actron Air - SCA290C	$L_{WAeq,15\ min}$	+	59	65	67	72	72	68	65	56	**76.9**
Toilet exhaust fan (continuous operation) Fantech - CHD 356	$L_{WAeq,15\ min}$	-	51	53	57	60	58	53	48	43	**64.4**
Island chiller condenser unit (continuous operation) ACPAC - APS8.3ML2-1	$L_{WAeq,15\ min}$	-	42	50	60	64	61	56	51	40	**67.3**
Coolroom condenser unit (continuous operation) ACPAC - APS11.7ML3-1	$L_{WAeq,15\ min}$	-	45	53	63	67	64	59	54	43	**70.3**
Freezer condenser unit (continuous operation) ACPAC - APB15.8ML3-4	$L_{WAeq,15\ min}$	-	47	55	65	69	66	61	56	45	**72.3**
Light-vehicle Movement Noise @ 5 km/hr (Measured as a Stationary Source)	Lw_{Aeq}	46	57	60	66	70	72	71	68	59	**77**
Heavy-vehicle Movement Noise @ 5km/hr (Measured as a Stationary Source)	Lw_{Aeq}	49	57	62	67	74	79	78	73	62	**83**
Light Vehicle Engine Starting (One engine 2 sec – corrected to 15 min)	$Lw_{Aeq,15min}$	16	32	35	34	43	46	48	48	42	**53**
Heavy Vehicle Engine Starting (One engine 2 sec – corrected to 15 min)	$Lw_{Aeq,15min}$	38	40	46	52	65	70	66	65	63	**74**
Air Brake Noise for Heavy Vehicles (B-Double and Semi-trailers only) (Air-brake for 2 sec – corrected to 15 min	$Lw_{Aeq,15min}$	38	51	55	65	66	70	71	73	71	**78.2**
Opening/Closing of Vehicle Door (One door 1 event – corrected to 15 min)	$Lw_{Aeq,15min}$	23	35	44	43	49	47	49	42	31	**54**

8.0 NOISE MODELLING

8.1 CADNA (A) NOISE MODEL

The proposed noise sources (in this case road traffic and mechanical plant) were modelled in a computer program called Cadna/A, which is a software package developed by DataKustik. Cadna/A incorporates a computer aided drafting (CAD) program that utilises the height of the ground, the position of buildings and other structures to run through a set of algorithms and calculate at user defined grid points and user input receiver locations the overall sound pressure level and frequency dependant noise level spectrum. It then interpolates the calculated noise levels at each of the grid points to produce noise level contours.

The noise level calculations take into account the propagation of sound from a sound source as a function of its distance, the shielding effects of barriers and buildings, the attenuation and reflection off the ground and buildings.

Receiver locations were assigned in the computer model at representative positions to determine the resultant noise levels at surrounding noise-affected residential premises. The predicted noise levels at these locations were used to provide recommendations of appropriate noise mitigation measures that would achieve the required noise reductions so as to comply with the nominated noise criterion.

Noise level contours were produced to illustrate the propagation of sound from the noise sources to the noise-affected residential premises. Noise level contour maps attached in **Appendix B**.

8.2 NOISE MODEL SCENARIO

SCENARIO 1

Mechanical Plant and Operational Noise Impact

The following noise sources were considered in all noise model scenario for one 15 minutes period:

- Two (2) outdoor AC condenser units (Actron Air - SCA290C) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*;
- One (1) toilet exhaust fan (Fantech - CHD 356) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*;
- One (1) island chiller condenser unit (ACPAC - APS8.3ML2-1) located inside an enclosure on the ground floor to the north side of the sales building;
- One (1) coolroom condenser unit (ACPAC - APS11.7ML3-1) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*, and
- One (1) freezer condenser unit (ACPAC - APB15.8ML3-4) located inside an enclosure on the ground floor to the north side of the sales building *(operating continuously)*.

SCENARIO 1.1 – Daytime (0700-1800)

Project Noise Trigger Levels at the neighbouring boundary:

- $L_{Aeq,\ 15\ min}$ ≤ 55 dB for residential premises (0700-1800), and
- $L_{Aeq,\ 15\ min}$ ≤ 65 dB for commercial premises.

The following noise sources were considered for the daytime noise model scenario - 15 minutes period:

- Twenty-one (21) light-vehicles traversing at 5 km/hr;
- Twenty-one (21) light-vehicle engines starting (2 sec corrected to 15 minutes), and
- Twenty-two (22) vehicle doors opening/closing (1 event corrected to 15 minutes).

SCENARIO 1.2 – Evening (1800-2200)

Project Noise Trigger Levels at the neighbouring boundary:

- $L_{Aeq,\ 15\ min}$ ≤ 50 dB for residential premises (1800-2200), and
- $L_{Aeq,\ 15\ min}$ ≤ 65 dB for commercial premises.

The following noise sources were considered for the evening noise model scenario - 15 minutes period:

- Eight (8) light-vehicles traversing at 5 km/hr;
- Eight (8) light-vehicle engines starting (2 sec corrected to 15 minutes), and
- Nine (8) vehicle doors opening/closing (1 event corrected to 15 minutes).

SCENARIO 1.3 – Night-time (2200-0700) – with recommendations in Section 8.5

Project Noise Trigger Levels at the neighbouring boundary:

- $L_{Aeq,\ 15\ min}$ ≤ 41 dB for residential premises (2200-0700), and
- $L_{Aeq,\ 15\ min}$ ≤ 65 dB for commercial premises.

The following noise sources were considered for the night-time noise model scenario - 15 minutes:

- Four (4) light-vehicles traversing at 5 km/hr;
- Four (4) light-vehicle engines starting (2 sec corrected to 15 minutes), and
- Five (4) vehicle doors opening/closing (1 event corrected to 15 minutes).

SCENARIO 1.4 – Night-time (2200-0700) – with recommendations in Section 8.5

Project Noise Trigger Levels at the neighbouring boundary:

- $L_{Aeq,\ 15\ min}$ ≤ 41 dB for residential premises (2200-0700), and
- $L_{Aeq,\ 15\ min}$ ≤ 65 dB for commercial premises.

The following noise sources were considered for the night-time noise model scenario - 15 minutes:

- Four (4) light-vehicles traversing at 5 km/hr;
- One (1) heavy-vehicles traversing at 5 km/hr;
- Four (4) light-vehicle engines starting (2 sec corrected to 15 minutes);
- One (1) heavy-vehicle engine starting (2 sec corrected to 15 minutes);
- One (1) heavy-vehicle air brake noise (2 sec corrected to 15 minutes), and
- Five (5) vehicle doors opening/closing (1 event corrected to 15 minutes).

8.3 CALCULATED NOISE LEVEL RESULTS

The predicted mechanical plant and operational noise impact from the development to the surrounding premises is summarised below for each of the scenario described previously.

Table 6. Mechanical Plant and Operational Noise Levels at the Surrounding Premises [dB]

Receivers		Calculated External Noise Levels $L_{Aeq,15min}$	Project Noise Trigger Level $L_{Aeq,15min}$	Exceeding
Scenario 1.1 Daytime (0700-1800)	R1	23	55	-
	R2	25		-
	R3	27		-
	R4	37		-
	R5	43		-
	R6	35		-
	R7	37		-
	R8	43		-
	R9	41		-
	R10	45	65	-
	R11	48	55	-
Scenario 1.2 Evening (1800-2200)	R1	23	50	-
	R2	24		-
	R3	26		-
	R4	35		-
	R5	39		-
	R6	34		-
	R7	37		-
	R8	43		-
	R9	38		-
	R10	43	65	-
	R11	47	50	-
Scenario 1.3 Night-time (2200-0700) *Without single truck event*	R1	22	41	-
	R2	23		-
	R3	25		-
	R4	33		-
	R5	38		-
	R6	33		-
	R7	38		-
	R8	42		1
	R9	37		-
	R10	40	65	-
	R11	47	41	6
Scenario 1.4 Night-time (2200-0700) *With single truck event*	R1	24	41	-
	R2	25		-
	R3	28		-
	R4	47		6
	R5	43		2
	R6	37		-
	R7	41		-
	R8	46		5
	R9	44		3
	R10	45	65	-
	R11	49	41	8

Scenario 1.1-1.2 complies with the nominated noise criteria during the daytime and evening periods.

Scenario 1.3 (without the single truck event) was found to exceed the nominated noise criteria by 6 dB at the nearest resident to the HVAC enclosure (first-floor at 12 Muscharry Rd) during the night-time period. The main noise sources affecting this resident are the mechanical plant located inside the HVAC enclosure. The noise model scenario considers all mechanical plant operating simultaneously and continuously within one 15-minute period. This is unlikely to occur and typical noise levels are expected to be 3-6 dB lower. Furthermore, the proposed mechanical plant is unknown at this stage and this assessment was based on utilising mechanical plant used on a similar development. All installed mechanical plant is likely to be quieter as newer models are more noise efficient. Provided the recommendations in Section 8.5 are implemented, it is in Koikas Acoustic's professional opinion that the nominated noise criteria can be achieved for Scenario 1.3.

As a single truck event may occur during any time of the day, the single truck event has been modelled in Scenario 1.4 during the night-time period (most stringent) with the other respective noise sources during this period. Scenario 1.4 exceeds the nominated noise criteria of $L_{Aeq,15min}$ 41 dB by up to 8 dB at surrounding residential premises. The total time of the truck noise activities is approximately 65 seconds (5 seconds impulsive activities such as air brakes/engine starting/doors closing and 60 seconds driving onsite/idling). Section 3.1.4 shows Table C3 (*Fact Sheet C: Corrections for annoying noise characteristics)* of the ***EPA's NPI***. This table outlines the allowable $L_{Aeq,15min}$ exceedance for one-off events within 2.5 hours in any assessment period. As the single truck event occurs for less than 90 seconds, an exceedance of 10 dB is allowed for the night-time period (2200-0700) and therefore compliance is achieved with the ***EPA's NPI*** for all assessment periods.

Refer to Appendix B for the receiver locations and Section 8.5 for the recommendations.

8.4 SLEEP DISTURBANCE NOISE

Noise impact from loudest noise source (truck air brakes) were considered to bedroom window of the nearest residential premises. The EPA's states that a maximum internal noise level of 55 dB(A) could cause awakening. An open window provides approximately 10 dB noise reduction. Therefore, the adopted noise criterion is L_{A1} 65 dB(A) for a position outside a bedroom window.

