Australian Nursing Home Foundation (ANHF)

ANHF Gordon

Acoustic review for Development Application

AC02

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Job number 258152-00

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Contents

Appendices

1 Introduction

Arup has been engaged by the Australian Nursing Home Foundation (ANHF) to carry out an acoustic review, and additional assessment where required, of the proposed residential care facility to be located at 25, 25A and 27 Bushland Avenue, Gordon.

The application is currently before the Sydney North Planning Panel (SNPP) and there are contentions relating to acoustics that need to be addressed.

An acoustic assessment for the applicant was prepared by Rodney Stevens Acoustics (RSA), dated 4 July 2017 (ref 150263R1, revision 3).

This report has been subject to review by Acoustic Logic Consultancy (on behalf of local residents, ref: 20170826.1/0801A/R0/TT, dated 1 August 2017) and The Acoustic Group (on behalf of Ku-ring-gai Council, ref: 47.5289.R1:MSC, dated 21 September 2017).

From review of the RSA report, we generally concur with the ALC and TAG reports, that there are matters requiring further clarification, discussion and/or assessment. These are summarised as:

- Clarification of long-term noise monitoring results and establishment of project noise goals,
- Car and bus operational noise, particularly movements on the basement car park access ramp, and
- Use of common areas and balconies.

The items above have been discussed in the subsequent sections.

2 Noise monitoring and project criteria

Raw measurement data has been obtained from RSA and processed in accordance with the procedures outlined in Appendix B of the NSW EPA Industrial Noise Policy (INP).

2.1 Noise measurement locations

Noise measurements are ideally carried out at the nearest or most potentially affected locations surrounding a development. An alternative, representative location should be established in the case of access restrictions or a safe and secure location cannot be identified. Furthermore, representative locations may be established in the case of multiple receivers as it is usually impractical to carry out measurements at all locations surrounding a site.

For the subject development, the long-term measurement locations utilised by RSA are outlined in Table and shown in Figure 1. It is noted that the locations as depicted in Figure 1 are approximate based on the RSA report. The locations are considered appropriate and representative of the surrounding residential receivers.

Table 1: Noise monitoring locations

ID	Address	Description
L1	25 Bushlands Avenue, Gordon	Front yard in the free-field
L2	25 Bushlands Avenue, Gordon	Rear Yard in the free-field

Figure 1: Site and noise monitoring locations

2.2 Long-term noise measurement results

Long-term noise monitoring was carried out from Friday, 7 August 2015 to Friday 14 August 2015. Table presents the overall single Rating Background Levels (RBL) and representative ambient L_{Aeq} noise levels for each assessment period, determined in accordance with the NSW INP.

The results as presented in Table 2 align with the observations made by ALC and TAG relating to the graphical results presented in the RSA report.

Graphical outputs and summary are presented in Appendix A.

Table 2: Long-term noise monitoring results, dB(A)

Location	Time period	Rating background noise levels, dBL_{A90}	Ambient dBL_{Aeq} noise levels
L1 – Front yard	Day	38	62
	Evening	36	48
	Night	31	44
L2 – Back yard	Day	39	57
	Evening	38	45
	Night	33	45

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
Evening: 18:00-22:00 Monday to Sunday & Public Holidays
Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

2.3 Noise targets

2.3.1 Intrusiveness criteria

Consistent with all reports, criteria is in accordance with the NSW INP. As identified in the RSA report, the intrusiveness criterion is the determining assessment criteria. The intrusiveness criterion, applicable only to residential receivers, is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level (RBL) plus 5 dB

As there was only slight variation in background noise levels at the two monitoring locations, the lowest levels have been adopted for all receivers, as summarised in Table 3.

It is noted that criteria have been established for two shoulder periods, time periods to reflect the times that the Community bus will be utilised. The prevailing background levels during the identified periods have been analysed. For the 10 pm to 11 pm period, while the calculated background level was higher than the evening period, the noise goals have been established from the evening period results. For the 6 am to 7 am period, the results reveal a higher background level to the day, which can be observed in the graphical results, presumably a result on an early morning peak period for distant traffic.

Table 3: Project intrusive noise goals, dB(A)

Assessment location	Time period	Rating background noise levels, dBL_{A90}	Intrusiveness criteria, $L_{Aeq(15minute)}$
All residential receivers	6 am to 7am	44	49
	Day	38	43
	Evening	36	41
	10 pm to 11 pm	37 (36)	41
	Night	31	36

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
Evening: 18:00-22:00 Monday to Sunday & Public Holidays
Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

2.3.2 Sleep disturbance

Noise emanating from project has been assessed for its potential to disturb sleep, for which criteria apply for operations between 10 pm and 7 am.

In accordance with current NSW EPA policy (http://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/nsw-industrial-noise-policy/applying-industrial-noise-policy), the sleep disturbance criteria of $L_{A1(1min)} \leq L_{A90(15min)} + 15$ dB(A) is to be used for initial assessment. The L_{Amax} may be used as an alternative to the $L_{A1(1min)}$. It is noted that the background $L_{A90(15minute)}$ noise level used for establishing the sleep disturbance criteria includes all background noise including noise from the project.

The NSW Road Noise Policy, while relating more specifically to traffic on the road network, outlines that research on sleep disturbance to date concludes:

- L_{Amax} (the maximum A-weighted noise level) internal noise levels below 50–55 dB(A) are unlikely to awaken people from sleep (corresponding to approximately 60-65 dB(A) external); and,
- One or two noise events per night, with maximum internal noise levels of 65–70 dB(A) (corresponding to approximately 75-80 dB(A) external), are not likely to affect health and wellbeing significantly.

The sleep disturbance criteria for the project are presented in Table 4.

Table 4: Sleep disturbance criteria

Assessment location	Time period	Rating background noise levels, dBL_{A90}	Sleep disturbance criteria, $L_{A1,1min}$, dB(A)	
			L_{A90} + 15 dB	Minimum level
All residential receivers	10 pm to 11 pm	37 (36 evening)	51	60
	11 pm to 6 am	31	46	60
	6 am to 7 am	44	59	60

3 On-site vehicular noise assessment

The ALC and TAG reports both sought clarification on the assessment carried out for vehicular movements on-site, which centres around light vehicle and community bus movements to and from the basement car park.

Access to the sites basement car park is proposed via a ramp at the western end of the site, neighbouring 29 Bushlands Avenue and opposite 32 Bushlands Avenue (see Figure 2).

