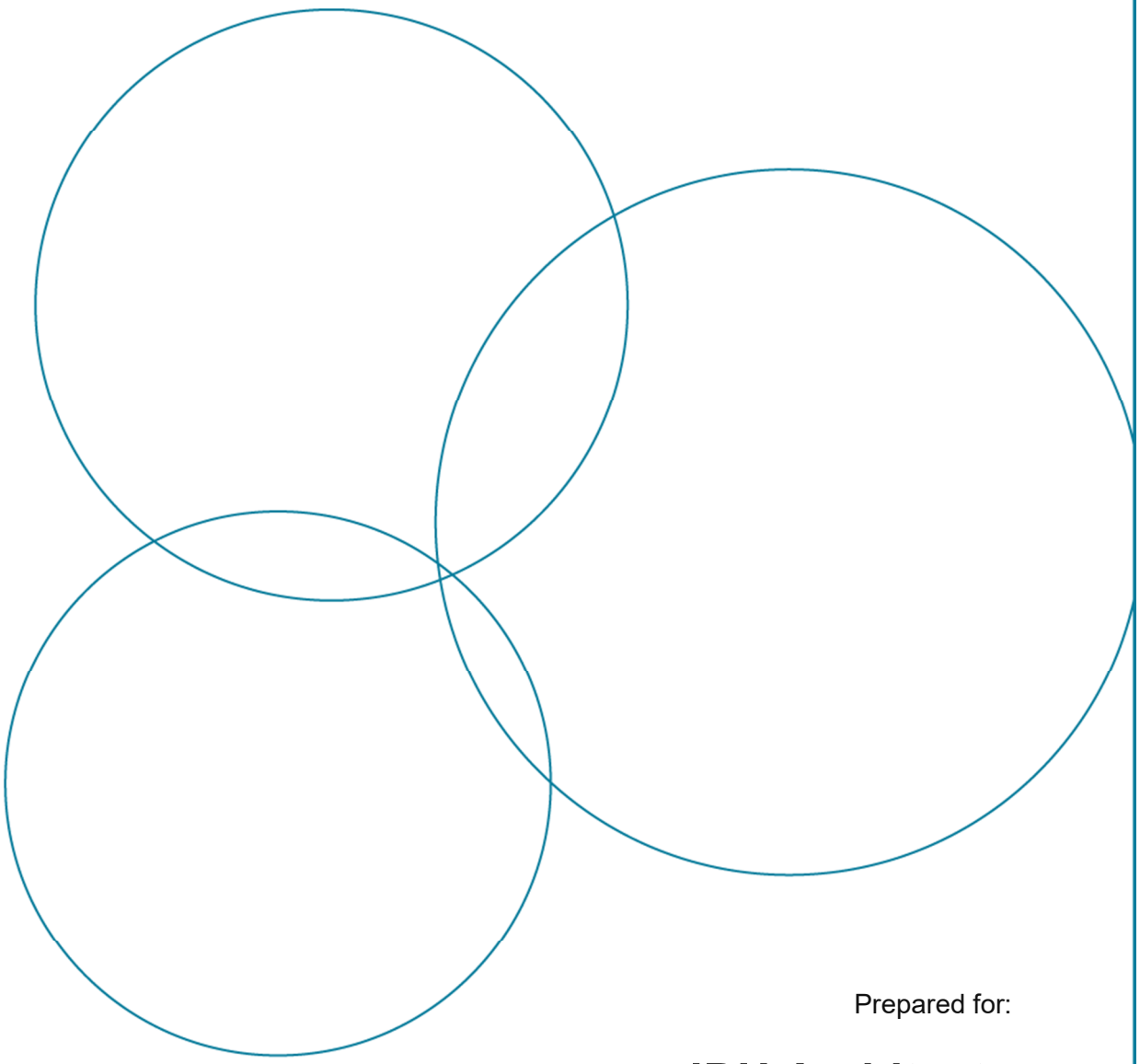
Appendix C – Acoustic Report

20 December 2017

Acoustic Report for DA Submission

1015558 – Fairvale High School



Prepared for:

JDH Architects

By Cundall
Level 1, 48 Alfred Street
Milsons Point, NSW 2061
Ph (02) 8424 7000
Fax (02) 8424 7099

Please contact:
Mark Evans

Author:	Mark Evans	
Checked by:	Patrick Carpenter	
Approved by:	Mark Evans	

Revision	**Description**	**Date**
-	First Issue for comment	14/07/2017
A	Incorporating comments	20/10/2017
B	Incorporating additional comments	31/10/2017
C	Incorporating additional comments	31/10/2017
D	Additional survey data added	18/12/2017
E	Incorporating minor comments	20/12/2017

The success and realisation of the proposed initiatives will be dependent upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved.

Contents

Executive Summary

This report presents acoustic input to the DA submission for the proposed development at Fairvale High School.

The project will constitute a State Significant Development (SSD), assessed by the Department of Planning & Environment (DPE). The proposed scheme has therefore been considered in accordance with the Secretary's Environmental Assessment Requirements, with specific reference to relevant policies and guidelines identified therein.

Acoustic analysis has been undertaken based upon data from noise surveys at the site. Acoustic design targets have been determined, based on appropriate standards and guidelines to achieve acceptable noise levels for:

- Noise break-in to the development and internal noise levels;
- Noise break-out to the community.

Noise intrusion from the surroundings affecting the development, such as general road traffic, can be controlled by the selection of appropriate façade glazing, external constructions, and ventilation strategy to meet the recommended internal noise levels.

Noise limits on emissions from plant have been set in accordance with the NSW INP.NPI. It is considered that any typical external noise sources could be adequately controlled using standard acoustic treatment techniques.

An assessment of potential activity noise breakout from the new multi-purpose Main Hall has been made. The proposed building orientation should adequately control noise impact on dwellings to the south, and distance attenuation should allow for activities generating high noise levels to be accommodated without undue disturbance to residential properties to the north, even with elements of the Hall's external façade open.

No adverse impact on surrounding noise-sensitive receptors is anticipated due to activity noise associated with the proposed increase in student numbers. Consideration has also been given to noise impact of the school bell and waste collection services. The use of temporary demountables has been considered and good practice measures identified to reduce associated noise impacts.

Existing out of hours community usage is expected to remain largely unchanged and therefore the noise impact of such activities should not significantly affect the local surroundings.

An assessment of noise emissions associated with an increased number of vehicle movements has been made, including reference to ESEPP/ISEPP and DoP guidelines. It is concluded that there should be negligible impact from road traffic noise on adjacent sensitive receptors and the school itself.

Applicable noise and vibration criteria associated with construction works have been set, based on guidelines set out by the DECC and EPA. Good practice guidance for controlling noise from construction sites has also been identified.

1 Introduction

Cundall has been commissioned by JDH Architects to carry out an assessment of noise levels affecting a proposed development at Fairvale High School, Fairfield West NSW, and consider noise break-out affecting neighbouring properties.

This report is based on the project brief provided to Cundall dated 5 May 2017 proposed development plans dated 6 October 2017, and the Secretary's Environmental Assessment Requirements dated 4 September 2017 (Application number SSD 8677).

1.1 Proposed development

Ground within the existing school site will be developed to provide the following facilities:

- New three storey building comprising general learning areas, art spaces, science labs, food technology, breakout spaces and wet areas, with new administration and staff facilities;
- New construction of a multi-purpose hall and canteen, accommodating learning areas, change areas, stage, performance facilities and staff facilities;
- New student COLA;
- Refurbishment and new construction of administration and staff areas.

1.2 Design criteria

In this report, acoustic design targets are established for:

- Noise impact of the surrounding community on the development, including internal noise levels;
- Noise impact of the development on the surrounding community.

It is noted that the school will be State Significant Development (SSD) assessed by the Department of Planning & Environment (DPE) rather than local government.

The acoustic design targets and guidance have been derived from relevant Australian codes, standards, and guidance, including the following:

- NSW Educational Facilities Standards and Guidelines [EFSG], DG11 – Acoustics;
- NSW EPA 'NSW Industrial Noise Policy' [INP] (January 2000);
- NSW EPA 'Noise Policy for Industry' [NPI] (October 2017)
- NSW DPE State Environmental Planning Policy – (Infrastructure) 2007 [ISEPP];
- NSW DPE State Environmental Planning Policy – (Educational Establishments and Child Care Facilities) 2017 [ESEPP];
- NSW DoP 'Development Near Rail Corridors and Busy Roads – Interim Guideline' (2008);
- NSW DECC 'Interim Construction Noise Guideline';
- NSE EPA 'Assessing Vibration: A Technical Guideline' (2006);
- Fairfield City Council 'Fairfield City Wide Development Control Plan 2013';
- Australian Standard AS2107 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (2016);
- Association of Australia Acoustical Consultants [AAAC] 'Guideline for educational facilities acoustics' (September 2010).

A glossary of acoustic terminology used in this report is included in Appendix A.

2 Site description

2.1 Existing site

The school was established in 1969 and, in addition to more traditional academic, sporting and vocational facilities, currently includes a multi-purpose Performing Arts and Creative Arts centre, and Hospitality kitchen.

The immediate vicinity is residential in nature, with dwellings located immediately adjacent to the north and east school boundary (Mellick Street and Maud Street properties, respectively) and south (across Thorney Road). Land to the west of the school site is Avery Park and beyond this lies the Cumberland Highway (A28), approximately 200 m from the western site boundary.

The adjacent roads generally serve local traffic only, however the A28 is a major route connecting to the M4 further to the north (approx. 7 km) and the M5 to the south (approx. 7 km).

The figure below indicates the site and the immediate surrounds.

Figure 1 – Site location and surrounds

2.2 Proposed site

The new Hall is to be constructed on the site of the existing COLA, with a new sports COLA established to the north as part of the redevelopment. It is understood that the existing Binishell building (Block G) will also be demolished and replaced with a new landscaped area.

The figures below indicate the existing and proposed site plans.

Figure 2 – Existing site plan (demolition highlighted)

It is noted that the project will include removal of the 18 existing demountables located in the north-eastern sector of the site.

The proposed upgrades will provide for an additional 200 students and an anticipated net gain of ten teaching staff. There will be no additional parking provided on site as part of the works.

The development will increase the number of students at the school by more than 50, and therefore the proposal is considered as 'traffic generating development' under Clause 57 of the ESEPP. Consideration of the potential acoustic impact of additional staff, students, and vehicle movements associated with the proposals will be considered further below.

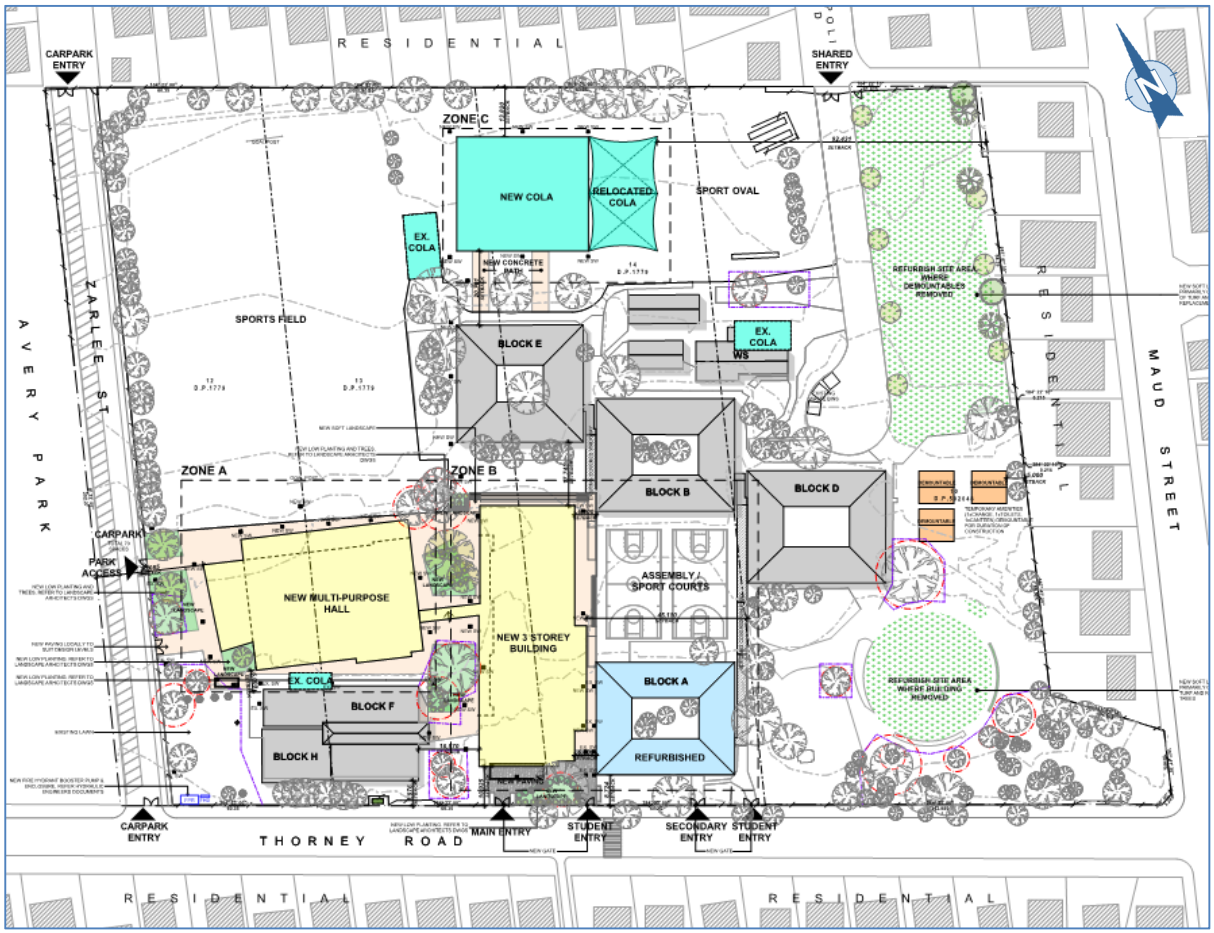


Figure 3 – Proposed site plan (new areas highlighted)

3 ISEPP road traffic noise assessment

The DoP Interim Guideline, Clause 3.5 'When is an acoustic assessment needed?' states that "Acoustic assessments for noise sensitive developments (as defined in Clauses 87 and 102 of the Infrastructure SEPP) may be required if located in the vicinity of a rail corridor or busy roads."

Clause 102 of the ISEPP relates to road noise. In summary, it requires that additional consideration be given to the potential impact of road noise if the proposed development is adjacent to a road corridor with an annual average daily traffic (AADT[1]) volume of more than 40,000 vehicles (based on traffic data published by the RMS), or any other road with an AADT volume of more than 20,000 vehicles or a high level of truck movements or bus traffic.

3.1 Traffic flows

Traffic volume maps for Infrastructure SEPP assessments are provided on the Roads and Maritime website[2], however Thorney Road does not fall on a route where traffic count data is provided. The nearest location is approximately 500 m to the south-west and relates to the A28 Cumberland Highway / New Cambridge Street – an AADT of 41,189 is reported at this location.

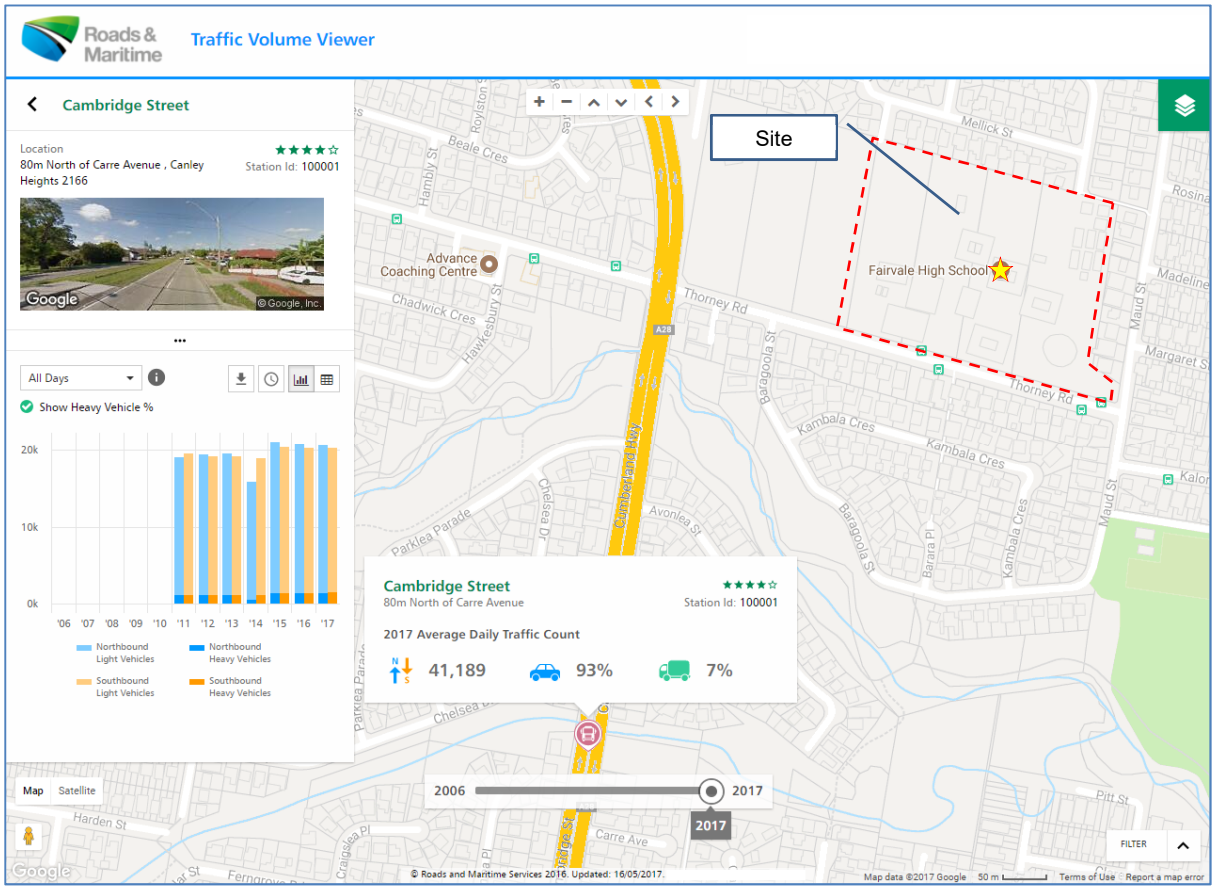


Figure 4 – Reported annual average daily road traffic volume

[1] AADT = Annual Average Daily Traffic flow. The total traffic using a road for a year, divided by 365.

[2] Ref: http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/index.html

It is expected the AADT would be significantly lower at the location of the development site. Nevertheless, the Cumberland Highway / New Cambridge Street lies approximately 200 m to the west of the site (see Figure 5) and there is a direct line of site to the road across Avery Park. It is therefore considered that the site is located adjacent to a major road corridor and an assessment against the criteria outlined in the ISEPP (derivation of appropriate noise control treatments for the building envelope) is therefore required.

It is noted that the speed limit on the A28 is 70 km/h.

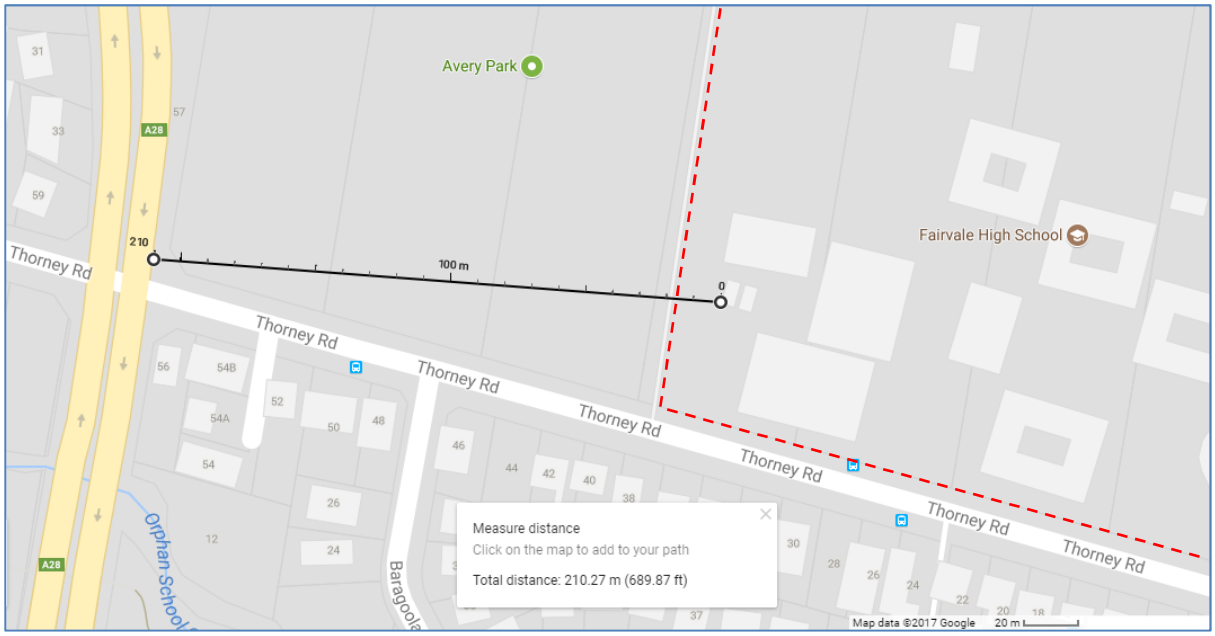


Figure 5 – Approximate distance between A28 and site

3.2 Screen tests

Educational building types are defined as 'other sensitive developments' within the Interim Guideline, and the document notes that a screen test should be conducted required to establish whether a detailed acoustic assessment is required.

The screen tests have been developed for residential buildings and other sensitive developments, and apply to façades which have a direct line-of-sight to roads within a distance of 10 to 300 metres.

The screen tests take into account the volume of traffic and distance between the proposed sensitive development and road. If an acoustic treatment is deemed necessary from the screen test, then appropriate noise control treatments will need to be developed to see that internal performance criteria for noise can be achieved.

The figure below reproduces the assessment criteria set out in Screen Test 2(a). It should be noted that, whilst the caption refers to 'habitable areas', the criteria also apply to sensitive developments such as educational establishments.

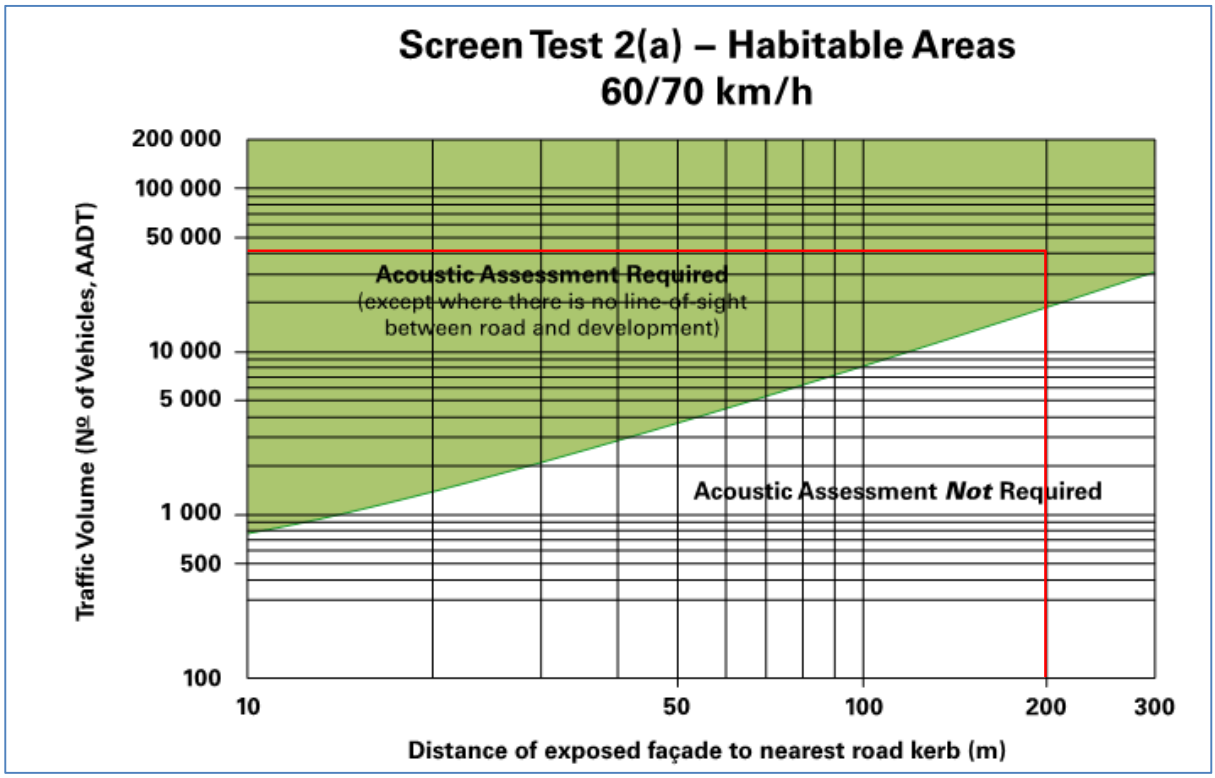


Figure 6 – Screen test for sensitive developments (for direct line-of-sight façades)[3]

3.3 Screen test 2(a)

With reference to Figure 6, an AADT traffic flow of 41,189 at a distance of 200 metres would fall within the category **Acoustic Assessment Required**.

