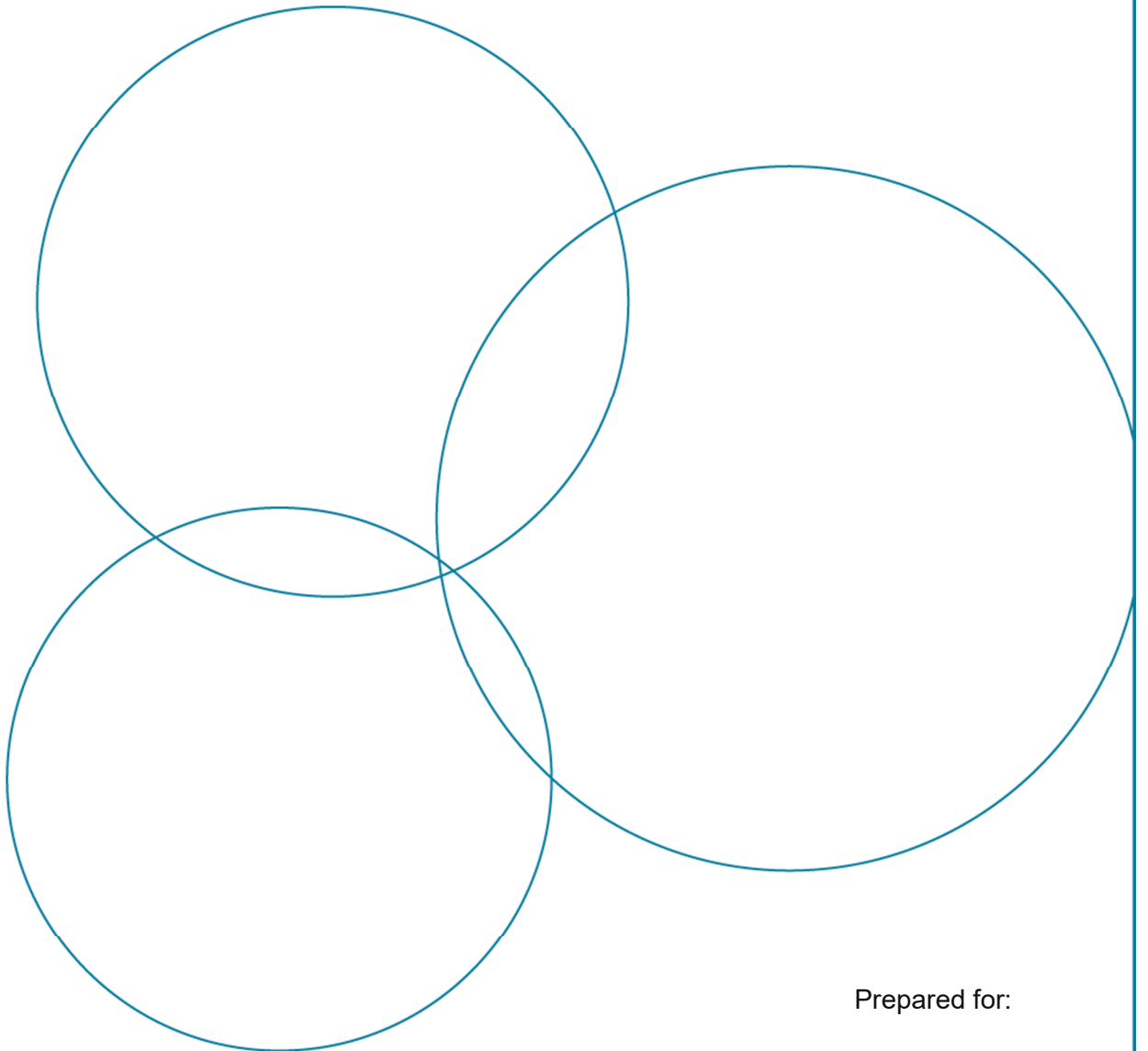


CUNDALL

15 January 2018

Acoustic Report for DA Submission

1015560 – Greystanes Public School






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<p>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.</p>		

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Executive Summary

This report presents acoustic input to the DA submission for the proposed development at Greystanes Public 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 (SEARs), 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, will be controlled by the selection of appropriate façade glazing, external construction, and ventilation systems 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.

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 relocation of the COLA, 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. It is not expected that there will be regular out of hours community use of the new facilities.

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 Greystanes Public School, Greystanes 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 10 October 2017, and the Secretary's Environmental Assessment Requirements dated 17 October 2017 (Application number SSD 8778).

1.1 Proposed development

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

- New three storey building comprising 24 general learning areas, breakout spaces and wet areas;
- New administration and staff facilities;
- New student COLA;
- Refurbishment of former administration area to multipurpose learning facilities.

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 DoE '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';
- NSW EPA 'Assessing Vibration: A Technical Guideline' (2006);
- Cumberland Council 'Holroyd 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

Greystanes Public School has been located on the current site since 1902. The immediate vicinity is residential in nature, with dwellings located immediately to the north, east and west of the site and across Merrylands Road to the south.

The eastern section of the site slopes significantly from street level at Merrylands Road down to the rear of properties on Bradman Street. The figure below indicates the site and the immediate surrounds.

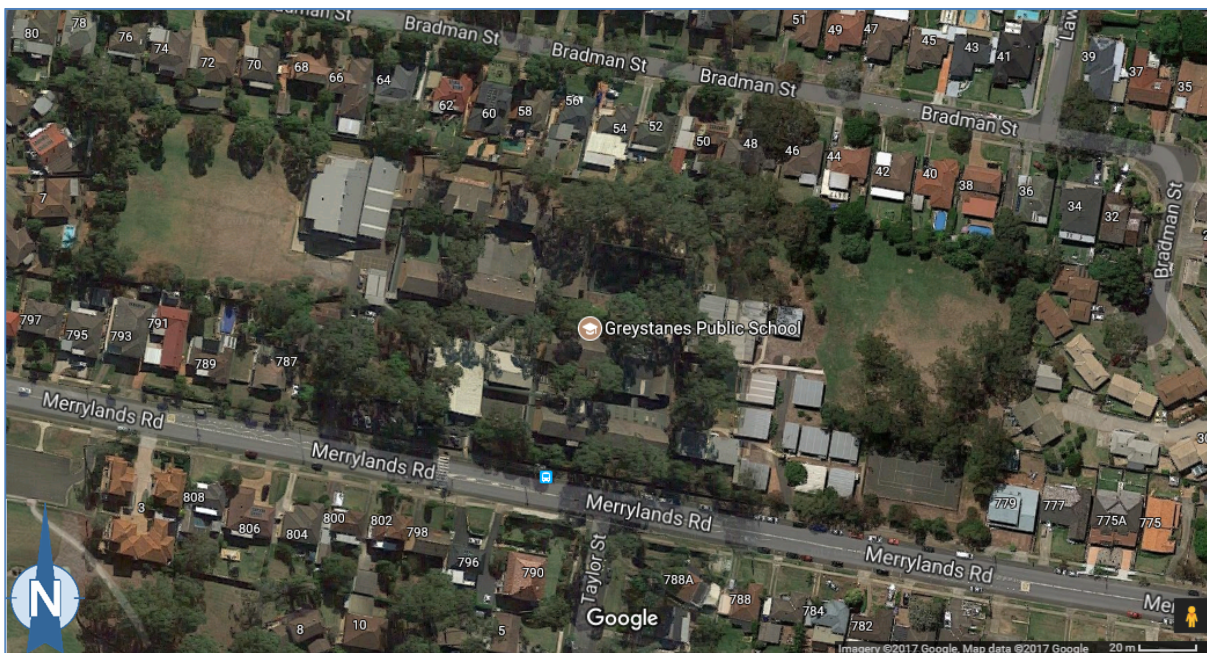


Figure 1 – Site location and surrounds

2.2 Proposed site



Figure 2 – Outline development proposals (Note: new areas highlighted)

As indicated in the figure above, a new three storey building is to be located on the eastern section of the site, with new and refurbished administration buildings to the centre. Temporary demountables are to be located to the west of the site, during construction works.

The proposed upgrades will provide for an additional 184 students and an anticipated net gain of eight 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.

3 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.

3.1 Methodology

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

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 (east location) and December 06 – 14 (west location).

In addition to the long-term measurements, attended surveys were undertaken on June 23 & 29, at locations adjacent to Merrylands Road.

3.2 Measurement locations

The survey locations are indicated below. Taking into account security and access considerations, the logger locations were considered representative of noise levels on the most exposed façades of the proposed development (subject to distance attenuation corrections where necessary) and characteristic of the background noise levels at the immediately adjacent residential properties.



Figure 3 – Approximate measurement positions

3.3 Conditions

Reported weather conditions at the nearest monitoring locations¹ were generally fine over the unattended logging periods. Conditions were therefore considered appropriate for representative noise measurements. 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.