Typical truck air brakes are anticipated to have a sound power level of about L_{A1} 72 dB at 15 meters.

8.4.1 Residential premises at 523 Londonderry Road

The distance between the truck parking and the nearest bedroom window is approximately 25 meters.

Distance attenuation over 10 metres along the ground floor will reduce noise by 6 dB (was previously incorrectly 2 dB). The 1.8 meters boundary fence will also provide a noise reduction of 6 dB. The resultant noise level outside the bedroom window of the nearest residential premises is: 72 – 6 (distance attenuation) – 6 (fence attenuation) = L_{A1} 62 dB. Compliance will therefore be achieved with the nominated sleep disturbance noise criterion L_{A1} 65 dB.

8.4.2 Residential premises at 12 Muscharry Road

The distance between the truck parking and the nearest bedroom window on the first-floor level is approximately 27 meters.

Distance attenuation over 12 metres will reduce noise by 6 dB to first floor window. As the residential premise is located on the first floor, and the truck brakes are location under the truck, an additional 3 dB noise reduction has been considered for the shielding from the truck. The resultant noise level outside the bedroom window of the nearest residential premises is: 72 – 6 (distance attenuation) – 3 (fence attenuation) = L_{A1} 63 dB. Compliance will therefore be achieved with the nominated sleep disturbance noise criterion L_{A1} 65 dB.

8.5 RECOMMENDATIONS

In order to achieve compliant noise levels to all surrounding premises (particularly during the night-time), a solid noise barrier/wall is to be constructed to the north and east side of the HVAC enclosure and be constructed of core filled block work. All mechanical plant should be installed inside the HVAC enclosure. The west side of the HVAC enclosure could be louvered for adequate ventilation. Refer to Figure 2 for the extent of the solid noise barrier shown in red.

Furthermore, a roof is required to be constructed over the entirety of the HVAC enclosure with no gaps between the walls and any panels. The roof of the HVAC enclosure may be constructed with the following (refer to Figure 3):

- 75 mm thick timber or 64 mm thick steel stud frame;
- One layer 18 mm thick compressed fibre cement sheet panel screw fixed to the outside;
- One layer of 50mm thick 24 kg/m^3 absorptive polyester batts fitted between the 18 mm fibre cement sheets and the stud wall frame (providing sound absorption to minimise flanking noise),
- One layer of perforated metal panel with a minimum 50% open cell area, and

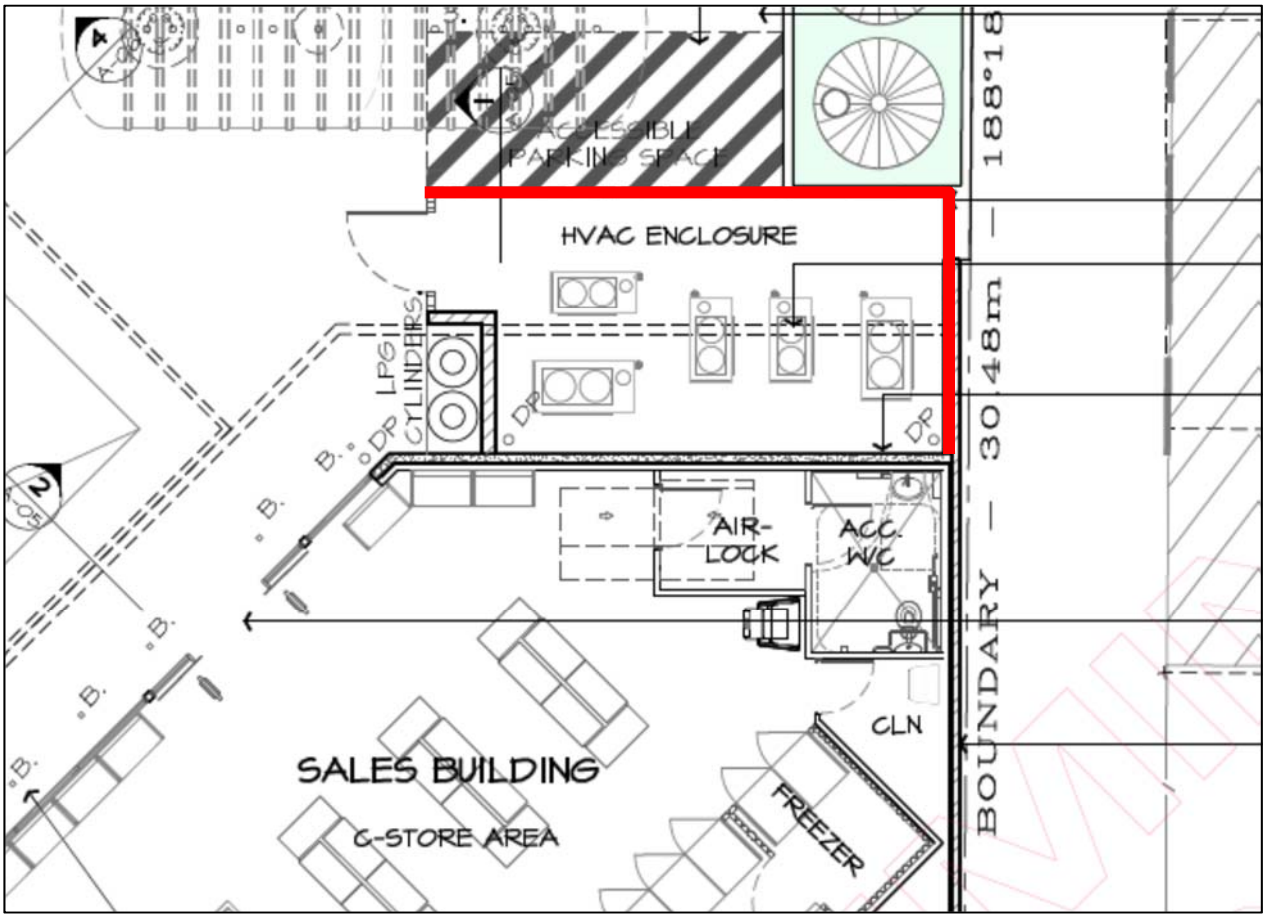


Figure 2: Architectural drawing outlining the extent of the noise barrier/wall and plant locations

Refer to Figure 3 for a plan view of the proposed roof system.

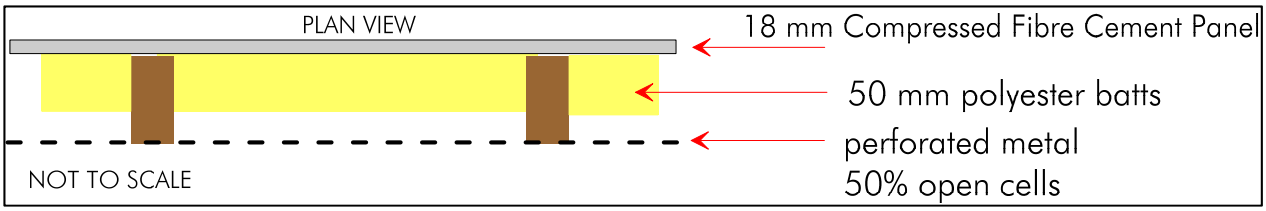


Figure 3: shows the extent of the noise barrier

On the basis that the exact type of mechanical plant is unknown at this stage, it is recommended that mechanical plant compliance testing be conduct prior to occupation. Following compliance testing of the mechanical plant servicing the subject premises, it may be the case that mechanical plant be calibrated and the settings fixed, or additional noise mitigation be implemented in order to achieve compliance with surrounding noise sensitive residential receivers.

9.0 SUMMARY AND CONCLUSION

Koikas Acoustics was requested to provide an acoustic assessment report for the proposed service station at No. 370-372 Carrington Road, Londonderry NSW 2753, which included unattended noise survey taken in December 2017.

- As per the assessment procedures described in the ***EPA's NPI***, the mechanical plant and operational noise criteria was determined based on the ambient background noise level. The project noise trigger levels for the mechanical plant and operational noise of this assessment site becomes:
    - $L_{Aeq,\ 15\ min}$ ≤ **55 dB** for residential premises (0700-1800);
    - $L_{Aeq,\ 15\ min}$ ≤ **50 dB** for residential premises (1800-2200);
    - $L_{Aeq,\ 15\ min}$ ≤ **41 dB** for residential premises (2200-0700), and
    - $L_{Aeq,\ 15\ min}$ ≤ **65 dB** for commercial premises.

- Based on our calculations, in order to achieve compliance (particularly during the night-time period), a solid block wall is required to the north and east of the HVAC enclosure with a roof as stated in Section 8.5 of this report and mechanical plant installed in the proposed locations.

- On the basis that the exact type of mechanical plant is unknown at this stage, it is recommended that mechanical plant compliance testing be conduct prior to occupation.

- If the mechanical plant type and locations change, additional calculations may be required to determine the appropriate recommendations.