3.4 Acoustic assessment

The Interim Guideline does not specify the types of noise control treatment required, but notes that they should be determined by an acoustic consultant. The target internal noise criterion for educational establishments is based on values in the Environmental Criteria for Road Traffic Noise (EPA 1999), which recommends a maximum level of 40 dB L_{Aeq}.

The Interim Guideline notes that an appropriate acoustic assessment should:

- document the level of noise impact;
- describe the measures proposed to meet the noise and vibration criteria;
- carry out noise measurements;
- calculate the resultant internal noise levels;
- take into account the particular features and intended use of the proposed development.

The following sections therefore summarise the results from noise monitoring at the site, determine appropriate internal ambient noise levels within the development, and identify any specific mitigation measures required to achieve these targets.

[3] Ref: Figure 3.4(a) Development near Rail Corridors and Busy Roads – Interim Guide.

4 Noise survey

The purpose of the noise survey was primarily to:

- identify sources of noise that are likely to affect the development and their expected levels;
- quantify existing ambient noise levels, to assist in setting appropriate noise criteria to assess the impact of the proposed development on the surroundings;
- identify potential noise sensitive receivers in the vicinity.

4.1 Methodology

The environmental noise survey was based on three long-term unattended monitoring positions, located to the south-west, north, and east of the school grounds.

The loggers recorded at variety of noise parameters at 15 minute intervals, including the prevailing noise level (L_{Aeq}) and background noise level (L_{A90}). Measurements were made between June 23 – 29 and December 06 – 14. In addition to the long-term measurements, an attended survey was undertaken on June 23.

4.2 Measurement locations

The survey locations are indicated on the figure below. Taking into account security and access considerations, the logger locations were considered appropriate to represent the noise climate at adjacent noise sensitive properties. The three positions were as follows:

- south-west: set back from Thorney Road so as to be representative of noise levels on the most exposed façade of the proposed new three-storey development, and characteristic of the background noise levels at the nearest adjacent residential properties on the opposite side of Thorney Road (set back at a similar distance as the measurement location);
- north: at the northern site boundary to determine prevailing noise levels affecting the rear of dwellings on Mellick Street;
- east: at the eastern site boundary to determine prevailing noise levels affecting the rear of dwellings on Maud Street

Short term measurements were also taken at a position at the eastern edge of Avery Park, considered representative of noise levels on the most affected façade of the new Hall building.

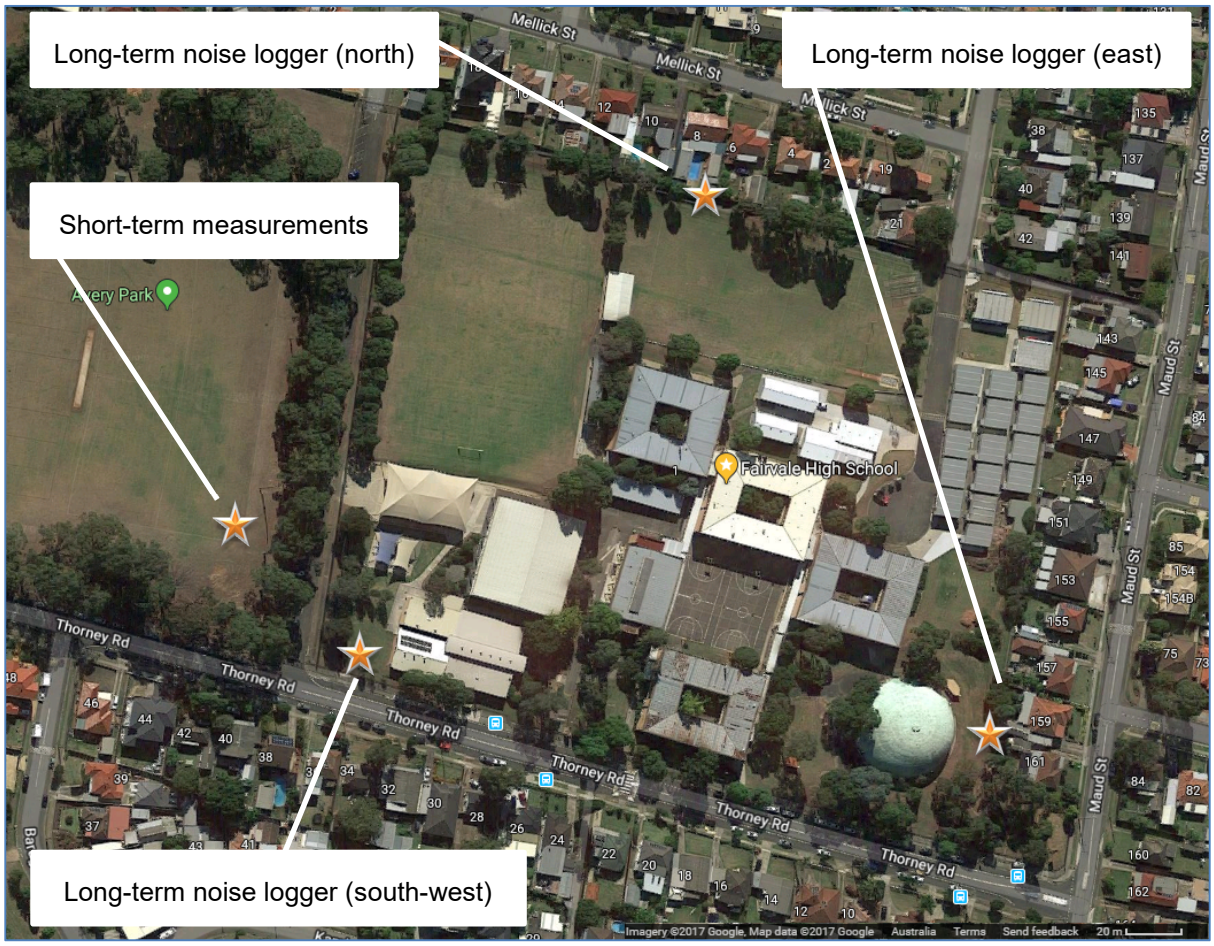


Figure 7 – Approximate measurement positions

4.3 Conditions

Reported weather conditions at the nearest monitoring location[4] were generally fine over the unattended logging periods. Conditions were therefore considered appropriate for representative noise data. Approximately 2 mm of rain was noted on Saturday 9 December and although not notably affecting the measured noise levels, this period has been excluded from the analysis.

It is considered that the survey generally meets recommendations given in relevant guidance documents.

[4] Ref: *http://www.bom.gov.au/climate/data/stations/*

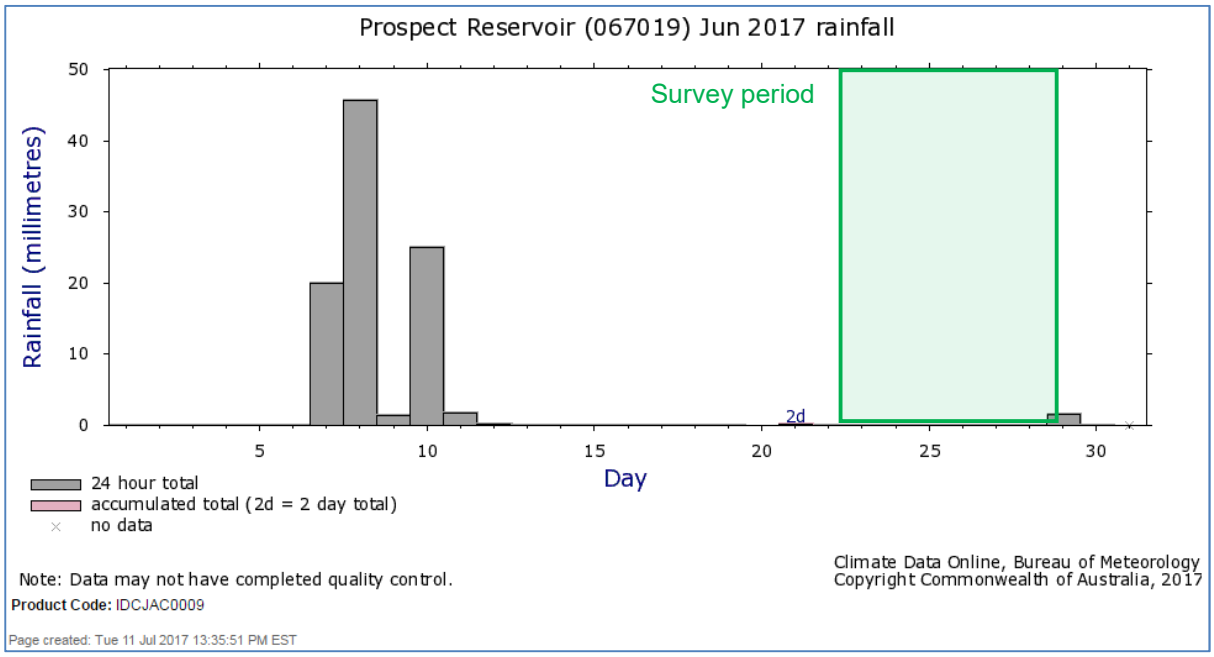


Figure 8 – June rainfall at the nearest monitoring location

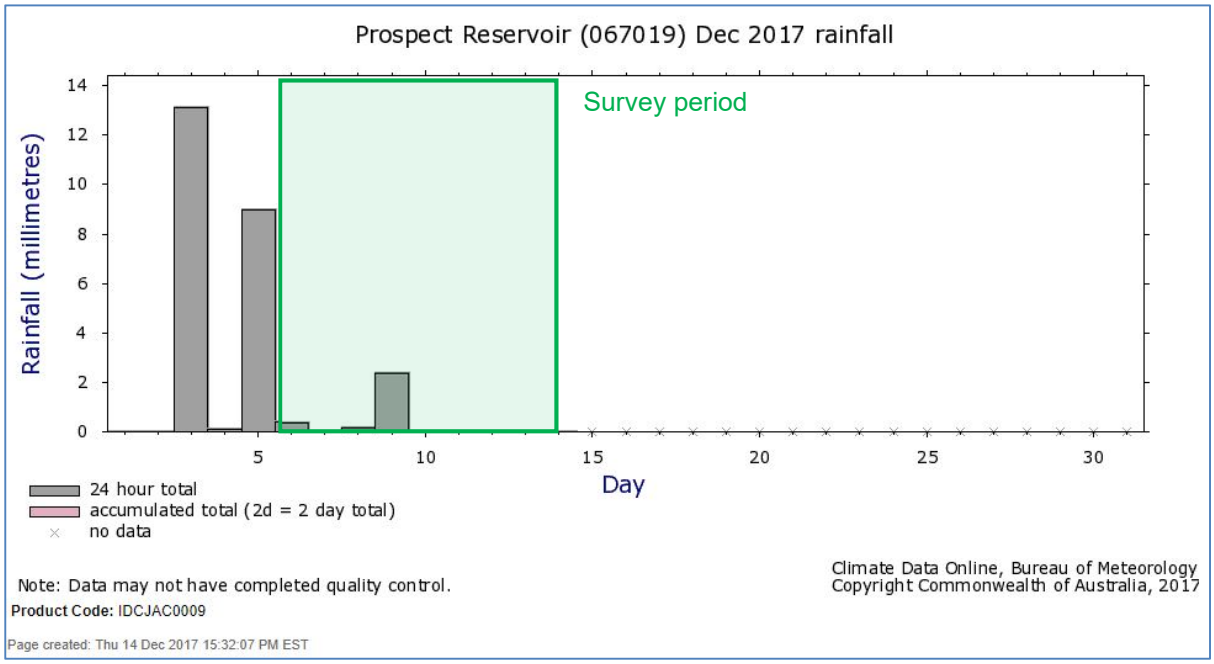


Figure 9 – December rainfall at the nearest monitoring location

4.4 Observations

From our site visits, the predominant noise source affecting the site and local area was considered to be road traffic on the A28 Cumberland Highway / New Cambridge Street to the west. Road traffic was observed to be consistent during the survey periods.

The A28 is not located immediately adjacent to the site, however it is considered to be a busy major thoroughfare. As noted above, reference to the RMS website indicates that the annual average daily traffic volume is just in excess of 40,000 vehicles.

4.5 Results

4.5.1 Attended measurements

Attended measurements indicated a typical average daytime noise level of 60 dB L_{Aeq} at a location approximately equivalent to the most affected façade of the new Hall building and considered representative of general noise levels at dwellings to the north. The typical background noise level recorded was 56 dB L_{A90}, considered representative of conditions at the residential properties to the north during typical school hours.

4.5.2 Long-term measurements (south-west)

The figure below illustrates the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring period, based on the 15 minute survey data at the position south-west of the grounds. Additional daily data is provided in the Appendix.

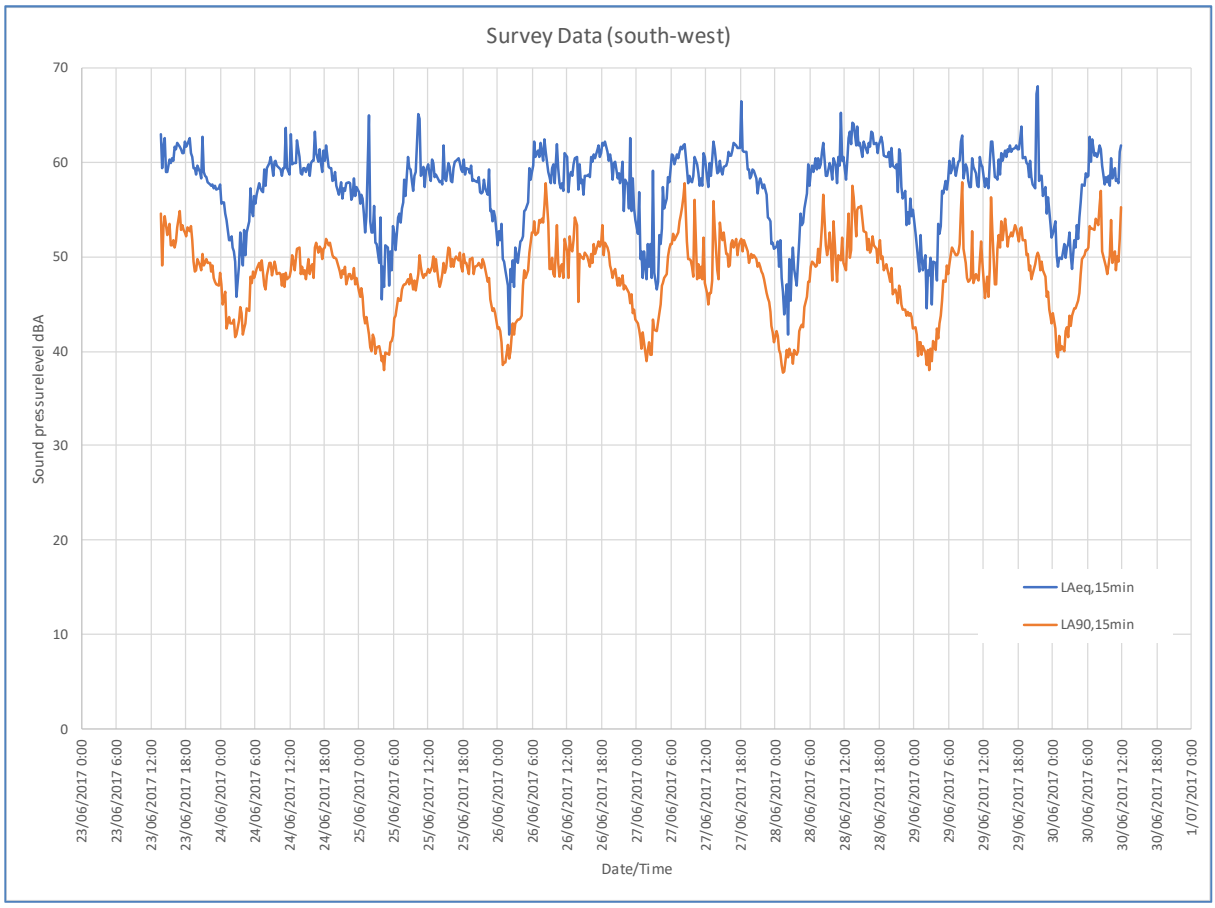


Figure 10 – Long-term noise level measurements (south-west)

The Table below presents the logarithmically averaged 15 minute L_{Aeq} values and typical L_{A90} values recorded across the whole survey period. It can be seen that there is only slight variation in the noise levels across each daytime, evening, and night-time period[5]. This would tend to support the view that prevailing noise levels are driven by consistent road traffic noise.

[5] Refer to Table 8 for definition of time periods.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
23 June (Fri)	57	60	55	51	49	42
24 June (Sat)	60	59	55	48	48	40
25 June (Sun)	60	58	55	47	48	40
26 June (Mon)	60	60	56	48	47	40
27 June (Tue)	60	60	54	47	49	39
28 Jun (Wed)	61	61	55	49	46	40
29 June (Thu)	60	62	56	47	48	40
30 June (Fri)	57	n/a	n/a	49	n/a	n/a

Table 1 – Averaged 15 minute noise levels (south-west)

The table below summarises the average weekday and weekend hourly L_{Aeq} values and typical L_{A90} values, based on the values given above.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	59	61	55	49	48	40
Weekend	60	59	55	47	48	40
Combined	**60**	**60**	**55**	**48**	**48**	**40**

Table 2 – Averaged weekday and weekend noise levels (south-west)

The measurement location was approximately 14 m from the centre of the road and was considered representative of conditions at the nearest affected residential properties, set back an equivalent distance on the other side of Thorney Road.

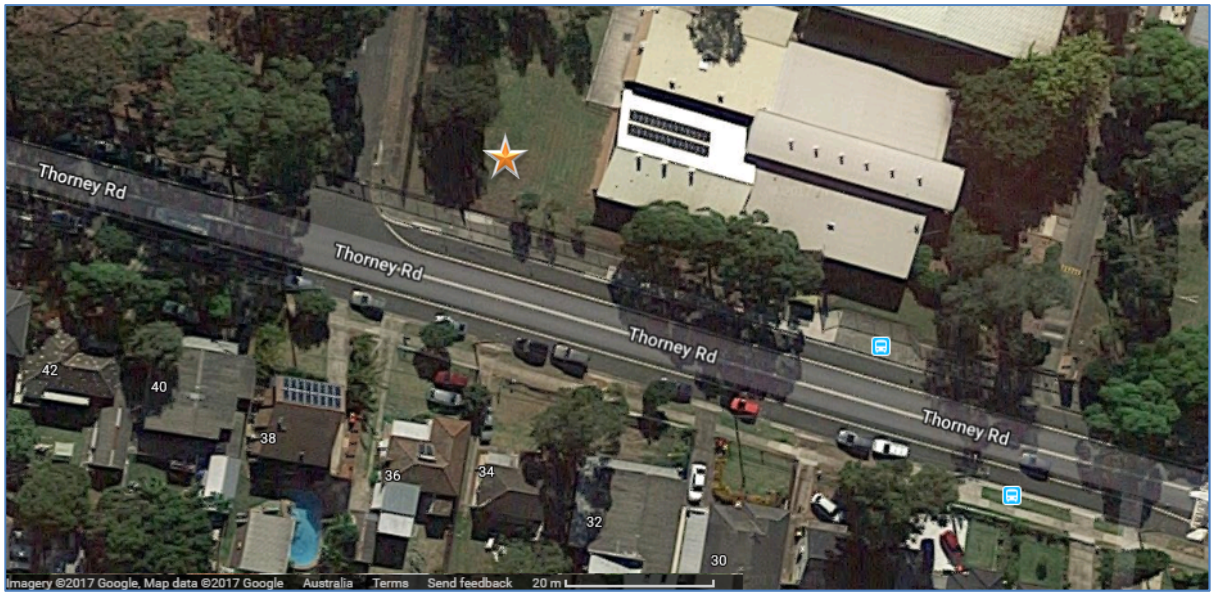


Figure 11 - Approximate measurement location (south-west)

4.5.3 Long-term measurements (north)

The figure below illustrates the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring period, based on the 15 minute survey data at the position south-west of the grounds. Additional daily data is provided in the Appendix.

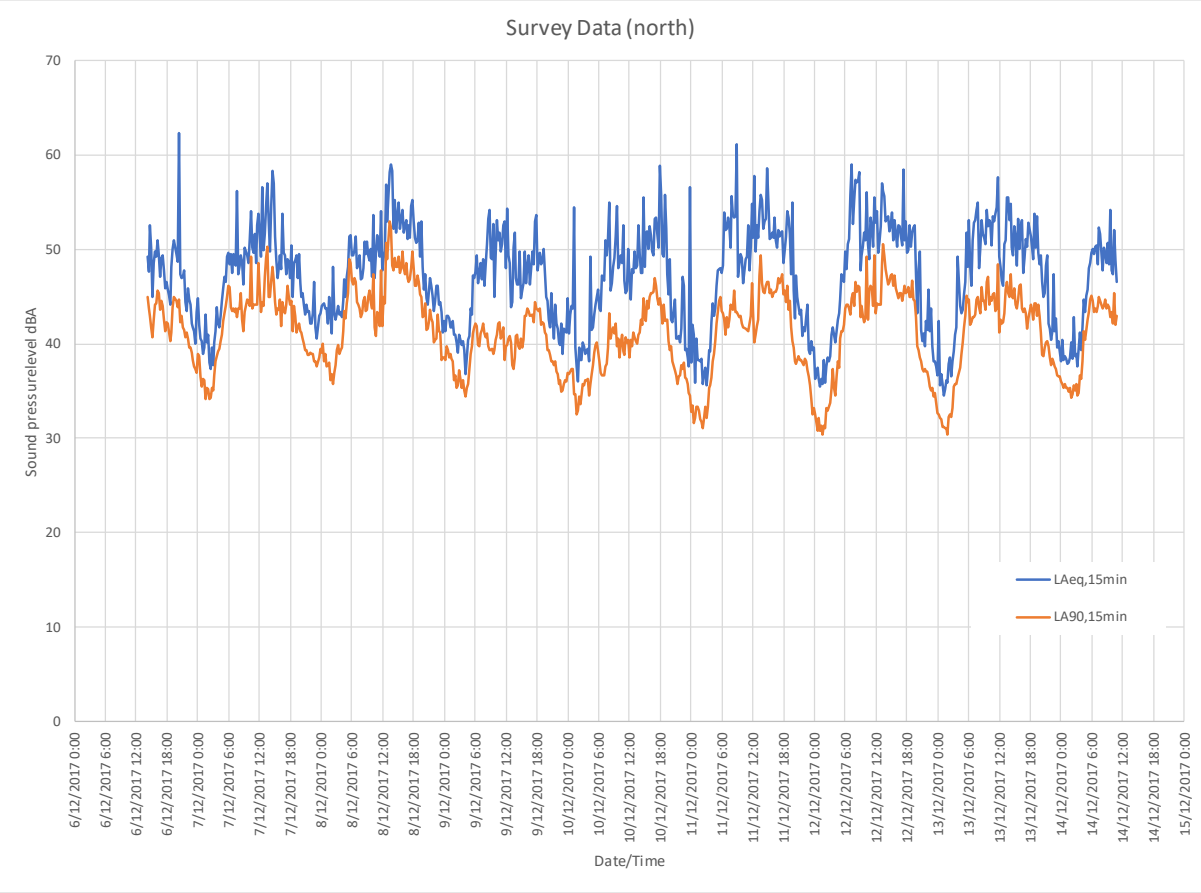


Figure 12 – Long-term noise level measurements (north)

The Table below presents the logarithmically averaged 15 minute L_{Aeq} values and typical L_{A90} values recorded across the whole survey period. It can be seen that there is only slight variation in the noise levels across each daytime, evening, and night-time period[6]. This would tend to support the view that prevailing noise levels are driven by consistent road traffic noise.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
06 Dec (Wed)	44	52	44	42	41	35
07 Dec (Thu)	52	47	46	43	39	37
08 Dec (Fri)	53	49	44	43	42	35
09 Dec (Sat)	50	47	45	39	39	34
10 Dec (Sun)	50	51	45	40	37	32
11 Dec (Mon)	53	50	44	42	38	31
12 Dec (Tue)	54	49	45	43	37	31

[6] Refer to Table 8 for definition of time periods.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
13 Dec (Wed)	52	49	44	43	39	35
14 Dec (Thu)	46	n/a	n/a	42	n/a	n/a

Table 3 – Averaged 15 minute noise levels (south-west)

The table below summarises the average weekday and weekend hourly L_{Aeq} values and typical L_{A90} values, based on the values given above.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	52	50	45	42	39	34
Weekend	50	49	45	39	38	33
Complete	**51**	**50**	**45**	**42**	**39**	**34**

Table 4 – Averaged weekday and weekend noise levels (south-west)

The measurement location was considered representative of conditions at the nearest affected residential properties to the north, set back off Mellick Street.