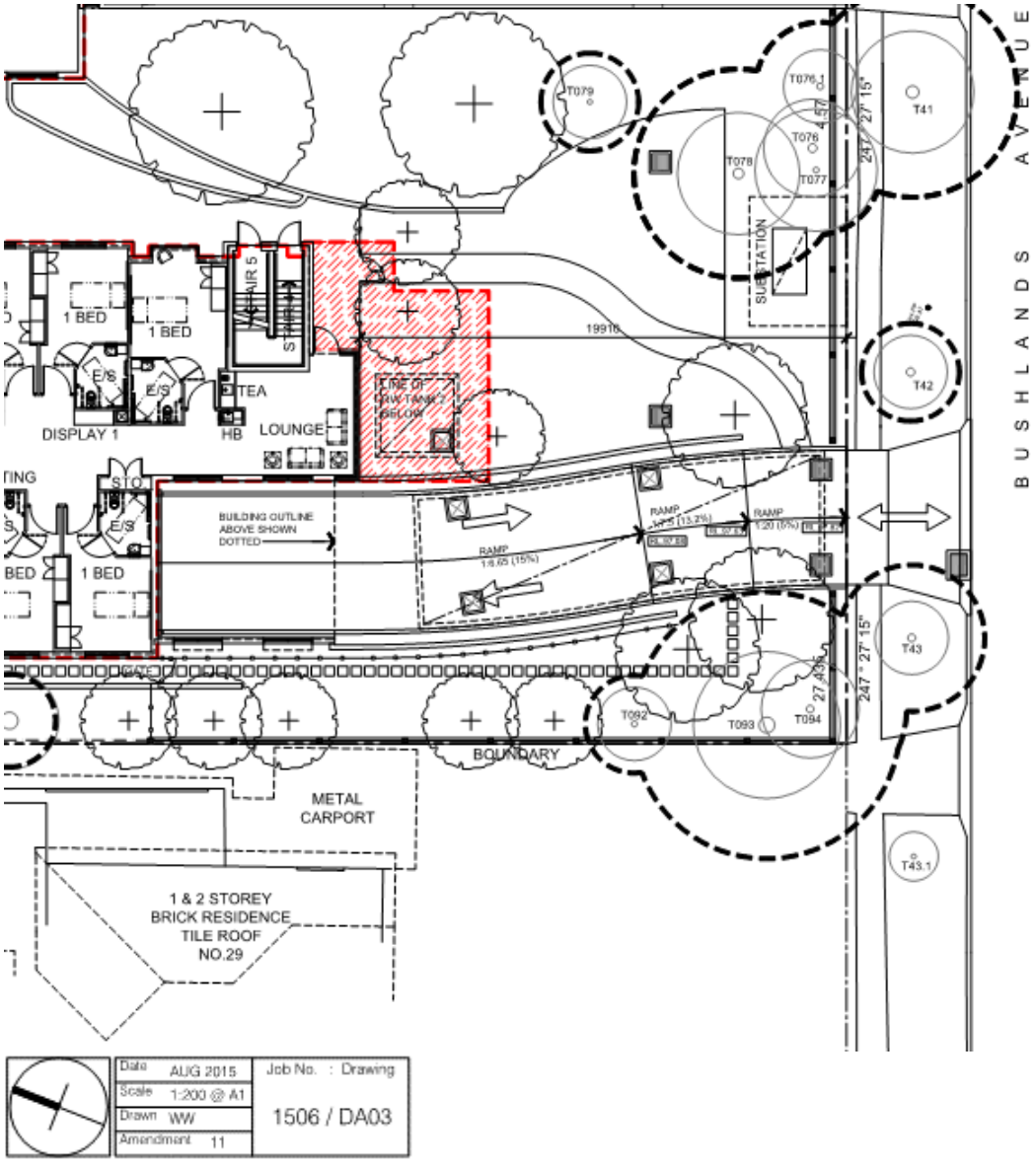

Figure 2: Lower Ground Floor Plan (Boffa Robertson)

3.1 Basis of assessment

The following information has been relied upon for the assessment:

- Boffa Robertson DA architectural drawings. Drawings relating to the car park are included in Appendix B.
- Plan of Management (ANHF), May 2017: EP15-18/ANHF Plan of Management
- Traffic Report: The Transport Planning Partnership, Report 15002 V03, 26/05/2017

From the above documents, the following assessment inputs have been utilised for the assessment:

- Noise predictions required to both 29 Bushlands Avenue and 32 Bushlands Avenue. While 29 Bushlands Avenue is in closer proximity, it is afforded some acoustic shielding from the ground level building envelope (over part of the ramp) and a 1.8 m high boundary fence, assumed to run along the full length of the western site boundary.
- The car park provides for 31 car spaces with one loading bay, one ambulance bay and one bay for the 21-seater community bus.
- Waste collection and general deliveries will occur between 8am – 6pm Monday to Friday. These are to be infrequent (7 deliveries, 7 waste collection per week as set out in Table 4.2 of the traffic report) and therefore excluded from the quantitative assessment below.
- The community bus will operate as a shuttle service between 6:45 and 23:00 on an hourly basis, except 1430-16:00 when frequency will be half hourly at main shift change. For the normal operating period, one bus movement up the ramp in a 15-minute period has been assessed as worst-case, while for the peak period, one in and one out has been adopted.
- Group events may result in use of an additional community bus from another ANHF facility. These are expected to be infrequent and therefore not included in the quantitative assessment below.
- Light vehicular movements in the peak hour period are outlined in Table 4.1 of the traffic report, which indicate 18 trips (assumed nine in, nine out). For the intrusiveness assessment, two in and two out has been adopted. During the evening and night period, light vehicular movement is expected to be reduced, and as such, one in and one out has been adopted.

3.2 Noise assessment

3.2.1 Source data

Noise data from Arup library have been utilised for the assessment, and is summarised in Table 5. For the L_{Aeq} assessment, a vehicle speed of 10 km/h has been assumed, resulting in a period of approximately 7 seconds to traverse the

primary exposed section of the entry ramp. Based on the data used, a slower speed results in higher result levels due to the longer exposure time.

Table 5: Vehicular noise level data

Vehicle	Movement	Sound power, dB(A)	
		L_{A1min}	$L_{Aeq15min}$
Community bus	Down ramp	85	64
	Accelerating – up ramp	96	75
Cars	Down ramp	80	59
	Accelerating – up ramp	89	68

3.2.2 Assessment locations

Predictions have been carried out to the following locations:

Table 6: Assessment locations

ID	Address	Details
A1	29 Bushlands Avenue	Single storey residential premise to west of the site. Intrusiveness assessment carried out to 1.5 m above ground 3 m in from the residential boundary (such that the receiver is not immediately behind the boundary fence), being approximately 9 m from centreline of down ramp and 12 m from centreline of up ramp. Regarding the sleep disturbance assessment, while there are no bedrooms understood to be located at the front of the dwelling, assessment has been carried out to the southeast corner of the residential façade as a reference, being approximately 14 m from centreline of up ramp (worst case movement). Shielding provided by a barrier along the western boundary of 1.8 m high has been included in the assessment. The height of the barrier has been assessed as 1.6 m for the Assessment assumes light vehicular at 0.5 m above ground, and 1 m above ground for Community bus.
A2	32 Bushlands Avenue	Single storey residential premise to on opposite side of Bushlands Avenue. Intrusiveness assessment carried out to 1.5 m above ground at residential boundary, being approximately 30 m from the mid-point of the ramp. Sleep disturbance assessment carried out to the northern residential façade, being approximately 30 m from top of the ramp (worst case). No acoustic shielding is included in the assessment however it is noted that some acoustic shielding may be afforded when the vehicle is at the base of the ramp.