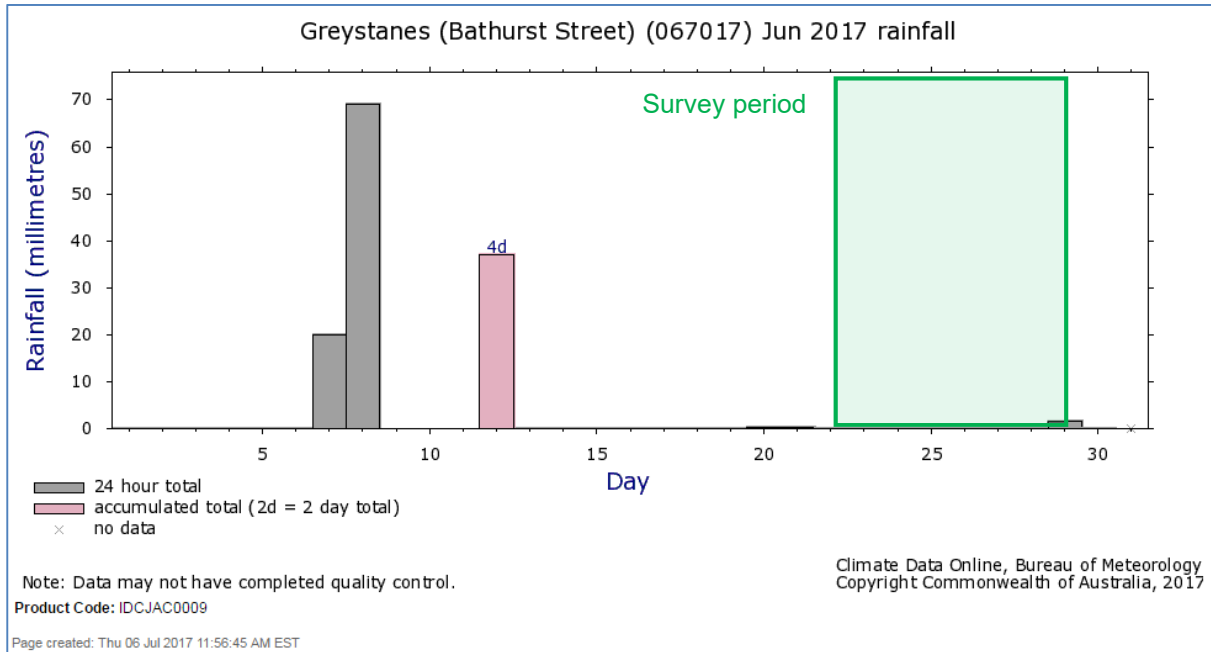


Figure 4 – June rainfall at the nearest monitoring location

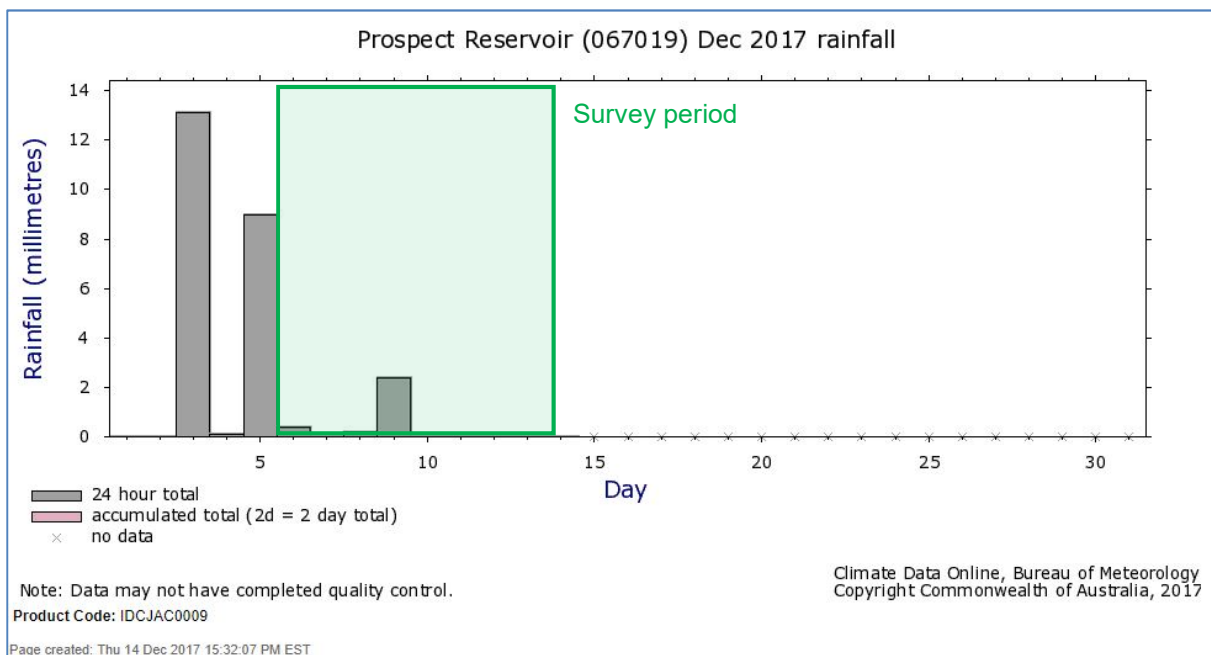


Figure 5 – December rainfall at the nearest monitoring location²

¹ Ref: <http://www.bom.gov.au/climate/data/stations/>

² Note: Measurement data from the Bathurst Street weather station is not available during this period.

It is considered that the surveys generally met the recommendations given in relevant guidance documents.

3.4 Observations

From our site visits, the predominant noise source affecting the site was considered to be road traffic on Merrylands Road.

3.5 Results

3.5.1 Long-term measurements

The figures below illustrate the recorded L_{Aeq} and L_{A90} noise levels over the long-term monitoring periods, based on the 15 minute survey data. Additional daily data is provided in the Appendix.

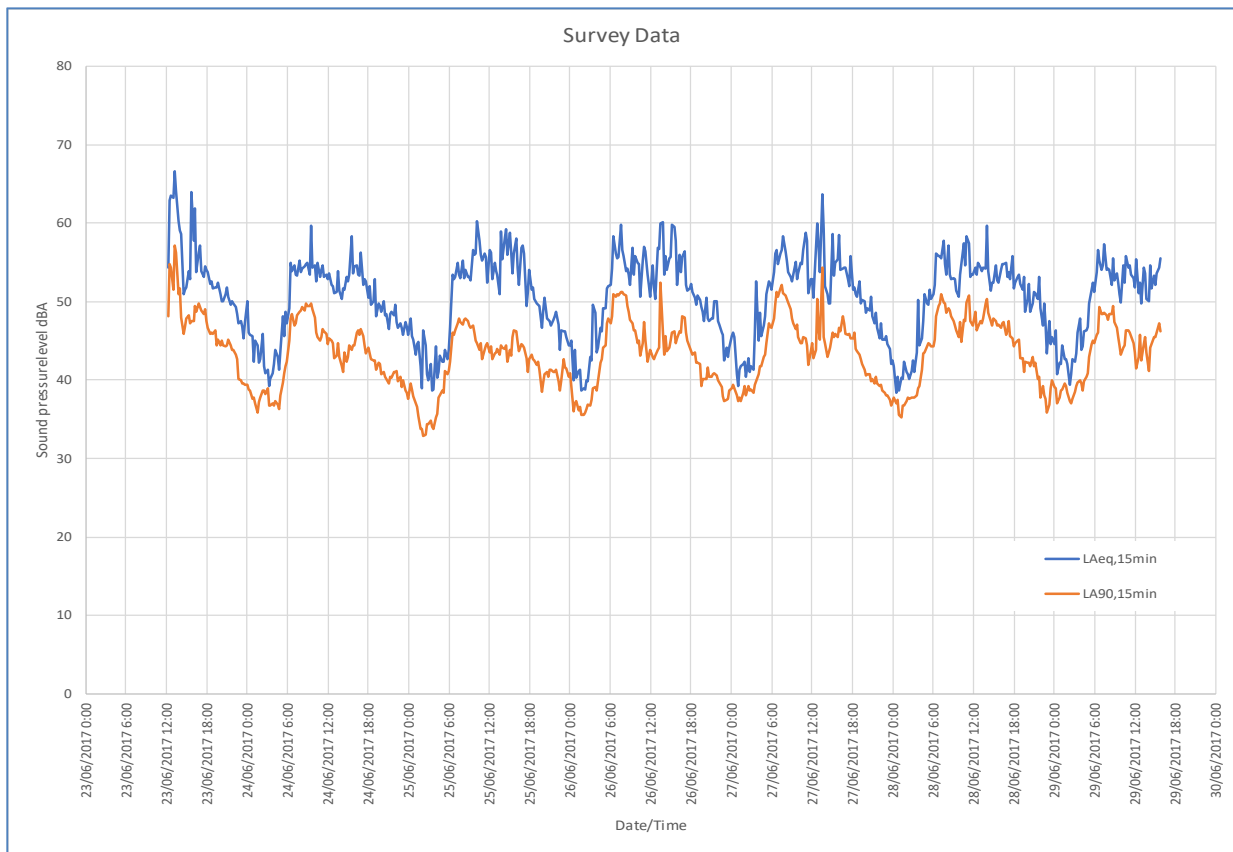


Figure 6 – Long-term noise level measurements (east)

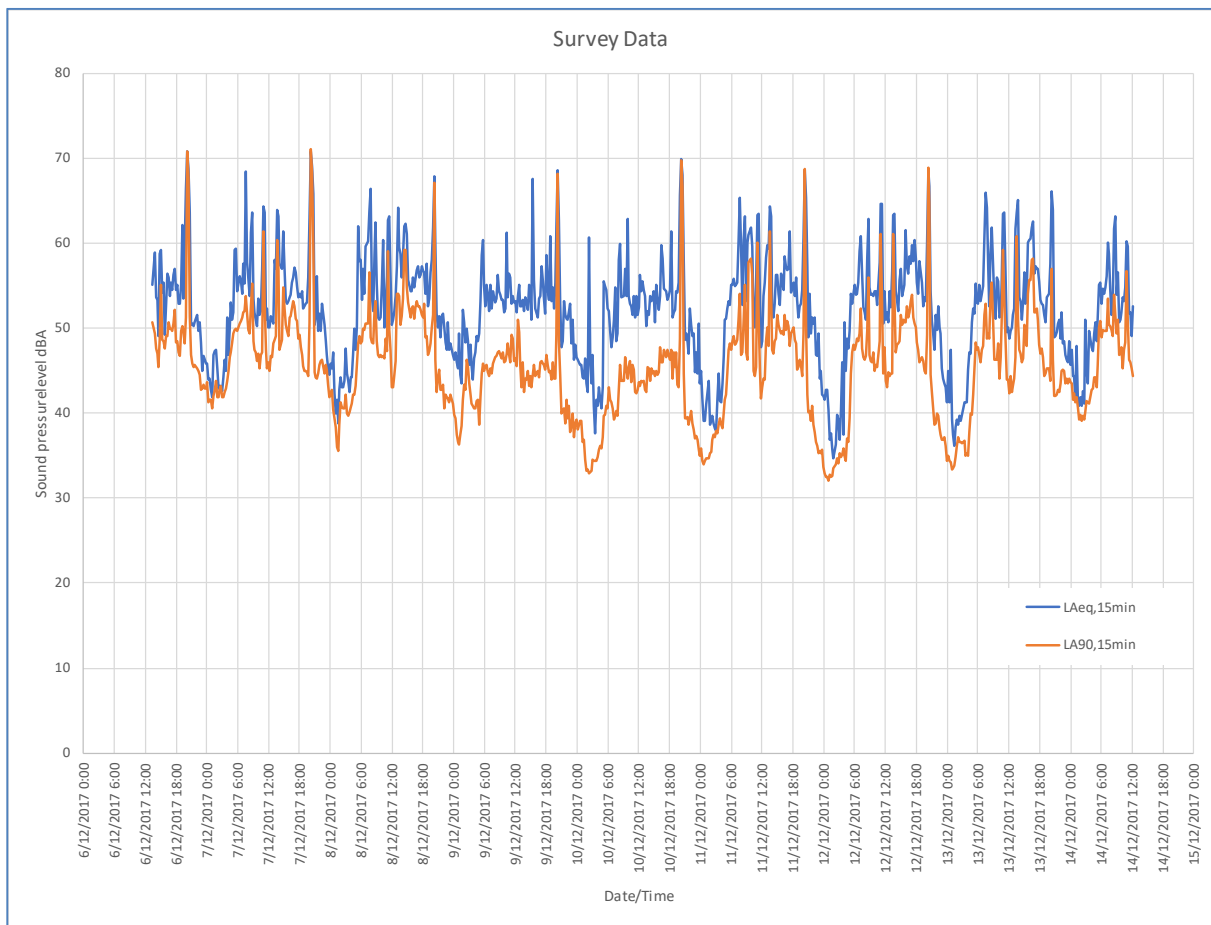


Figure 7 – Long-term noise level measurements (west)

The Tables below present the logarithmically averaged 15 minute L_{Aeq} values and typical L_{A90} values recorded across the whole survey periods. It can be seen that there is only slight variation in the noise levels across each daytime, evening, and night-time period³, at both locations.

Date	Averaged $L_{Aeq,15min}$ (dB)			Typical $L_{A90,15min}$ (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
23 June (Fri)	57.3	52.1	46.9	47.3	44.4	36.8
24 June (Sat)	54.1	50.0	47.5	42.9	42.9	33.8
25 June (Sun)	55.9	50.0	48.8	43.1	40.1	36.1
26 June (Mon)	55.8	49.9	48.2	43.1	40.2	37.6
27 June (Tue)	56.0	50.8	47.4	43.7	40.0	36.8
28 June (Wed)	54.7	52.0	48.3	46.3	41.5	37.2
29 June (Thu)	52.9	n/a	n/a	43.1	n/a	n/a

Table 1 – Averaged 15 minute noise levels (east)

³ Refer to Table 6 for definition of time periods.