Figure 13 - Approximate measurement location (north)

4.5.4 Long-term measurements (east)

The figure below illustrates the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring period, based on the 15 minute survey data at the position south-west of the grounds. Additional daily data is provided in the Appendix.

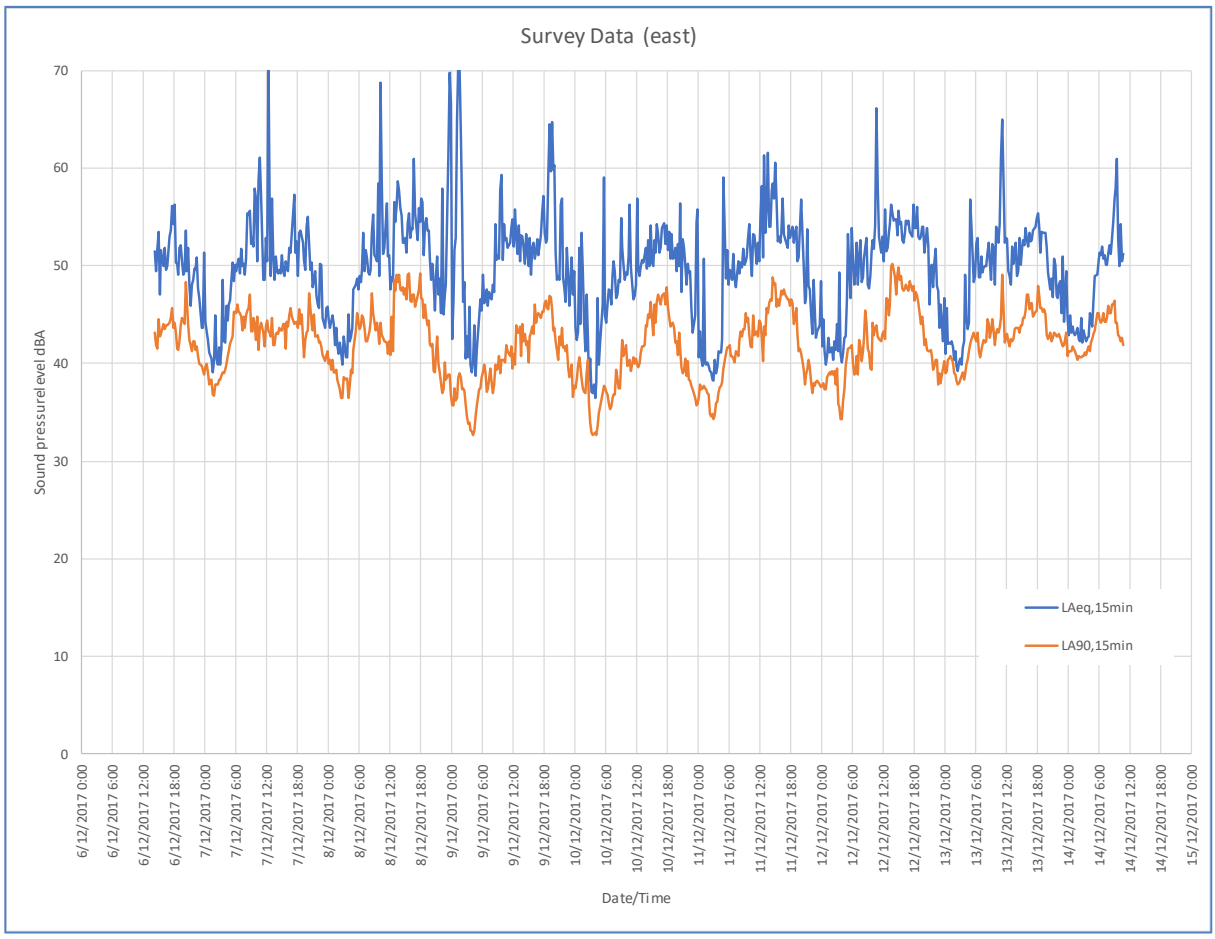


Figure 14 – Long-term noise level measurements (east)

The Table below presents the logarithmically averaged 15 minute L_{Aeq} values and typical L_{A90} values recorded across the whole survey period. It can be seen that there is only slight variation in the noise levels across each daytime, evening, and night-time period[7]. This would tend to support the view that prevailing noise levels are driven by consistent road traffic noise.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
06 Dec (Wed)	48	51	47	42	41	38
07 Dec (Thu)	57	52	46	42	42	38
08 Dec (Fri)	56	52	48	42	39	34
09 Dec (Sat)	53	59	48	39	39	33
10 Dec (Sun)	52	52	48	39	39	35
11 Dec (Mon)	55	52	47	41	39	36
12 Dec (Tue)	55	53	48	41	41	38

[7] Refer to Table 8 for definition of time periods.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
13 Dec (Wed)	54	52	47	42	43	41
14 Dec (Thu)	50	n/a	n/a	42	n/a	n/a

Table 5 – Averaged 15 minute noise levels (east)

The table below summarises the average weekday and weekend hourly L_{Aeq} values and typical L_{A90} values, based on the values given above.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	55	52	47	42	41	37
Weekend	52	56	48	39	39	34
Complete	**54**	**54**	**47**	**41**	**40**	**36**

Table 6 – Averaged weekday and weekend noise levels (east)

The measurement location was considered representative of conditions at the nearest affected residential properties to the east, set back off Maud Street.

Figure 15 - Approximate measurement location (east)

5 Internal acoustic criteria

5.1 Internal noise level targets

The internal noise level within each space is the combination of any building services and intrusive external noise levels.

Recommended design levels for steady-state internal noise levels within educational buildings are given in Australian Standard AS2107:2016 and referred to within the AAAC Guideline for Educational Facilities Acoustics. The EFSG also provides guidelines, which are presented in the table below for typical spaces within the proposed development.

Room type	Design sound level range (dB $L_{Aeq,T}$)
Classroom	35
Open-plan teaching	40
Laboratory (teaching)	35
Art Studio	40
Fitness Room	40
Drama Studio	30
Assembly Hall (>250 seats)	35
Sports Hall	< 50

Room type	Design sound level range (dB $L_{Aeq,T}$)
Office – General	40
Office – Admin	35
Conference Room	35
Interview Room	35
Staff Common Room	40
Staff Work Room	40
Toilet / Change	< 55
Corridors & Lobbies	< 45

Table 7 – Internal noise level requirements

5.2 Applicable project-specific noise levels

With reference to the above considerations, it is recommended that the building envelope (including glazed elements) and ventilation strategies (including any openings) be designed such that an internal noise level of ≤ 35 dB $L_{Aeq,T}$ can generally be achieved in noise-sensitive spaces. This would also be in line with the design criterion recommended in the DoP guidance document 'Development Near Rail Corridors and Busy Roads – Interim Guideline'.

5.3 Acoustic design recommendations

Daytime noise levels monitored are objectively moderate at the proposed façades. To comply with the internal noise criteria given in Section 5.2, attention should be given to provide the necessary sound insulation performance of the façade and glazing and the selection of suitable ventilation systems.

Based on the worst-case façade noise level of 60 dB L_{Aeq}, rooms will need to provide glazing attenuation of 25 dB R_w+C_{tr} to adequately control intrusiveness of road traffic noise.

This level of performance can be achieved by standard single or double-glazed units such as 6 mm thick float glass or 6/12/6 double glazed units.

The acoustic performance of glazing systems should not be compromised by the framing system or seals. It is recommended that any selected systems be reviewed by a suitably qualified acoustic consultant.

It is noted from current outline proposals, that the Main Hall will not have noise-sensitive rooms on the more exposed southern and western facades, with the exception of the stage, which is unlikely to be provided with glazing for operational reasons.

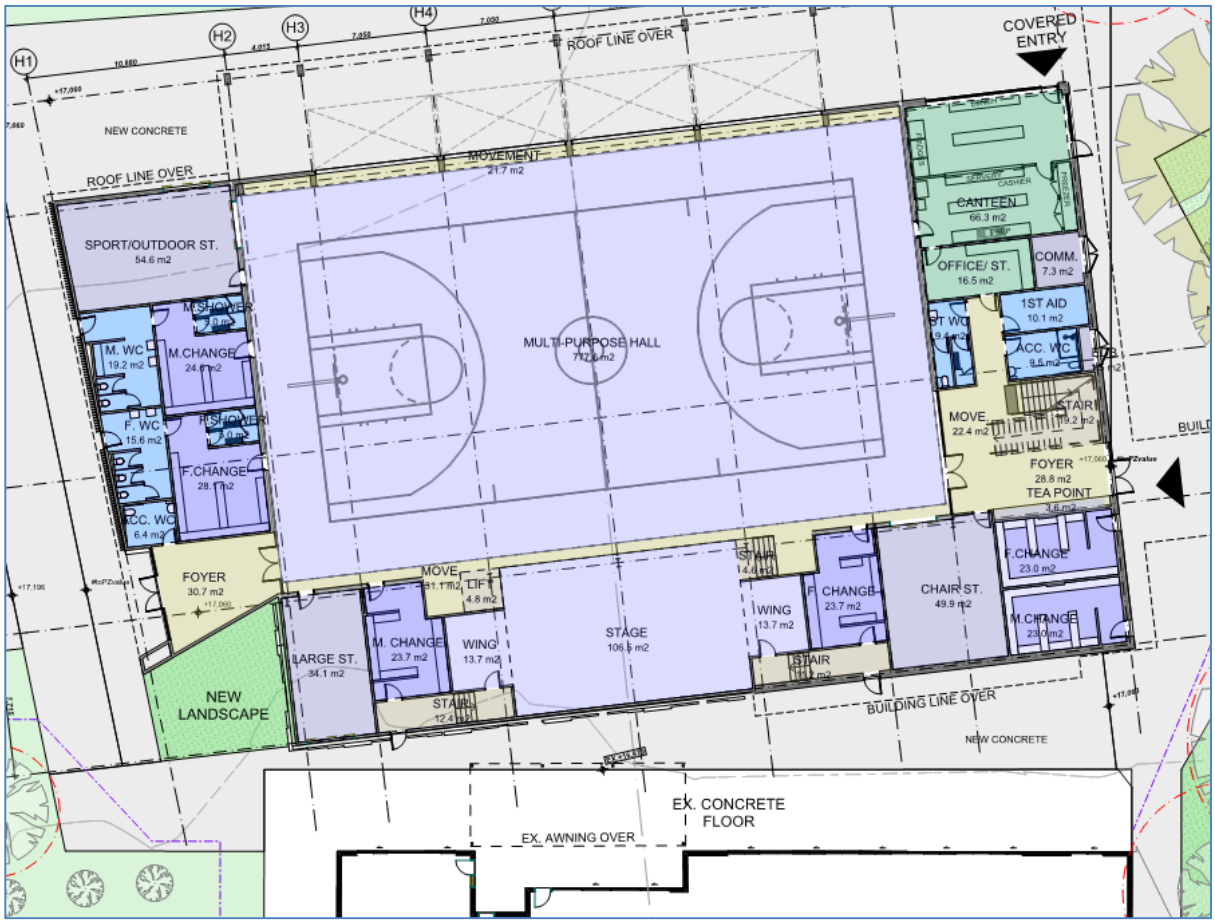


Figure 16 – Proposed ground floor (Hall)

6 External plant noise emissions

It is understood that the development proposals include assisted mechanical exhaust/ventilation (but not A/C units) to general learning spaces, and there is the potential for localised items of plant (e.g. toilet extract fans, server room services).

Any environmental emissions from the proposed development must be designed to comply with the requirements of the NSW Environment Protection Authority's Industrial Noise Policy [INP] dated January 2000.

The objective of the INP is to protect residential areas and other sensitive receivers from noise generated by commercial, industrial, or trade premises. Noise limits are set based on land use in the area and existing background noise levels. Compliance is achieved if the adjusted L_{Aeq} noise level at any residence affected by noise from the facility is below these noise limits. The adjusted L_{Aeq} is determined by applying corrections for such noise characteristics as duration, intermittency, tonality, and impulsiveness.

The INP separates the day into three different time periods – day, evening and night. These time periods are detailed below.

Period	Day of week	Time period
Day	Monday-Saturday Sunday, Public Holiday	07:00 – 18:00 hours 08:00 – 18:00 hours
Evening	Monday-Sunday	18:00 – 22:00 hours
Night	Monday-Saturday Sunday, Public Holiday	22:00 – 07:00 hours 22:00 – 08:00 hours

Table 8 – INP Time periods

The INP provides guidance on acceptable noise levels from the introduction of new industrial noise sources to an area. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences; and
- Protecting noise level amenity for particular land uses such as residences and commercial offices etc.

Both of these components suggest noise criteria that should not be exceeded in order to minimise adverse noise impacts on the affected areas. Both criteria should be taken into account when assessing the noise impact of industrial source(s) associated with the proposed development, and where the intrusiveness and the amenity criterion differ, the lower of the noise criteria should be adopted as the project-specific noise criterion.

It should be noted that the assessment is based on industrial noise sources, which in this case would relate to mechanical services plant etc. Activity noise from children falls outside of this assessment and is considered further below.

6.1 Selection of noise sensitive receivers

The existing buildings most affected by potential noise from the redevelopment are considered to be the residential properties to the south of Thorney Road and those to the north, off Mellick Street.

6.2 Intrusiveness criteria

A 15-minute sampling period is typically used when measuring the level of intrusive noise. This is taken to be a reasonable estimate of the period over which annoyance may occur. The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15min} \leq L_{A90,15min}$ (i.e. background level) + 5 dB.

Because of the variable nature of background noise levels, the INP specifies single number background noise levels for use in setting the intrusiveness noise criterion. The Assessment Background Level [ABL] for each time period is the level exceeded by 90% of the $L_{A90,15min}$ measurements. The Rating Background Level [RBL] for a particular time period is the median of the ABL values for that time period for each day of the measurement period.

The applicable intrusiveness criteria for the development based on site measurement data from the noise logger are provided below.

Location	Time Period	RBL	Intrusiveness Criterion
		dBA	RBL + 5 dB
Nearest residential properties (south-west)	Day	48	53
	Evening	48	53
	Night	40	45
Nearest residential properties (north)	Day	42	47
	Evening	39	44
	Night	35	40
Nearest residential properties (east)	Day	42	47
	Evening	40	45
	Night	36	41

Table 9 – Derivation of Intrusiveness Criteria

6.3 Amenity criteria

Criteria for the protection of amenity are given for various types of receiver and different times of day. The amenity criterion is set so that the L_{Aeq} noise level from the industrial noise source does not increase the total industrial noise levels at the receiver above the acceptable noise level [ANL] for that receiver.

The amenity criterion is set based on how close the existing average L_{Aeq} industrial noise levels are to the ANL, using the adjustment factors given in Table 2.2 of the INP.

In cases where the existing L_{Aeq}, average noise levels exceed the ANL by more than 2 dB, and the existing noise levels are unlikely to decrease in future, then the amenity criterion is set to be 10 dB lower than the existing noise levels at the receiver.

A summary of the amenity criteria using data from the noise logger is presented below.

Location	Class	Time period	Existing noise level dB L_{Aeq} [8]	ANL[9] dB L_{Aeq}	Modification factor [10] dB	Amenity Criterion dB L_{Aeq}
Nearest residential properties (south-west)	Suburban	Day	60	55	L_{Aeq} – 10	50
		Evening	60	45	L_{Aeq} – 10	50
		Night	55	40	L_{Aeq} – 10	45
Nearest residential properties (north)	Suburban	Day	51	55	ANL – 2	53
		Evening	50	45	L_{Aeq} – 10	40
		Night	45	40	L_{Aeq} – 10	35
Nearest residential properties (east)	Suburban	Day	54	55	ANL – 6	49
		Evening	54	45	L_{Aeq} – 10	44
		Night	47	40	L_{Aeq} – 10	37

Table 6 – Derivation of Amenity Criteria

6.4 Applicable project-specific noise levels

The most stringent of the intrusiveness and the amenity criteria should be set as the limiting project-specific noise level to be met by the development. The Table below compares the intrusiveness and the amenity criteria, and identifies the limiting criterion for each time period.

Location	Class	Time period	Intrusiveness Criterion	Amenity Criterion	Project-specific Criterion dB $L_{Aeq,15min}$
Nearest residential properties (south-west)	Suburban	Day	53	50	**50**
		Evening	53	50	**50**
		Night	45	45	**45**
Nearest residential properties (north)	Suburban	Day	47	53	**47**
		Evening	44	40	**40**
		Night	40	35	**35**
Nearest residential properties (east)	Suburban	Day	47	49	**47**
		Evening	45	44	**44**
		Night	41	37	**37**

Table 10 – Project-specific noise levels

A review of all plant with respect to site specific noise criteria will be required at detailed design stage. At that stage, any necessary noise mitigation can be determined and included in the detailed design of mechanical service so that compliance with site specific noise criteria is achieved.

[8] Ref: Lowest values recorded in Table 2 above.
[9] Ref: Acceptable Noise Level for suburban residences, according to Table 2 of NSW INP, 2000.
[10] Ref: According to Table 2.2 of NSW INP, 2000.

6.5 Acoustic design recommendations

The development proposals include assisted mechanical exhaust/ventilation (but not A/C units). Noise from any mechanical plant should be controlled to meet the criteria given in Table 10 when assessed at the nearest affected noise-sensitive location(s).

Typical noise mitigation strategies include selection of low noise outdoor equipment, locating plant to take advantage of shielding from building elements, and the use of plant enclosures or screens if necessary.

6.5.1 Additional guidelines

Noise generated by waste collection or other service vehicles should be controlled by management of the collection/delivery times to ensure that disturbance to nearby residents during typical sleeping hours is avoided. It is anticipated that there will be no changes to existing waste collection services strategy.

Other simple measures that should be adopted include the use of self-close gates with soft close hinges, and ensuring car park surfaces and access ways are smooth.

7 Consideration of activity noise

Student activity noise from schools is typically one of the most understandable, and tangible, causes of concern from the occupants of neighbouring premises.

There are no specific State criteria for student activity noise from schools and the local DCP does not reference educational facilities other than childcare centres.

7.1 Current noise impacts

The site is an existing and established school, covering a large site, and therefore adjacent noise-sensitive dwellings will already be acclimatised to the sounds of general school activity.

7.2 Potential noise impacts

Notwithstanding the above, there is the potential for a change to the noise impact of the school associated with the proposed works. Noise sources that need to be considered include:

- increase in student numbers;
- change in activities;
- relocation of COLA;
- school bell / announcement system;
- waste collection services;
- use of temporary demountables for duration of the works;
- grounds maintenance;
- out of hours usage (e.g. community use).

These potential impacts are considered further below.

7.3 Increase in student numbers

The proposed upgrades will provide for 200 additional students (approximately 15% increase). Whilst growth in student numbers could potentially affect noise from the site, it is not considered that this degree of change will result in significant variation to the profile of general school activity noise.

Although not a direct comparison to the proposed changes, as it is not likely that all students will be located in the same place at the same time, it is also noted that an increase in a number of noise sources by 15% would result in a change to the overall noise level of less than 1 dB.

7.4 Impact of new Hall on dwellings to the south

Provision of a new multi-use Hall, slightly further to the north from the existing music facilities, should not significantly affect the noise impact on properties to the south. The existing teaching blocks (F & H) will provide a good degree of barrier attenuation against any potential activity noise breakout, and it is noted that the proposed Hall has been designed such that the only significant open areas of façade face northwards.

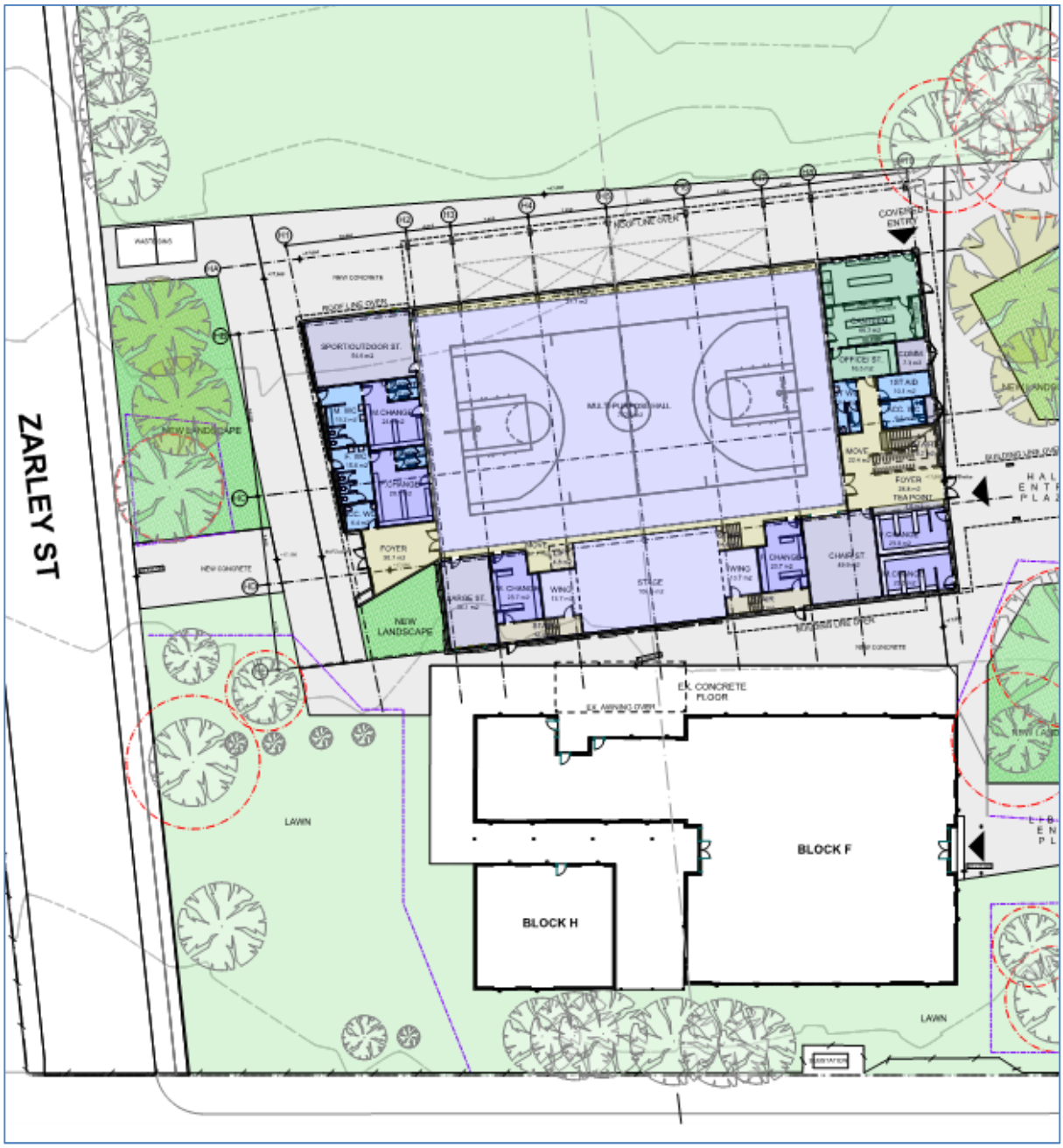


Figure 17 – Outline schematic design proposals for the new Hall (ground floor)

7.5 Impact of new Hall on dwelling to the north

It is noted that the NSW Department of Education DG11 Acoustics Section 11.04 Noise Emission (To The Environment) states "*Noise associated with school activity (such as music or sport within a hall) is not a stationary noise source and is not subject to the Industrial Noise Policy (EPA 2000) requirements*".

It is recognised that external doors on the northern façade of the new Hall could potentially be opened during periods of high activity noise (e.g. during a sports event, concert, or other performance). The impact of noise emissions from within the Hall, travelling via these openings and across the sports pitches to dwellings to the north will therefore be considered.

7.5.1 Assessment criteria

As noted above, there are no specific State criteria for the assessment of activity noise from schools, and the local council development plan does not refer to any desirable targets. However, development approval commonly requires noise generating developments to:

- Be sited and designed so that noise is kept to a minimum and does not create offensive noise as defined by the Protection of the Environment Operations Act 1997;
- Be accompanied by an acoustic report that demonstrates the development is sited and designed to:
    - minimise the effect of noise and vibration on surrounding sensitive land uses, and
    - comply with relevant State Government and Council guidelines.