3.2.3 Predicted noise levels

Table 7 presents the intrusiveness noise assessment for the car park entry and indicates compliance at all locations. Comparable noise levels are predicted at both locations. While A1 is in closer proximity compared to A2, acoustic shielding is afforded by the boundary fence.

Table 7: Intrusive noise assessment – no mitigation, dB(A)

Assessment location	Time period	Predicted noise level, $L_{Aeq(15minute)}$	Intrusiveness criteria, $L_{Aeq(15minute)}$
A1 - 29 Bushlands Avenue	6 am to 7 am	39	49
	Day	40	43
	Evening	39	41
	10 pm to 11 pm	39	41
	Night	31	36
A2 - 32 Bushlands Avenue	6 am to 7 am	40	49
	Day	41	43
	Evening	40	41
	10 pm to 11 pm	40	41
	Night	33	36

Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
Evening: 18:00-22:00 Monday to Sunday & Public Holidays
Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays

Regarding potential sleep disturbance, the predicted noise levels for vehicle movements up the ramp are presented in Table 8. The results indicate general exceedance of the screening criteria, while compliance with the upper level 60 dB(A) criteria is predicted.

It is noted that only two bus events are expected to occur during the night period, one in each shoulder period. Car movements during the night period are also expected to be minimal. Furthermore, it is noted that the predicted levels are below the maximum noise events recorded by the logger in the front yard of 25 Bushlands Avenue.

Table 8: Sleep disturbance assessment

Assessment location	Predicted noise level, $L_{A1\text{-}1min}$		Sleep disturbance criteria, $L_{A1,1min}$, dB(A)		
	Car – up ramp	Bus – up ramp	Time period	Screening L_{A90} + 15 dB	Upper level
29 Bushlands Avenue	50	58	10 pm to 11 pm	51	60
			11 pm to 6 am	46	60
			6 am to 7 am	53	60
32 Bushlands Avenue	52	59	10 pm to 11 pm	51	60
			11 pm to 6 am	46	60
			6 am to 7 am	53	60

3.3 Recommendations

The assessment of vehicular movements indicate compliance with the intrusiveness criteria and upper level sleep disturbance criteria. The assessment however relies upon acoustic shielding provided by a barrier of 1.8 m high along

the western boundary of the site. It is possible however to reduce the height of the barrier at the front of the site to approximately 1.2 m for the first 3 m of the barrier. The barrier could alternatively be located at the edge of the drive way ramp, which could allow a reduction in its height, as it will be closer to the noise source (approximately 1.6 m at its highest point above the receiver ground level, also lowering at the front of the site).

Predictions indicate noise reduction of 7-8 dB(A) can be provided, though this relies on the fence being of sufficient mass, recommended to be no less than 15 kg/m^2. This can be achieved with a range of materials, including aerated concrete (ie Hebel), fibre-cement sheeting and/or polycarbonate. The construction and detailing of the fence shall be reviewed by an acoustic consultant during the design development and certified prior to issue of the construction certificate.

It is also recommended that acoustically absorptive treatment is installed to both sides of the retaining wall sections of the ramp, at least to the roller door alignment. Materials such as Pyrotek Reapor or Quietstone may be suitable due to being exposed to the environment locations. This design aspect should be reviewed further during the design development, to confirm material specifications and locations. This aspect shall be certified by an acoustic consultant prior to issue of the construction certificate.

Regarding the roller door, while not expected to be louder than bus movements, operation of door has the potential to impact on residents surrounding and within the facility if not appropriately designed and its use managed. In terms of design, slatted roller doors should be avoided and consideration should be given to a sectional overhead door. Motors will need to be appropriately specified or acoustically treated, inclusive of vibration isolation to minimise structure radiated noise to within the facility. Regarding operation of the door, it is understood that the door is to remain open during the daytime, however it is preferred to close during the evening and night period for additional security. Both the design and management of the car park security door shall be assessment and certified by an acoustic consultant prior to issue of the construction certificate.

Drainage grates that may be located at the base of the ramp shall be design and installed so as limited impact noise as vehicles traverse.

5 Other site activities

The TAG report raises the matter of other activities on site, particularly common or social areas. While TAG indicate that outdoors areas for daytime use are not expected to result in acoustic issues, clarification was sought regarding use of other areas such as activity rooms and associated balconies.

As outlined in the Plan of Management and architectural drawings, a range of common areas and recreational facilities are to be provided on site, including:

- Café: at ground level
- Lounge/Dining: at each level, with deck from ground floor.
- Worship meetings and activities: at level 1, e.g Christian Praise and Workshop service; Australian Love and Kindness Association (Buddhism); Evangelical Free Church of Australia;
- Library;
- Theatre: at lower ground level, with courtyard opening to rear of site;
- Gymnasium: located at lower ground level, opening to Courtyard 2 near centre of the site.;
- Activity and common areas: for various activities, such as Arts and Crafts Tutorials.

Generally, the activities are seen to be of low intensity, and thus limited potential for acoustic impacts.

Additional acoustic design is however warranted during the design development for the Theatre space and any other areas that may involve some level of audio equipment for entertainment purposes, particularly if these areas are desired to be used during the evening and night period. Noise emission from these spaces can readily be address through a combination of acoustic treatment to the building envelope (walls, glazing, doors etc.) and active control and limiting of any sound systems that may be installed.

Regarding use of outdoor areas, while a purely residential development would not have restrictions placed on the use of outdoor areas, in the context of the current land-use and environment, it is recommended that the use of outdoor areas and decks for large gatherings during the evening and night periods are limited, and doors/windows closed for similar internal activities. The presence of on-site staff is a benefit in this regard, as such aspects can be actively managed.

6 Conclusion

On behalf of Australian Nursing Home Foundation (ANHF), Arup has completed a review of the acoustic assessments and reports prepared in relation to the proposed residential care facility to be located at 25, 25A and 27 Bushland Avenue, Gordon.