Date	Averaged L _{Aeq,15min} (dB)			Typical L _{A90,15min} (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
06 Dec (Wed)	51.8	62.7	51.2	47.4	45.7	41.7
07 Dec (Thu)	58.6	62.5	51.7	46.2	44.3	39.0
08 Dec (Fri)	58.9	58.9	51.5	46.4	42.8	38.0
09 Dec (Sat)	55.9	59.6	50.6	44.0	44.0	33.4
10 Dec (Sun)	55.2	61.7	49.4	42.7	39.4	34.7
11 Dec (Mon)	58.9	59.6	49.1	44.5	40.2	32.6
12 Dec (Tue)	58.1	60.1	49.0	44.6	39.6	34.3
13 Dec (Wed)	59.1	57.6	49.7	43.9	42.1	39.8
14 Dec (Thu)	53.9	n/a	n/a	45.4	n/a	n/a

Table 2 – Averaged 15 minute noise levels (west)

The tables below summarise the average weekday and weekend hourly L_{Aeq} values and typical L_{A90} values for both the eastern and western monitoring locations, based on the values given above.

Date	Averaged L _{Aeq,15min} (dB)			Typical L _{A90,15min} (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	56	51	48	45	41	37
Weekend	55	50	48	43	42	35
Combined	55	51	48	44	41	36

Table 3 – Averaged weekday and weekend noise levels (east)

Date	Averaged L _{Aeq,15min} (dB)			Typical L _{A90,15min} (dB)		
	Daytime	Evening	Night	Daytime	Evening	Night
Weekday	58	61	50	45	42	38
Weekend	56	61	50	43	42	34
Combined	57	61	50	45	42	38

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

3.5.2 Attended measurements

Attended measurements indicated a typical average noise level of 62 dB L_{Aeq} at a location approximately 7 m from the centre of the road. As the most exposed façade will be set back approximately 20 m from the centre of the road, an attenuation due to the additional distance needs to be applied to obtain the expected façade noise level.

Due to the low number of vehicles passing the measurement point, each can be considered as a separate point source and therefore the correction to measured levels can be determined as follows:

- Attenuation = $20 \times \log_{10}[7/20] = -9$ dB

The typical average noise level at the most exposed (nearest) façade would therefore be expected to be approximately 53 dB L_{Aeq}.

4 Internal acoustic criteria

4.1 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})	Room type	Design sound level range (dB L _{Aeq,T})
Classroom	≤ 35	Office – General	≤ 40
Open-plan teaching	≤≤40	Office – Admin	≤ 35
Computer rooms	≤ 40	Toilet	≤ 55
Staff room	≤ 40	Corridors & Lobbies	≤ 45

Table 5 – Internal noise level requirements

4.2 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 be achieved in all noise-sensitive spaces.

4.3 Acoustic design recommendations

Daytime noise levels monitored are objectively moderately low, even at the nearest proposed façade. To comply with the internal noise criteria given in Section 4.2, 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 daytime measurement data of 59 dB L_{Aeq}, rooms will need to provide a glazing attenuation performance of 24 dB R_w+C_{tr} to adequately control intrusiveness of road traffic noise.

This level of performance can be easily 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.

5 External plant noise emissions

It is understood that the development proposals include assisted mechanical exhaust/ventilation (but not A/C units), 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	07:00 – 18:00 hours
	Sunday, Public Holiday	08:00 – 18:00 hours
Evening	Monday-Sunday	18:00 – 22:00 hours
Night	Monday-Saturday	22:00 – 07:00 hours
	Sunday, Public Holiday	22:00 – 08:00 hours

Table 6 – 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.

5.1 Selection of noise sensitive receivers

The existing buildings most affected by potential noise from the development are the adjacent residential properties on Merrylands Road, both to the east (adjacent to the proposed teaching block) and to the west (adjacent to the proposed administration/staff block).

5.2 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 (east)	Day	43	48
	Evening	41	46
	Night	37	42
Nearest residential properties (west)	Day	45	50
	Evening	42	47
	Night	36	41

Table 7 – Derivation of Intrusiveness Criteria

5.3 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	Classification	Time period	Existing noise level dB L _{Aeq} ⁴	ANL ⁵ dB L _{Aeq}	Modification factor ⁶ dB	Amenity Criterion dB L _{Aeq}
Nearest residential properties (east)	Suburban	Day	55	55	ANL – 8	47
		Evening	51	45	L _{Aeq} – 10	41
		Night	48	40	L _{Aeq} – 10	38
Nearest residential properties (west)	Suburban	Day	57	55	L _{Aeq} – 10	47
		Evening	61	45	L _{Aeq} – 10	51
		Night	50	40	L _{Aeq} – 10	40

Table 8 – Derivation of Amenity Criteria

5.4 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	Classification	Time period	Intrusiveness Criterion	Amenity Criterion	Project-specific Criterion dB L _{Aeq,15min}
Nearest residential properties (east)	Suburban	Day	48	47	47
		Evening	46	41	41
		Night	42	38	38
Nearest residential properties (west)	Suburban	Day	50	47	47
		Evening	47	51	47
		Night	41	40	40

Table 9 – Project-specific noise levels

5.5 Acoustic design recommendations

The development proposals include assisted mechanical exhaust/ventilation (but not A/C units). It is understood that A/C will be provided to Comms Rooms (1 unit to the Admin Block and up to 5 units associated with the Learning Block).

Noise from any mechanical plant should be specified and controlled to meet the criteria given in Table 9 when assessed at the nearest affected noise-sensitive location.

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.

⁴ Ref: Lowest values recorded in Table 3 above.

⁵ Ref: Acceptable Noise Level for suburban residences, according to Table 2 of NSW INP, 2000.

⁶ Ref: According to Table 2.2 of NSW INP, 2000.

5.5.1 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 understood that there are no changes proposed to existing waste collection services.

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.

6 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 children activity noise from schools and the local DCP does not reference educational facilities other than childcare centres.

6.1 Current noise impacts

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

6.2 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.

6.3 Increase in student numbers

The proposed upgrades will provide for 184 additional students (approximately 25% 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 25% would result in a change to the overall noise level of less than 1 dB.

6.4 Change in activities

The proposals do not include new spaces with a high level of activity noise (such as music rooms). As such, it is not anticipated that the sounds of general school activity will be significantly altered by the proposed scheme.

6.5 Relocation of COLA

It is noted that the EFSG⁷ 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.

However, the slightly relocated COLA will benefit from additional shielding by the proposed new buildings, when viewed from adjacent residential properties. There should therefore be no adverse effect associated with the proposals, when considering activity noise associated with the COLA at nearby noise sensitive receptors.

6.6 School bell / announcement system

As noted above, adjacent noise-sensitive dwellings will already be acclimatised to the existing sounds of general school activities, including school bell. However, it is noted that the proposed new student Learning Block will be located nearer to residential properties to the east of the site 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 residential façades, where this is practicable. The use of bells/loudspeakers with a reduced sound level may also be considered where there is close proximity to residential properties.

6.7 Waste collection services

It is not anticipated that the proposals will result in 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.

6.8 Use of temporary demountables

Proposals are for the use of demountable classrooms during the construction works, and these are to be located to the west of the site.

To minimise noise impact associated with the use of demountables, 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 0 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 Ref: NSW Department of Education DG11 – Acoustics, Section 11.04 Noise Emission (To The Environment).

6.9 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.

6.10 Out of hours usage

Regular community use of the new school buildings, particularly outside of school hours, is considered unlikely given the proposed new facilities (i.e. learning areas and administration). Any associated noise impact should therefore be avoided and no additional assessment is considered necessary.

6.11 Conclusions

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.

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 regular out of hours community usage associated with the new facilities. It is also noted that typical school activity noise will also be limited to the daytime period and would be unusual at weekends or public holidays.

7 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 development⁸.

The report notes that Greystanes Public 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. It is noted that existing staff parking areas are at capacity and 13 spaces are to be removed as part of the site development, however the report concludes that there is sufficient space on the adjacent streets for these and the eight additional staff vehicles forecast. It is noted that additional student drop-off / pick-up demand generated can easily be accommodated within the adjacent streets.

The proposed upgrades include a net increase of eight teaching spaces, accommodating 184 additional students and an assumed eight additional staff. A total of 76 additional vehicular trips are forecast. The Traffic and Transport Assessment concludes that 'minimal impact on the local road network due to the additional traffic generated' is expected.

7.1 Road traffic assessments

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 volume of more than 40,000 vehicles (based on traffic data published by the RMS).

Traffic volume maps for Infrastructure SEPP assessments are provided on the Roads and Maritime website⁹, however Merrylands Road does not fall on or near any routes where traffic count data is provided. The nearest location is approximately 2.8 km to the south-west and relates to Victoria Street – an AADT¹⁰ of 5716 is reported (west-bound) at this location. It is expected that an AADT of no greater than this value would be expected at the location of the development site.

The site is therefore not located adjacent to a major road corridor and assessment against the criteria outlined in the ISEPP (derivation of appropriate noise control treatments for the building envelope) is therefore not required.

⁸ Ref: Arup document 254846-00 Rev C, November 21 2017.

⁹ Ref: <http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/index.html>

¹⁰ AADT = Annual Average Daily Traffic flow. This is the total volume of traffic using a road for a year, divided by 365.

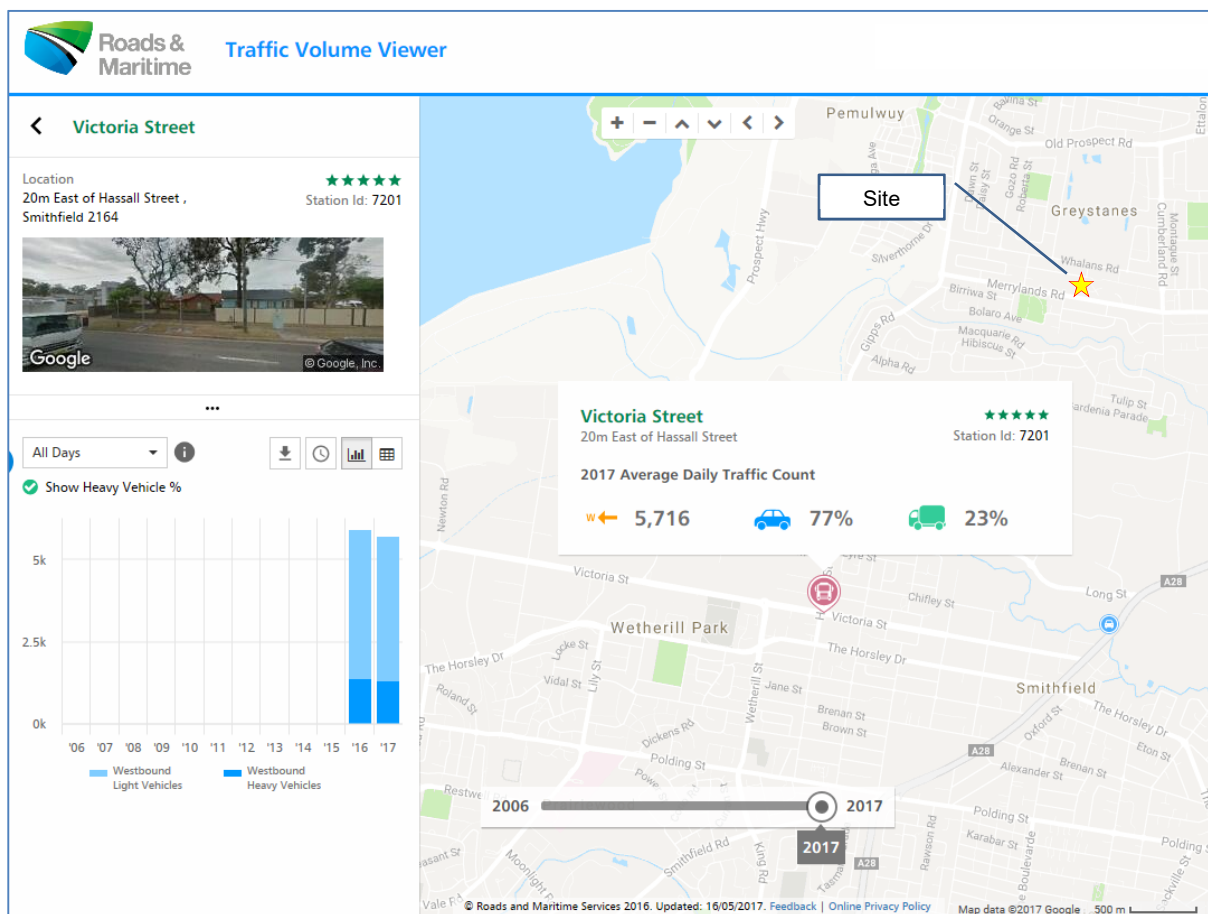


Figure 8 - Reported annual average daily road traffic volume

7.2 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 roads surrounding the school, however it is not anticipated that an additional 76 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.