'Offensive noise' is specifically defined in the NSW 'Protection of the Environment Operations Act' however relates this to noise that is "harmful" or "interferes unreasonably with the comfort or repose of a person outside the premises from which it is emitted". This may be due to the "level, nature, character or quality" of the noise, or "the time at which it is made".

It is noted that activity noise from schools is vastly different, in terms of both character and duration, from typical industrial activities or commercial plant items. Typically, school activity noise is also limited to the daytime period and is unusual at weekends or public holidays.

Guidance from the Association of Australia Acoustical Consultants [AAAC] in relation to outdoor play areas in childcare centres suggests that impacts should be based on an emergence above the prevailing background noise level as follows:

- Up to 2 hours (total) per day
  The $L_{Aeq,15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location;
- More than 2 hours per day
  The $L_{Aeq,15min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

The '10 dB on background' noise goal has been accepted in the NSW Land and Environment Court on a number of occasions[11] and has been used as the basis for realistic noise goals from other childcare centres.

On this basis, it is considered reasonable to adopt the 10 dB above background level as the assessment criteria for the impact of activity noise associated with the proposed redevelopment.

With reference to the determined Rating Background Level during the daytime and evening periods of 42/39 dB L_{A90} (refer to Table 9), this would mean that activity noise levels should be no greater than 52/49 dB L_{Aeq} when assessed at dwellings to the north.

7.5.2 Attenuation of activity noise

Sound is attenuated with distance due to geometric spreading, and the distance of approximately 130 m of soft ground between the northern façade of the proposed Hall and the site boundary should provide an attenuation of 42 dB.

[11] Ref: 'Carrying out noise assessments for proposed childcare facilities', Proceedings of Acoustics 2006.

Sound is also attenuated when passing through an opening in a building façade, although in this case (due to the potentially expansive open area) it is not expected that any such attenuation will exceed 5 dB.

7.5.3 Determination of internal activity noise level

Given the noise limit of 49 dB L_{Aeq} at the northern site boundary and the attenuation due to distance and openings, the highest permissible internal activity noise level within the Hall can be calculated as follows:

- Activity noise limit = [noise limit at boundary] + [distance attenuation] + [façade attenuation]
- Activity noise limit = 49 + 42 + 5 = 96 dB L_{Aeq}.

This is a high level for activity noise, and would be comparable to a typical nightclub. As such, it is not expected that the average noise from typical school activities would exceed this level and therefore the impact on residential properties to the north should be negligible.

7.5.4 Summary

Even with very high internal activity noise levels within the proposed Hall and with the northern façade fully opened, it is considered that impact on residential properties to the north would not exceed the nominated criterion of 10 dB above the background value.

It is also noted that the occasions when such noise levels could be generated (e.g. during a concert or similar performance) are likely to be infrequent in nature, and generally limited to the daytime/evening periods during weekdays.

In light of the above, it is not anticipated that there will be a significant impact at dwellings to the north, and no additional mitigation measures should be required.

7.6 New / relocated COLA

The relocated COLA will be situated to the north of the site.

It is noted that the EFSG[12] states "*Noise associated with school activity (such as music or sport within a hall) are not a stationary noise source and is not subject to the Industrial Noise Policy (EPA 2000) requirements*".

Noise from playgrounds and associated with general school activities including music, sport or outdoor teaching has therefore not been assessed, as it is not a specific requirement of the Secretary's Environmental Assessment Requirements.

7.7 School bell / announcement system

As noted above, adjacent noise-sensitive dwellings will already be acclimatised to the existing sounds of general school activities, including the school bell. It is noted that the proposed new buildings will be located no nearer to residential properties than at present.

To minimise the potential noise impact of the school bell, it is recommended that sounders be located such that there is no direct line of sight to adjacent residential façades, where this is practicable. The

[12] Ref: NSW Department of Education DG11 – Acoustics, Section 11.04 Noise Emission (To The Environment).

use of bells/loudspeakers with a reduced sound level may also be considered where there is close proximity to residential properties.

The proposed redevelopment also includes removal of 18 demountables to the north-eastern sector of the site, and this will eradicate existing noise from school bells within this area.

7.8 Waste collection services

It is not anticipated that the proposals will result in significant additional waste collection services, and there will be no change to the existing site access for services vehicles. It is therefore considered that there will be no significant noise impact from waste collection. As noted in Section 6.5.1, noise generated by waste collection or other service vehicles should be controlled by management of the collection/delivery times to ensure that disturbance to nearby residents during typical sleeping hours is avoided.

7.9 Use of temporary demountables

As part of the proposed development, 18 existing demountable classrooms located in the north-eastern sector of the site are to be removed during the works. The existing noise impact associated with these units on adjacent residential properties will therefore also be eliminated.

Proposals are for three temporary amenities demountables (change, toilets and canteen) to be utilised during the construction period, located to the east of the site. To minimise noise impacts, it is recommended that access doors be located such that they face away from residential properties (i.e. generally towards the centre of the site).

Use of solar shading should be considered where appropriate, to reduce solar gain heat build-up within spaces and hence minimise the requirement for opening windows for thermal comfort. Any temporary mechanical plant should be selected and located such that the cumulative noise level does not exceed the limits set out in section 5.2 above when assessed at the nearest affected residential property.

The internal acoustic environment of demountables should also be considered, to control the build-up of activity noise and hence reduce noise break-out to the surrounding area.

7.10 Grounds maintenance

It is not anticipated that the proposals will result in significant changes to grounds maintenance activities, particularly with reference to the use of powered equipment such as mowers and leaf blowers.

7.11 Out of hours usage

It is understood that the following activities currently take place on the site, outside of typical school operating hours:

- the sports oval is used by Fairvale Old Boys on Saturdays;
- the Bini Hall is used on week nights for school performances, plays, musicals etc - approximately 20 nights per year;
- the gym space in the Bini is used during the mornings before school for cardio club and after school three days a week.

Following the proposed redevelopment, the following activities are anticipated by the school:

- the sports oval is used on Saturdays at various times between 9 am and 5 pm;

- the new Hall will be used on week nights for school performances, plays, musicals etc – approximately 20 nights per year – up to 10 pm;
- the new Gym space will be used on mornings before school for cardio club (7 am to 8.30 am) and after school three days a week until 7pm.

It can be seen that there is no significant change from the current activity programme, although the location of internal events will move from the existing Binishell to the purpose-built Hall. This is expected to reduce the noise impact of out of hours activities, by:

- removing existing noise emissions from the Bini building and hence impact on residential properties to the south-east of the site;
- controlling activity noise from the new Hall by orientating the building away from nearby dwellings and controlling noise breakout by use of an appropriate building envelope.

It is also noted that the continuing school performances, plays, musicals etc will form part of the curriculum and drama requirements of a high school, and these activities will not be related to the private hire of the Hall. The EFSG[13] states "*Noise associated with school activity (such as music or sport within a hall) are not a stationary noise source and is not subject to the Industrial Noise Policy (EPA 2000) requirements*".

The existing teaching blocks (F & H) will provide a good degree of barrier attenuation against any potential activity noise breakout from the Hall, and it is noted that the proposed building has been designed such that the only significant open areas of façade face northwards.

From the assessment in Section 7.5 above, it has been demonstrated that – even with very high internal activity noise levels within the proposed Hall and with the northern façade fully opened – the impact on residential properties to the north would not exceed the nominated criterion of 10 dB above the background value.

Regular community use of the new school buildings, particularly outside of school hours, will not differ from the existing provision, and it is therefore considered that the associated impact of activity noise on adjacent properties will remain unchanged.

Any proposed out of hours community activities will occur during the day or evening period, therefore sleep disturbance impacts are not expected. As noted above, school events within the Hall should finish by 10 pm, avoiding associated sleep disturbance noise impacts.

7.12 Conclusions

It is noted that typical school activity noise will also be limited to the daytime period and would be unusual at weekends or public holidays.

A number of good practice measures have been proposed, to minimise the potential for noise impacts on the surrounding area.

It is not anticipated that there will be significant change to the current out of hours community usage when associated with the new facilities and, to some extent, may reduce the existing noise impact.

In light of the above, it is not anticipated that there will be a significant change to the prevailing acoustic environment due to the proposed development, and additional detailed assessments are not necessary.

[13] Ref: NSW Department of Education DG11 – Acoustics, Section 11.04 Noise Emission (To The Environment).

8 Consideration of additional road traffic

The development will increase the number of students at the school by more than 50, and therefore the proposal is considered as 'traffic generating development' under Clause 57 of the ESEPP. Consideration of the potential acoustic impact of additional staff, students, and vehicle movements associated with the proposals is therefore considered below.

A Traffic and Transport Assessment has been carried out as part of the DA submission, identifying the likely changes to road traffic as a result of the proposed development.

The report notes that Fairvale High School is well served by public transport, unrestricted parking areas on the immediate roads, and dedicated drop-off / pick-up zones adjacent to the school. Additional student drop-off / pick-up demand generated can easily be accommodated within the adjacent streets.

The proposed upgrades include a net increase of ten teaching spaces, accommodating 200 additional students and an assumed ten additional staff. A total of 44 additional vehicular trips are forecast. The Traffic and Transport Assessment concludes that 'no significant impact to the existing network performance' is expected.

8.1 Noise impact

Specific state guidance on the change to road traffic noise with increased traffic flow is not available, however the Design Manual for Roads and Bridges notes that:

- An increase in traffic flow of 25% is associated with an increase in traffic noise of 1 dB.

Traffic count data are not available on the local roads surrounding the school, however it is not anticipated that an additional 44 vehicle movements would result in an increase to traffic flows in excess of 25% and therefore the worst-case noise impact would be less than 1 dB.

8.2 Conclusion

It is not considered that there will be any significant change in local road traffic noise generation on the basis of 44 additional vehicle movements, even assuming a worst-case assessment that all new vehicle movements affect one specific location.

On this basis, it is considered that any change to the noise impact from road traffic on adjacent sensitive receptors will be negligible, and the noise impact on the school itself will not be affected.

9 Consideration of construction noise

Detailed assessment of demolition and construction noise is outside the scope of this report; however it should be noted that all work, including demolition, excavation, and building work should comply with the current Cumberland Council Policy and Australian Standard *AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.*

It is noted that the school is classified as State Significant Development and noise and vibration associated with construction works are to be evaluated according to the requirements of the Secretary's Environmental Assessment Requirements. These are referred to in the following sections.

It is recommended that a detailed construction noise and vibration management plan be developed at a later stage of the project, prior to the commencement of site works, once a contractor has been appointed and construction activities confirmed. This assessment would identify proposed construction hours and provide details of the instances where it is expected that works will be required to be carried out outside the standard construction hours.

9.1 Good-practice measures

Standard good-practice procedures should be adopted on site, including the following:

- Where possible, noise generating equipment should be strategically positioned to take advantage of natural screening from structures to reduce the transmission of noise to sensitive receptors;
- Fixed plant should be appropriately selected and sited and, where necessary, fitted with appropriate silencers or acoustic enclosures;
- Noisy plant operating simultaneously close together should be avoided to the greatest extent practicable, adjacent to noise affected sensitive receptors;
- All plant and equipment should be maintained in a proper and efficient manner to minimise noise emissions, including the replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and the repair of leakages in air lines;
- All plant and equipment should be operated in the correct manner to minimise noise emissions;
- Noise generating equipment should be orientated away from nearby receivers where feasible to minimise noise impacts;
- Minimise plant and vehicles idling when not in use;
- PPE including hearing protection should be made available and worn where noise levels require.

9.2 Applicable noise criteria

Noise from the site is to be assessed in accordance with the Department of Environment and Climate Change 'Interim Construction Noise Guideline'.

The steps for managing noise impacts from construction are:

1. identify sensitive land uses that may be affected;
2. identify hours for the proposed construction works;
3. identify noise impacts at sensitive land uses;
4. select and apply the best work practices to minimise noise impacts.

Depending on the extent of impact and the scale of the works, managing noise impacts may involve engaging the community. As more information becomes available through each stage of the project, the description of feasible and reasonable work practices will need to be made more detailed.

The recommended standard hours for construction work are shown in the table below; however, they are not mandatory. There are some situations where construction work may need to be undertaken outside of these hours. The likely noise impacts and the ability to undertake works during the recommended standard hours should be considered when scheduling work.

Work type	Recommended standard hours of work
Normal construction	Monday to Friday: 7 am to 6 pm
	Saturday: 8 am to 1 pm
	No work on Sundays or public holidays

Table 11 - Preferred and maximum weighted rms values for impulsive vibration acceleration (m/s²) 1-80 Hz

Once the proposed hours of work are identified, the next step in assessing and managing noise impacts is to select the assessment method. The quantitative assessment method involves predicting noise levels and comparing them with the levels in the appropriate section of the Guideline.

The table below sets out management levels for noise at residences and how they are to be applied. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level. The rating background level (RBL) is used when determining the management level; this is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Time of day	Management level $L_{Aeq,15min}$ *	How to apply
Recommended standard hours	"Noise affected" RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	"Highly noise affected" 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: o times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences o if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of day	Management level $L_{Aeq,15min}$ *	How to apply
Outside recommended standard hours	"Noise affected" RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Table 12 – Noise at residences using quantative assessment

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Other sensitive land uses, such as schools, typically consider noise from construction to be disruptive when the properties are being used (such as during school times). The table below presents management levels for noise at other sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. The proponent should consult with noise sensitive land use occupants likely to be affected by noise from the works to schedule the project's work hours to achieve a reasonable noise outcome.

Land use	Management level $L_{Aeq,15min}$ *
Classrooms	Internal noise level 45 dBA (applies when properties are being used)

Table 13 – Noise at schools using quantative assessment

* Internal noise levels are to be assessed at the centre of the occupied room. Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences.

9.3 Applicable vibration criteria

Vibration from the site is to be assessed in accordance with the Department of Environment and Conservation NSW Environmental Noise Management 'Assessing Vibration: A Technical Guideline' dated February 2006.

This document sets out what are considered acceptable values of human exposure to continuous and impulsive vibration, dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area).

The guidance document notes that activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community.

It is also noted that situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short term duration. An example is a construction or excavation project.

When short-term works such as piling, demolition and construction give rise to impulsive vibrations, undue restriction on vibration values may significantly prolong these operations and result in greater annoyance. Short-term works are generally works that occur for a duration of approximately one week.

Preferred and maximum values for continuous and impulsive vibration are reproduced in the table below. There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values.

Impulsive vibration	Assessment period[14]	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Table 14 - Preferred and maximum weighted rms values for impulsive vibration acceleration (m/s²) 1-80 Hz

[14] Daytime is 7:00 am to 10:00 pm.

10 Conclusions

This report presents acoustic input to the DA submission for the proposed redevelopment at Fairvale High School.

It is noted that the school will be State Significant Development (Application number SSD 8677), assessed by the Department of Planning & Environment (DPE). The proposed scheme has therefore been considered in accordance with the Secretary's Environmental Assessment Requirements, with specific reference to relevant policies and guidelines identified therein.

The site has been assessed in accordance with the Infrastructure SEPP and DoP Interim Guideline, as it is considered to be located within the vicinity of a busy road. Results from noise monitoring at the site are documented, appropriate internal ambient noise levels within the development identified, and specific mitigation measures required to achieve these targets determined.

Based on appropriate standards and guidance, intrusive noise impact on the development from the surroundings (primarily road traffic noise) has been assessed. It has been found that standard glazing solutions should provide an acceptable acoustic environment within all areas of the development.

Prevailing noise levels at positions considered equivalent to the nearest properties to the south-west, north and east have been measured over a period of at least 7 days.

Noise limits on emissions from plant have been set in accordance with the NSW INP, to see that any plant noise impact of the development on the surrounding community is acceptable. It is noted that current proposals incorporate assisted mechanical exhaust/ventilation (but not A/C) within new spaces.

An assessment of potential activity noise breakout from the new Hall has been made. The proposed building orientation should adequately control noise impact on dwellings to the south, and distance attenuation should allow for activities generating high noise levels to be accommodated without undue disturbance to residential properties to the north, even with elements of the Hall's external façade open.

Consideration has been given to the potential for change in activity noise due to an increased number of students, potential change in school activities, and noise impact of the school bell and waste collection services. The use of temporary demountables has been considered and good practice measures identified to reduce associated noise impacts.

Existing out of hours community usage is expected to remain largely unchanged and therefore the noise impact of such activities should not significantly affect the local surroundings.

An assessment of noise emissions associated with an increased number of vehicle movements has been made, including reference to ESEPP/ISEPP and DoP guidelines. It is concluded that there should be no significant adverse impact.

Applicable noise and vibration criteria associated with construction works have been set, based on guidelines set out by the DECC and EPA. A detailed construction noise and vibration management plan will need to be developed at a later stage of the project, prior to the commencement of site works, once a contractor has been appointed and construction activities confirmed. This assessment would identify proposed construction hours and provide details of the instances where it is expected that works will be required to be carried out outside the standard construction hours. Good practice guidance for controlling noise from construction sites has been identified.

Appendices

Appendix A Acoustic terms

ASSESSMENT BACKGROUND LEVEL (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.

'A'-WEIGHTED SOUND LEVEL dBA

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dBA. An A-weighting network can be built into a sound level measuring instrument such that sound levels in dBA can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

DECIBEL

The ratio of sound pressures which we can hear is a ratio of one million to one. For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{Aeq})

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used.

For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrower frequency bands.

RATING BACKGROUND LEVEL (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey.

The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

SOUND POWER AND SOUND PRESSURE

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source.

The sound pressure level (L_p) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted L_{A10}, dB L_{A90} etc. The reference time period (T) is normally included, e.g. dB $L_{A10\ 5min}$ or dB $L_{A90,8hr}$.

$L_{A90\ (T)}$

Refers to the sound pressure level measured in dBA, exceeded for 90% of the time interval (T) – i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

$L_{A10\ (T)}$

Refers to the sound pressure level measured in dBA, exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

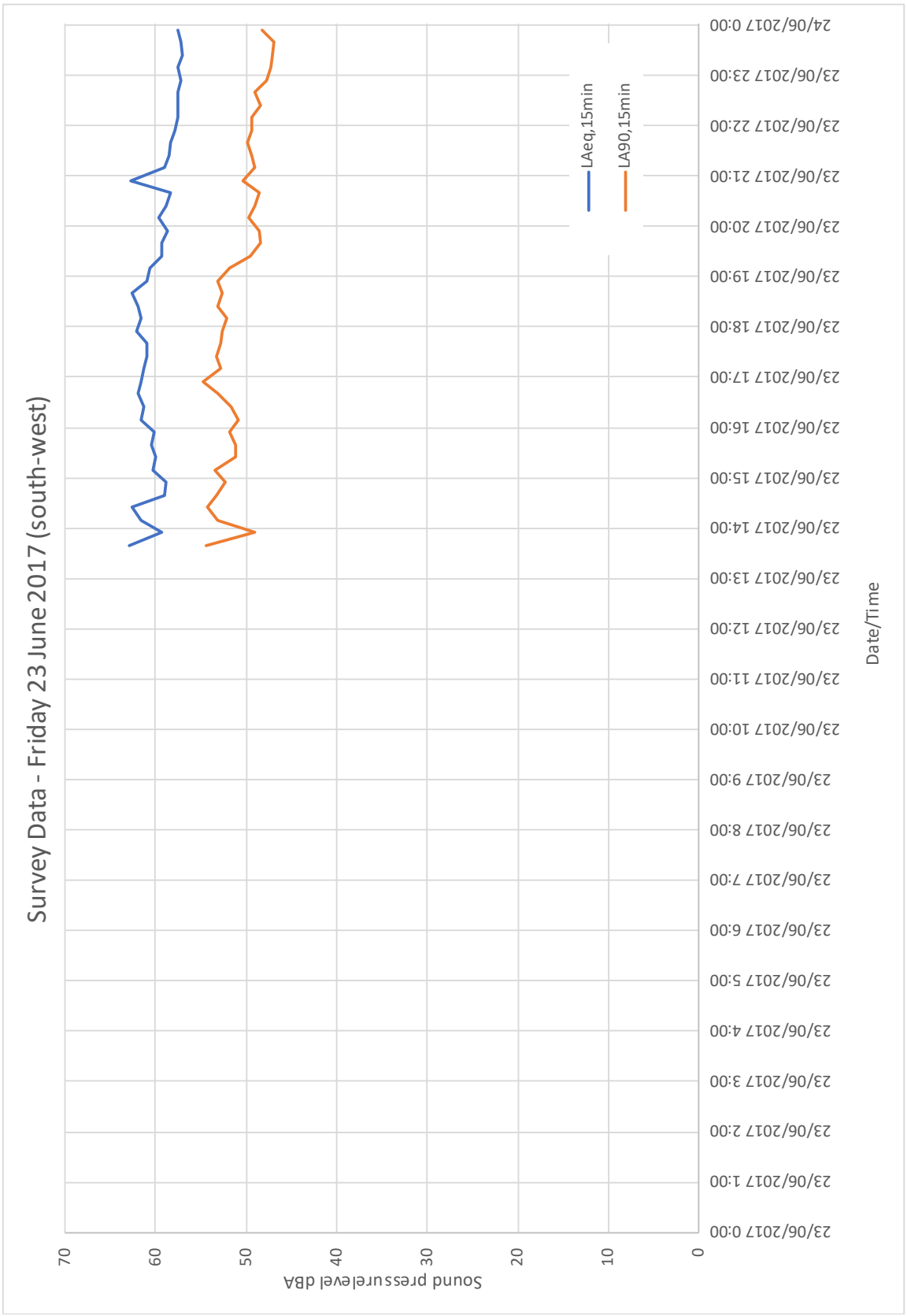
$L_{A1\ (T)}$

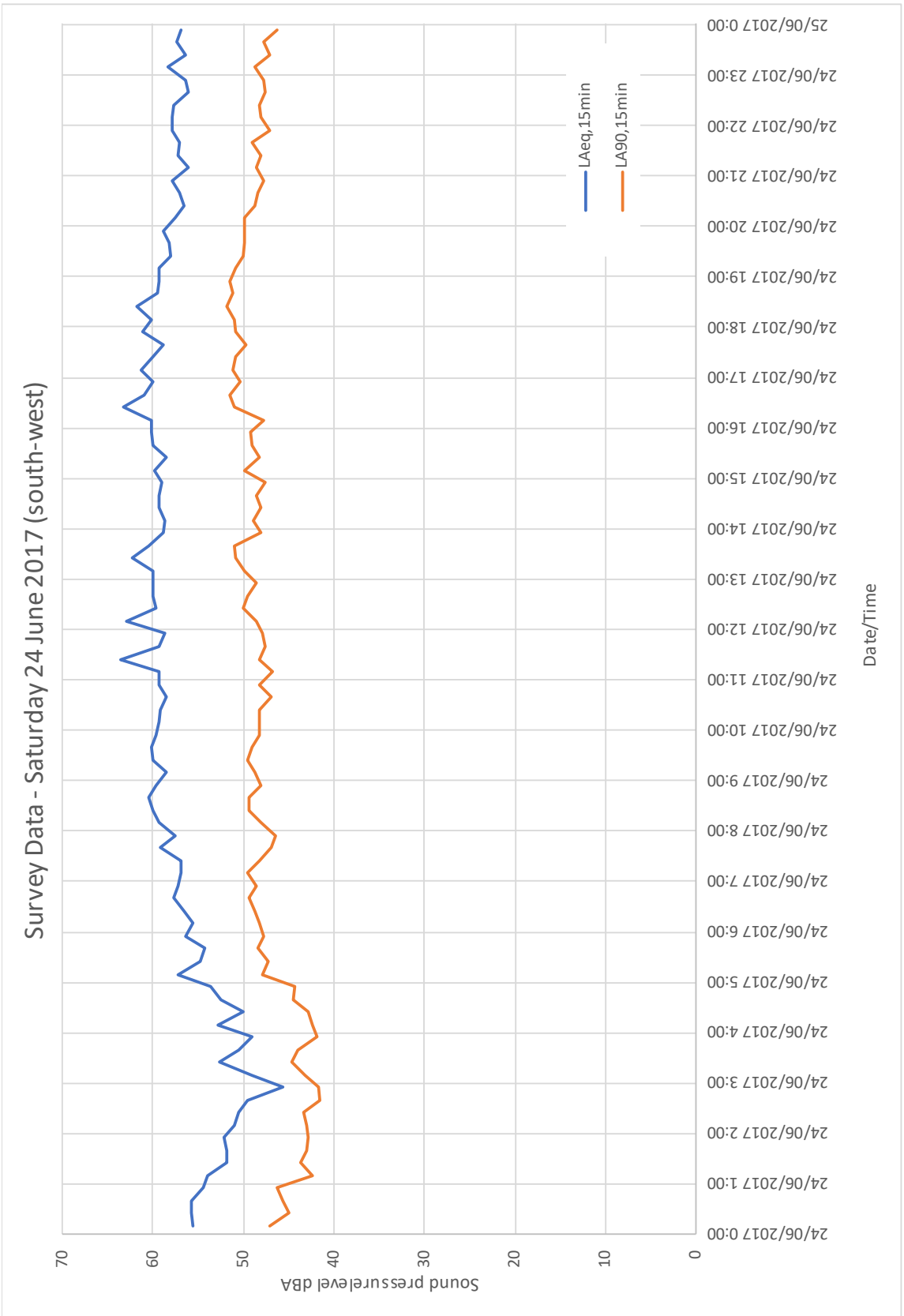
Refers to the sound pressure level measured in dBA, exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.