This report presents an independent assessment further to the applicant's original assessment prepared by Rodney Stevens Acoustics (RSA), dated 4 July 2017 (ref 150263R1, revision 3). This report primarily seeks to address contentions raised in acoustic reports prepared on behalf of residents and Ku-ring-gai Council (Acoustic Logic Consultancy and The Acoustic Group respectively).

From review of the acoustic reports currently before the Sydney North Planning Panel (SNPP), we generally concur with the ALC and TAG reports, that there were matters not adequately addressed in the RSA report.

Accordingly, this report addresses the following:

- Clarification of long-term noise monitoring results and establishment of project noise goals which concur with the views of ALC and TAG in their reports,
- Assessment of car and bus noise to and from the basement car park, which concluded that criteria could be satisfied with noise mitigation in the form of a barrier along the western boundary or ramp edge, acoustically absorptive treatment to entry ramp retaining walls, secured drain grates and 'roller door' design and management.
- Regarding the sleep disturbance assessment, it is noted that the lower screening criteria was not likely to be satisfied, however the upper limit criteria for likely disturbance was predicted to be achieved.
- From review of activities in internal and external common areas, is expected that a combination of building design and management will be required to address potential acoustic impacts.

While it is considered that the development is capable of satisfying relevant acoustic criteria, further acoustic design and assessment will be warranted during the design development phases. Should the development be approved, it is recommended that conditions require that the acoustic design is further assessed and certified prior to issue of the Construction Certificate. This would include aspects such as:

- Drive way ramp barrier (western side)
- Access ramp acoustic treatment
- Roller door design
- Building services equipment, and
- Building envelope design for activity spaces such as Theatre

Appendix A

Noise logger graphs

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L1 - 25 Bushlands Avenue, Front yard (Free Field)

Additional detail:

Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

	L_{A90} Background noise levels[4]			L_{Aeq} Ambient noise levels		
Date	**Day[1]**	**Evening[2]**	**Night[3]**	**Day[1]**	**Evening[2]**	**Night[3]**
Friday-07-August-2015		36	31		50	42
Saturday-08-August-2015	39	36	30	52	51	44
Sunday-09-August-2015	33	36	29	53	46	47
Monday-10-August-2015	36	37	32	52	47	45
Tuesday-11-August-2015	38	36	30	64	50	43
Wednesday-12-August-2015	41	38	32	53	47	44
Thursday-13-August-2015	40	39	31	65	48	44
Friday-14-August-2015						
Representative Week[5]	**38**	**36**	**31**	**62**	**48**	**44**

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for L_{A90} and logarithmic average for L_{Aeq}

Road / Rail noise monitoring results

	L_{Aeq} Noise levels		$L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile)	
Date	**Day[1]**	**Night[2]**	**Day**	**Night**
Friday-07-August-2015	51	42	53	48
Saturday-08-August-2015	52	43	53	48
Sunday-09-August-2015	51	47	52	55
Monday-10-August-2015	51	45	55	51
Tuesday-11-August-2015	63	43	69	49
Wednesday-12-August-2015	52	44	58	50
Thursday-13-August-2015	64	44	65	50
Friday-14-August-2015	58		63	
Representative Week[3]	**59**	**44**	**63**	**51**

Notes:

1. Day is 7:00am to 10:00pm
2. Night is 10:00pm to 7:00am
3. Logarithmic average of daily L_{Aeq}

Unattended monitoring: L1 - 25 Bushlands Avenue, Front yard (Free Field)

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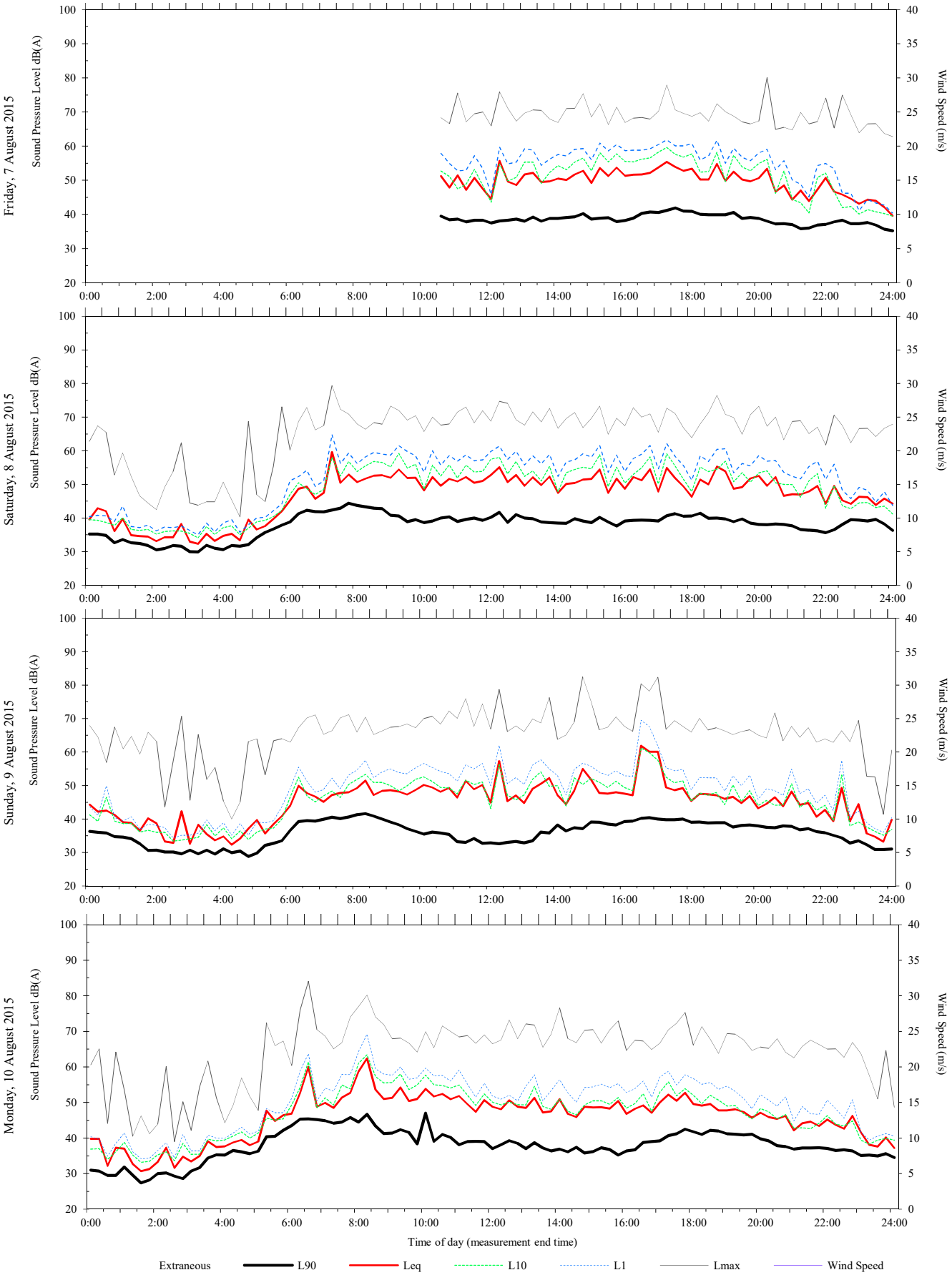