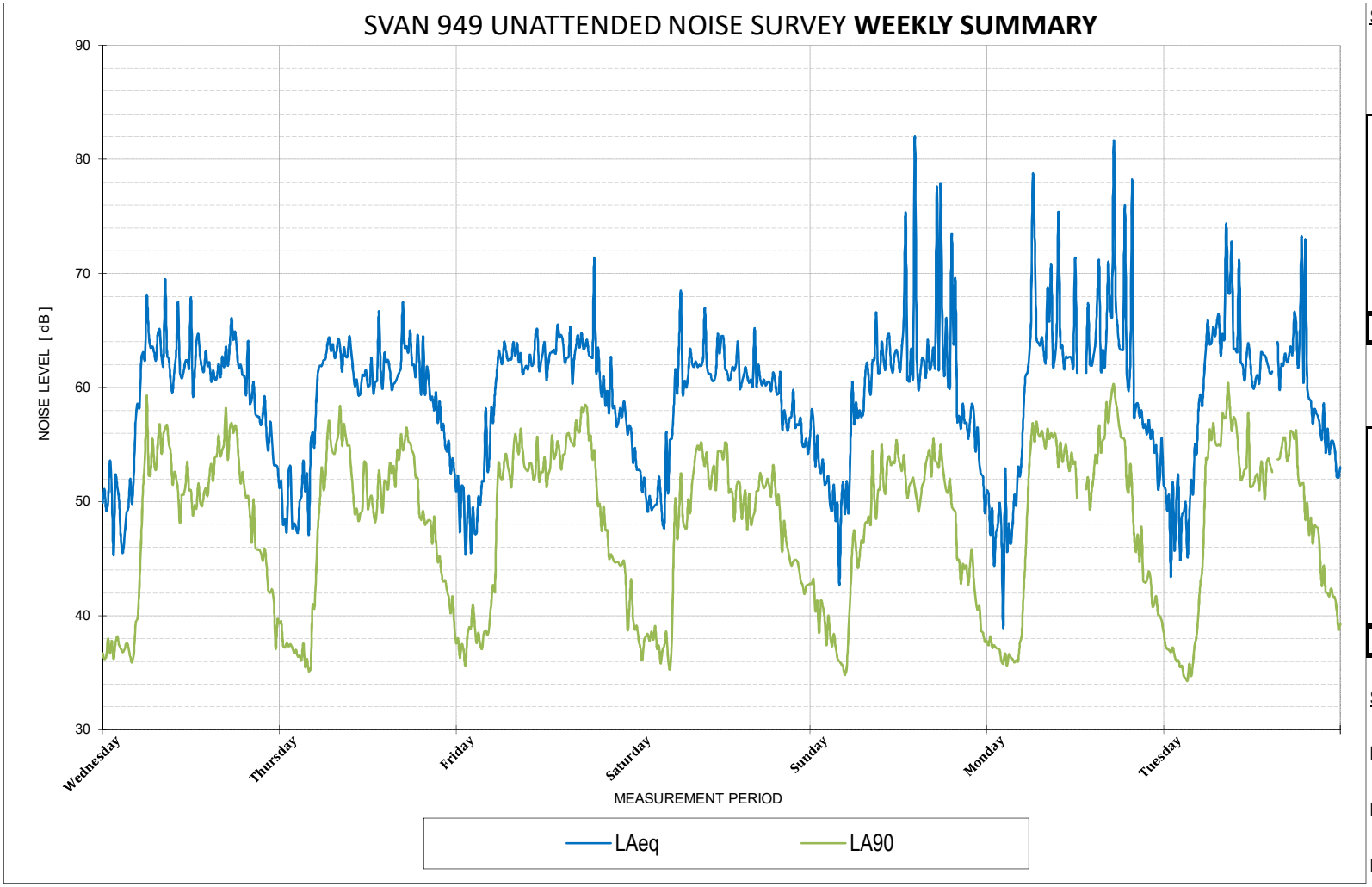
Koikas Acoustics therefore certifies that the proposed service station at No. 370-372 Carrington Road, Londonderry NSW 2753 can satisfy the nominated mechanical plant and operational noise criteria. Koikas Acoustics is supportive of this development.

APPENDIX A

APPENDIX A

APPENDIX A

WEEKLY SUMMARY LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry PERIOD: 13th to the 19th December 2017



Sundays and Public Holidays the hours change to 0800

SUMMARY OF AMBIENT LEVELS

	LA90 Daytime	*LA90* Evening	*LA90* Night-time
Day 1	50	46	36
Day 2	49	46	36
Day 3	52	45	37
Day 4	48	45	36
Day 5	48	43	36
Day 6	51	43	36
Day 7	51	45	35
RBL	50	45	36

	LAeq Daytime	*LAeq* Evening	*LAeq* Night-time
Day 1	63	61	59
Day 2	63	61	57
Day 3	63	63	57
Day 4	62	59	58
Day 5	70	65	56
Day 6	69	69	65
Day 7	65	65	58
Average	66	64	60

SUMMARY OF TRAFFIC LEVELS

LAeq 15 hrs	0700-2200	66	dB
LAeq 9 hrs	2200-0700	60	dB
Max LAeq 1 hr	0700-2200	65	dB
Max LAeq 1 hr	2200-0700	62	dB

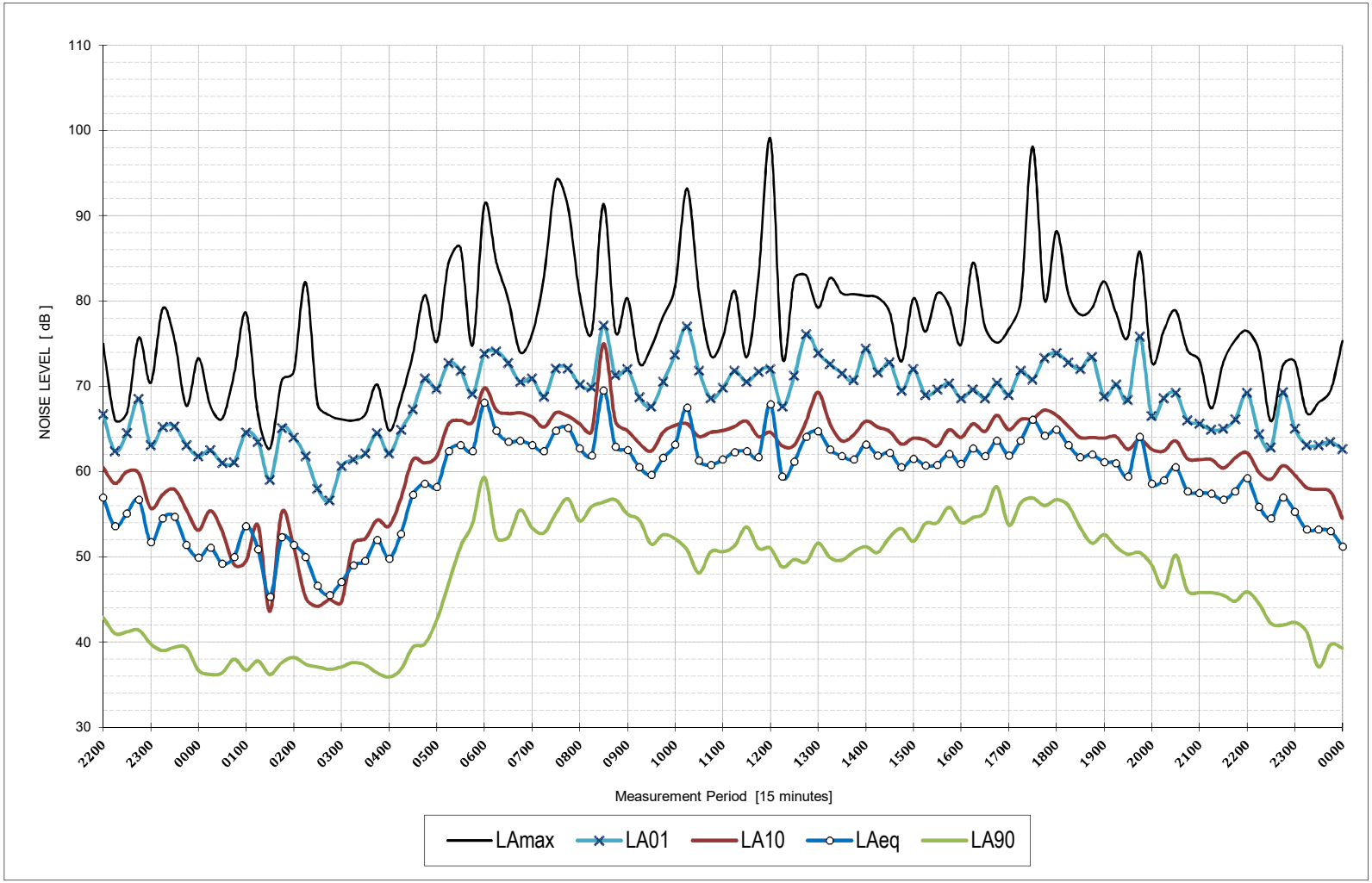
WEEKKLY SUMMARY	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	17	28	35	40	41	45	44	41	34	50
10% min LA90 Evening	6:00 PM	10:00 PM	16	22	30	33	35	40	39	32	33	45
10% min LA90 Night	10:00 PM	7:00 AM	16	18	26	28	27	24	21	25	32	36
10% min LA90 Period	7:00 AM	10:00 PM	16	26	32	37	38	42	42	36	31	47
10% min LA90 Period	10:00 PM	7:00 AM	16	18	26	28	27	24	21	25	32	36
LAeq 15 hours	7:00 AM	10:00 PM	27	42	48	51	54	58	56	63	53	66
LAeq 9 hours	10:00 PM	7:00 AM	21	36	42	45	48	53	52	56	47	60
Max LAeq 1 hour Day	7:00 AM	10:00 PM	25	40	48	50	53	57	56	61	51	65
Max LAeq 1 hour Night	10:00 PM	7:00 AM	24	40	45	49	52	56	55	56	47	62

Maximum noise events as defined in the Environmental Noise Management Manual 30

7 day average - [LAmax - LAeq ≥ 15]

KOIKAS ACOUSTICS PTY LTD

DAY 1 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Wednesday, 13 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	50	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	61	dB
LAeq Night-time	2200-0700	59	dB