Appendix B Daily noise survey data

The following charts provide daily data for the unattended noise sampling that was undertaken.

B.1 South-west logger station

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LA90,15min
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50
40
30
20
10
0
Date/Time
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24/06/2017 23:00
24/06/2017 22:00
24/06/2017 21:00
24/06/2017 20:00
24/06/2017 19:00
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24/06/2017 6:00
24/06/2017 5:00
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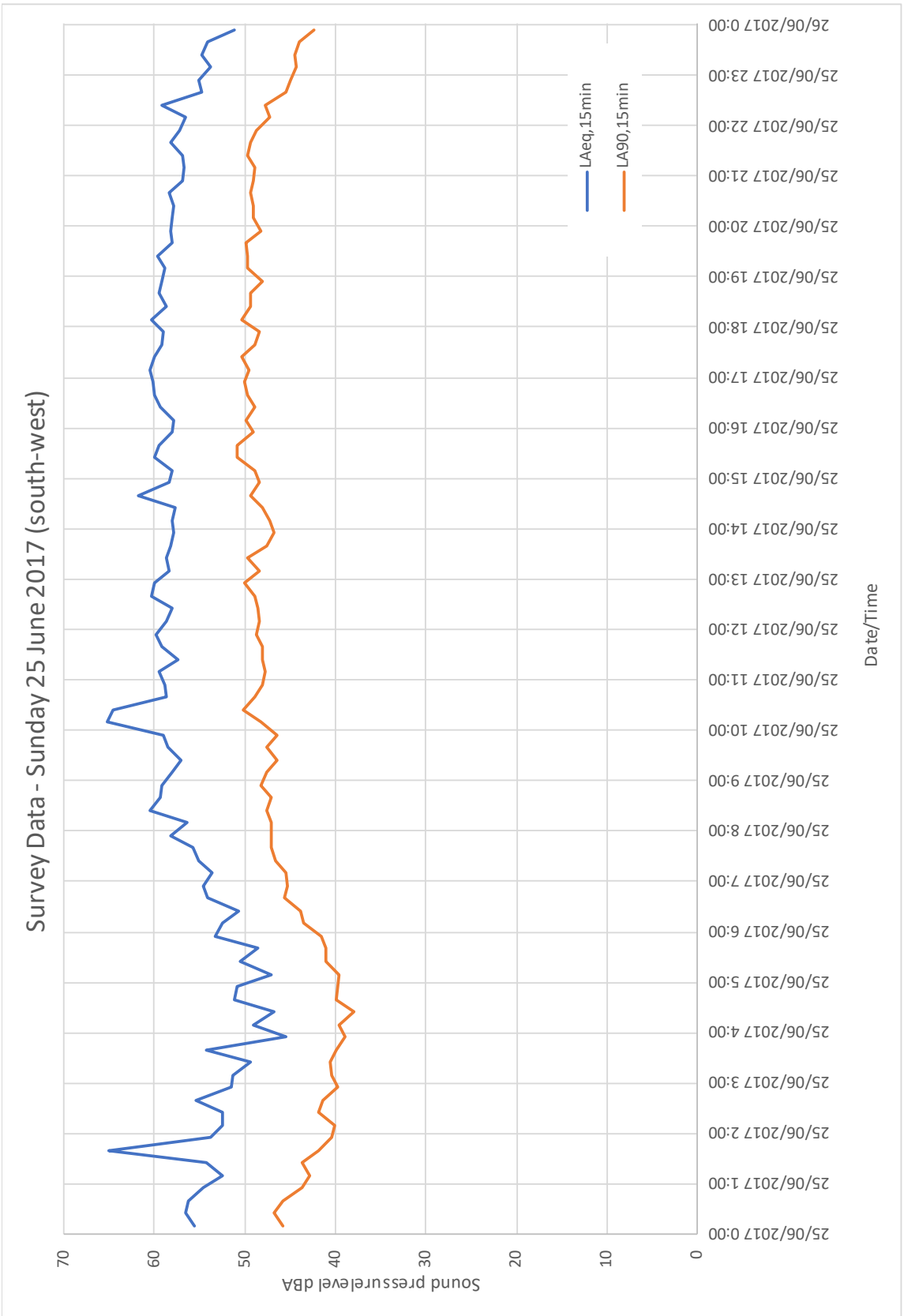
24/06/2017 2:00
24/06/2017 1:00
24/06/2017 0:00


Survey Data - Sunday 25 June 2017 (south-west)
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LA90,15min
Sound pressurelevel dBA
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30
20
10
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Date/Time
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25/06/2017 1:00
25/06/2017 2:00
25/06/2017 3:00
25/06/2017 4:00
25/06/2017 5:00
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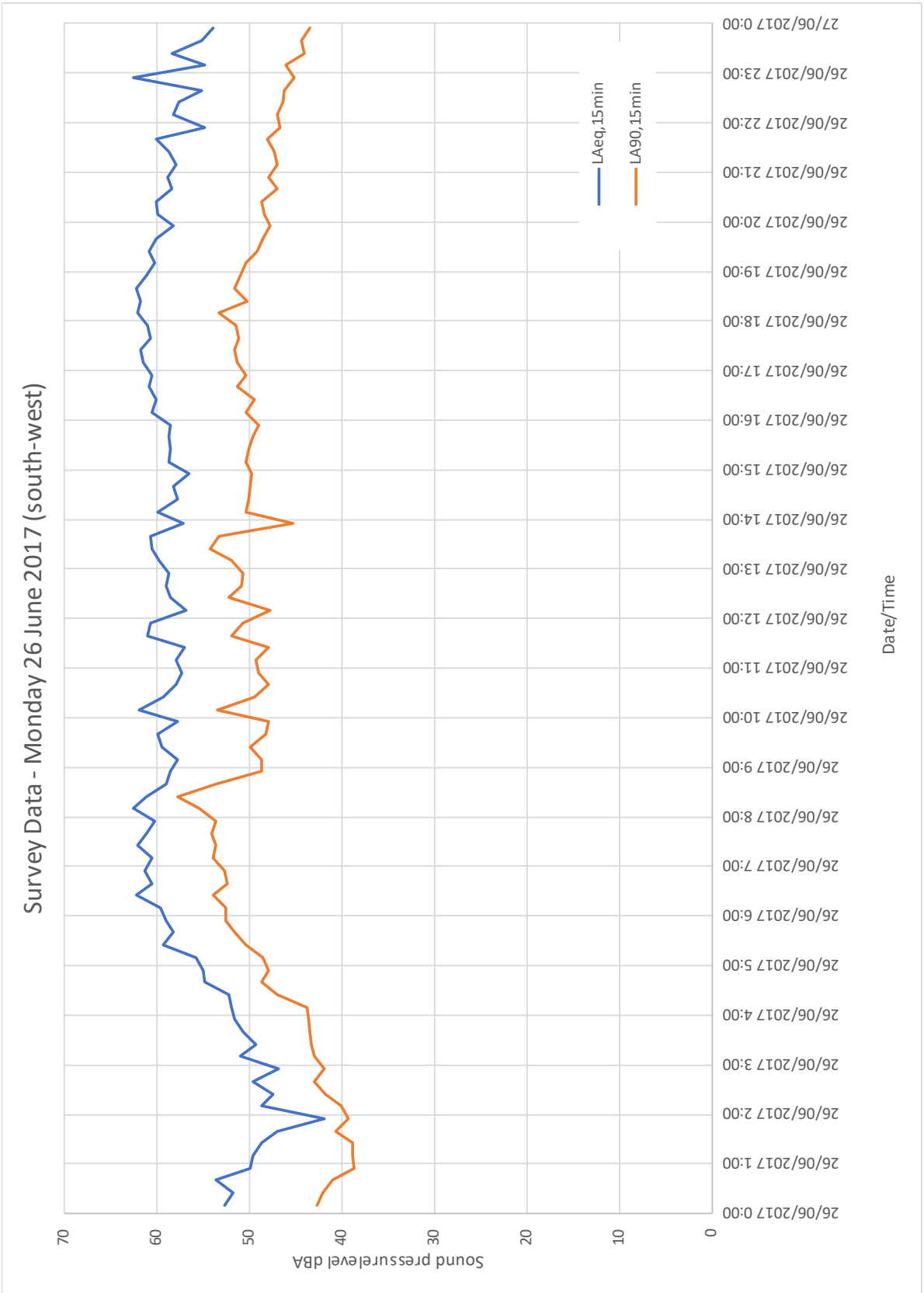
Survey Data - Monday 26 June 2017 (south-west)
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LA90,15min
Sound pressurelevel dBA
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40
30
20
10
0
Date/Time
26/06/2017 0:00
26/06/2017 1:00
26/06/2017 2:00
26/06/2017 3:00
26/06/2017 4:00
26/06/2017 5:00
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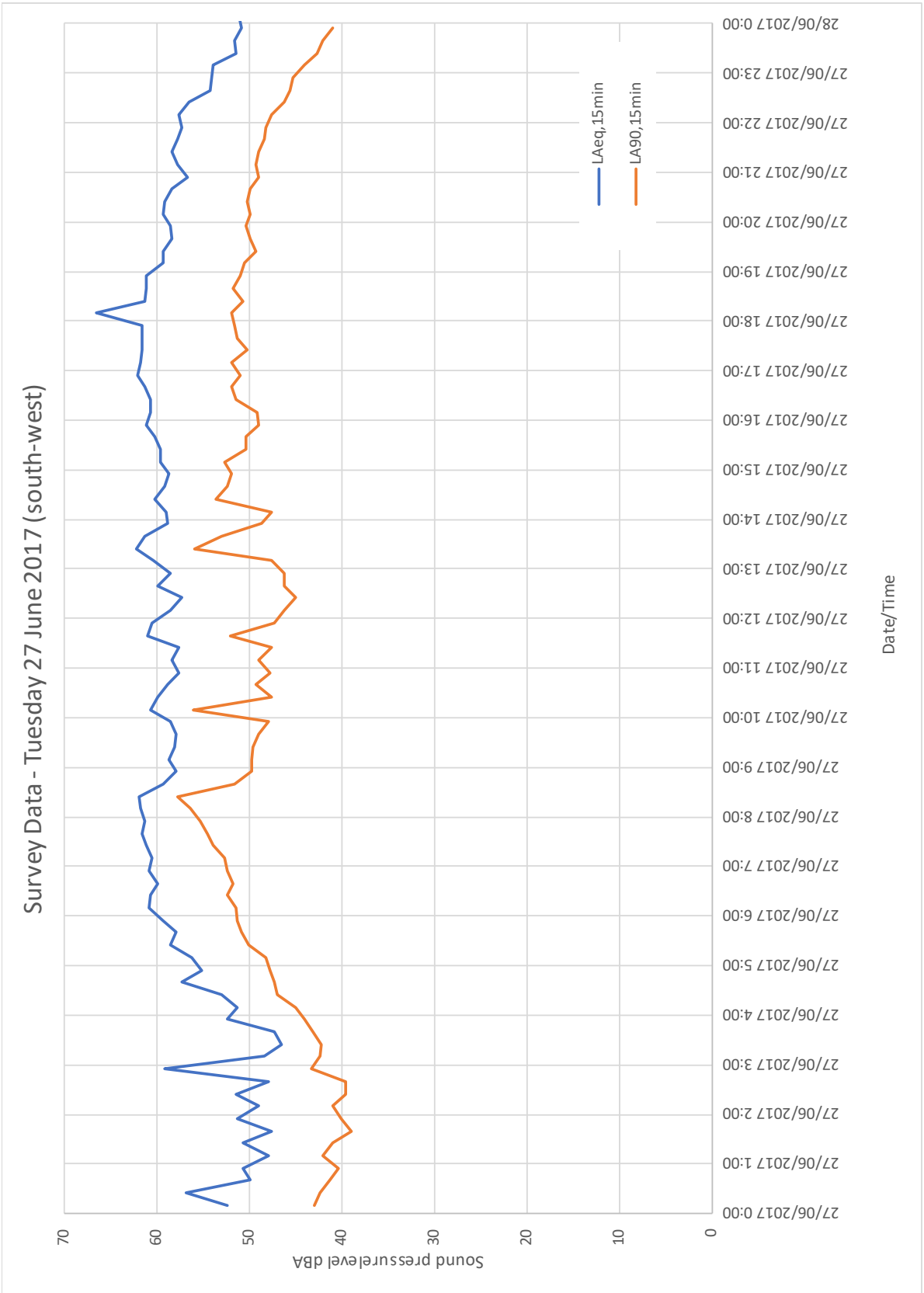
Survey Data - Tuesday 27 June 2017 (south-west)
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LA90,15min
Sound pressurelevel dBA
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40
30
20
10
0
Date/Time
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27/06/2017 1:00
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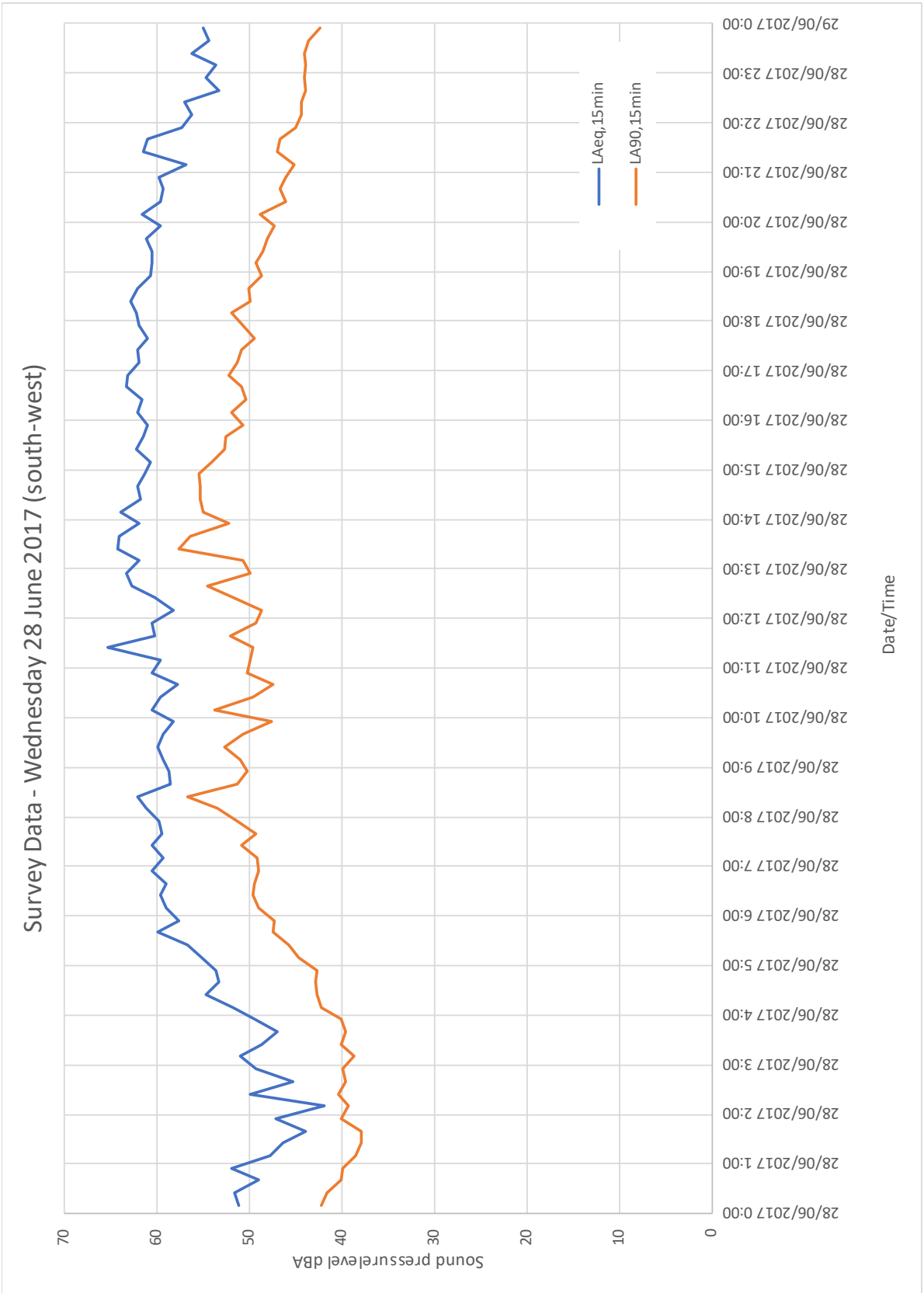
Survey Data - Wednesday 28 June 2017 (south-west)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
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40
30
20
10
0
Date/Time
29/06/2017 0:00
28/06/2017 23:00
28/06/2017 22:00
28/06/2017 21:00
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28/06/2017 6:00
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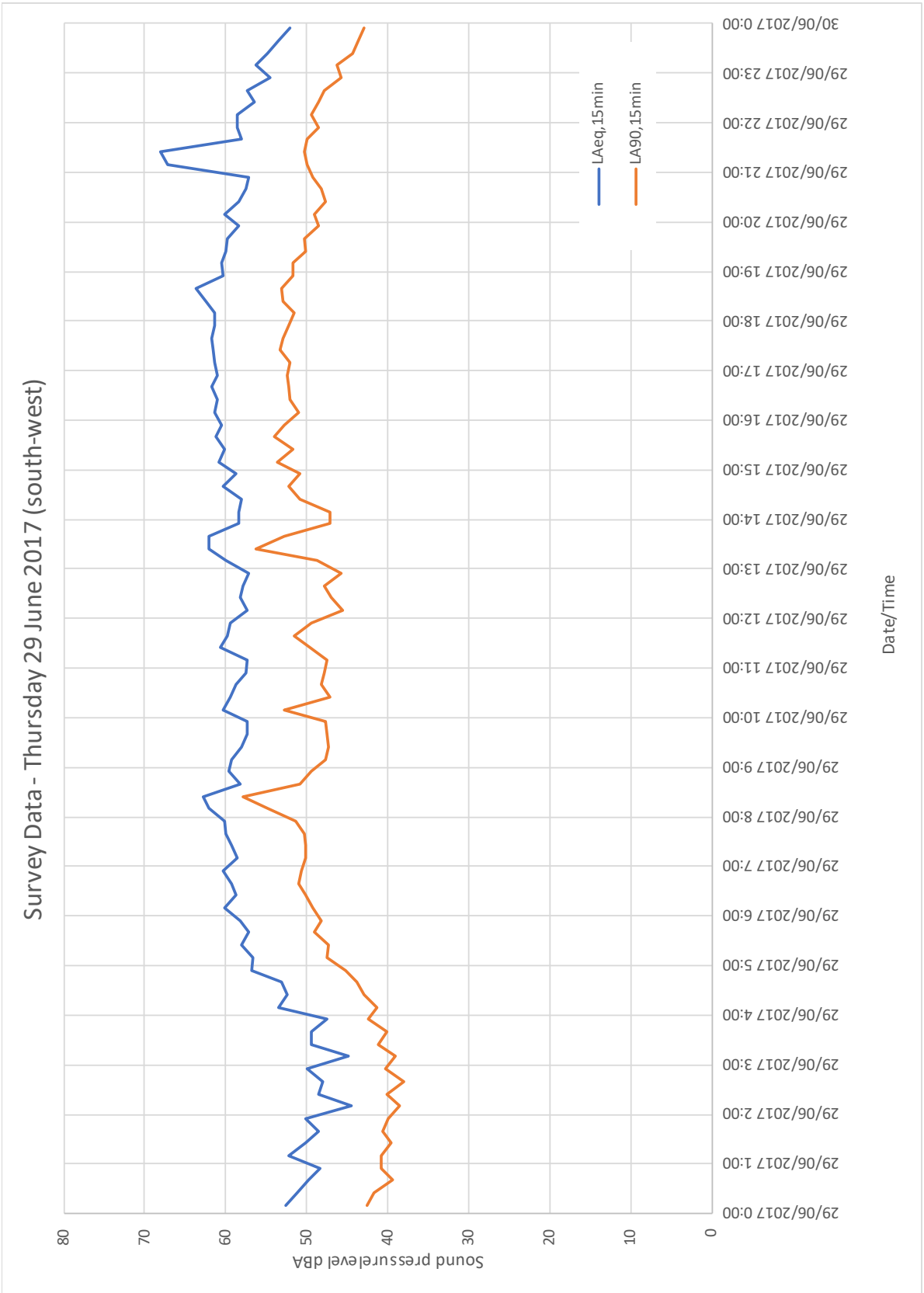
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LA90,15min
Sound pressurelevel dBA
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20
30
40
50
60
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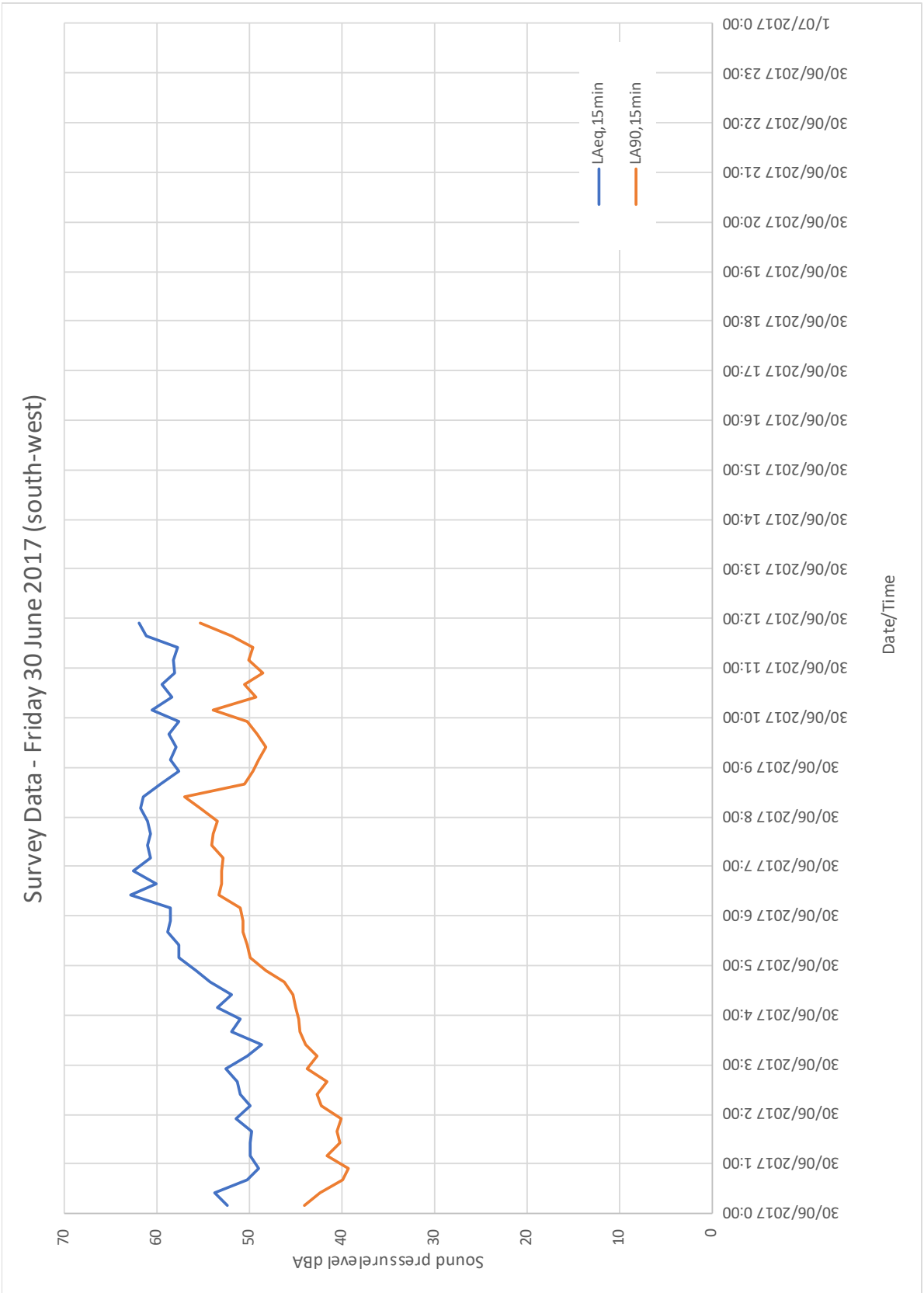
Survey Data - Friday 30 June 2017 (south-west)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
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10
20
30
40
50
60
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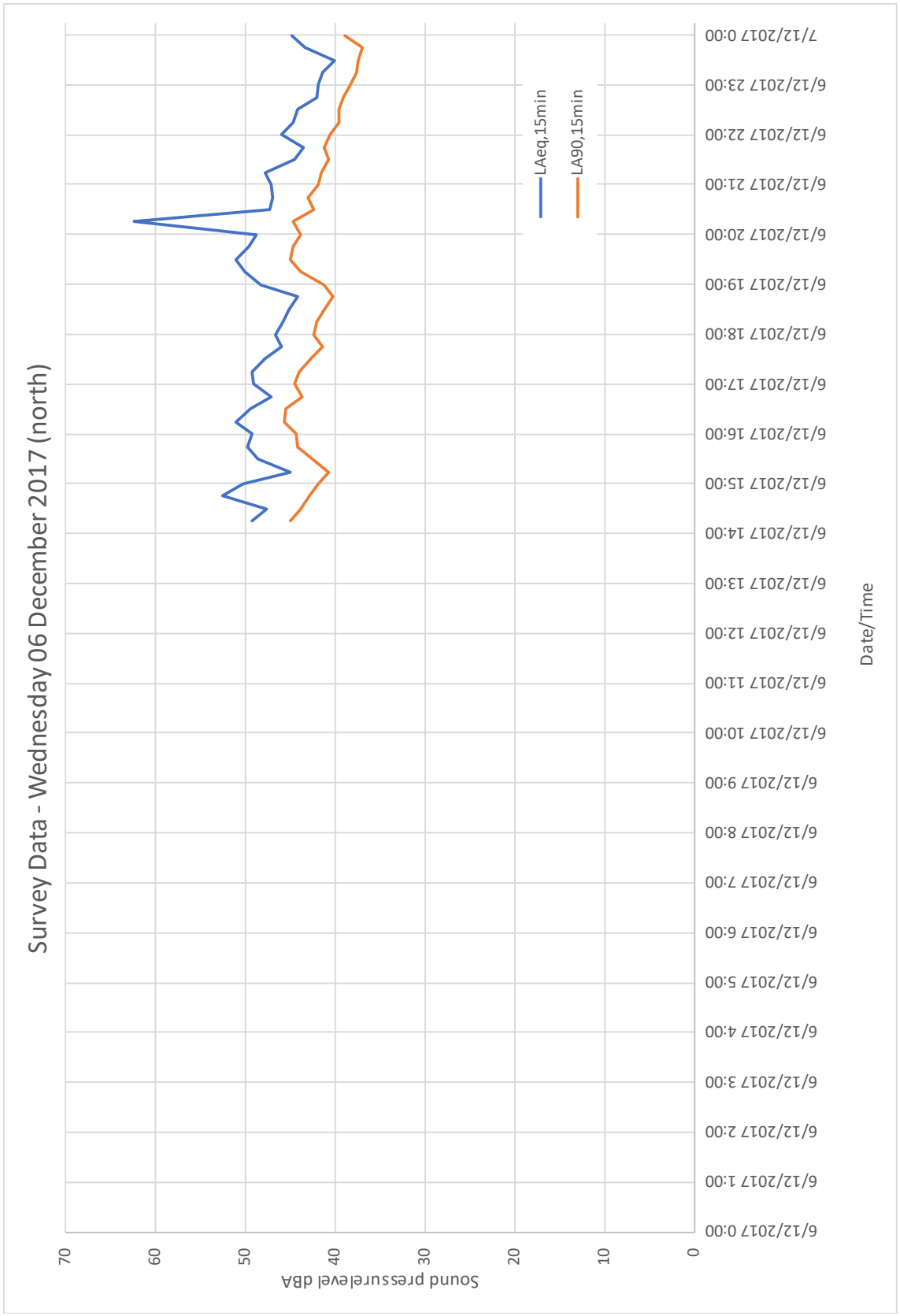
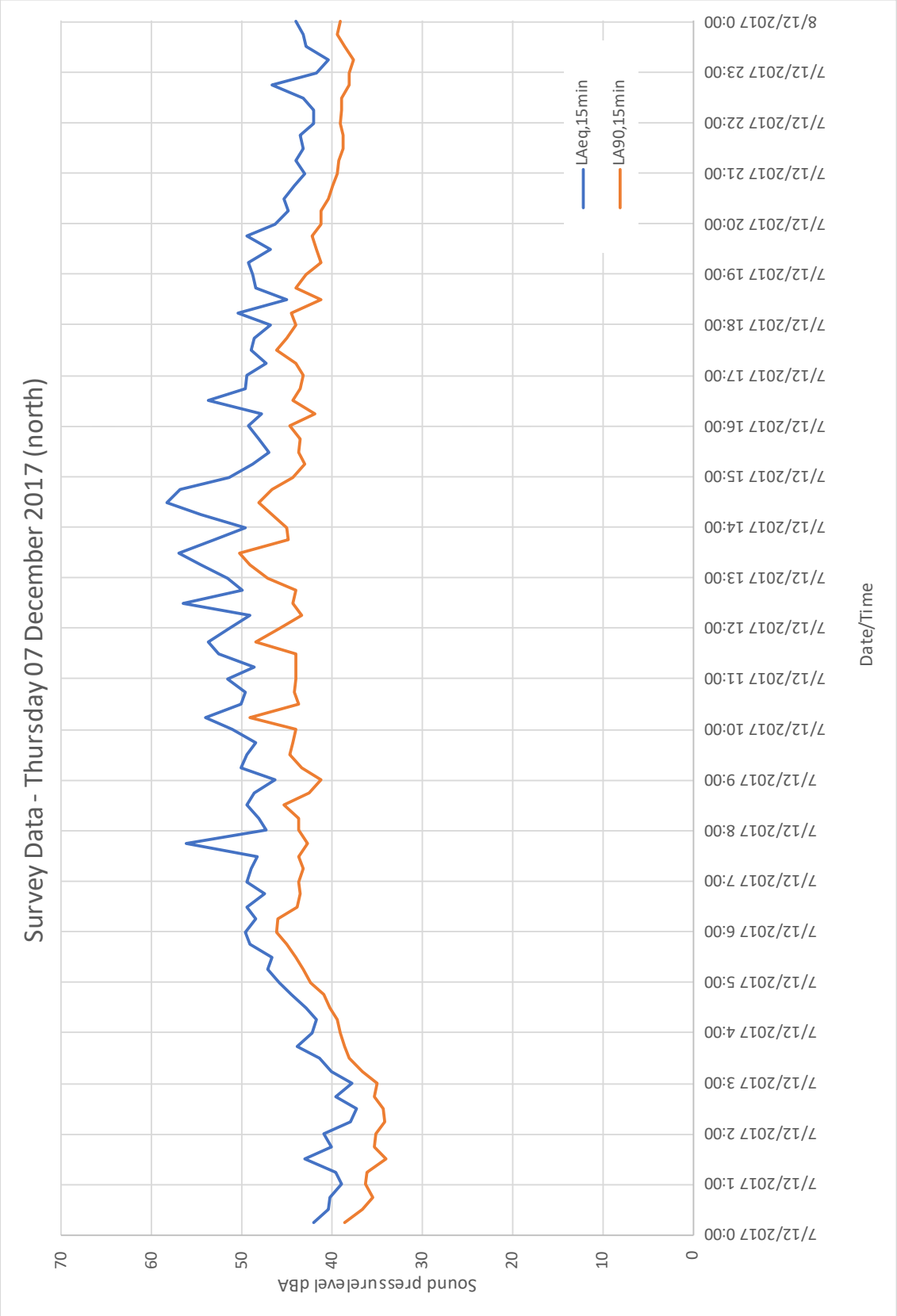
1/07/2017 0:00