Unattended monitoring: L1 - 25 Bushlands Avenue, Front yard (Free Field)

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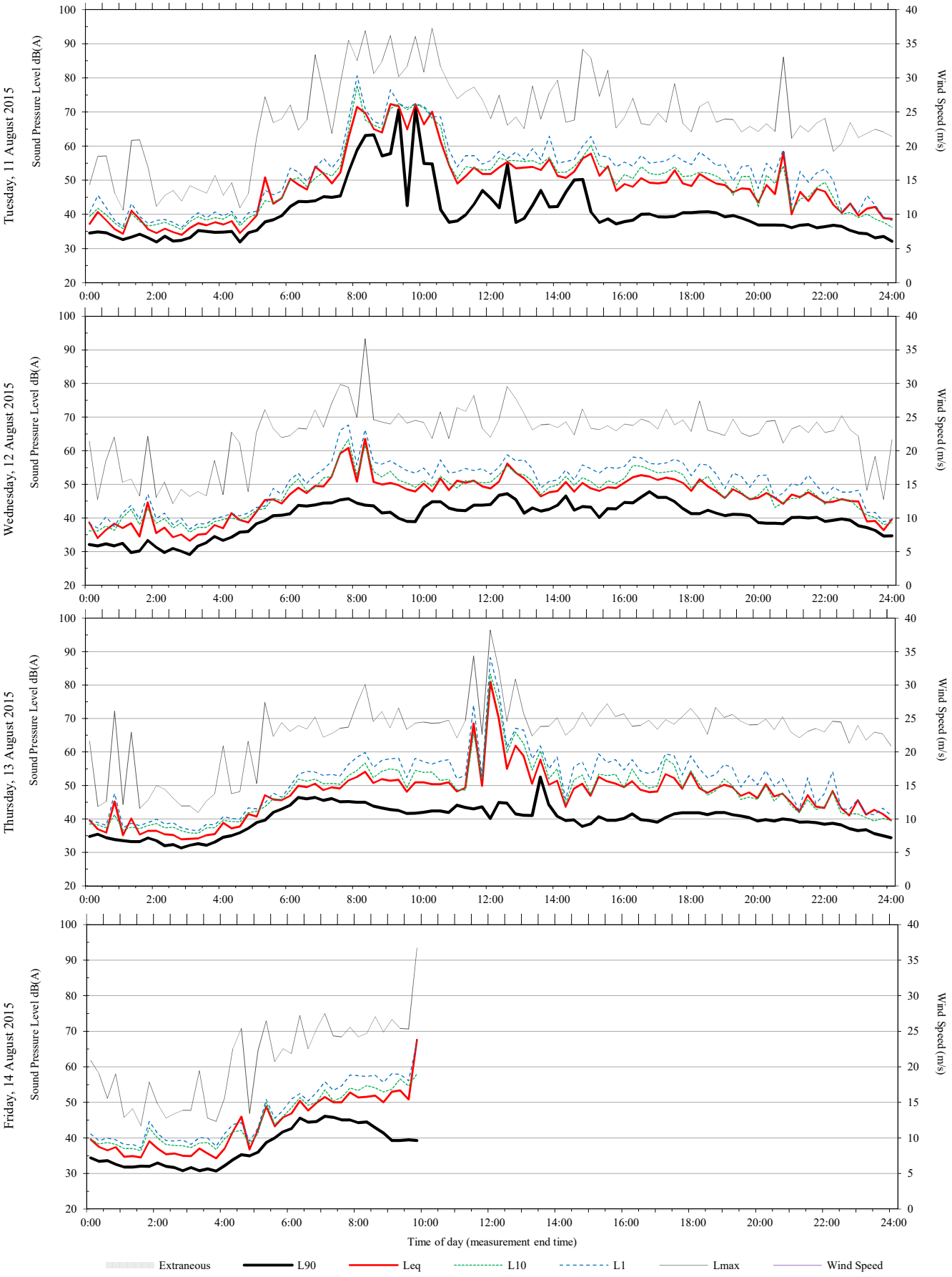

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L2 - 25 Bushlands Avenue - Back yard (Free Field)

Additional detail:

Background and ambient noise monitoring results - NSW 'Industrial Noise Policy', 2000

	L_{A90} Background noise levels[4]			L_{Aeq} Ambient noise levels		
Date	**Day[1]**	**Evening[2]**	**Night[3]**	**Day[1]**	**Evening[2]**	**Night[3]**
Friday-07-August-2015		36	31		48	41
Saturday-08-August-2015	39	36	30	51	49	43
Sunday-09-August-2015	34	41	34	47	45	45
Monday-10-August-2015	38	42	37	62	47	46
Tuesday-11-August-2015	38	38	34	49	45	46
Wednesday-12-August-2015	43	41	33	51	46	44
Thursday-13-August-2015	39	38	33	54	44	44
Friday-14-August-2015						
Representative Week[5]	**39**	**38**	**33**	**57**	**45**	**45**

Notes:

1. Day is 8:00am to 6:00pm on Sunday and 7:00am to 6:00pm at other times
2. Evening is 6:00pm to 10:00pm
3. Night is the remaining periods
4. Assessment Background Level (ABL) for individual days
5. Rating Background Level (RBL) for L_{A90} and logarithmic average for L_{Aeq}

Road / Rail noise monitoring results

	L_{Aeq} Noise levels		$L_{Aeq\ 1hr}$ Noise levels (upper 10th percentile)	
Date	**Day[1]**	**Night[2]**	**Day**	**Night**
Friday-07-August-2015	49	41	51	48
Saturday-08-August-2015	50	42	53	47
Sunday-09-August-2015	47	45	50	51
Monday-10-August-2015	61	46	66	51
Tuesday-11-August-2015	48	46	51	53
Wednesday-12-August-2015	50	44	53	50
Thursday-13-August-2015	52	44	59	50
Friday-14-August-2015	53		53	
Representative Week[3]	**54**	**44**	**59**	**50**

Notes:

1. Day is 7:00am to 10:00pm
2. Night is 10:00pm to 7:00am
3. Logarithmic average of daily L_{Aeq}

Unattended monitoring: L2 - 25 Bushlands Avenue - Back yard (Free Field)

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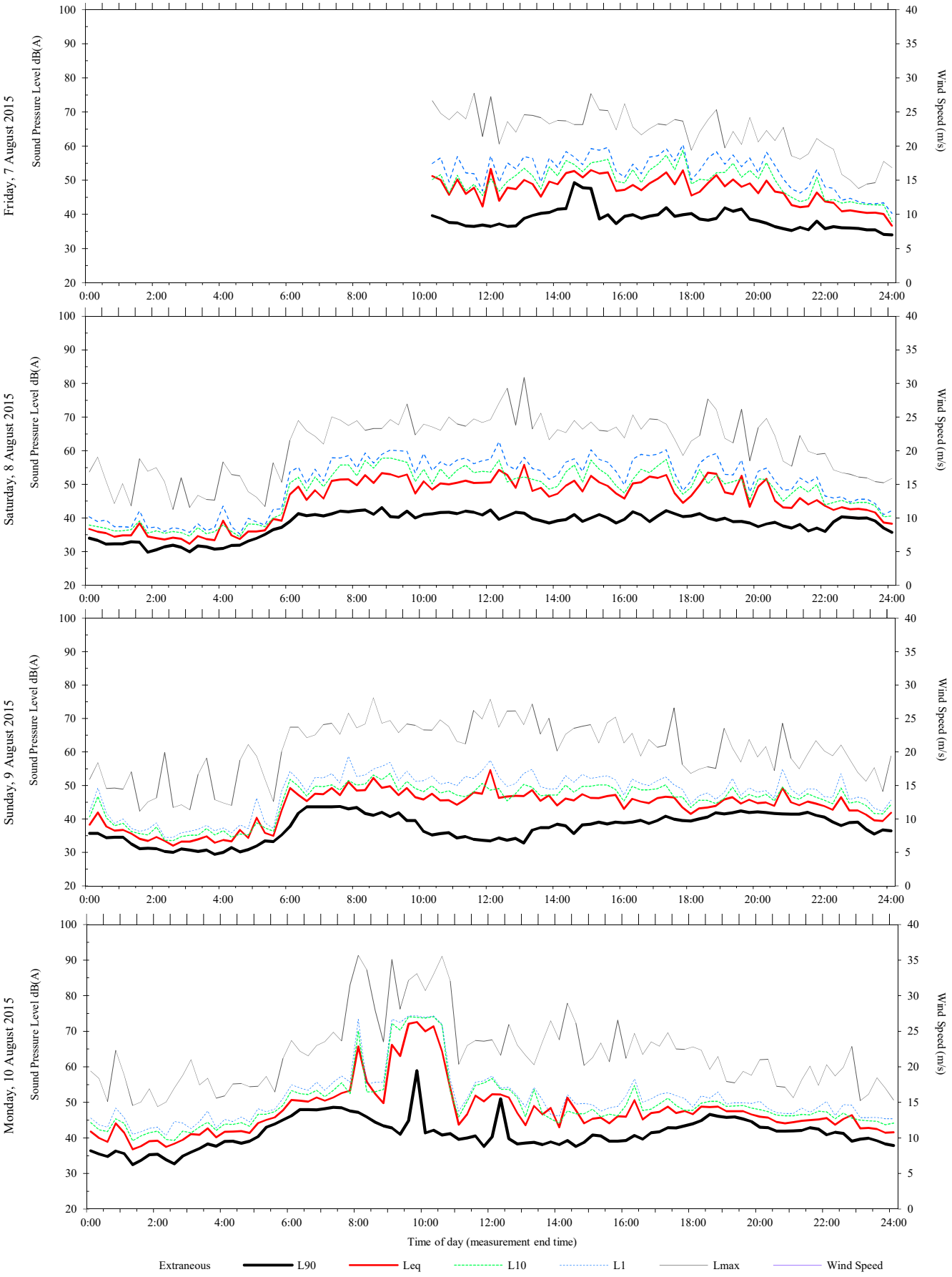

Unattended monitoring: L2 - 25 Bushlands Avenue - Back yard (Free Field)