7.3 Conclusion

It is not considered that there will be any significant change in road traffic noise generation on the basis of 76 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.

8 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.

8.1 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.

8.2 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 10 – Recommended standard hours of work

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	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> • 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	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ 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) ○ 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. <ul style="list-style-type: none"> 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 11 – Noise at residences using quantitative 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 12 – Noise at schools using quantitative 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.

8.3 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 ¹¹	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 13 - Preferred and maximum weighted rms values for impulsive vibration acceleration (m/s²) 1-80 Hz

¹¹ Daytime is 7:00 am to 10:00 pm.

9 Conclusions

This report presents acoustic input to the DA submission for the proposed development at Greystanes Public School.

It is noted that the school will be State Significant Development (Application number SSD 8778), 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.

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 determined that standard glazing solutions should provide an acceptable environment within the development.

Prevailing noise levels at positions considered equivalent to the nearest residential properties to the east (adjacent to the proposed teaching block) and to the west (adjacent to the proposed administration/staff block) 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/NPI, to see that any 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, and local A/C units to Comms Rooms.

Consideration has been given to the potential for change in activity noise due to an increased number of students, potential change in school activities, relocation of the COLA, 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. It is not expected that there will be regular out of hours community use of the new facilities.

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_{Aeq} . 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} , L_{A90} etc. The reference time period (T) is normally included, e.g. $L_{A10,5min}$ or $L_{A90,8hr}$.

$L_{A90}(T)$

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 as the background noise level.

$L_{A10}(T)$

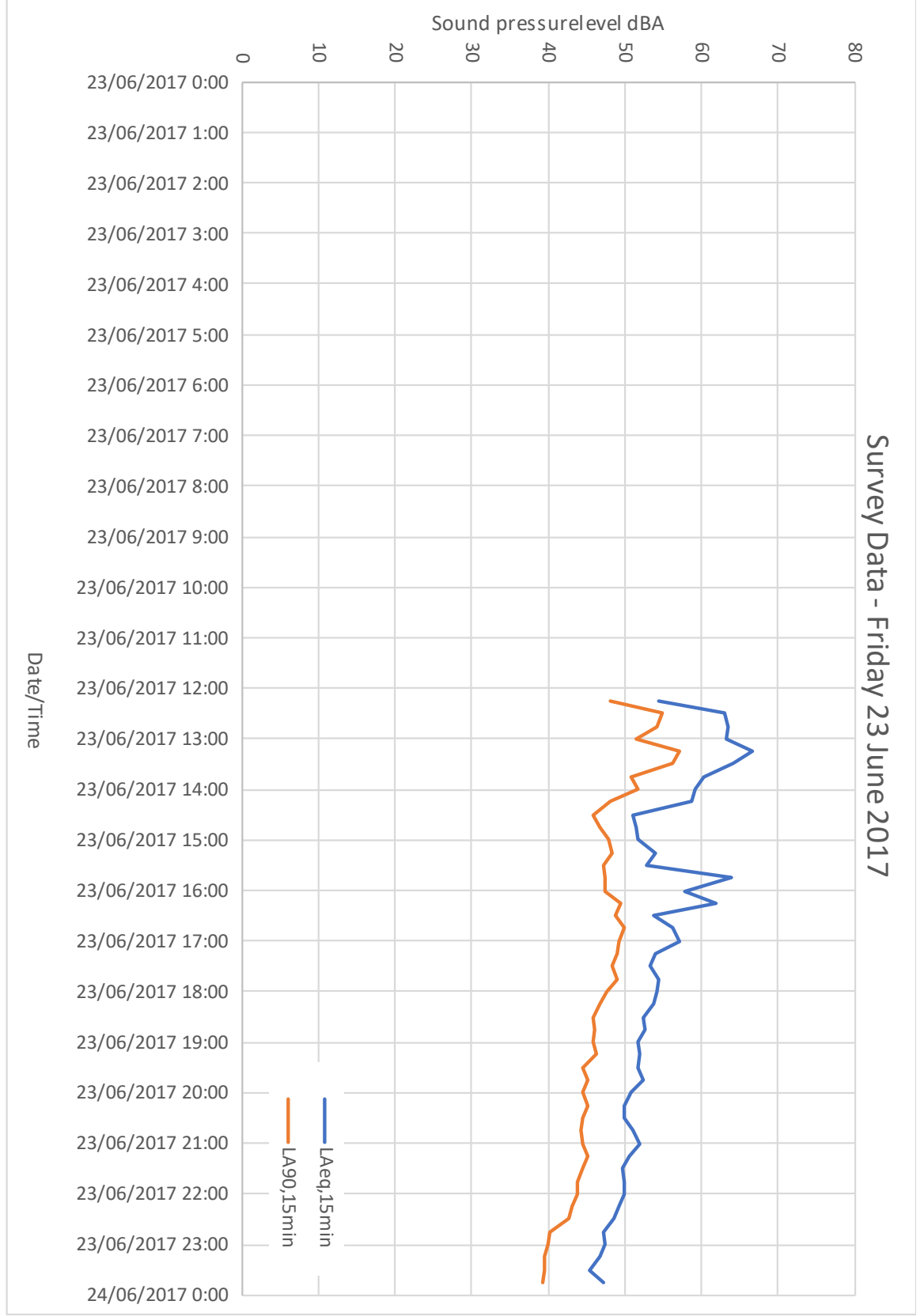
Refers to the sound pressure level measured in dBA, exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