B.2 North logger station




Survey Data - Thursday 07 December 2017 (north)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
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60
50
40
30
20
10
0
Date/Time
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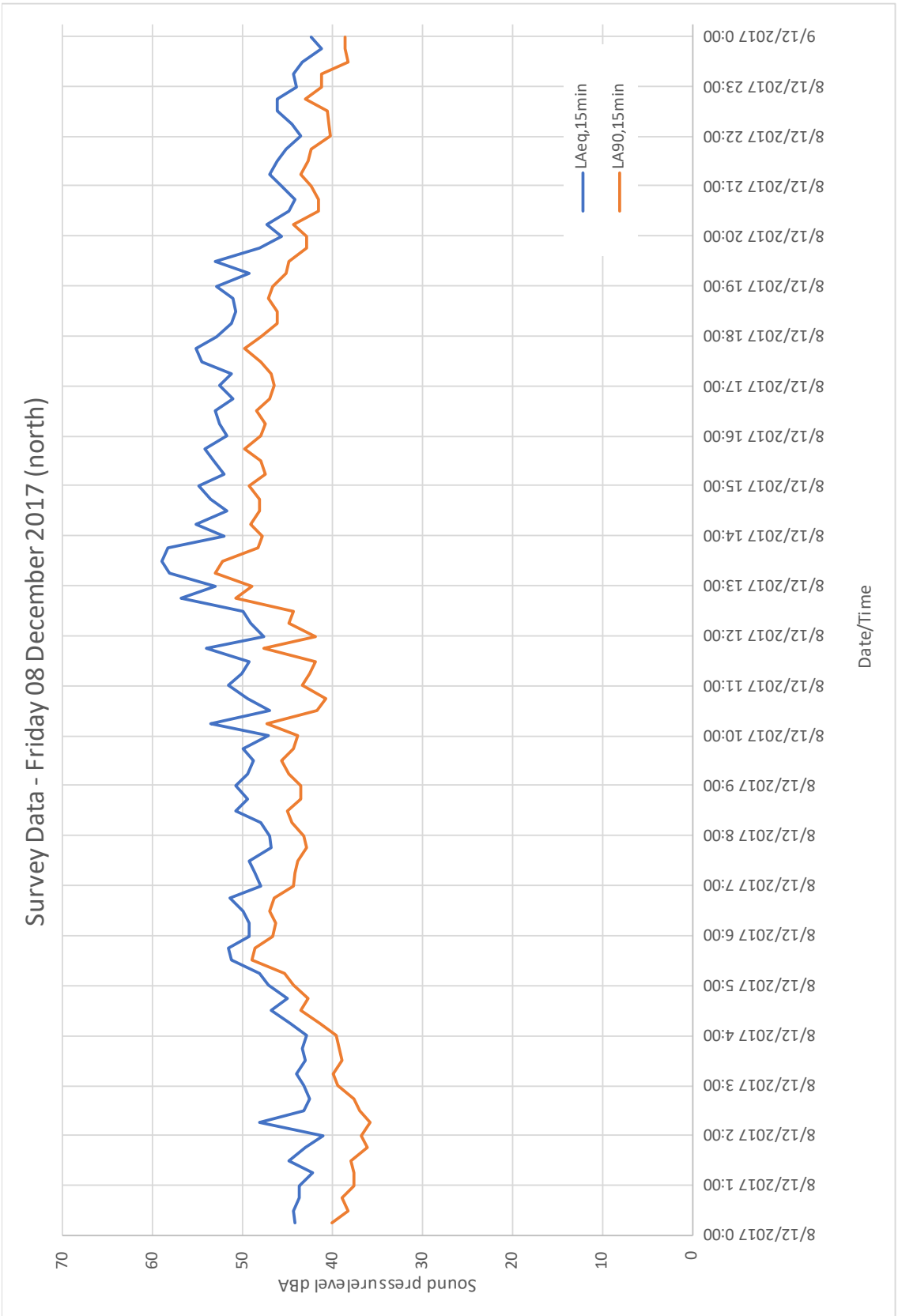
Survey Data - Friday 08 December 2017 (north)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
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60
50
40
30
20
10
0
Date/Time
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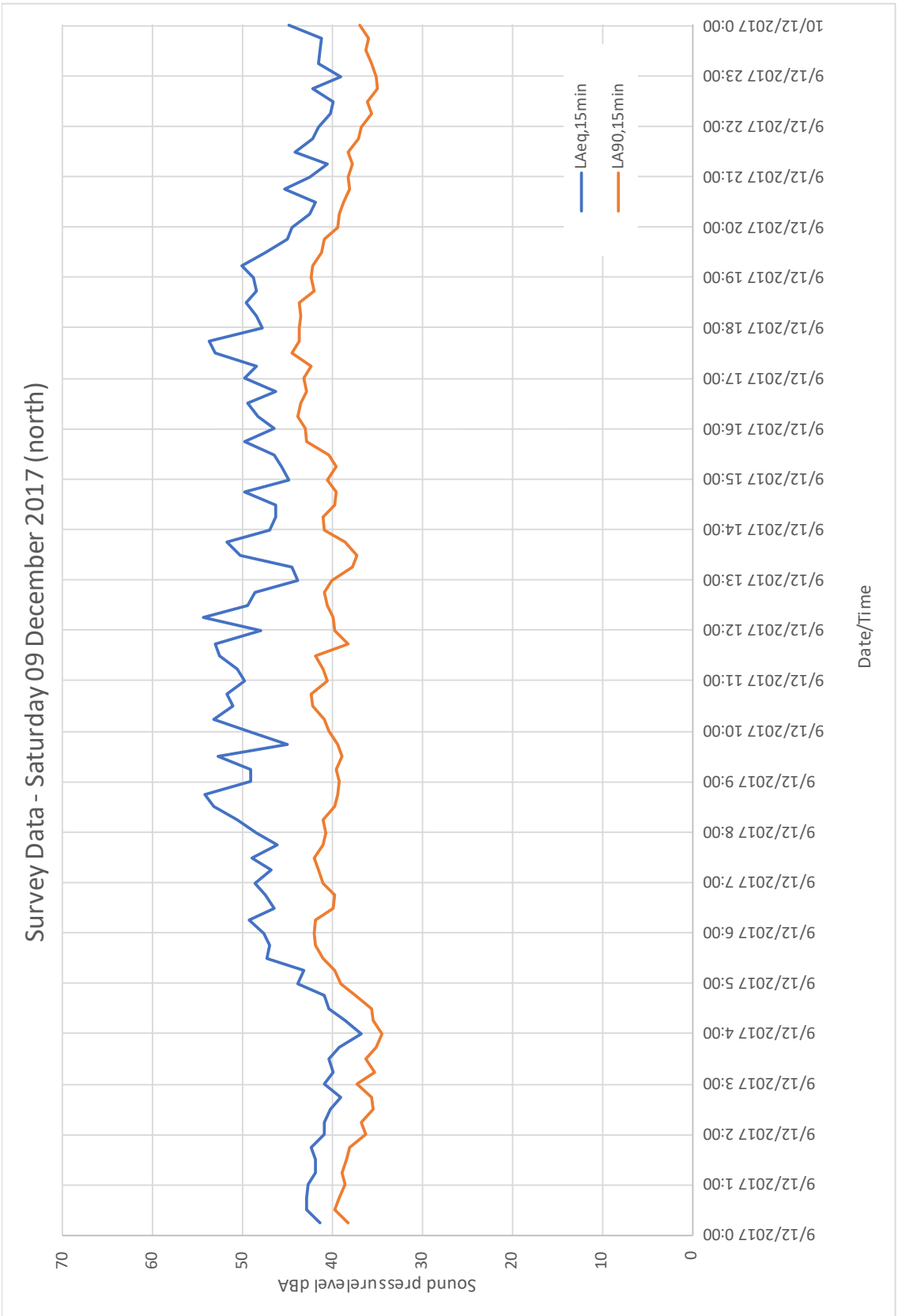
Survey Data - Saturday 09 December 2017 (north)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
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40
30
20
10
0
Date/Time
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9/12/2017 1:00
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9/12/2017 5:00
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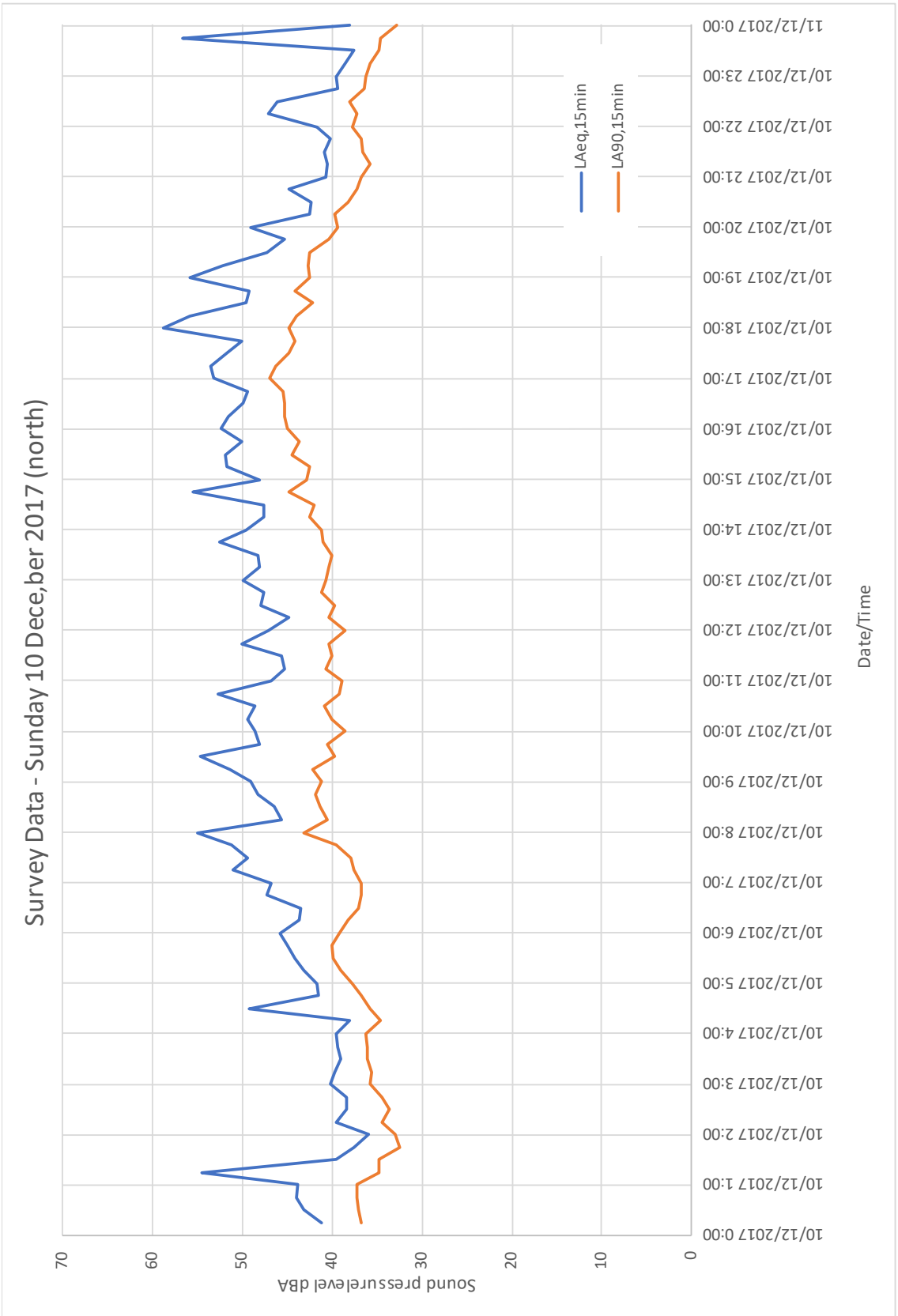
Survey Data - Sunday 10 Dece,ber 2017 (north)
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LA90,15min
Sound pressurelevel dBA
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20
30
40
50
60
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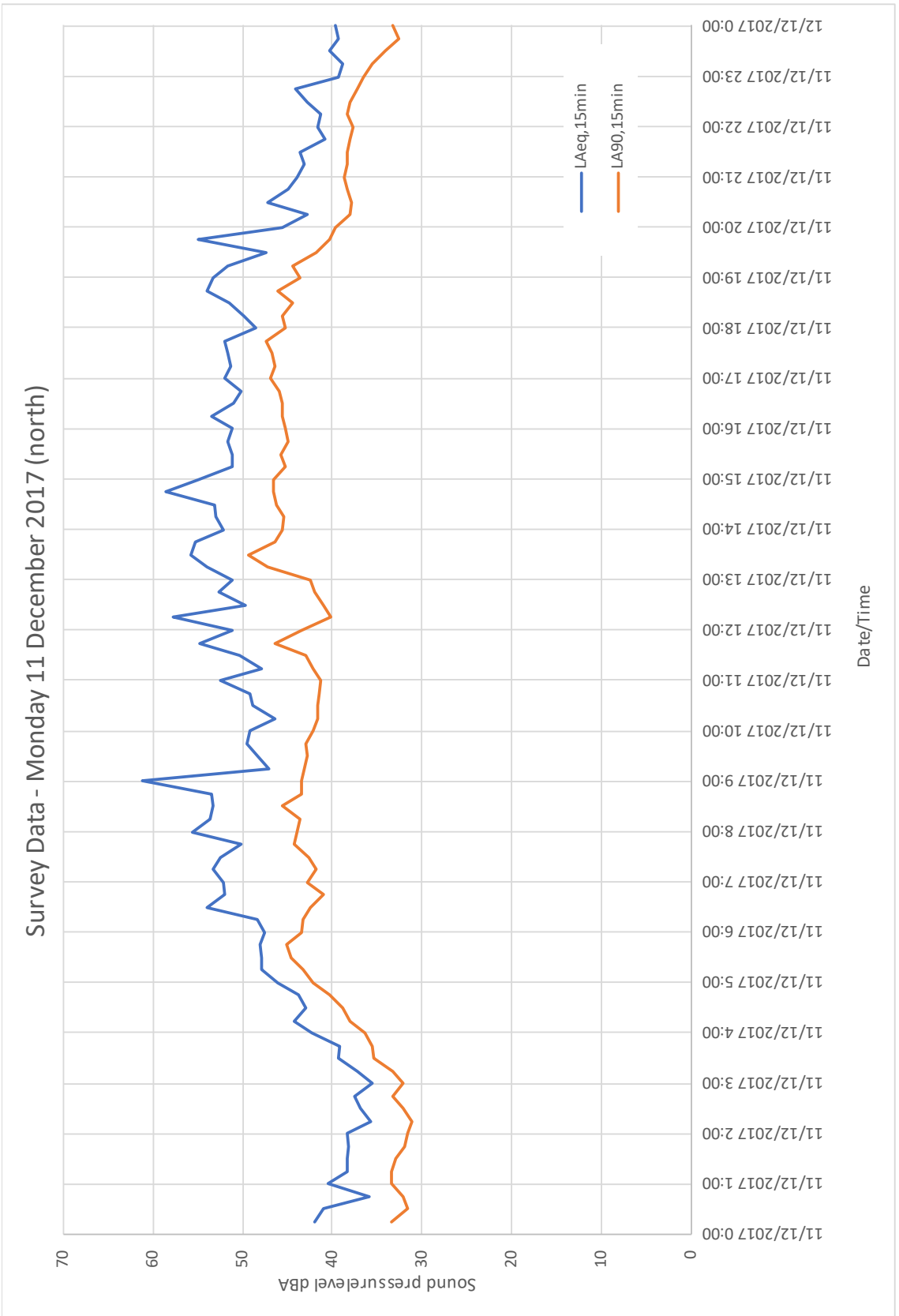
Survey Data - Monday 11 December 2017 (north)
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LA90,15min
Sound pressurelevel dBA
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20
10
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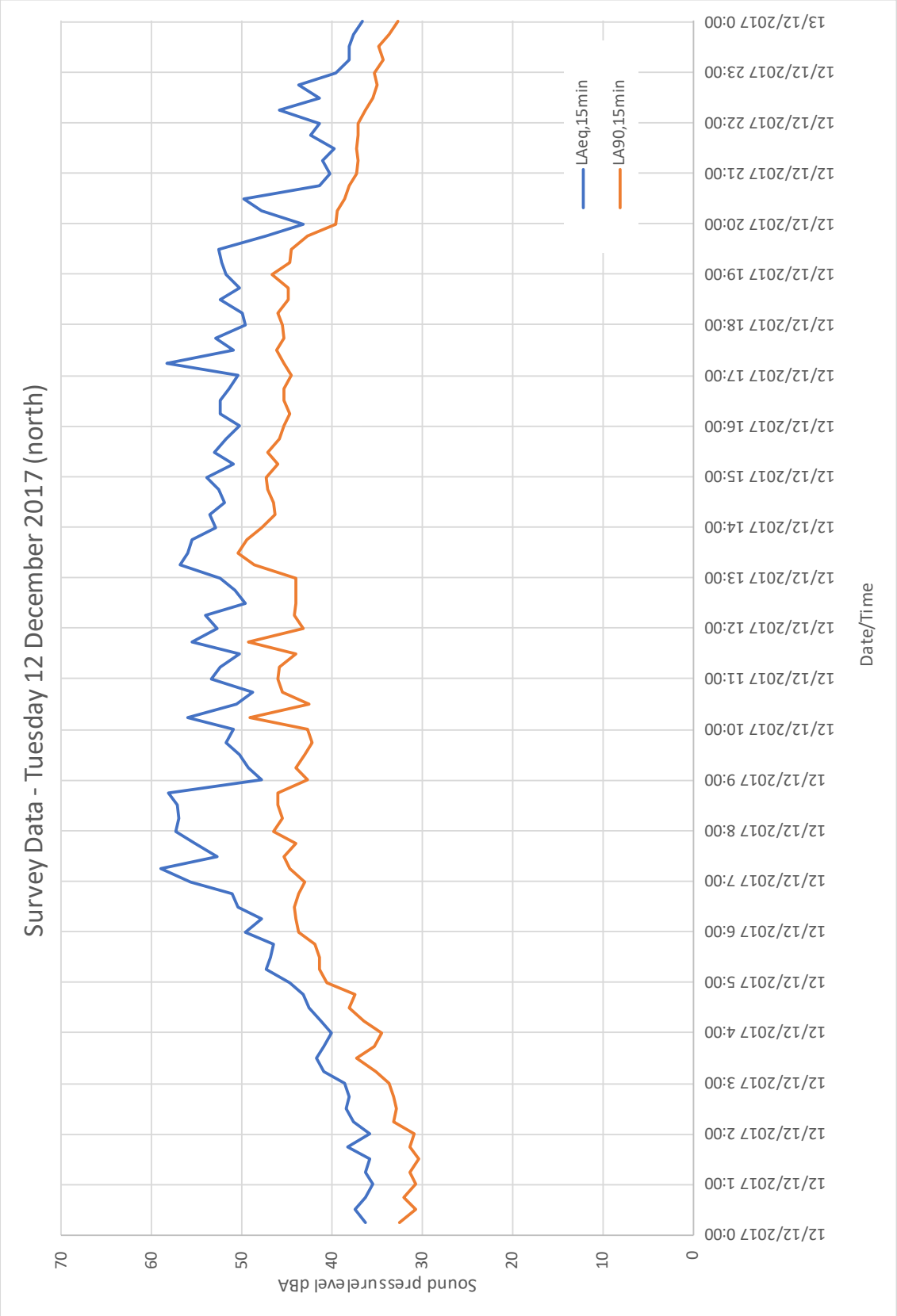
Survey Data - Tuesday 12 December 2017 (north)
LAeq,15min