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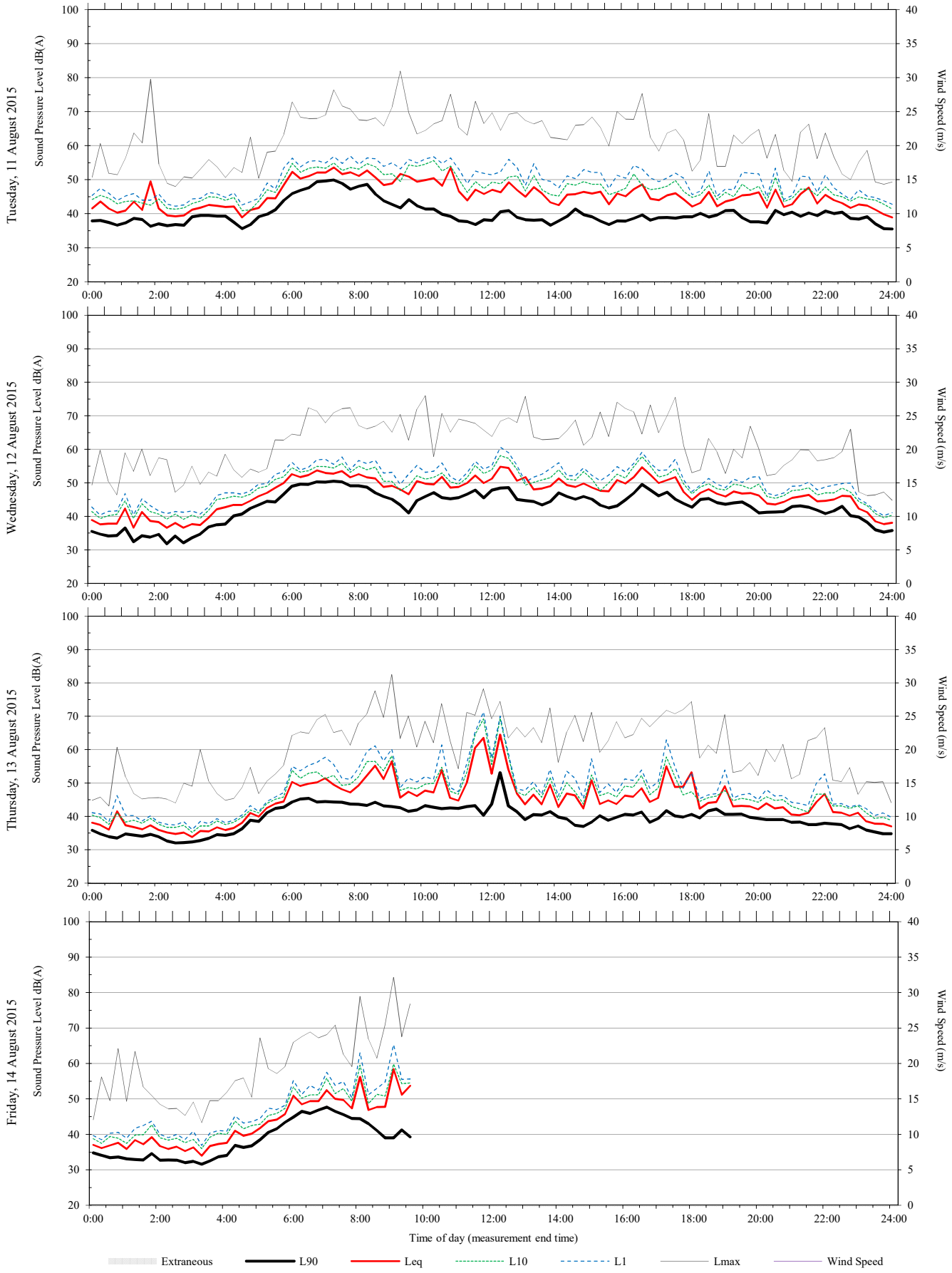
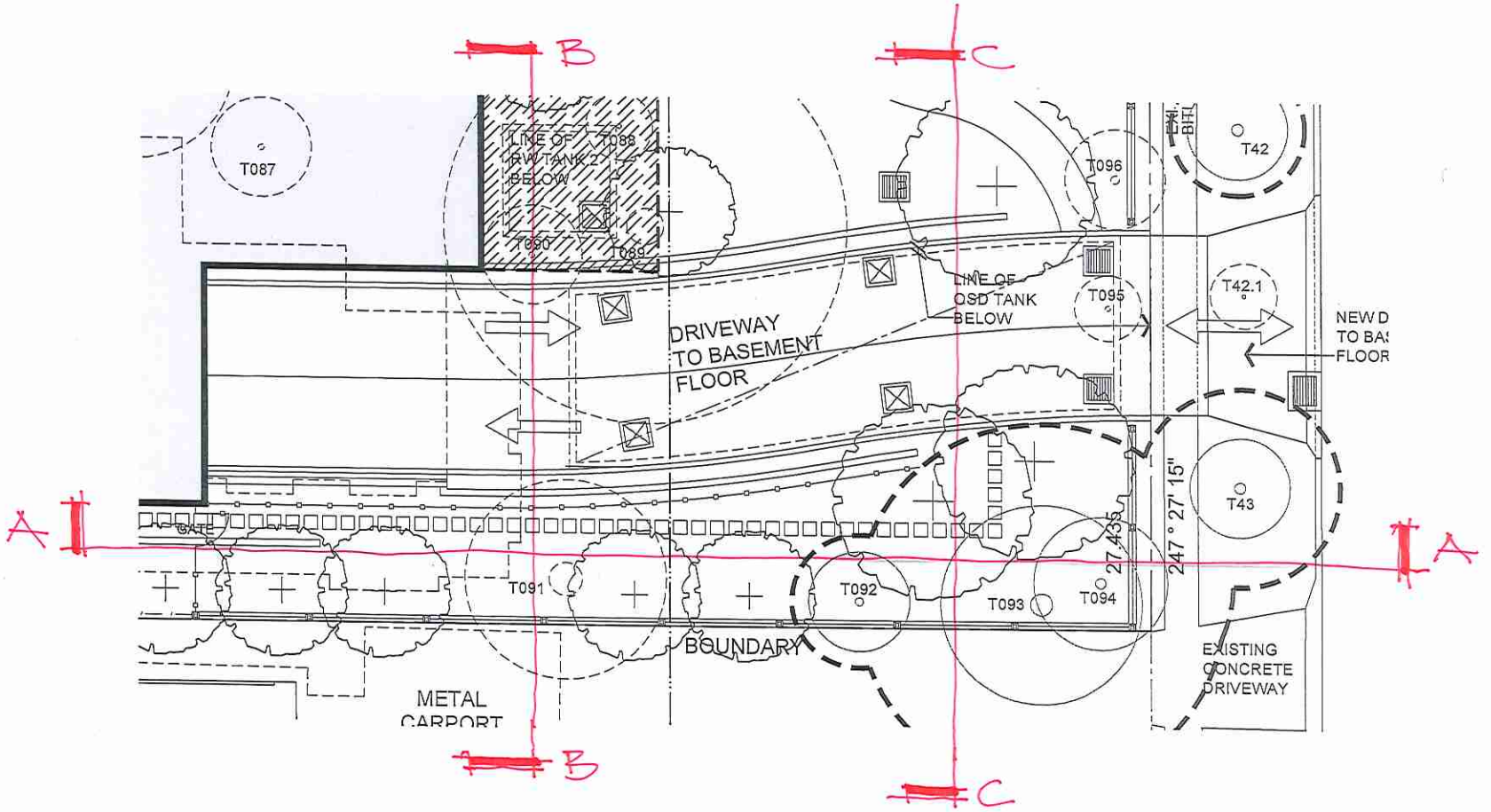