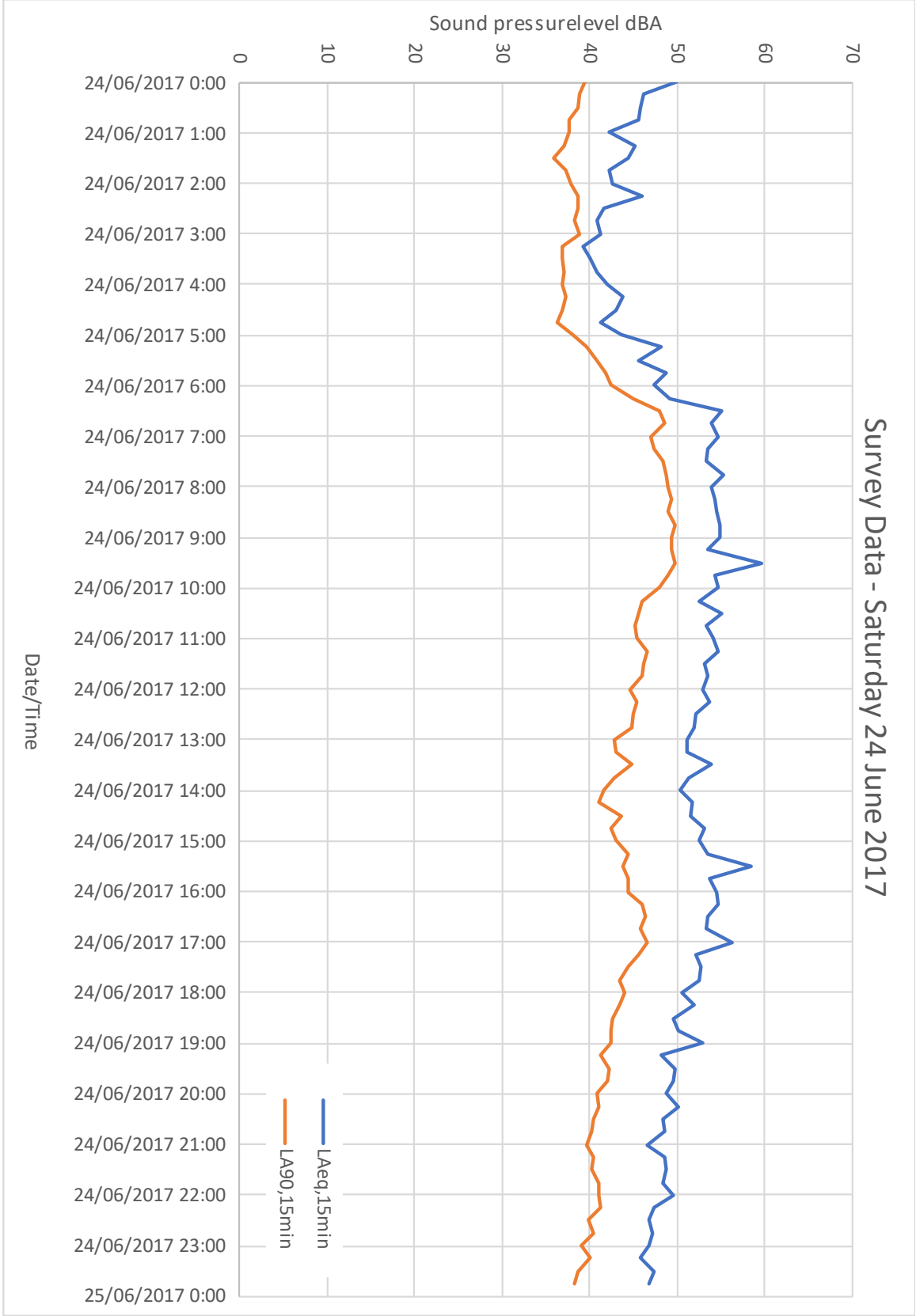
$L_{A1}(T)$

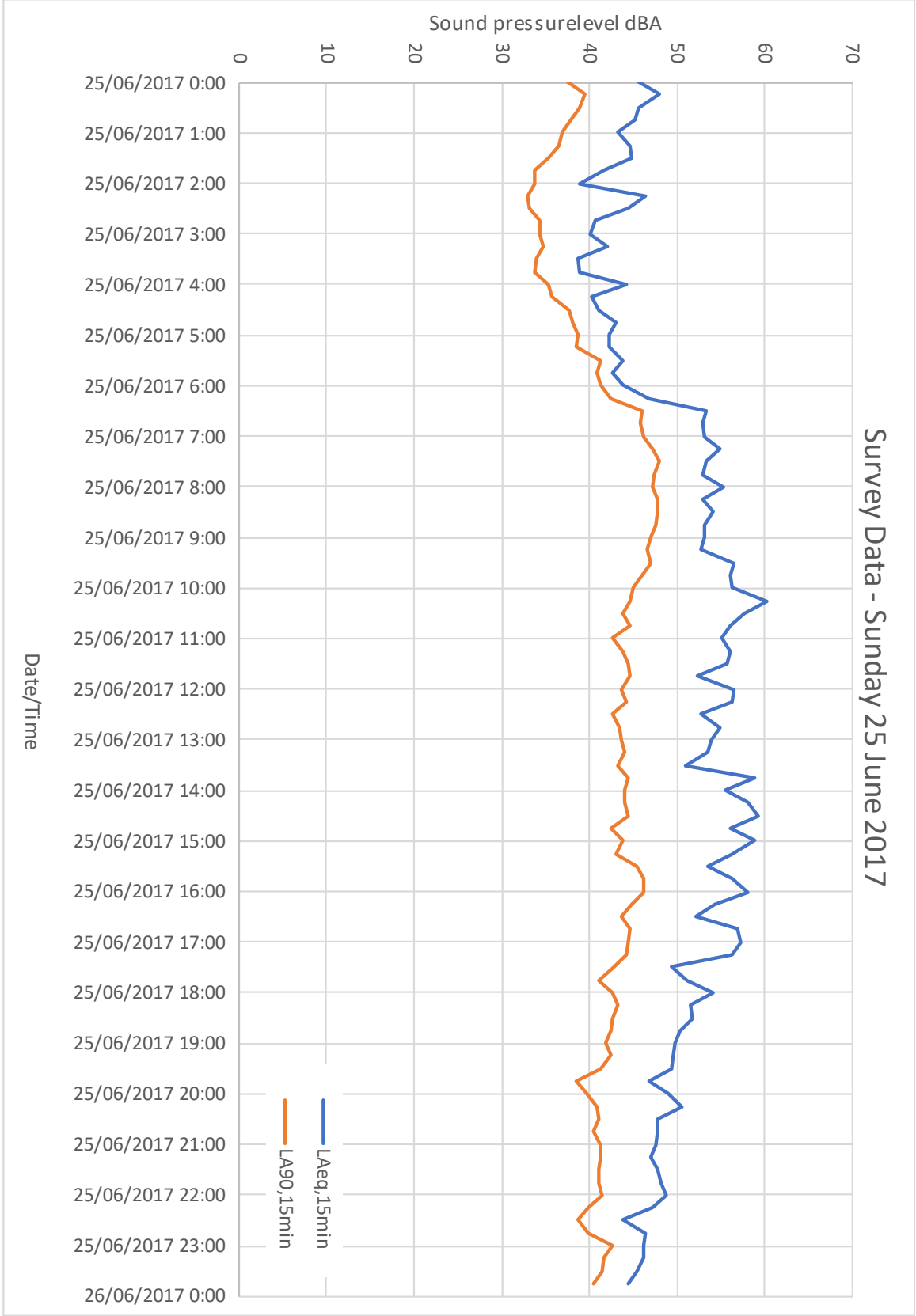
Refers to the sound pressure level measured in dBA, exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.

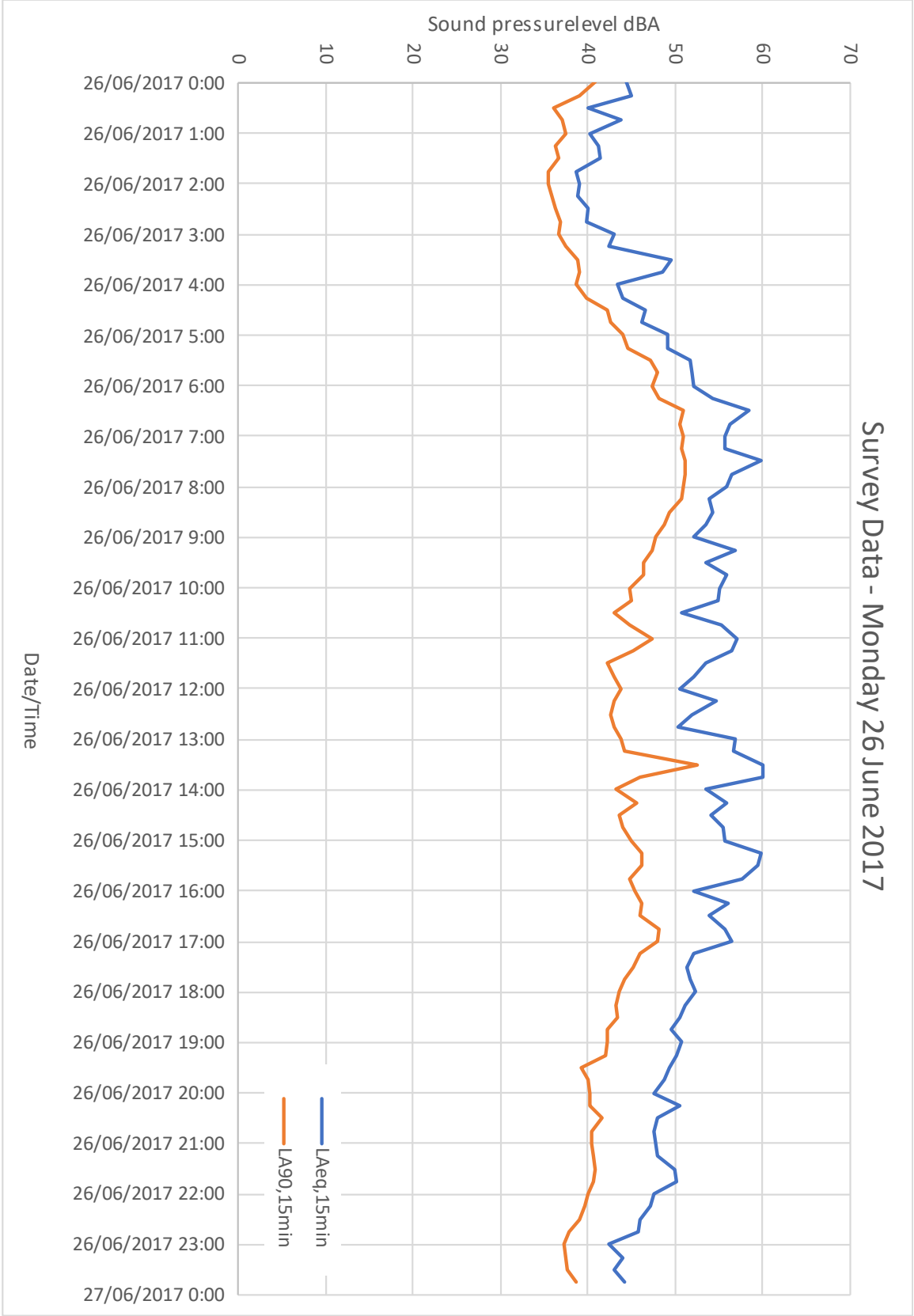
Appendix B Daily noise survey data

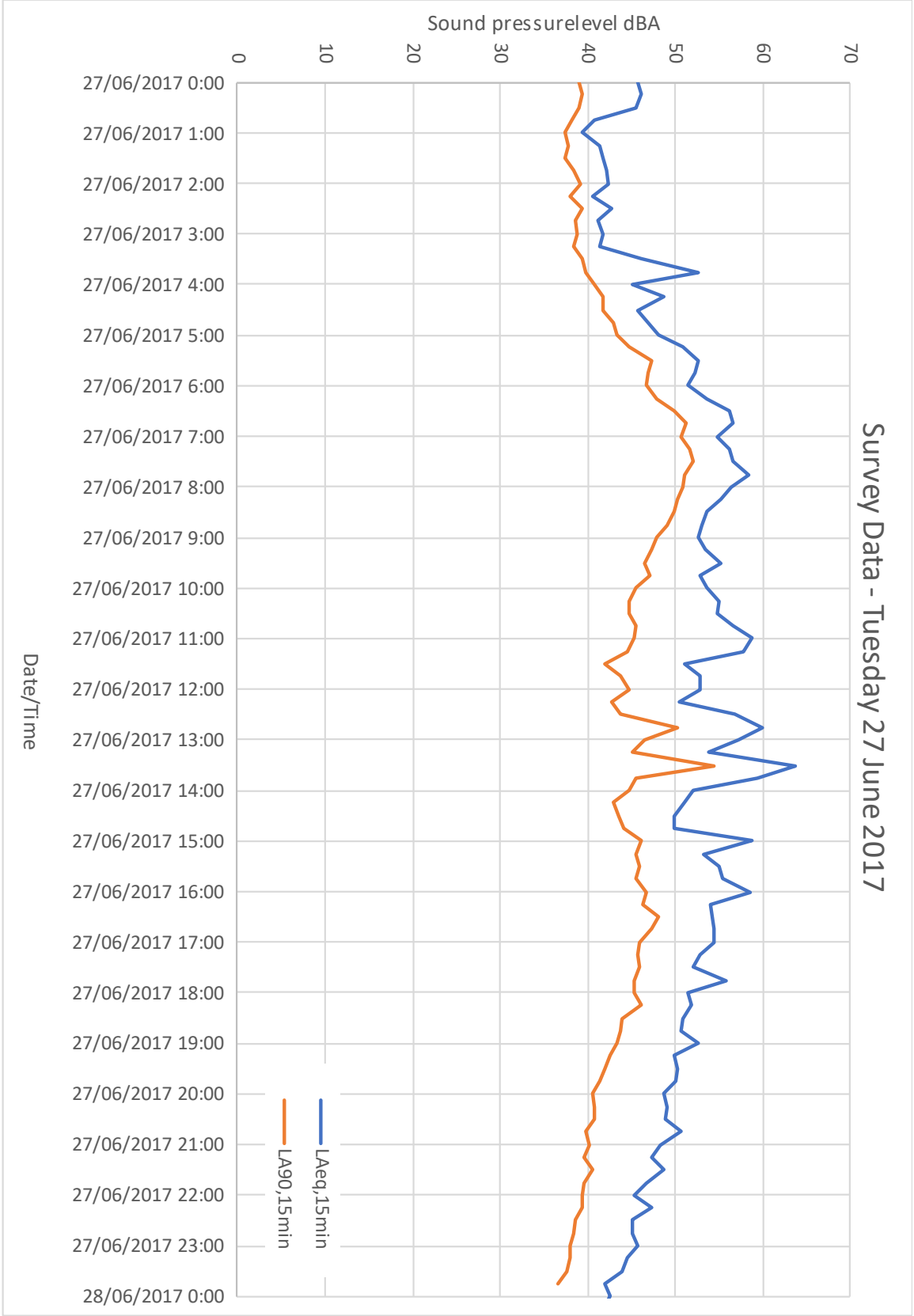
The following charts provide daily data for the unattended noise sampling that was undertaken.