LA90,15min
Sound pressure level dBA
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60
50
40
30
20
10
0
Date/Time
12/12/2017 0:00
12/12/2017 1:00
12/12/2017 2:00
12/12/2017 3:00
12/12/2017 4:00
12/12/2017 5:00
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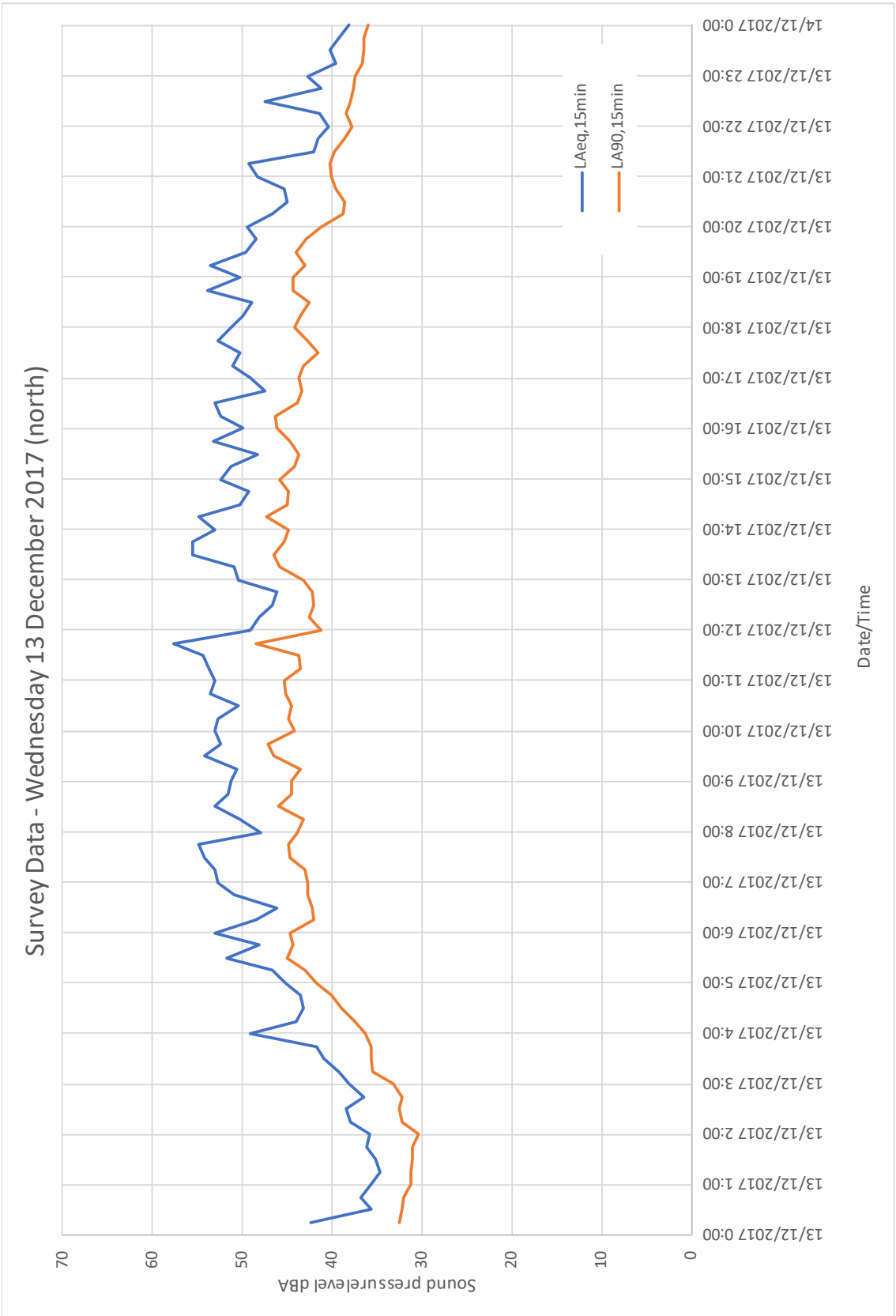
Survey Data - Wednesday 13 December 2017 (north)
LAeq,15min
LA90,15min
Sound pressure level dBA
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60
50
40
30
20
10
0
Date/Time
13/12/2017 0:00
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13/12/2017 2:00
13/12/2017 3:00
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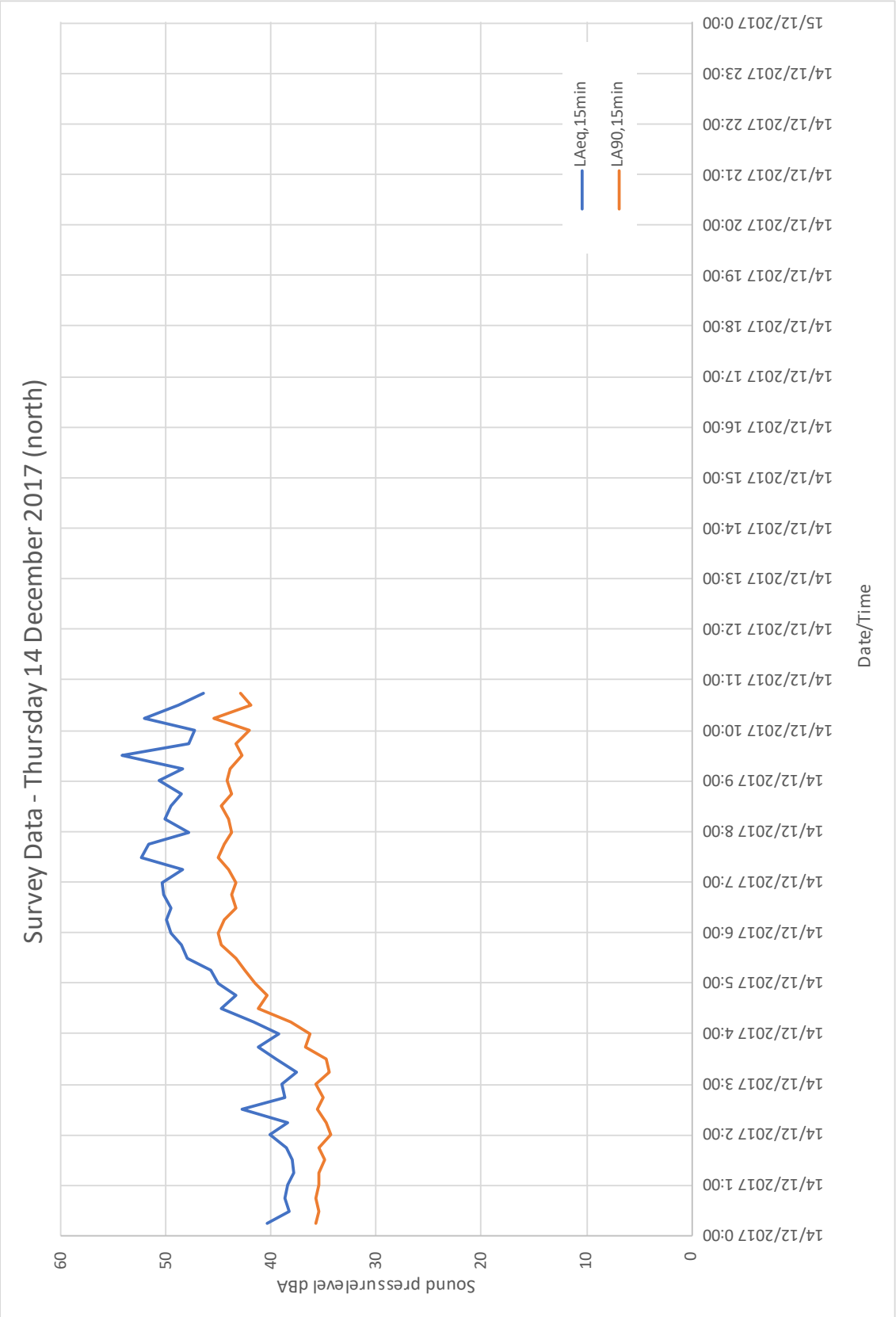
Survey Data - Thursday 14 December 2017 (north)
LAeq,15min
LA90,15min
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Sound pressurelevel dBA
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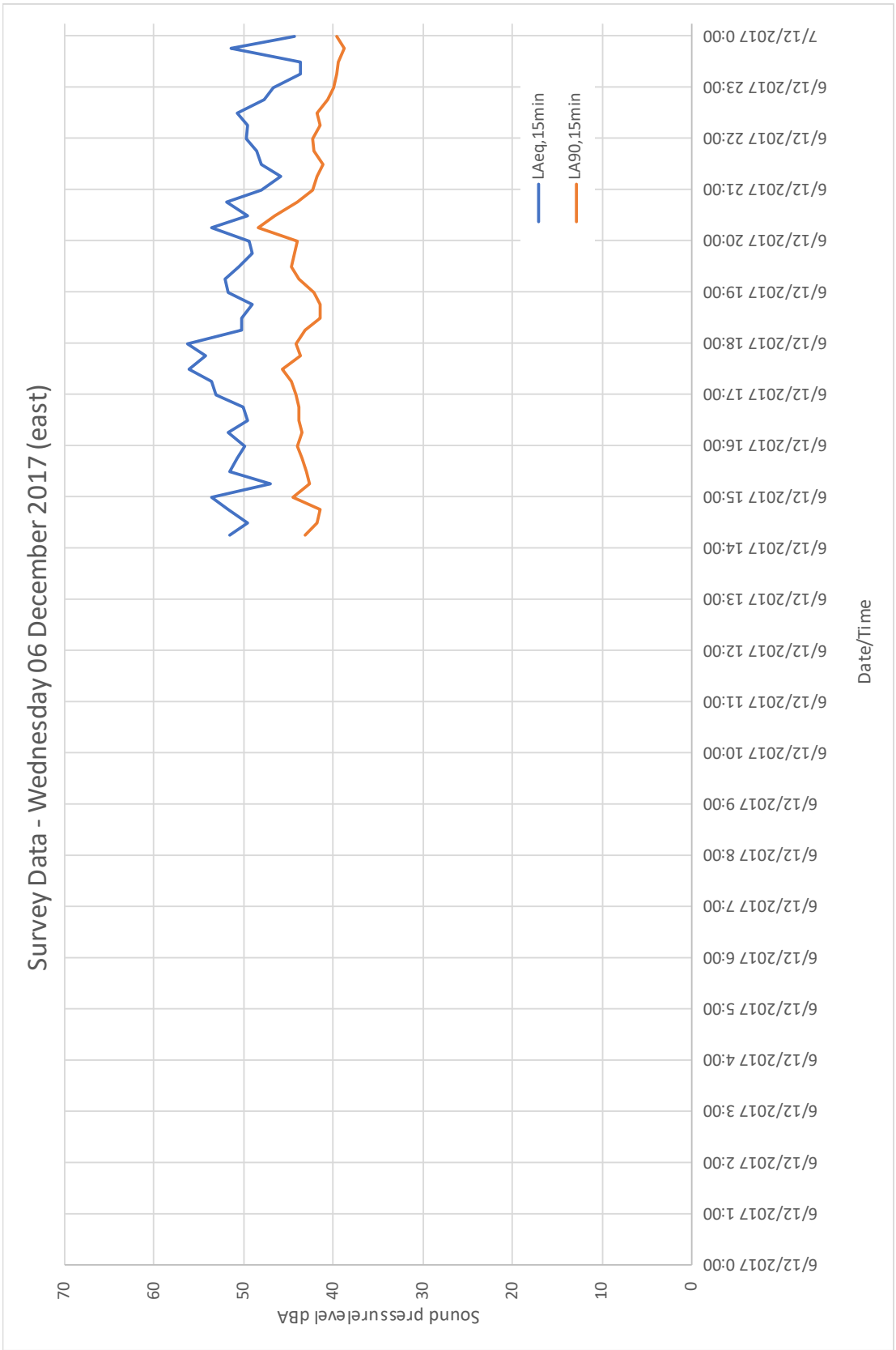
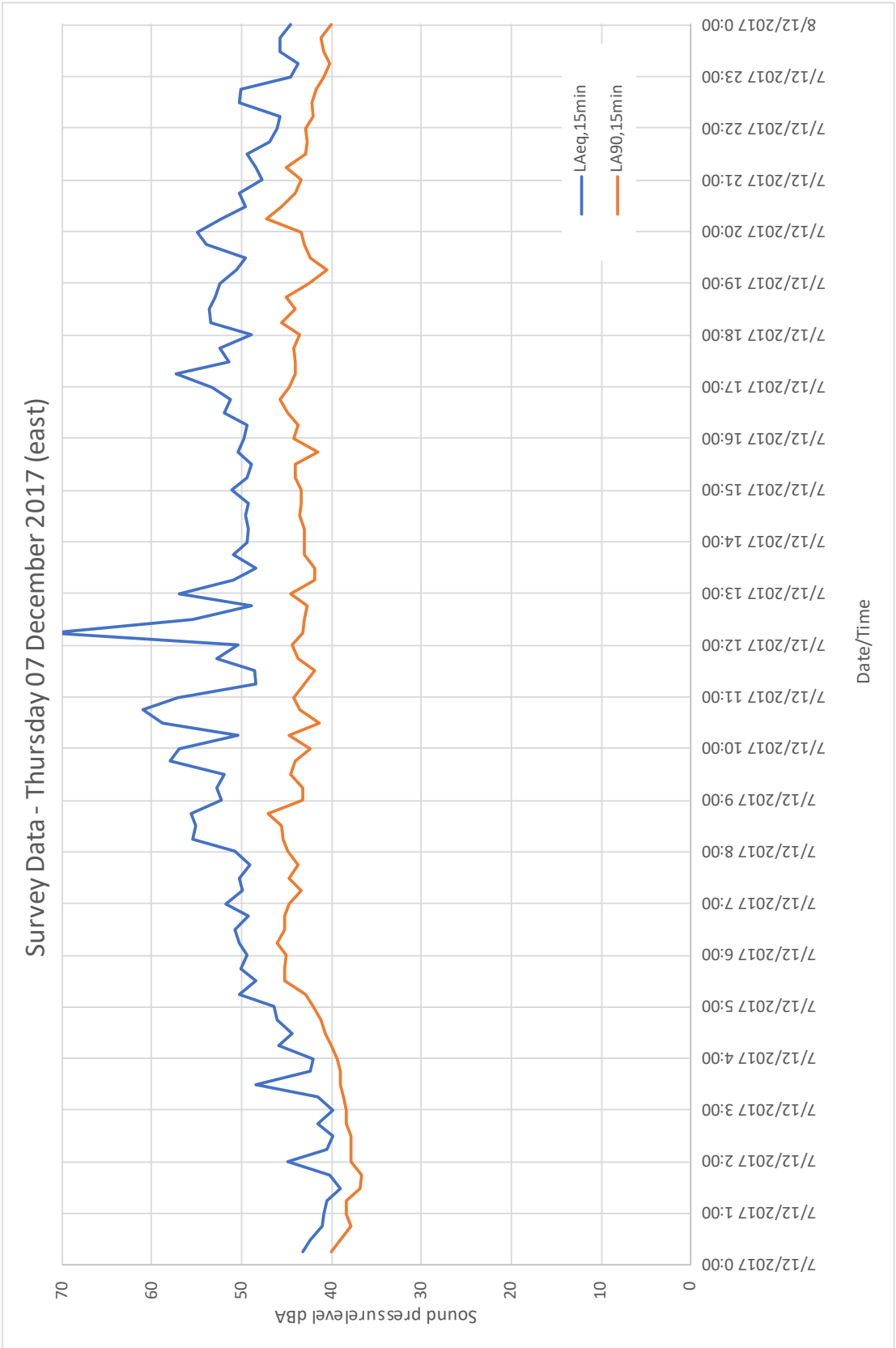
50
40
30
20
10
0

B.3 East logger station




Survey Data - Thursday 07 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressure level dBA
0
10
20
30
40
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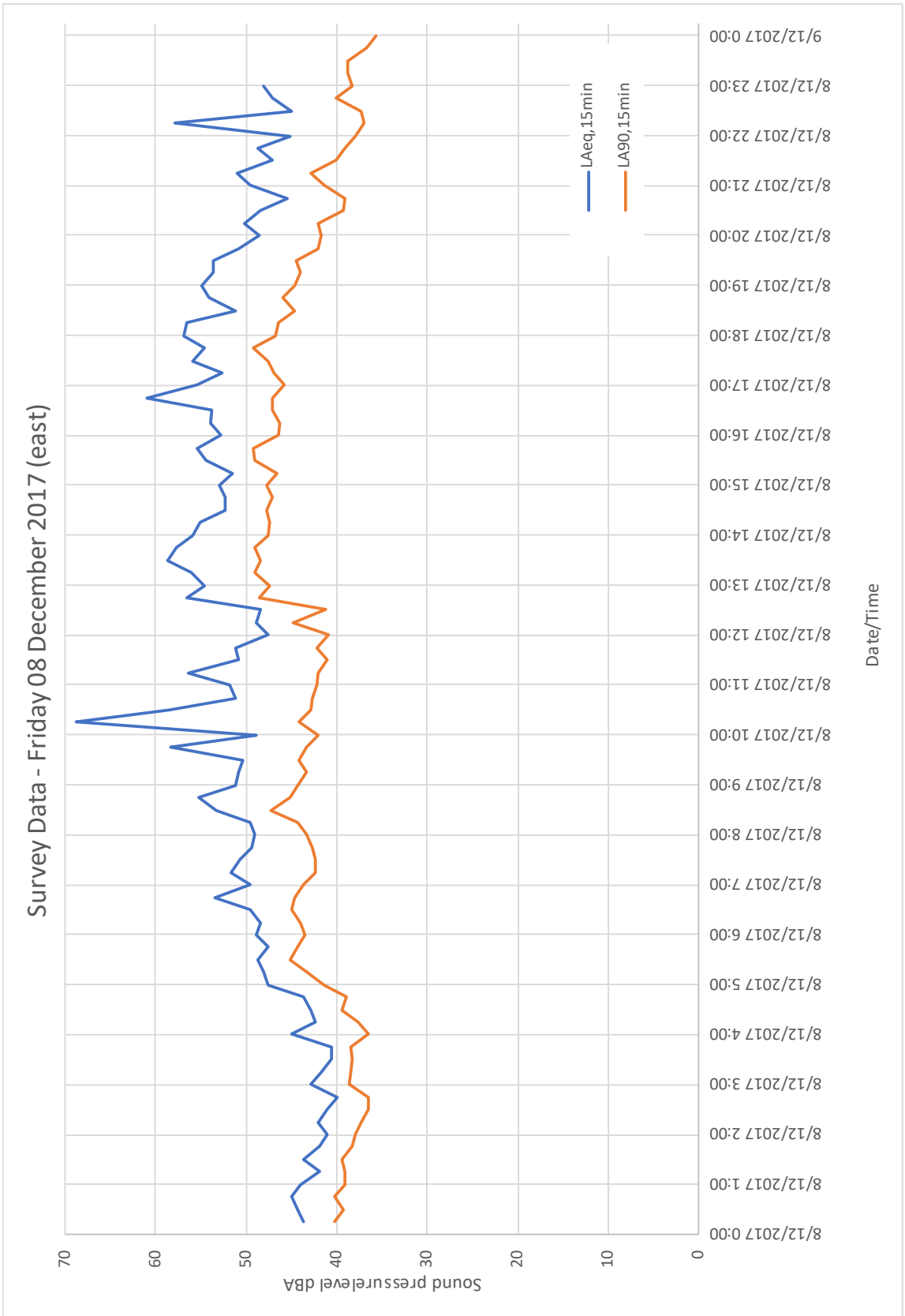
60
70
Date/Time
7/12/2017 0:00
7/12/2017 1:00
7/12/2017 2:00
7/12/2017 3:00
7/12/2017 4:00
7/12/2017 5:00
7/12/2017 6:00
7/12/2017 7:00
7/12/2017 8:00
7/12/2017 9:00
7/12/2017 10:00
7/12/2017 11:00
7/12/2017 12:00
7/12/2017 13:00
7/12/2017 14:00
7/12/2017 15:00
7/12/2017 16:00
7/12/2017 17:00
7/12/2017 18:00
7/12/2017 19:00
7/12/2017 20:00
7/12/2017 21:00
7/12/2017 22:00
7/12/2017 23:00
8/12/2017 0:00