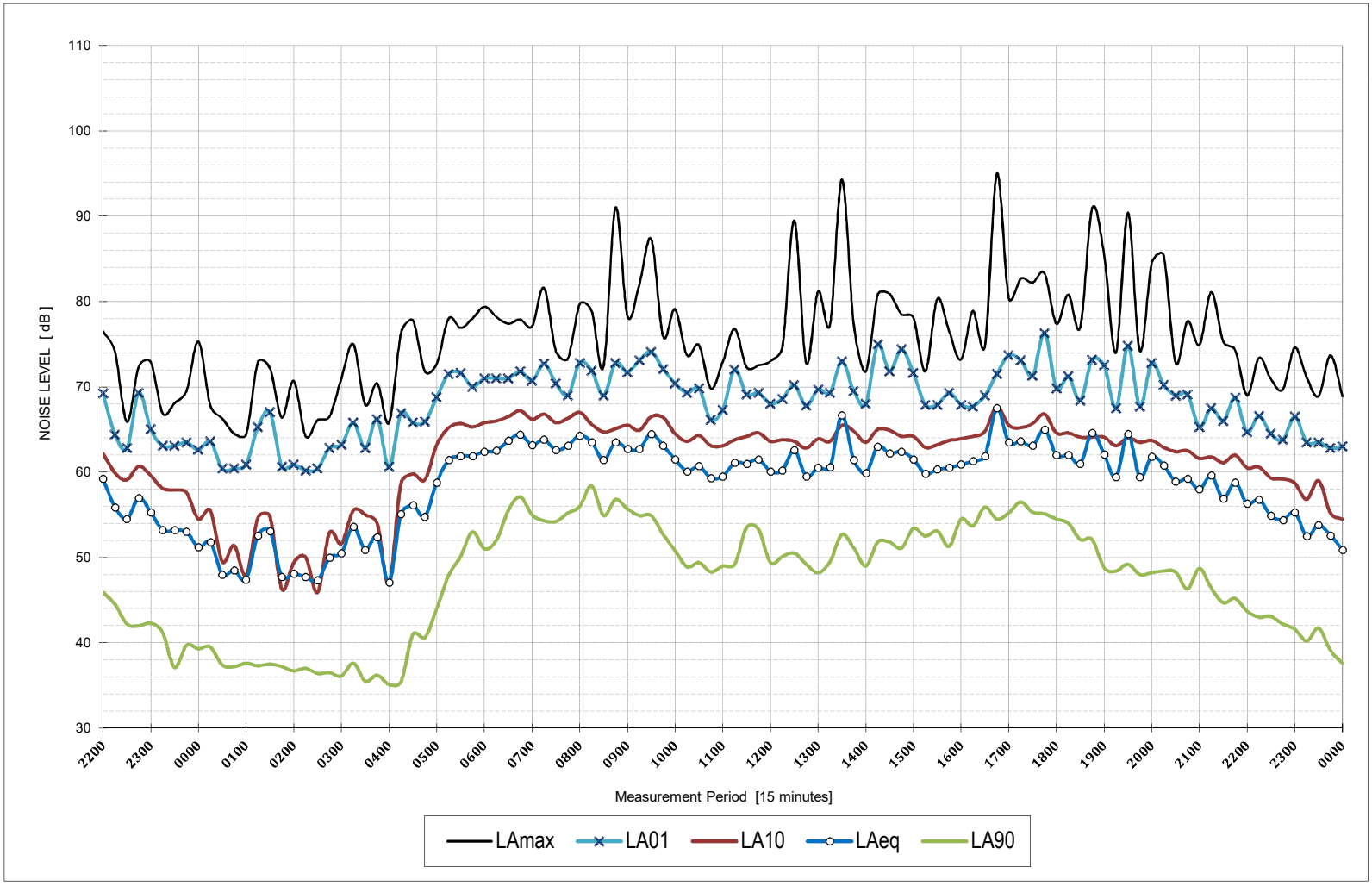
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	63	dB
LAeq 9 hours	2200-0700	59	dB
Max LAeq 1 hour	0700-2200	65	dB
Max LAeq 1 hour	2200-0700	64	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		32	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	17	28	35	41	41	45	44	38	32	50
10% min LA90 Evening	6:00 PM	10:00 PM	16	23	31	35	36	41	40	32	33	46
10% min LA90 Night	10:00 PM	7:00 AM	16	17	26	28	26	24	21	26	33	36
10% min LA90 Period	7:00 AM	10:00 PM	17	29	35	39	38	42	42	38	35	47
10% min LA90 Period	10:00 PM	7:00 AM	16	17	26	28	26	24	21	26	33	36
LAeq 15 hours	7:00 AM	10:00 PM	27	42	48	51	54	58	57	53	49	63
LAeq 9 hours	10:00 PM	7:00 AM	22	38	43	47	50	54	53	49	44	59
Max LAeq 1 hour Day	7:00 AM	10:00 PM	28	43	49	52	56	60	58	55	49	65
Max LAeq 1 hour Night	10:00 PM	7:00 AM	27	43	48	52	55	60	58	55	49	64

KOIKAS ACOUSTICS PTY LTD

DAY 2 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Thursday, 14 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	49	dB
LA90 Evening	1800-2200	46	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	61	dB
LAeq Night-time	2200-0700	57	dB

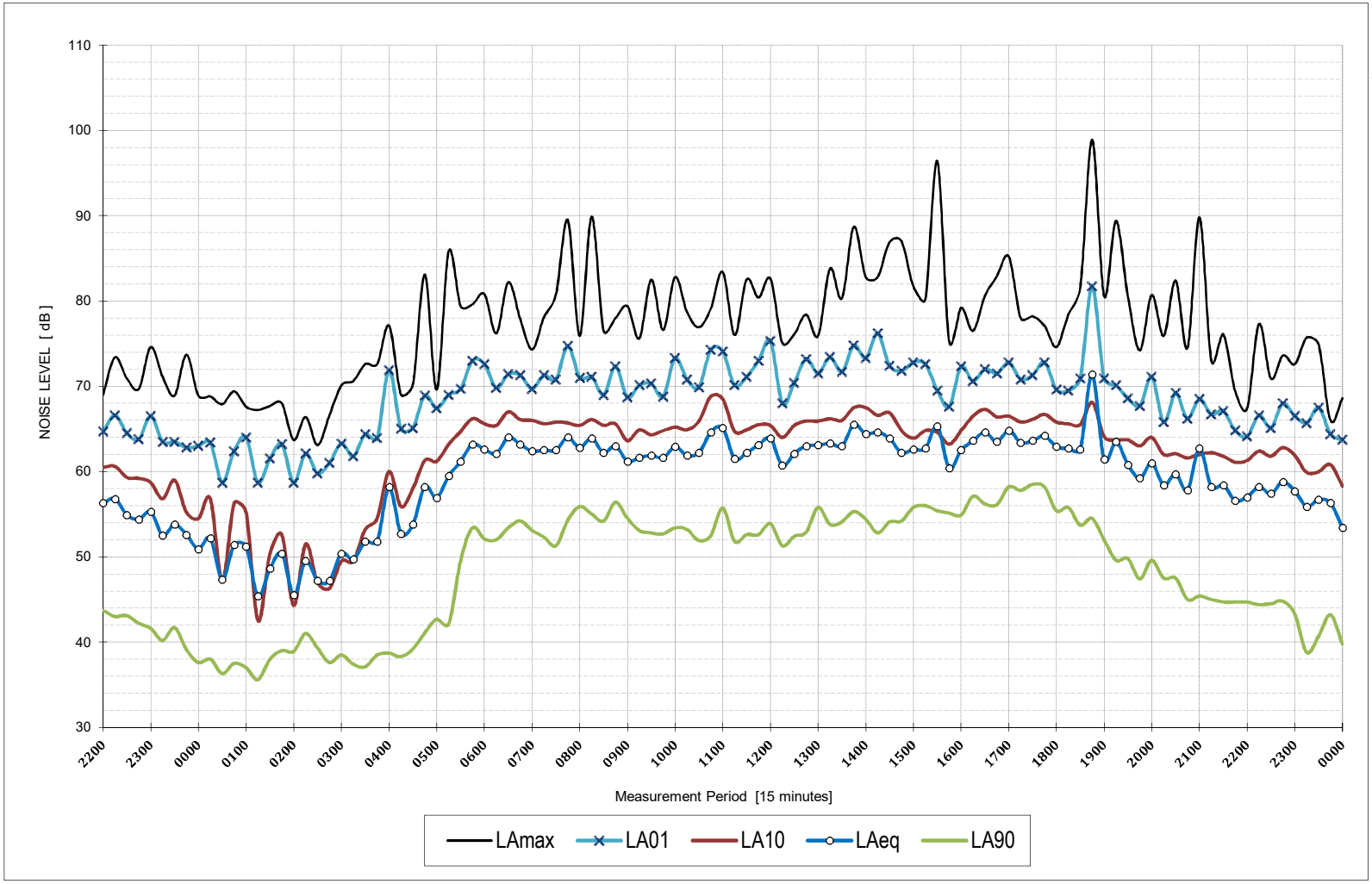
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	62	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	64	dB
Max LAeq 1 hour	2200-0700	62	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		30	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	17	28	35	40	40	44	43	37	28	49
10% min LA90 Evening	6:00 PM	10:00 PM	16	23	30	33	36	42	40	32	32	46
10% min LA90 Night	10:00 PM	7:00 AM	16	18	26	29	26	24	21	24	32	36
10% min LA90 Period	7:00 AM	10:00 PM	16	26	34	40	39	43	42	36	29	48
10% min LA90 Period	10:00 PM	7:00 AM	16	18	27	29	26	24	20	24	32	36
LAeq 15 hours	7:00 AM	10:00 PM	27	42	48	52	54	58	56	53	47	62
LAeq 9 hours	10:00 PM	7:00 AM	20	35	41	45	48	53	52	49	41	57
Max LAeq 1 hour Day	7:00 AM	10:00 PM	28	43	49	53	55	59	57	54	45	64
Max LAeq 1 hour Night	10:00 PM	7:00 AM	23	40	46	49	52	57	56	54	45	62

KOIKAS ACOUSTICS PTY LTD

DAY 3 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Friday, 15 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	52	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0700	37	dB
LAeq Daytime	0700-1800	63	dB
LAeq Evening	1800-2200	63	dB
LAeq Night-time	2200-0700	57	dB