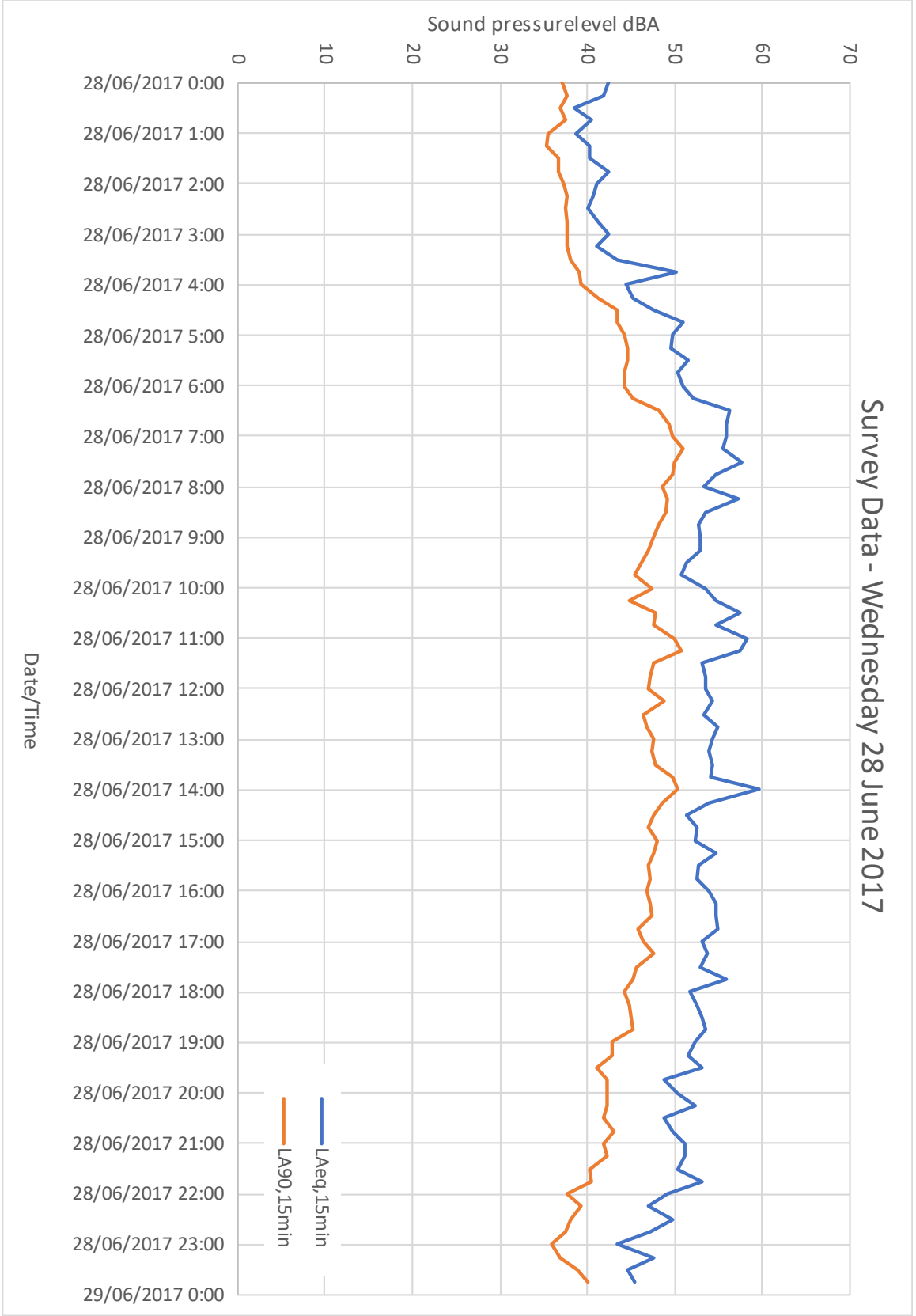


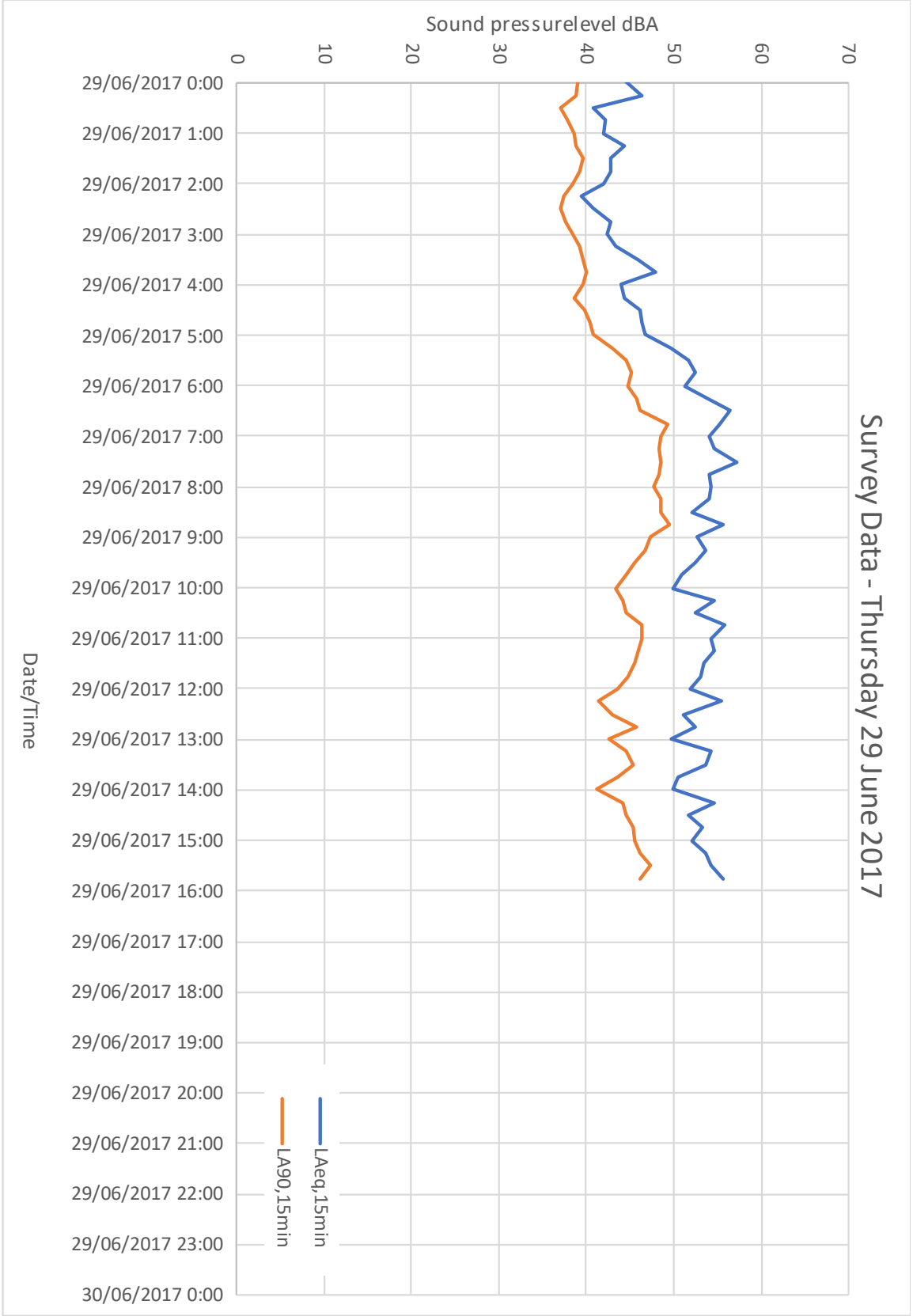


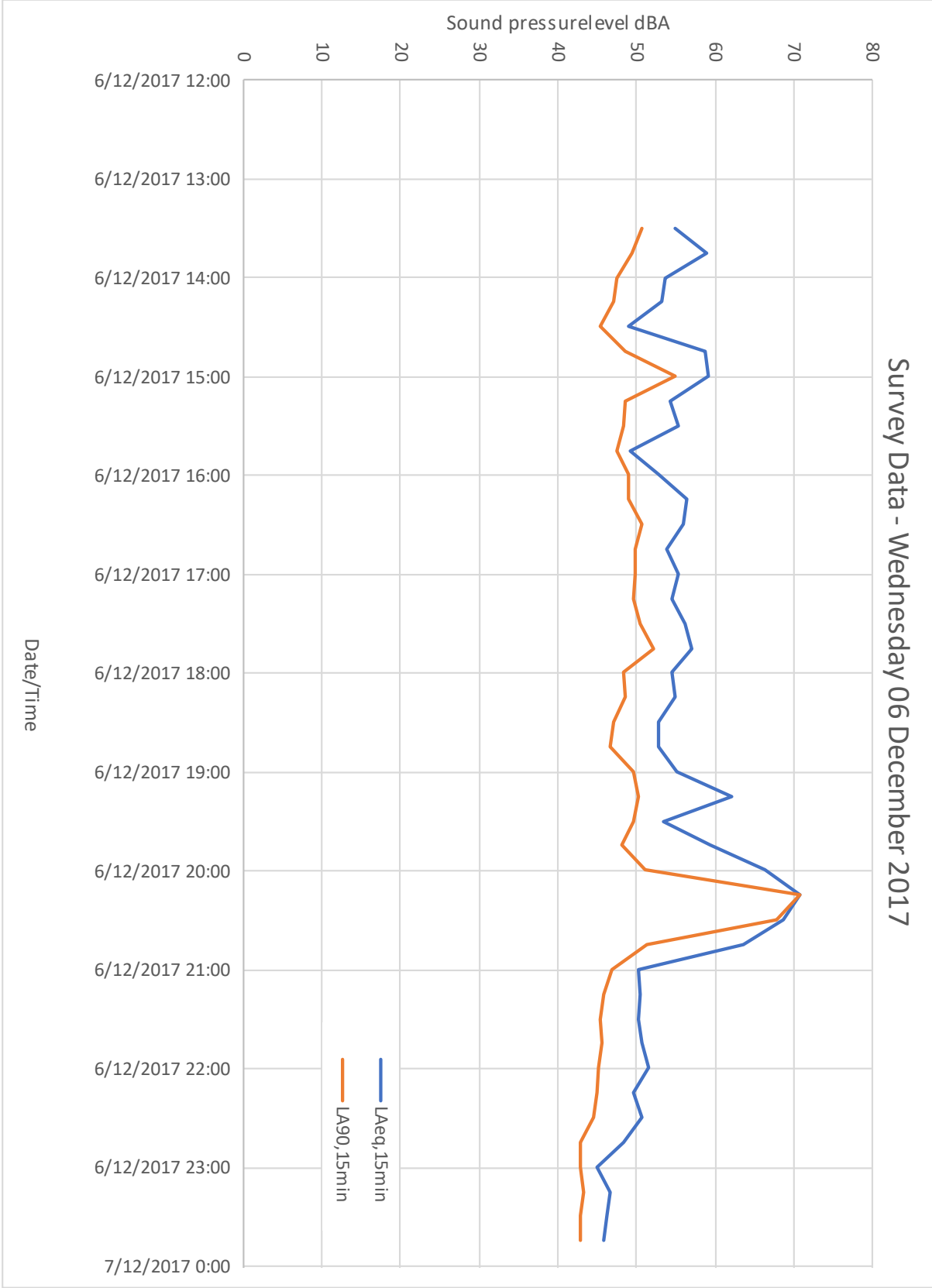