Survey Data - Friday 08 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
0
10
20
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40
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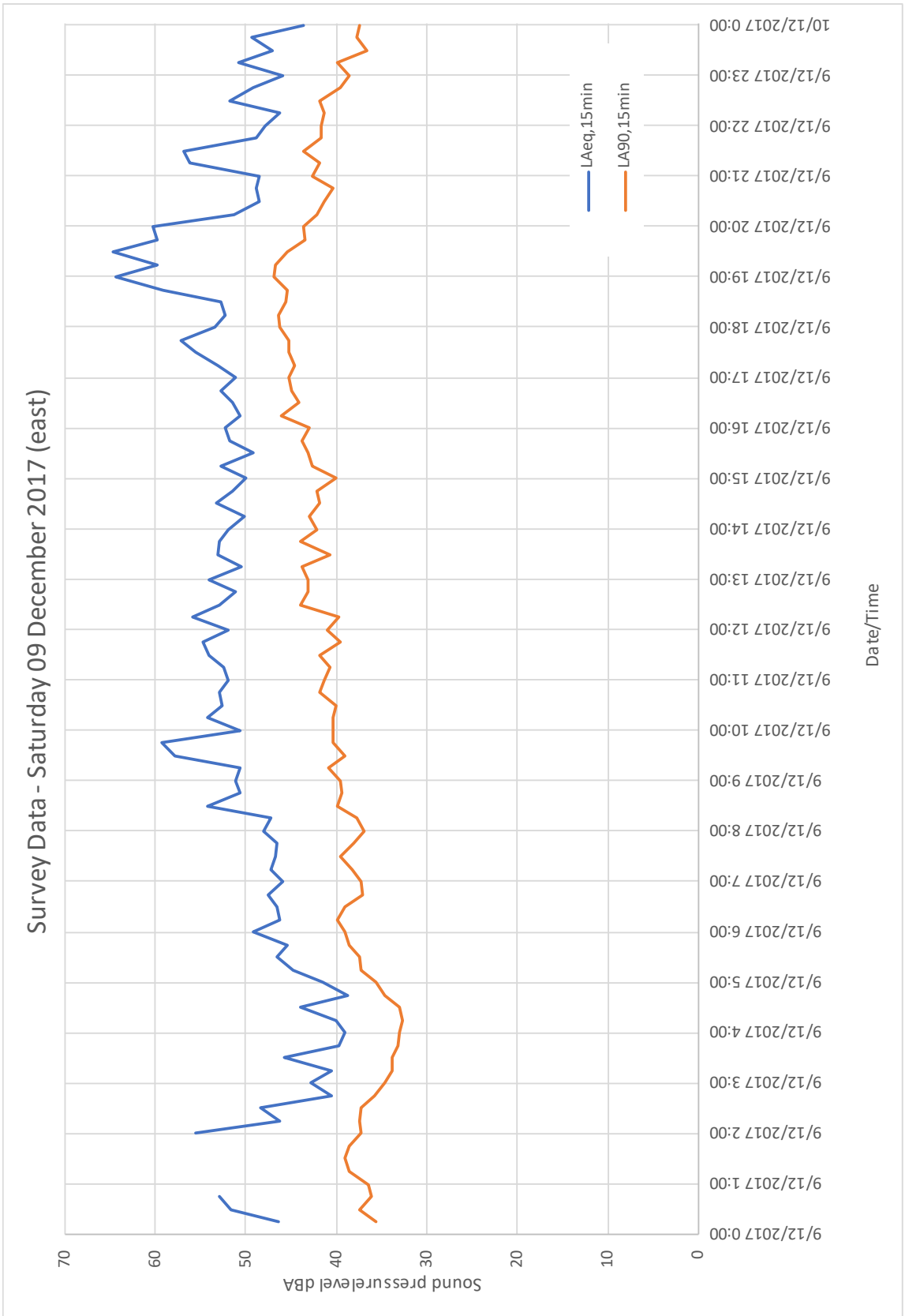
60
70
Date/Time
8/12/2017 0:00
8/12/2017 1:00
8/12/2017 2:00
8/12/2017 3:00
8/12/2017 4:00
8/12/2017 5:00
8/12/2017 6:00
8/12/2017 7:00
8/12/2017 8:00
8/12/2017 9:00
8/12/2017 10:00
8/12/2017 11:00
8/12/2017 12:00
8/12/2017 13:00
8/12/2017 14:00
8/12/2017 15:00
8/12/2017 16:00
8/12/2017 17:00
8/12/2017 18:00
8/12/2017 19:00
8/12/2017 20:00
8/12/2017 21:00
8/12/2017 22:00
8/12/2017 23:00
9/12/2017 0:00


Survey Data - Saturday 09 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
0
10
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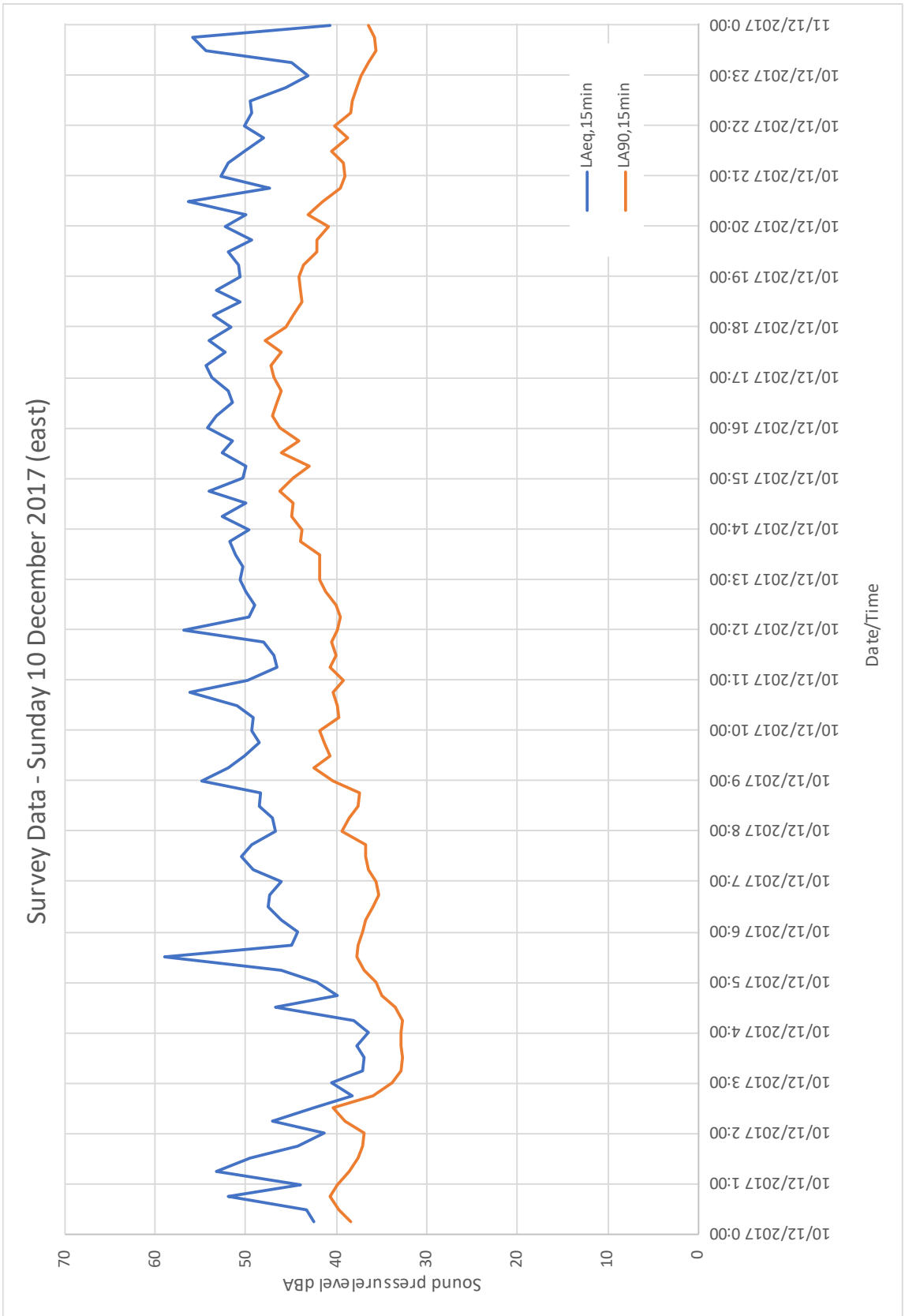
Date/Time
9/12/2017 0:00
9/12/2017 1:00
9/12/2017 2:00
9/12/2017 3:00
9/12/2017 4:00
9/12/2017 5:00
9/12/2017 6:00
9/12/2017 7:00
9/12/2017 8:00
9/12/2017 9:00
9/12/2017 10:00
9/12/2017 11:00
9/12/2017 12:00
9/12/2017 13:00
9/12/2017 14:00
9/12/2017 15:00
9/12/2017 16:00
9/12/2017 17:00
9/12/2017 18:00
9/12/2017 19:00
9/12/2017 20:00
9/12/2017 21:00
9/12/2017 22:00
9/12/2017 23:00
10/12/2017 0:00


Survey Data - Sunday 10 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressure level dBA
0
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Date/Time
10/12/2017 0:00
10/12/2017 1:00
10/12/2017 2:00
10/12/2017 3:00
10/12/2017 4:00
10/12/2017 5:00
10/12/2017 6:00
10/12/2017 7:00
10/12/2017 8:00
10/12/2017 9:00
10/12/2017 10:00
10/12/2017 11:00
10/12/2017 12:00
10/12/2017 13:00
10/12/2017 14:00
10/12/2017 15:00
10/12/2017 16:00
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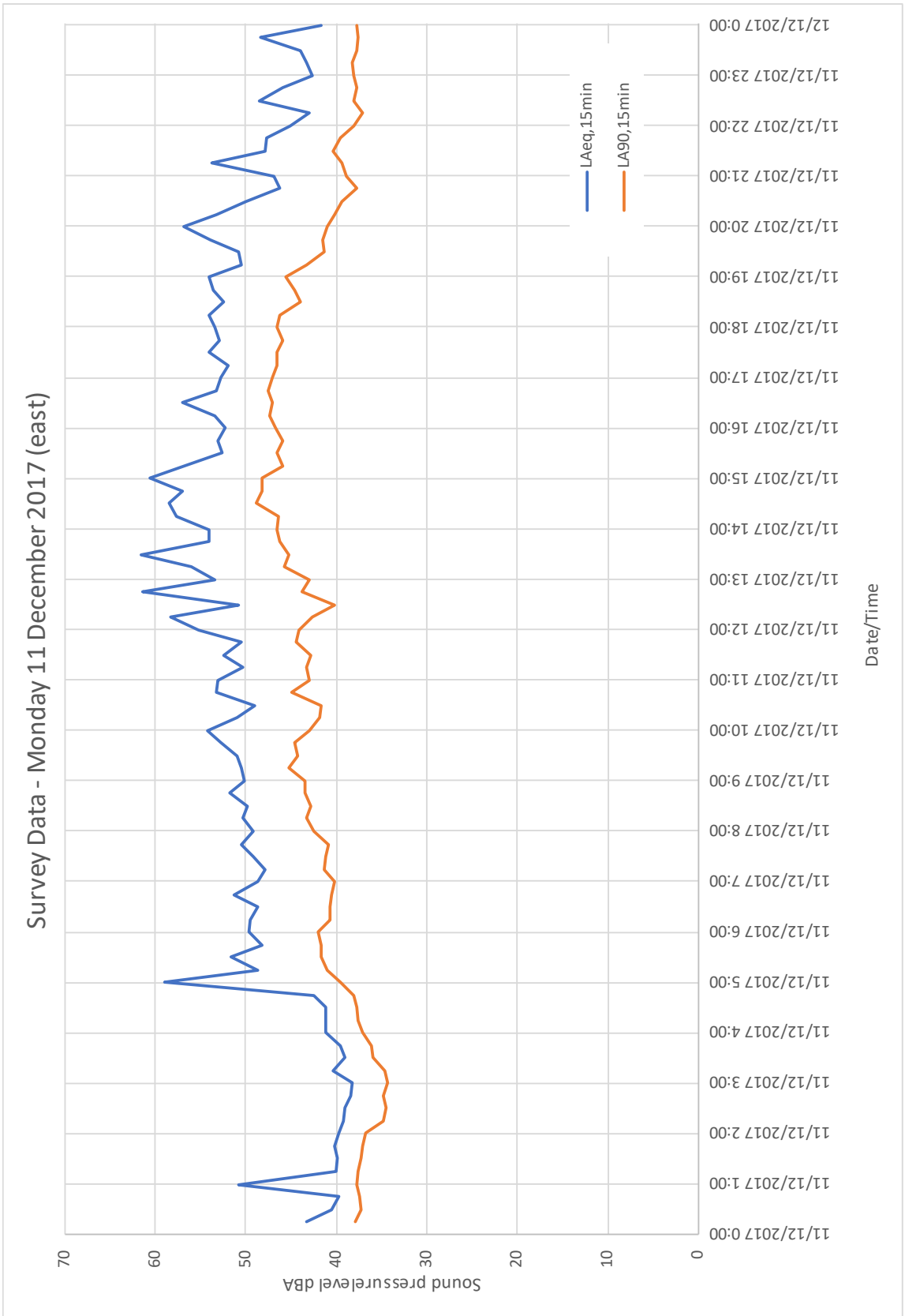
10/12/2017 18:00
10/12/2017 19:00
10/12/2017 20:00
10/12/2017 21:00
10/12/2017 22:00
10/12/2017 23:00
11/12/2017 0:00


Survey Data - Monday 11 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
0
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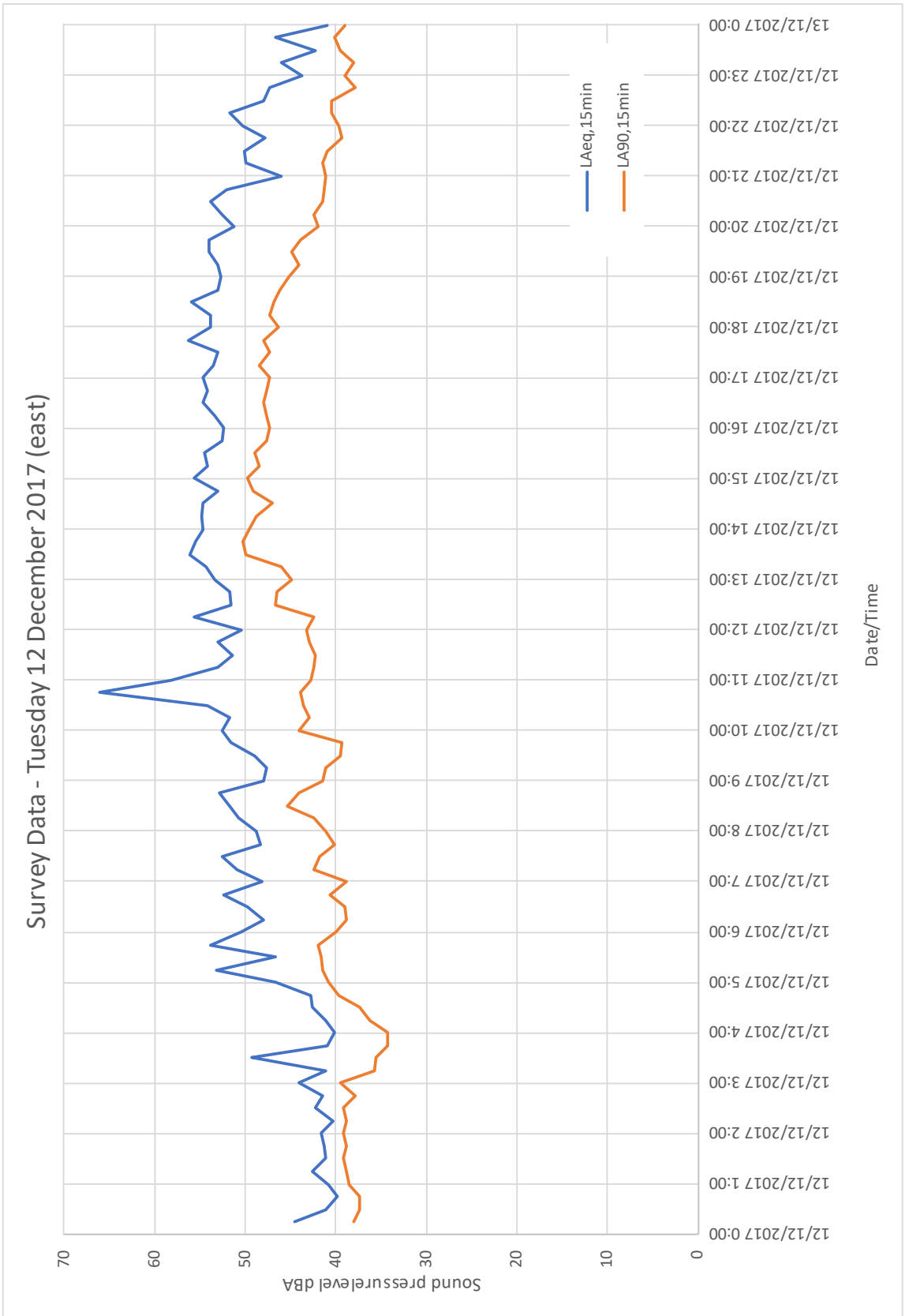
Date/Time
11/12/2017 0:00
11/12/2017 1:00
11/12/2017 2:00
11/12/2017 3:00
11/12/2017 4:00
11/12/2017 5:00
11/12/2017 6:00
11/12/2017 7:00
11/12/2017 8:00
11/12/2017 9:00
11/12/2017 10:00
11/12/2017 11:00
11/12/2017 12:00
11/12/2017 13:00
11/12/2017 14:00
11/12/2017 15:00
11/12/2017 16:00
11/12/2017 17:00
11/12/2017 18:00
11/12/2017 19:00
11/12/2017 20:00
11/12/2017 21:00
11/12/2017 22:00
11/12/2017 23:00
12/12/2017 0:00


Survey Data - Tuesday 12 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
0
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Date/Time
12/12/2017 0:00
12/12/2017 1:00
12/12/2017 2:00
12/12/2017 3:00
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12/12/2017 9:00
12/12/2017 10:00
12/12/2017 11:00
12/12/2017 12:00
12/12/2017 13:00
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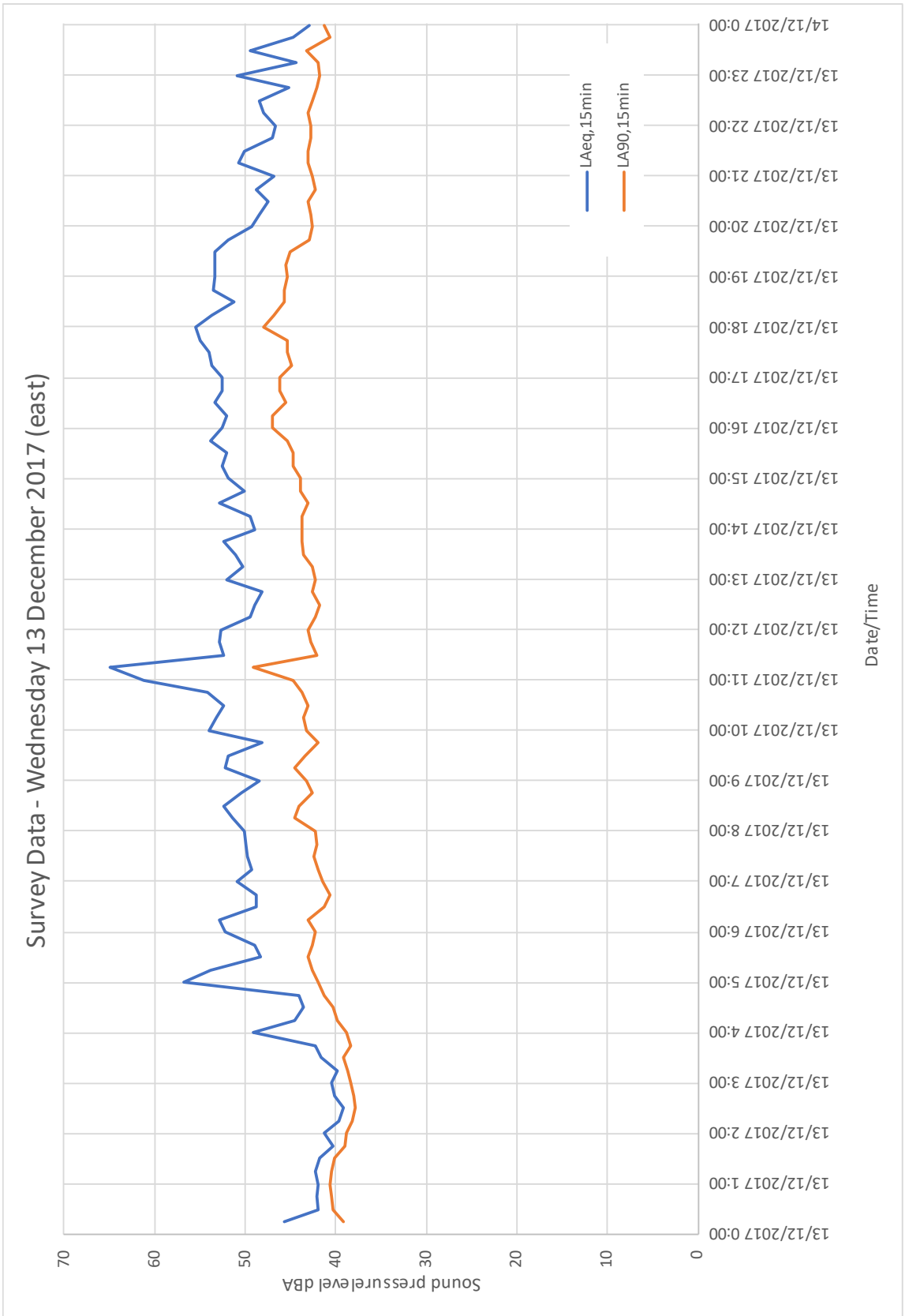
12/12/2017 18:00
12/12/2017 19:00
12/12/2017 20:00
12/12/2017 21:00
12/12/2017 22:00
12/12/2017 23:00
13/12/2017 0:00


Survey Data - Wednesday 13 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressure level dBA
0
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Date/Time
13/12/2017 0:00
13/12/2017 1:00
13/12/2017 2:00
13/12/2017 3:00
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13/12/2017 6:00
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13/12/2017 18:00
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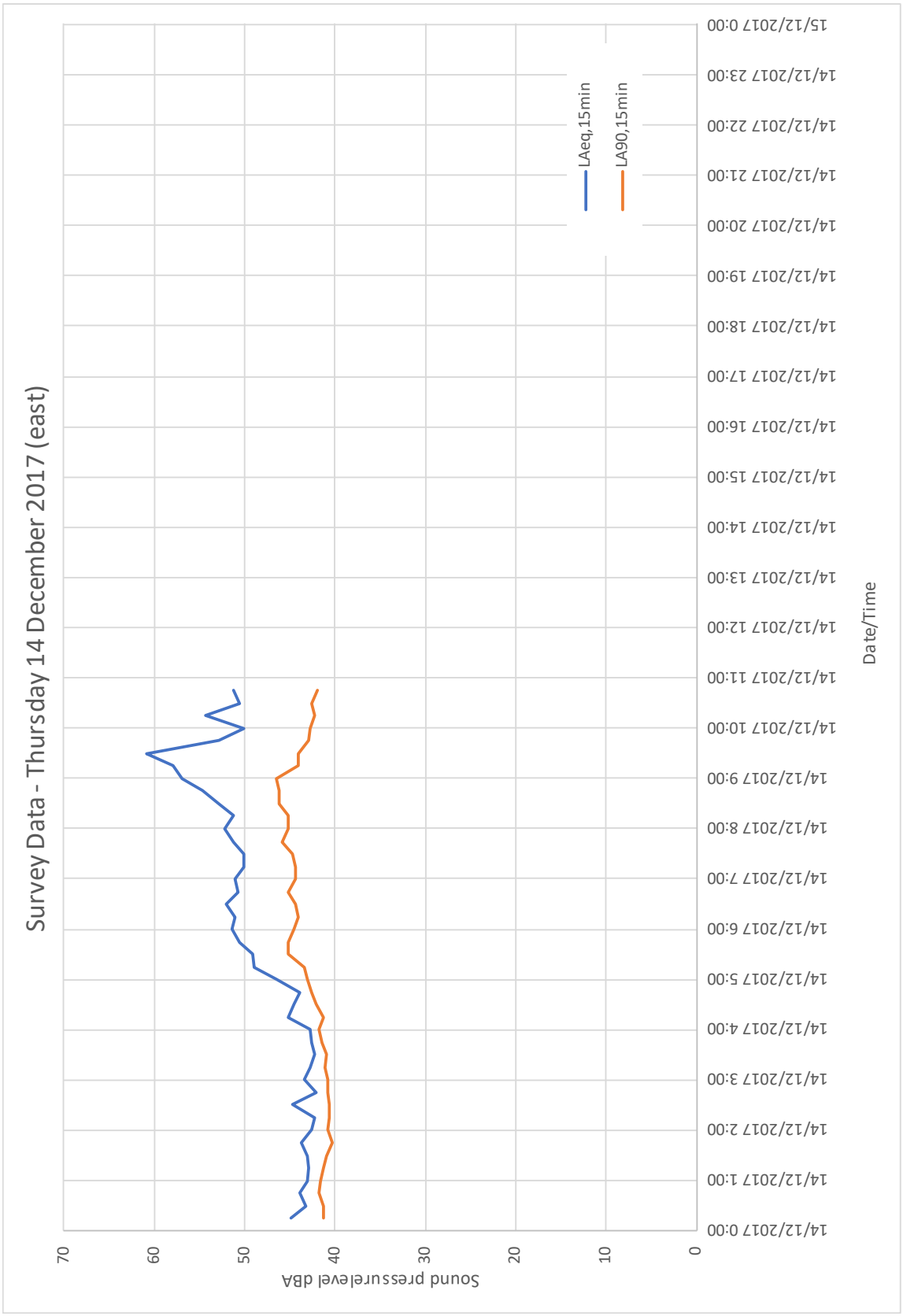
13/12/2017 20:00
13/12/2017 21:00
13/12/2017 22:00
13/12/2017 23:00
14/12/2017 0:00


Survey Data - Thursday 14 December 2017 (east)
LAeq,15min
LA90,15min
Sound pressurelevel dBA
0
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Date/Time
14/12/2017 0:00
14/12/2017 1:00
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14/12/2017 23:00
15/12/2017 0:00