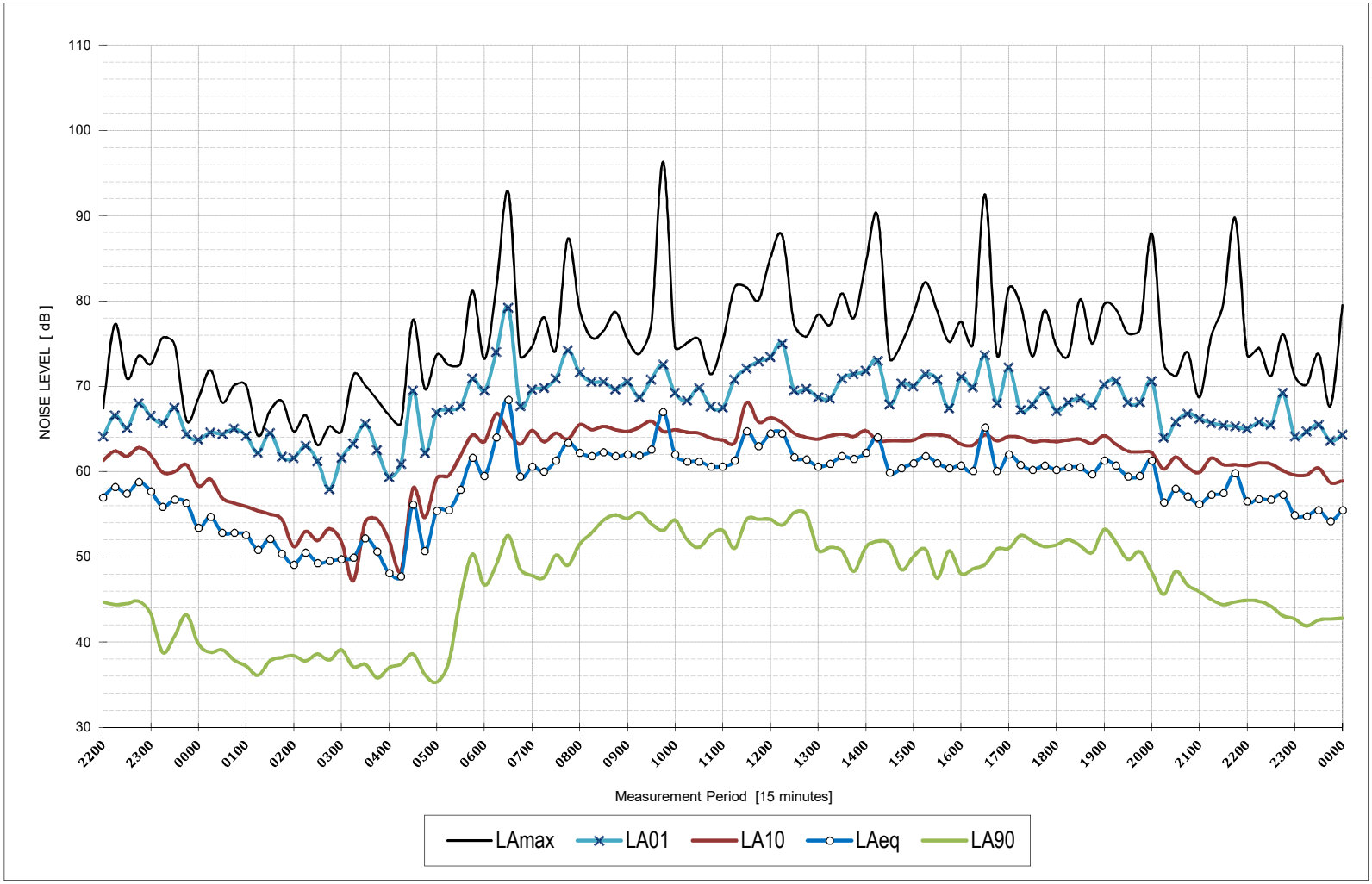
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	63	dB
LAeq 9 hours	2200-0700	57	dB
Max LAeq 1 hour	0700-2200	64	dB
Max LAeq 1 hour	2200-0700	62	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		32	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	17	29	36	40	43	47	46	42	35	52
10% min LA90 Evening	6:00 PM	10:00 PM	16	22	30	33	35	40	40	31	35	45
10% min LA90 Night	10:00 PM	7:00 AM	16	18	27	29	27	25	23	25	34	37
10% min LA90 Period	7:00 AM	10:00 PM	16	26	32	35	37	42	43	37	31	47
10% min LA90 Period	10:00 PM	7:00 AM	16	18	27	29	27	25	23	25	34	37
LAeq 15 hours	7:00 AM	10:00 PM	28	43	48	52	54	59	57	54	48	63
LAeq 9 hours	10:00 PM	7:00 AM	21	36	42	45	48	53	51	49	41	57
Max LAeq 1 hour Day	7:00 AM	10:00 PM	29	44	49	52	55	60	58	54	48	64
Max LAeq 1 hour Night	7:00 AM	10:00 PM	24	40	45	49	52	57	55	55	45	62

KOIKAS ACOUSTICS PTY LTD

DAY 4 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Saturday, 16 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	48	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	62	dB
LAeq Evening	1800-2200	59	dB
LAeq Night-time	2200-0700	58	dB

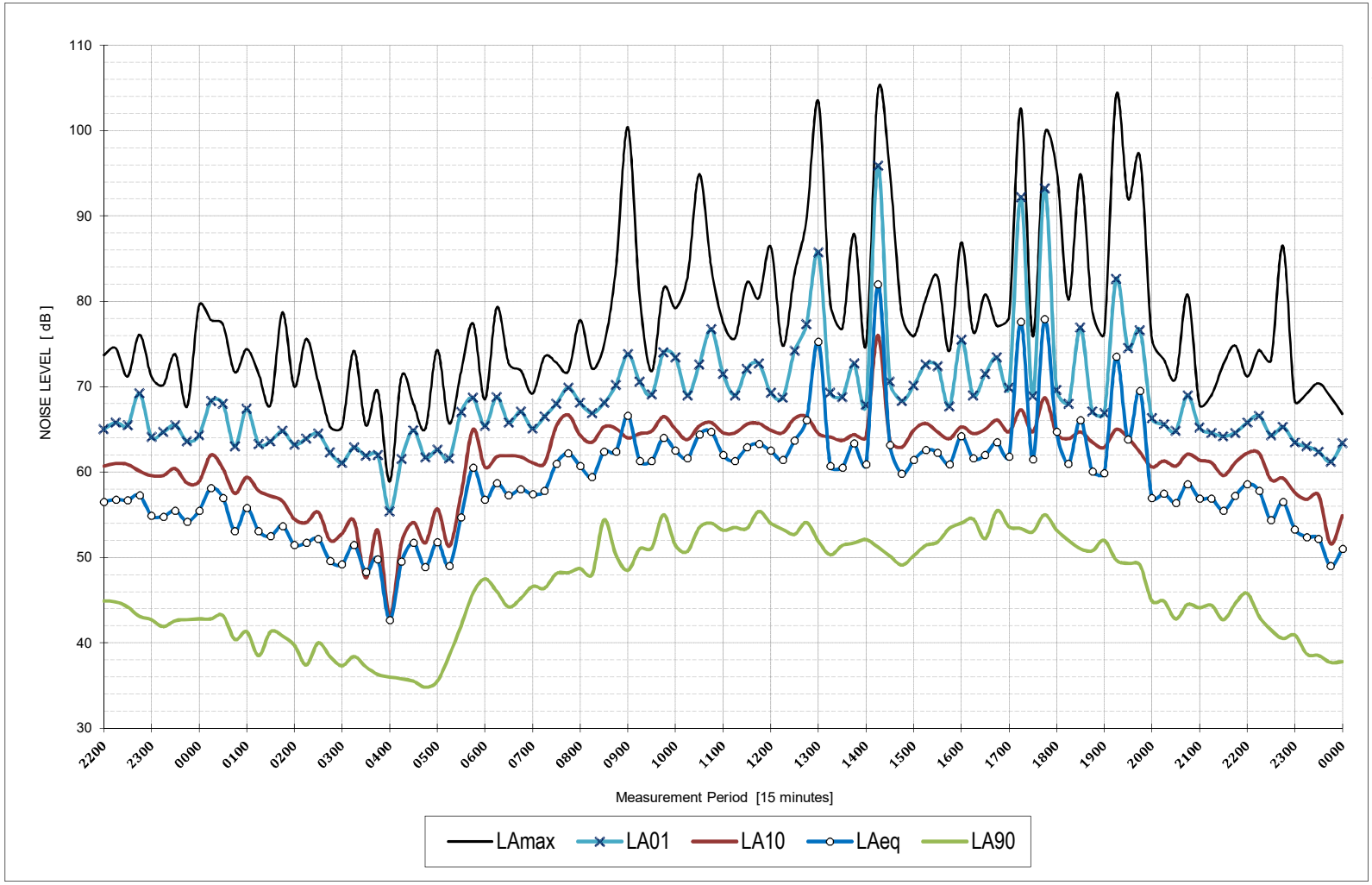
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	62	dB
LAeq 9 hours	2200-0700	58	dB
Max LAeq 1 hour	0700-2200	64	dB
Max LAeq 1 hour	2200-0700	59	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		26	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	17	28	34	40	39	42	42	38	31	48
10% min LA90 Evening	6:00 PM	10:00 PM	16	22	30	34	36	40	39	32	33	45
10% min LA90 Night	10:00 PM	7:00 AM	16	18	26	29	27	25	23	25	32	36
10% min LA90 Period	7:00 AM	10:00 PM	16	25	32	37	38	42	41	35	30	47
10% min LA90 Period	10:00 PM	7:00 AM	16	18	26	29	27	25	23	25	32	36
LAeq 15 hours	7:00 AM	10:00 PM	26	41	48	51	53	57	55	52	44	62
LAeq 9 hours	10:00 PM	7:00 AM	24	36	42	46	48	53	53	48	45	58
Max LAeq 1 hour Day	7:00 AM	10:00 PM	28	42	50	52	55	59	57	54	47	64
Max LAeq 1 hour Night	10:00 PM	7:00 AM	24	37	42	48	50	54	53	50	44	59

KOIKAS ACOUSTICS PTY LTD

DAY 5 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Sunday, 17 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0800-1800	48	dB
LA90 Evening	1800-2200	43	dB
LA90 Night-time	2200-0800	36	dB
LAeq Daytime	0800-1800	70	dB
LAeq Evening	1800-2200	65	dB
LAeq Night-time	2200-0800	56	dB