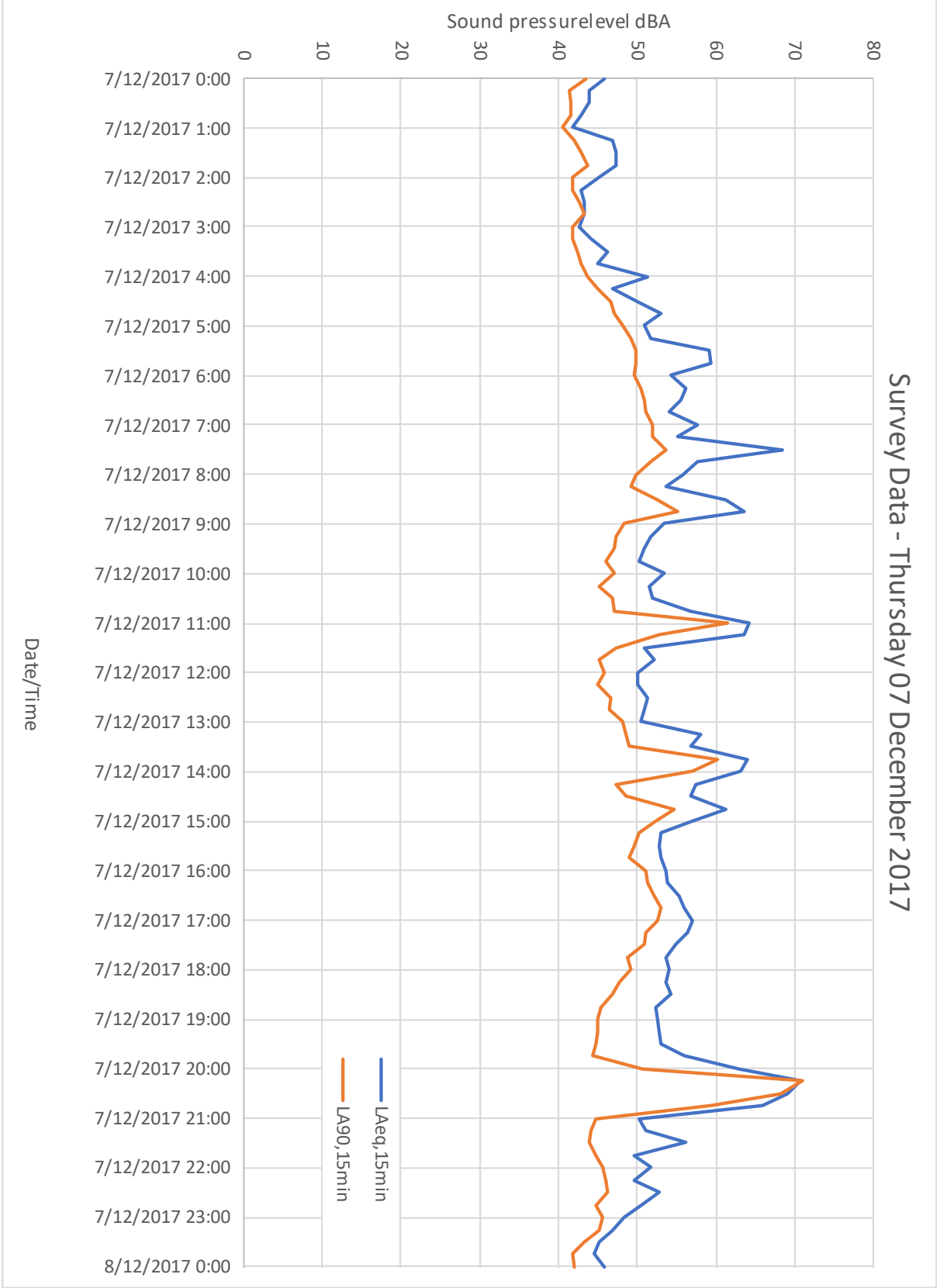


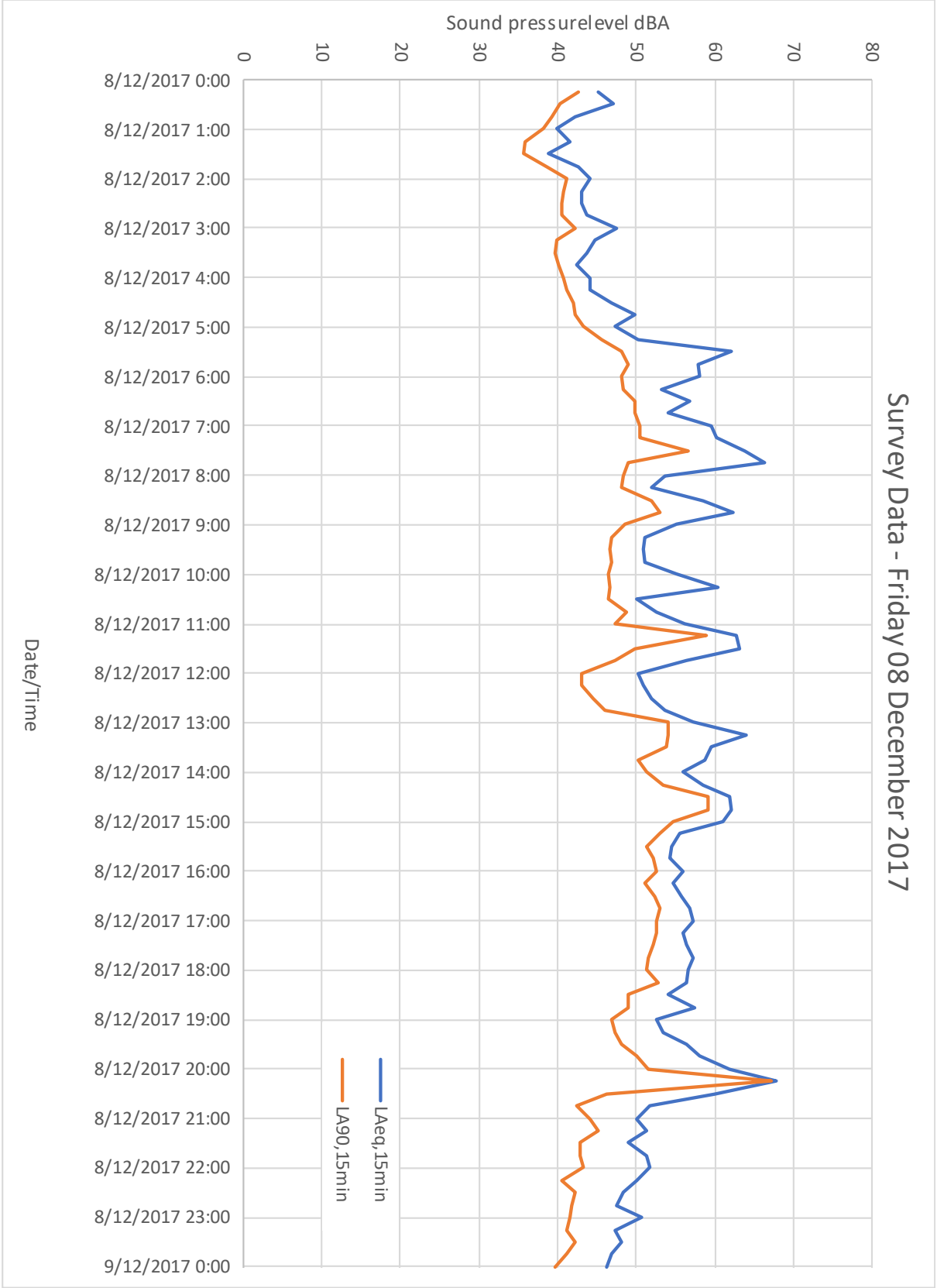


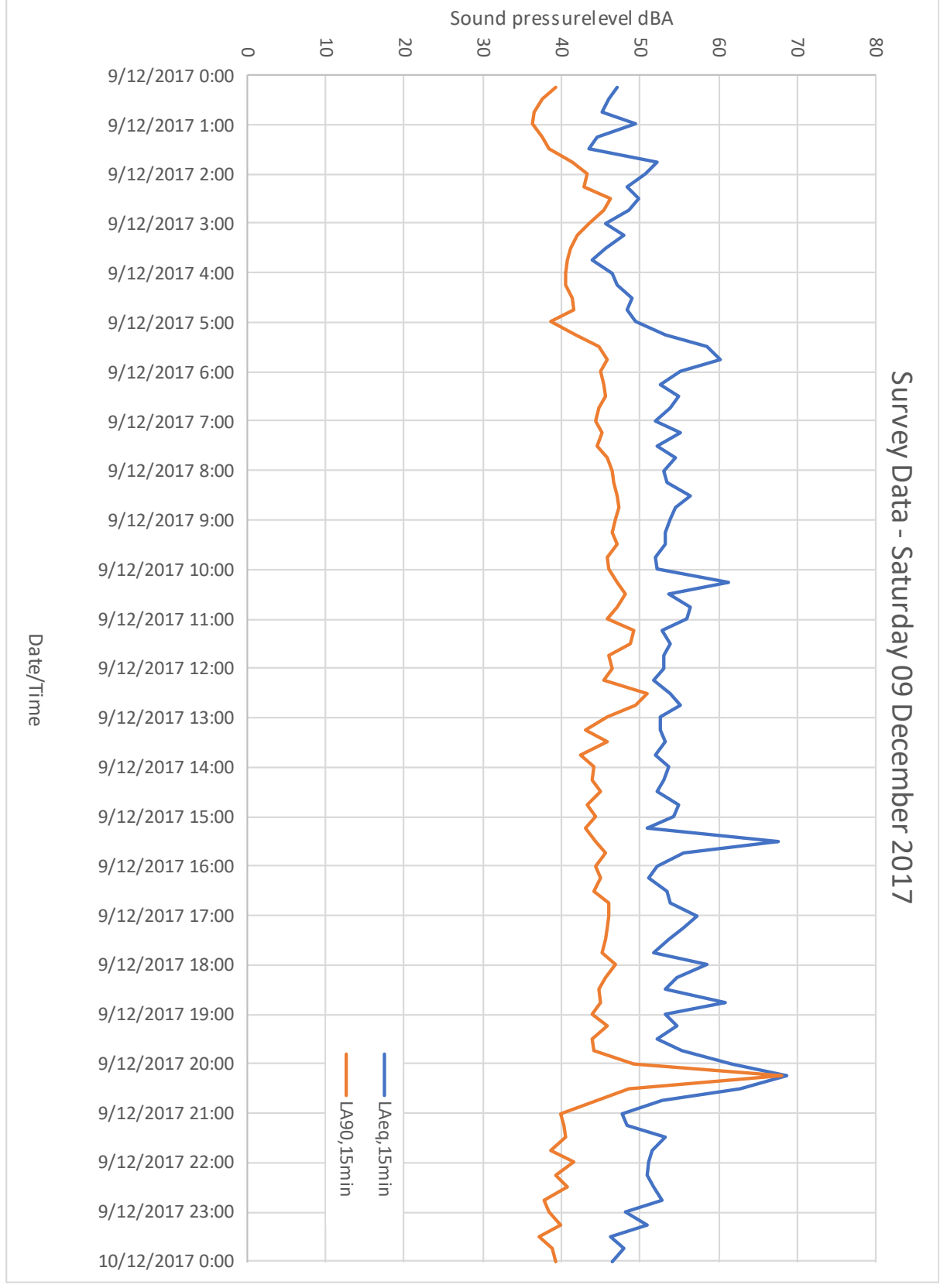


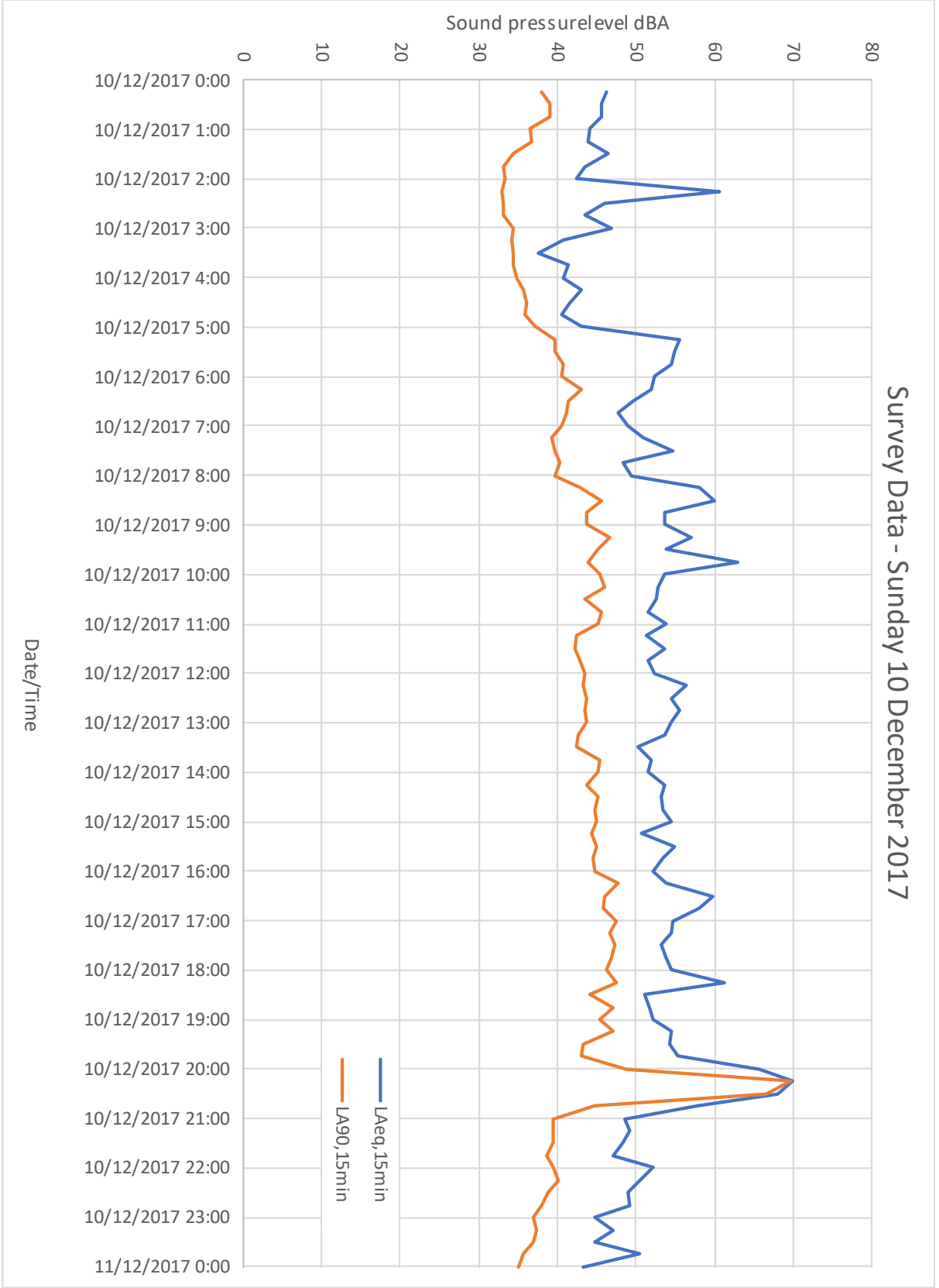


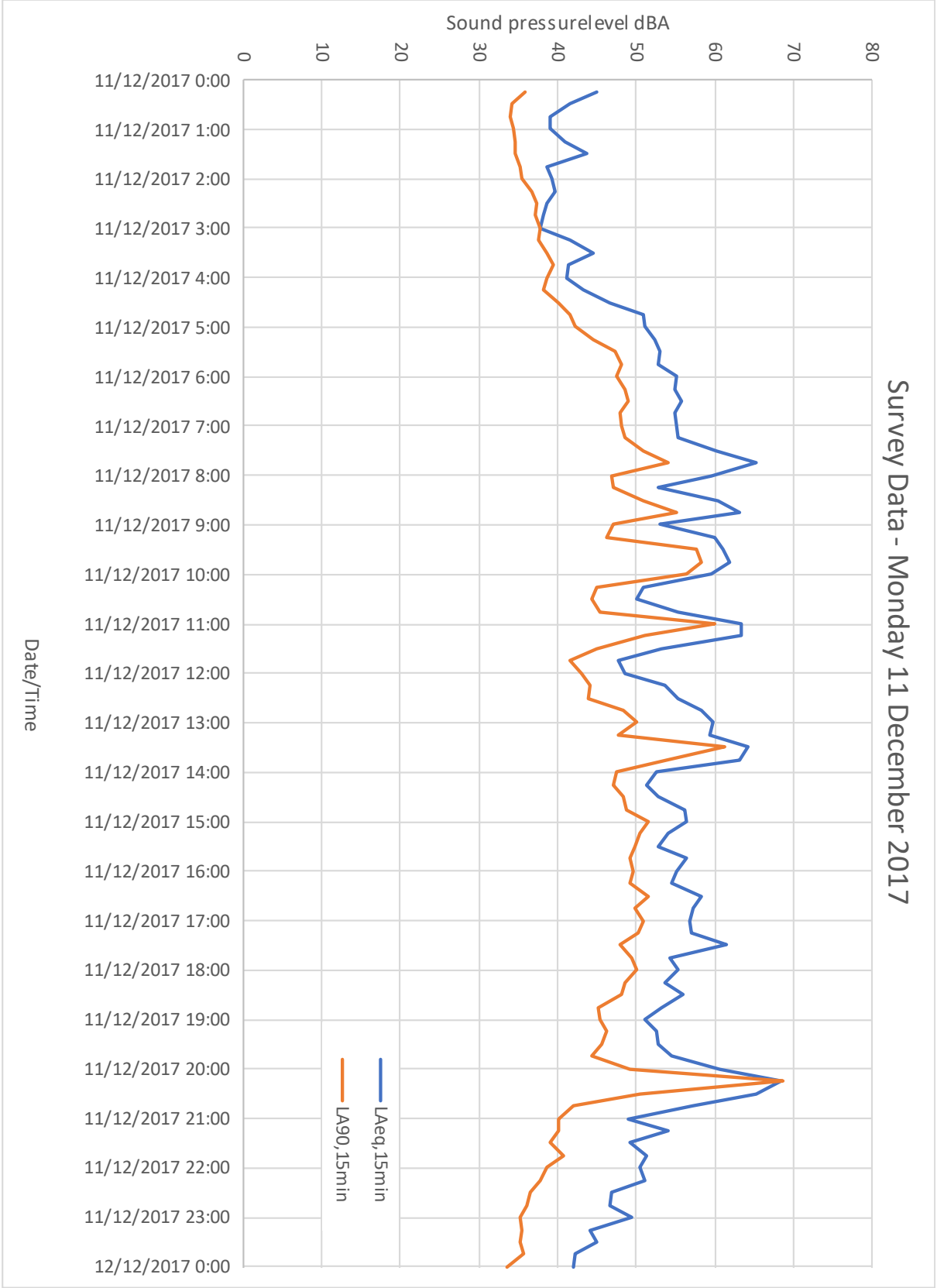


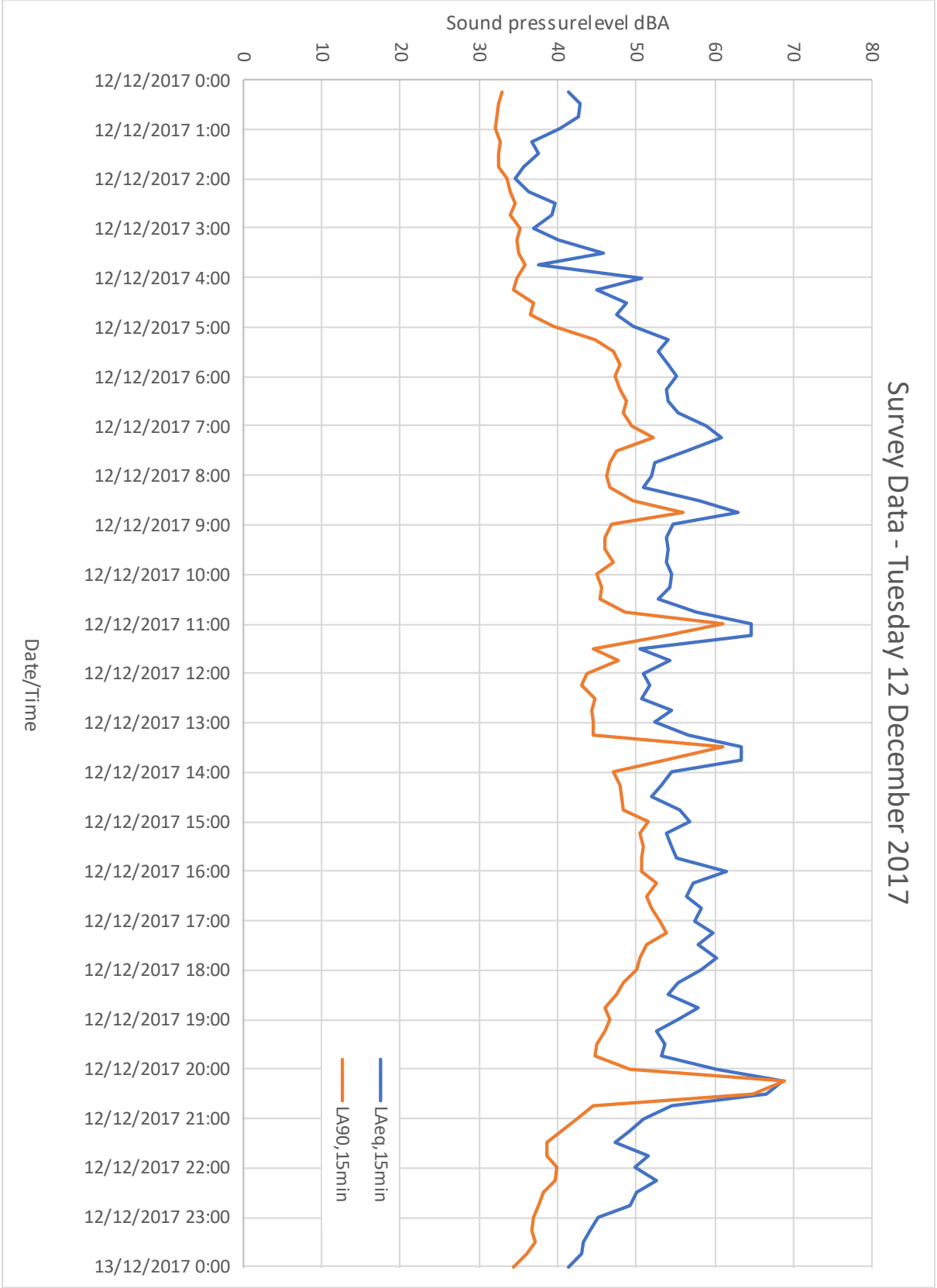












Survey Data - Tuesday 12 December 2017