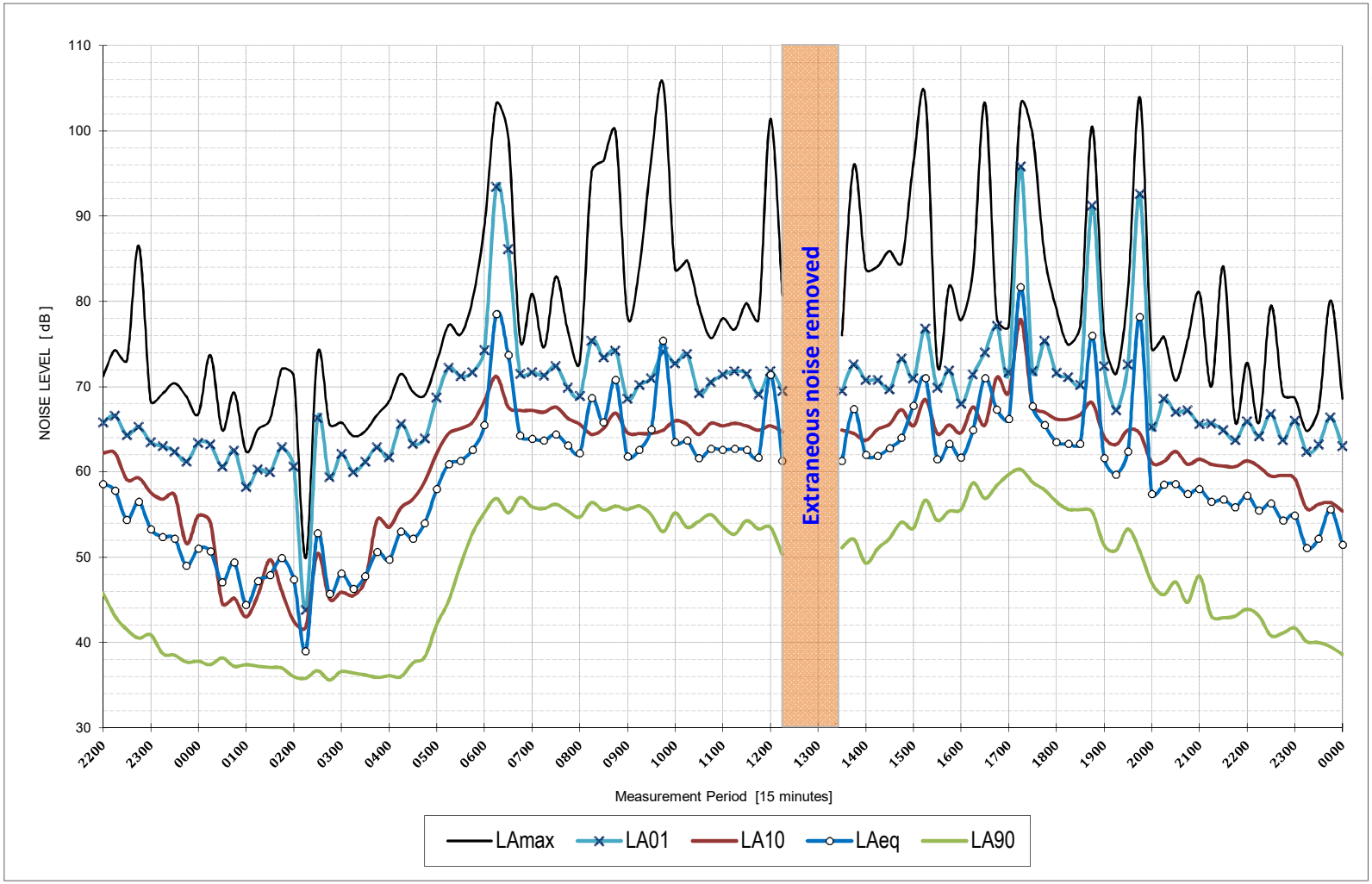
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	55	dB
Max LAeq 1 hour	0700-2200	73	dB
Max LAeq 1 hour	2200-0700	57	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		32	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	8:00 AM	6:00 PM	18	25	33	37	38	42	43	41	36	48
10% min LA90 Evening	6:00 PM	10:00 PM	16	20	28	32	32	36	39	29	32	43
10% min LA90 Night	10:00 PM	8:00 AM	16	17	26	28	27	25	23	25	32	36
10% min LA90 Period	7:00 AM	10:00 PM	16	21	29	32	34	38	41	31	32	44
10% min LA90 Period	10:00 PM	7:00 AM	16	17	25	28	27	25	23	25	32	36
LAeq 15 hours	7:00 AM	10:00 PM	23	40	48	50	52	57	56	68	57	69
LAeq 9 hours	10:00 PM	7:00 AM	19	34	43	43	45	50	49	46	40	55
Max LAeq 1 hour Day	7:00 AM	10:00 PM	29	44	54	56	58	62	63	70	59	73
Max LAeq 1 hour Night	10:00 PM	7:00 AM	20	35	43	44	47	52	51	47	41	57

KOIKAS ACOUSTICS PTY LTD

DAY 6 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Monday, 18 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	51	dB
LA90 Evening	1800-2200	43	dB
LA90 Night-time	2200-0700	36	dB
LAeq Daytime	0700-1800	69	dB
LAeq Evening	1800-2200	69	dB
LAeq Night-time	2200-0700	65	dB

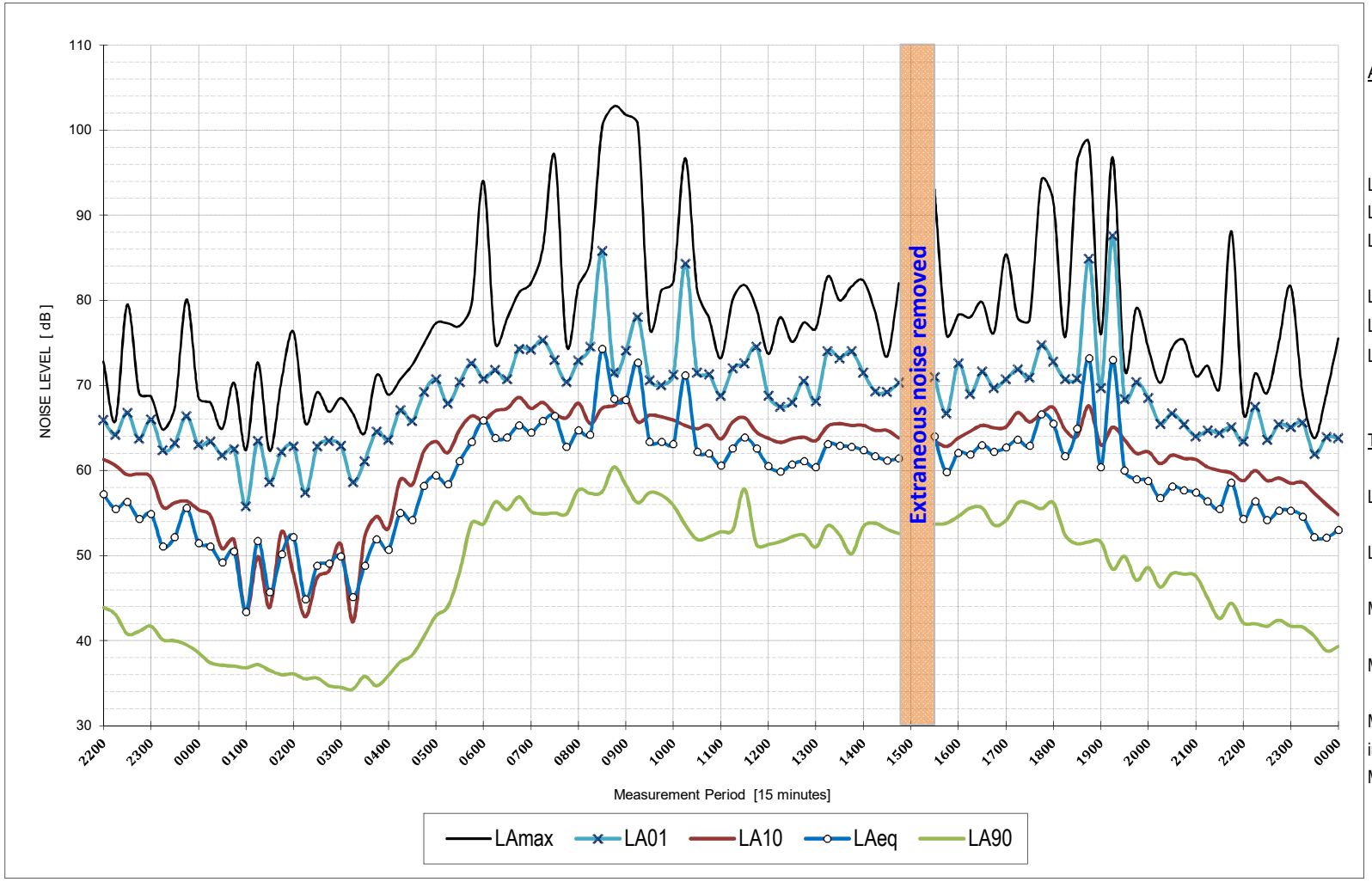
TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	69	dB
LAeq 9 hours	2200-0700	65	dB
Max LAeq 1 hour	0700-2200	72	dB
Max LAeq 1 hour	2200-0700	63	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		31	

	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	18	30	36	42	42	45	45	41	36	51
10% min LA90 Evening	6:00 PM	10:00 PM	16	22	27	31	31	37	39	29	35	43
10% min LA90 Night	10:00 PM	7:00 AM	16	17	26	28	27	23	20	23	32	36
10% min LA90 Period	7:00 AM	10:00 PM	16	26	32	36	37	41	41	36	32	46
10% min LA90 Period	10:00 PM	7:00 AM	16	17	26	28	27	23	20	23	32	36
LAeq 15 hours	7:00 AM	10:00 PM	26	41	47	50	53	58	57	68	57	69
LAeq 9 hours	10:00 PM	7:00 AM	21	37	42	45	48	53	52	64	54	65
Max LAeq 1 hour Day	7:00 AM	10:00 PM	31	45	53	56	59	63	63	66	58	72
Max LAeq 1 hour Night	10:00 PM	7:00 AM	20	37	41	44	47	51	50	59	51	63

KOIKAS ACOUSTICS PTY LTD

DAY 7 LOGGER LOCATION: No. 370-372 Carrington Road, Londonderry DATE: Tuesday, 19 December 2017



AMBIENT NOISE METRICS

Descriptor	Period	Level	Units
LA90 Daytime	0700-1800	51	dB
LA90 Evening	1800-2200	45	dB
LA90 Night-time	2200-0700	35	dB
LAeq Daytime	0700-1800	65	dB
LAeq Evening	1800-2200	65	dB
LAeq Night-time	2200-0700	58	dB

TRAFFIC & MISC. NOISE METRICS

LAeq 15 hours	0700-2200	65	dB
LAeq 9 hours	2200-0700	58	dB
Max LAeq 1 hour	0700-2200	69	dB
Max LAeq 1 hour	2200-0700	63	dB
Maximum noise events as defined in the Environmental Noise Management Manual [LAmax - LAeq ≥ 15]		30	

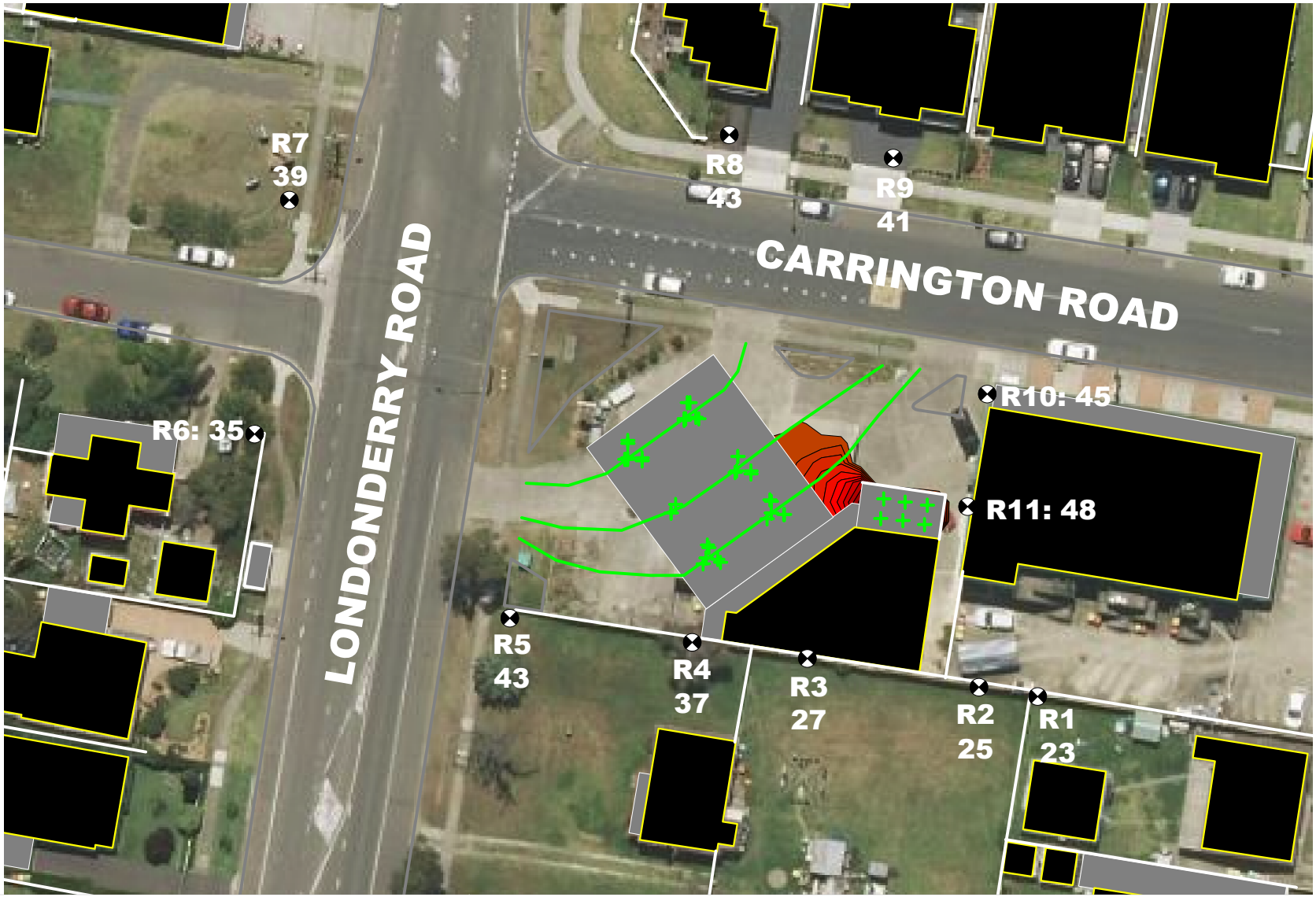
	Period		Frequency [Hz]									
Descritpor	Start	End	31.5	63	125	250	500	1000	2000	4000	8000	Total A
10% min LA90 Daytime	7:00 AM	6:00 PM	19	30	36	42	42	47	45	41	34	51
10% min LA90 Evening	6:00 PM	10:00 PM	16	23	30	33	35	41	39	32	31	45
10% min LA90 Night	10:00 PM	7:00 AM	16	20	25	28	25	21	18	26	31	35
10% min LA90 Period	7:00 AM	10:00 PM	16	25	32	39	39	43	42	36	30	48
10% min LA90 Period	10:00 PM	7:00 AM	16	20	25	28	25	21	18	26	31	35
LAeq 15 hours	7:00 AM	10:00 PM	28	42	48	51	54	57	55	63	54	65
LAeq 9 hours	10:00 PM	7:00 AM	20	36	42	44	48	53	51	53	43	58
Max LAeq 1 hour Day	7:00 AM	10:00 PM	27	42	49	52	55	58	57	67	57	69
Max LAeq 1 hour Night	10:00 PM	7:00 AM	22	39	43	47	51	56	55	59	47	63

KOIKAS ACOUSTICS PTY LTD

APPENDIX B

APPENDIX B

APPENDIX B



Scenario 1.1
(Daytime)
**** NOISE SOURCES ****

~ 2 x AC condenser units
~ 1 x Exhaust fans
~ 1 x Island chiller condenser unit
~ 1 x Coolroom condenser unit
~ 1 x Freezer condenser unit
~ 21 x Light vehicles @ 5km/hr
~ 21 x Light vehicles engine starting
~ 1 x Heavy vehicle @ 5km/hr
~ 1 x Heavy vehicles engine starting
~ 1 x Heavy vehicles air brake
~ 22 x Doors opening/closing

Note:
- LAeq,15mins noise level contours shown are at a height of 1.5 m above the ground floor and end at the limiting criteria of 55 dB.
- All receiver points are 1.5m above the ground, except R11= 4.5m.
- The maximum reading at the nearest residential boundary is 48 dB.
PRINT DATE: 05/08/19

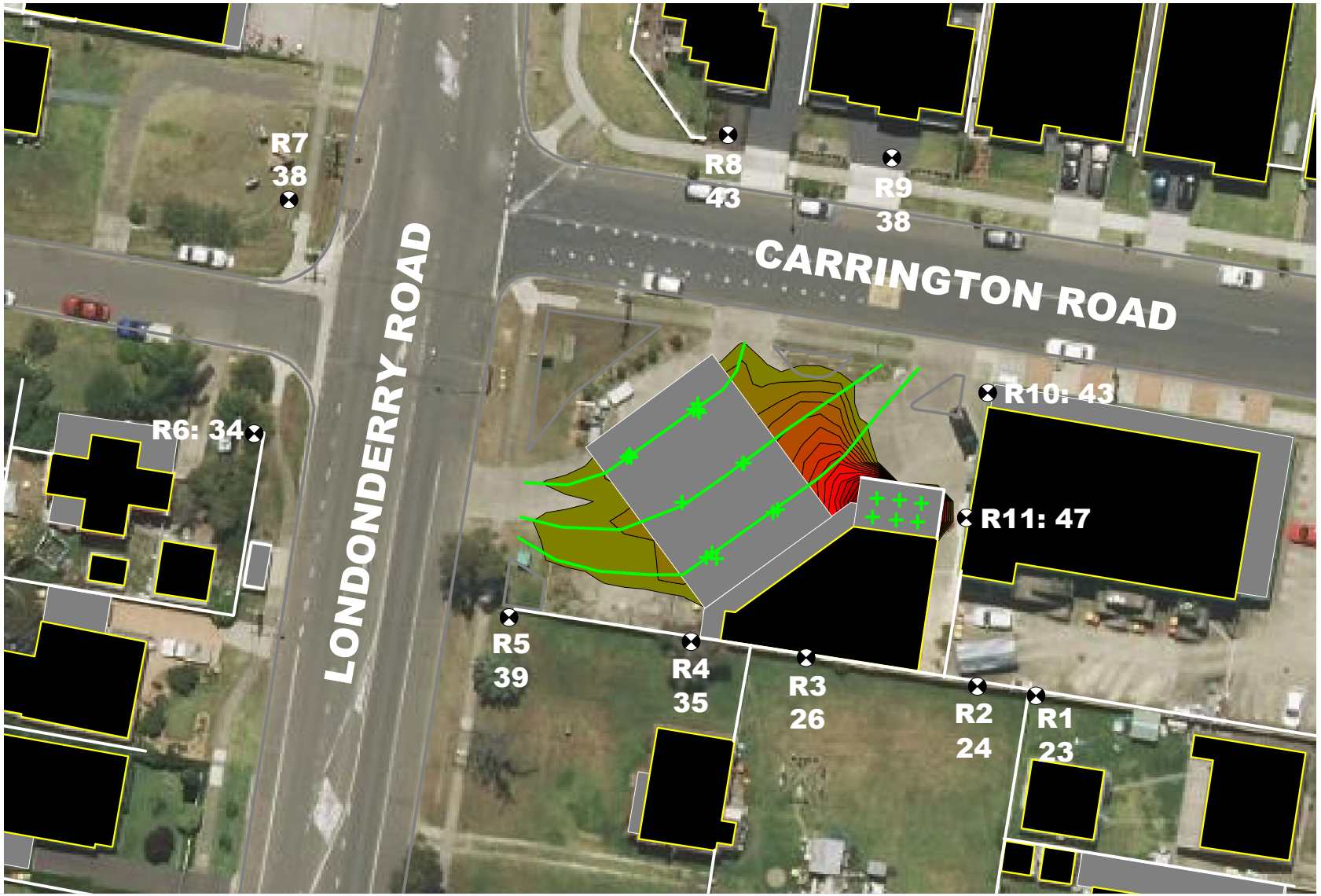
Point Source
Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 50.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 80.0 dB
> 85.0 dB
> 90.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3334
CLIENT: Maria Galas Pty Ltd C/- R.J. Sinclair Pty Ltd
SITE ADDRESS: No. 370-372 Carrington Road, Londonderry
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 55 dB(A) - Residential (0700-1800)

N
W E
S



Scenario 1.2
(Evening)
**** NOISE SOURCES ****

~ 2 x AC condenser units
~ 1 x Exhaust fans
~ 1 x Island chiller condenser unit
~ 1 x Coolroom condenser unit
~ 1 x Freezer condenser unit
~ 8 x Light vehicles @ 5km/hr
~ 8 x Light vehicles engine starting
~ 8 x Doors opening/closing

Note:
- LAeq,15mins noise level contours shown are at a height of 1.5 m above the ground floor and end at the limiting criteria of 50 dB.
- All receiver points are 1.5m above the ground, except R11= 4.5m.
- The maximum reading at the nearest residential boundary is 47 dB.
PRINT DATE: 05/08/19

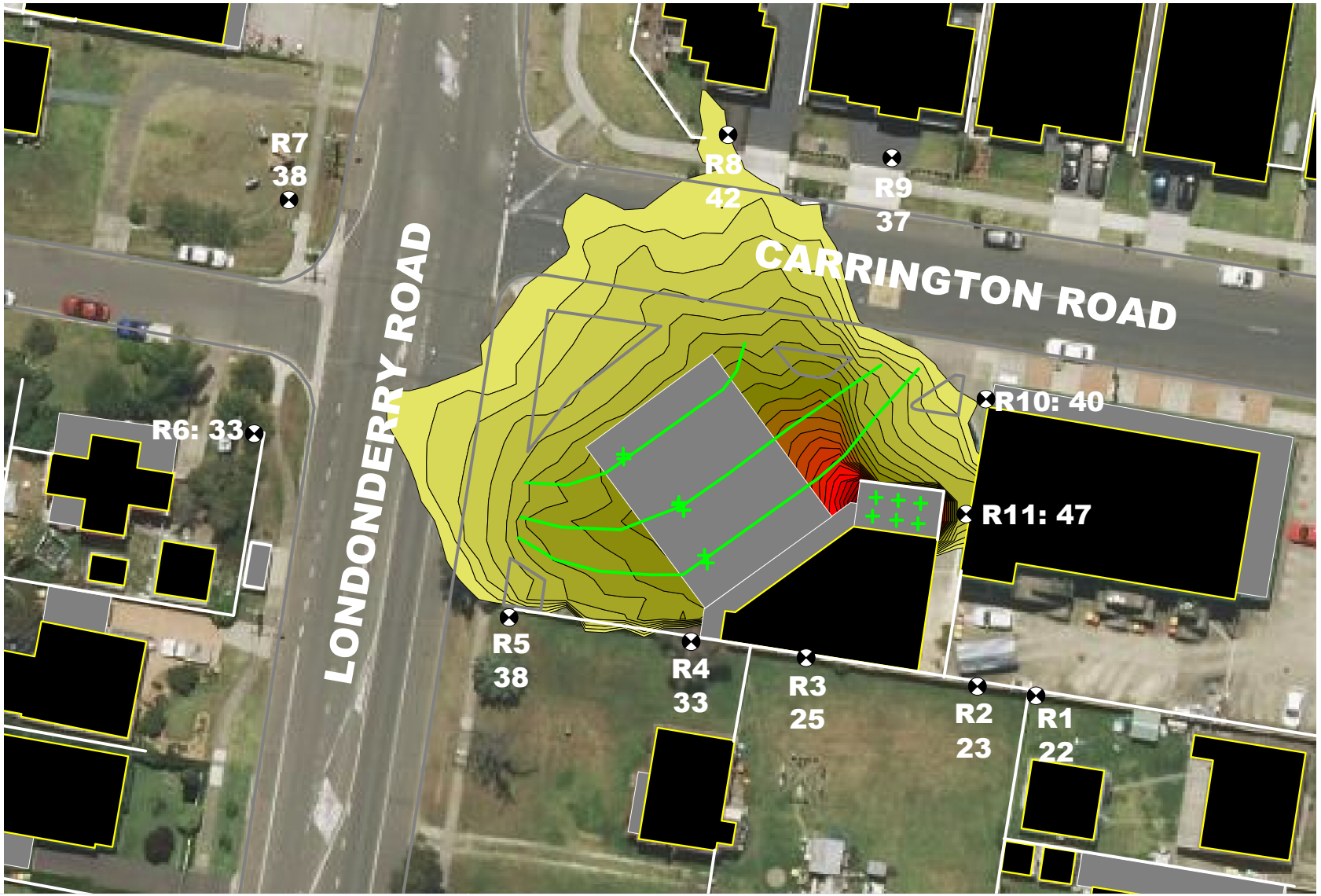
Point Source
Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 50.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 80.0 dB
> 85.0 dB
> 90.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3334
CLIENT: Maria Galas Pty Ltd C/- R.J. Sinclair Pty Ltd
SITE ADDRESS: No. 370-372 Carrington Road, Londonderry
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 50 dB(A) - Residential (1800-2200)

N
W E
S



Scenario 1.3
(Night-time)
**** NOISE SOURCES ****

~ 2 x AC condenser units
~ 1 x Exhaust fans
~ 1 x Island chiller condenser unit
~ 1 x Coolroom condenser unit
~ 1 x Freezer condenser unit
~ 4 x Light vehicles @ 5km/hr
~ 4 x Light vehicles engine starting
~ 4 x Doors opening/closing

Note:
- LAeq,15mins noise level contours shown are at a height of 1.5 m above the ground floor and end at the limiting criteria of 41 dB.
- All receiver points are 1.5m above the ground, except R11= 4.5m.
- The maximum reading at the nearest residential boundary is 47 dB.

PRINT DATE: 05/08/19

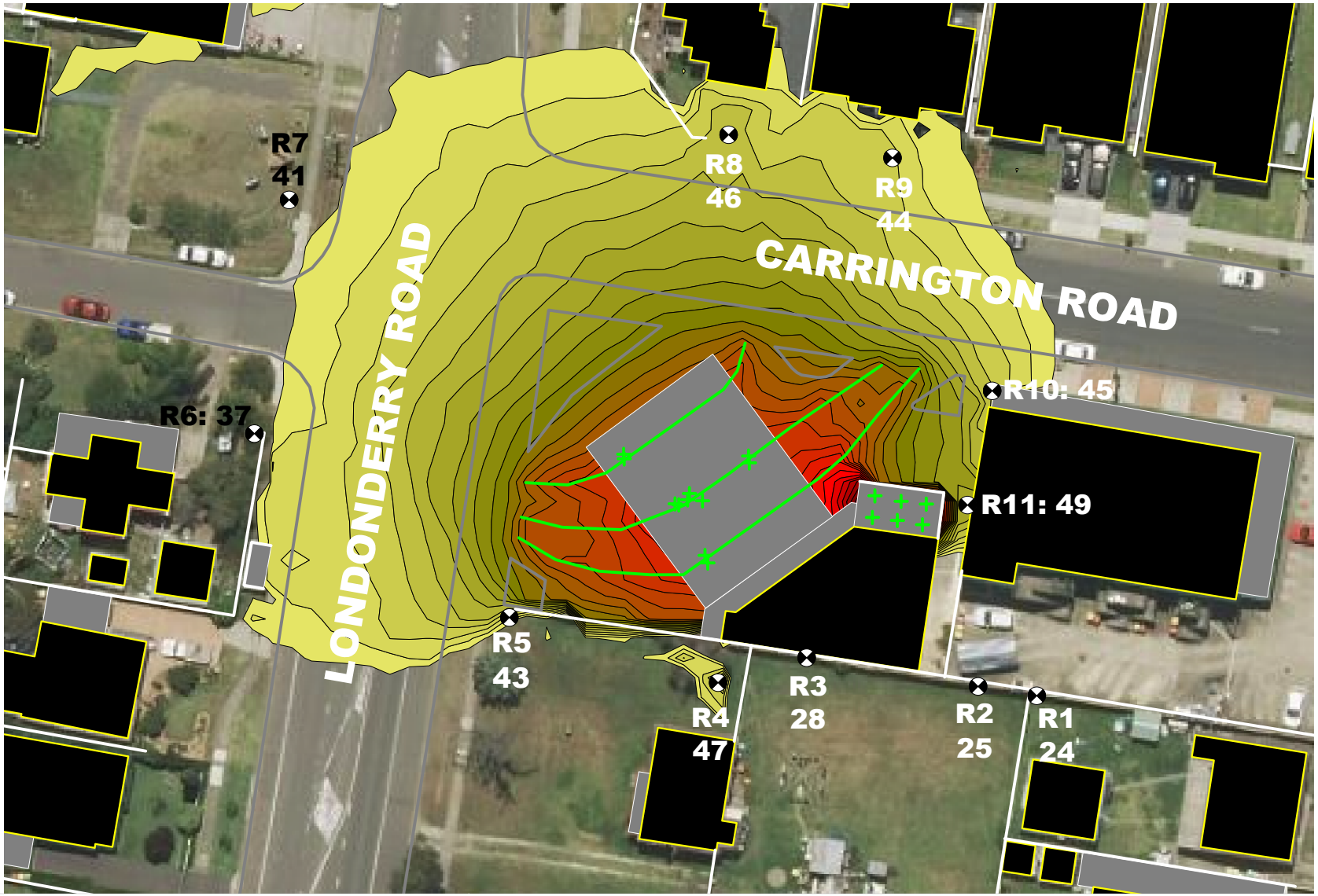
Point Source
Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 40.0 dB
> 50.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 80.0 dB
> 85.0 dB
> 90.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3334
CLIENT: Maria Galas Pty Ltd C/- R.J. Sinclair Pty Ltd
SITE ADDRESS: No. 370-372 Carrington Road, Londonderry
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 41 dB(A) - Residential (2200-0700)

N
W E
S



Scenario 1.4
(Night-time)
**** NOISE SOURCES ****

~ 2 x AC condenser units
~ 1 x Exhaust fans
~ 1 x Island chiller condenser unit
~ 1 x Coolroom condenser unit
~ 1 x Freezer condenser unit
~ 4 x Light vehicles @ 5km/hr
~ 4 x Light vehicles engine starting
~ 1 x Heavy vehicle @ 5km/hr
~ 1 x Heavy vehicles engine starting
~ 1 x Heavy vehicles air brake
~ 5 x Doors opening/closing

Note:
- LAeq,15mins noise level contours shown are at a height of 1.5 m above the ground floor and end at the limiting criteria of 41 dB.
- All receiver points are 1.5m above the ground, except R11= 4.5m.
- The maximum reading at the nearest residential boundary is 49 dB.
PRINT DATE: 05/08/19

Point Source
Line Source
Building
Barrier
3D-Reflector
Contour Line
Receiver
Calculation Area

> 40.0 dB
> 50.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 80.0 dB
> 85.0 dB
> 90.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 3334
CLIENT: Maria Galas Pty Ltd C/- R.J. Sinclair Pty Ltd
SITE ADDRESS: No. 370-372 Carrington Road, Londonderry
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 41 dB(A) - Residential (2200-0700)

N
W E
S