Appendix B

Architectural drawings - Car park ramp



ANHF RCF BUSHLANDS AVE

PLAN EXTRACT

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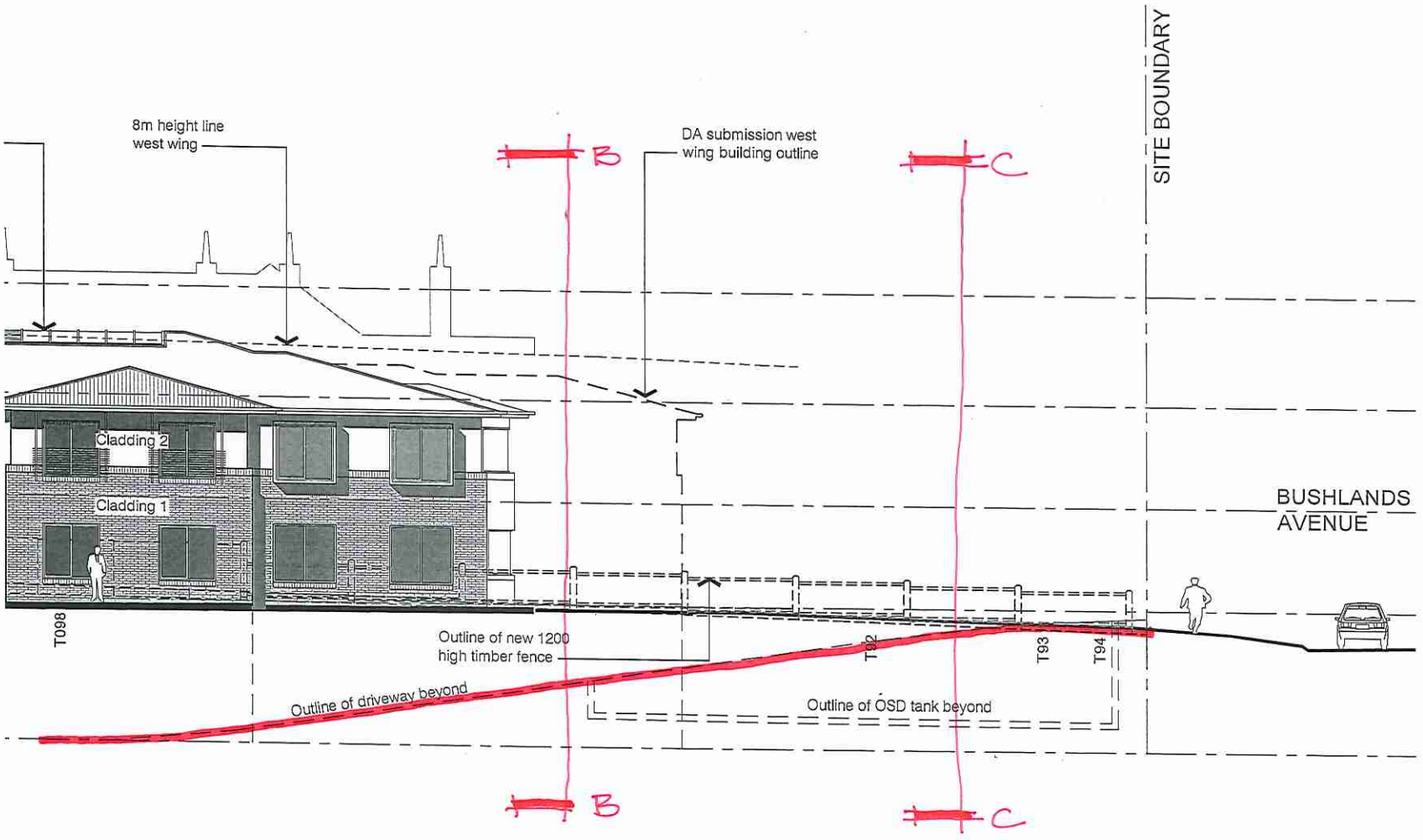
BPG 11/10/17



ANHP RCF BUSHLANDS AVE

SECTION A

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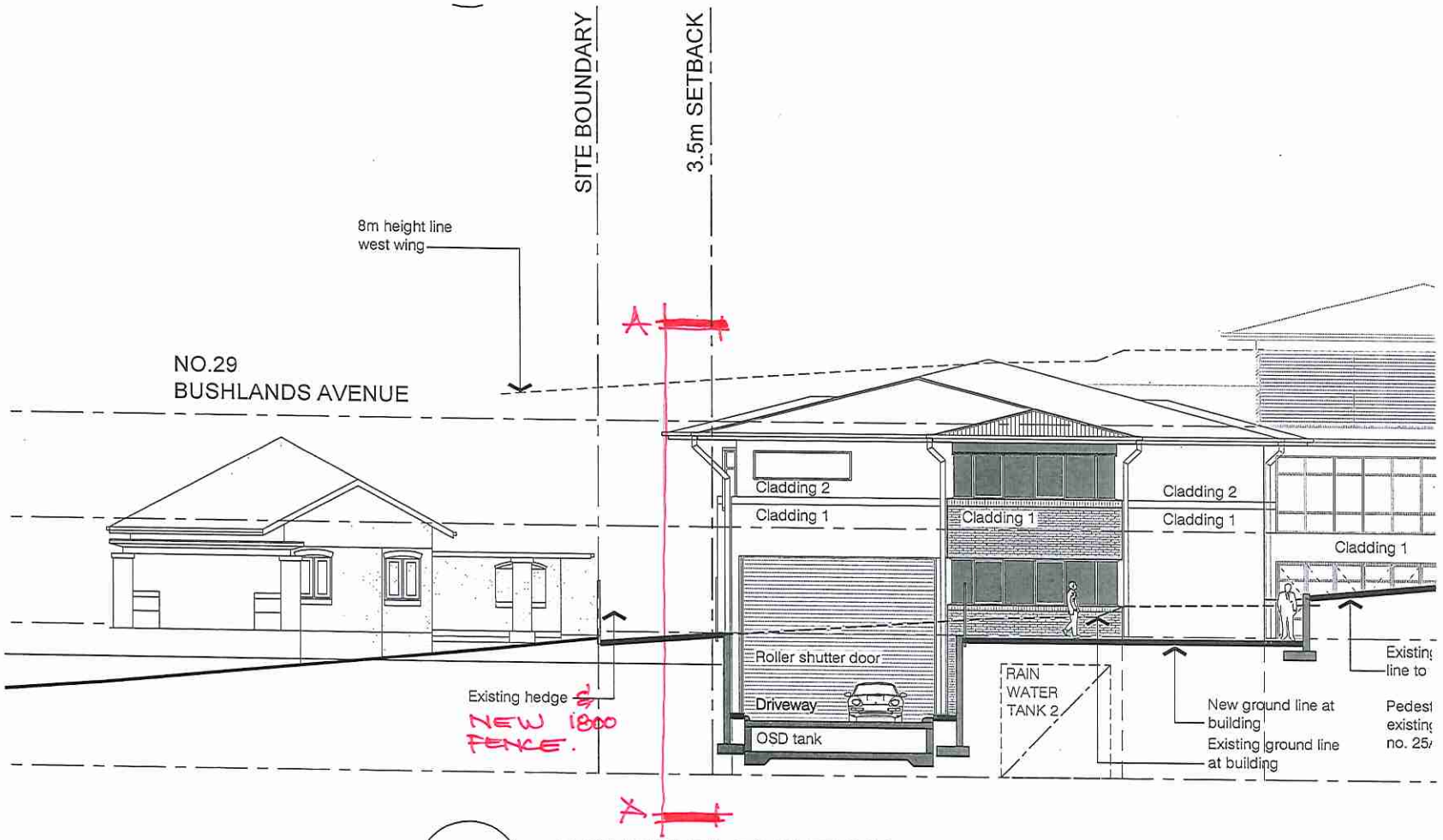

SOUTH ELEVATION

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ANHF RCP BUSHLANDS AVE

SECTION D

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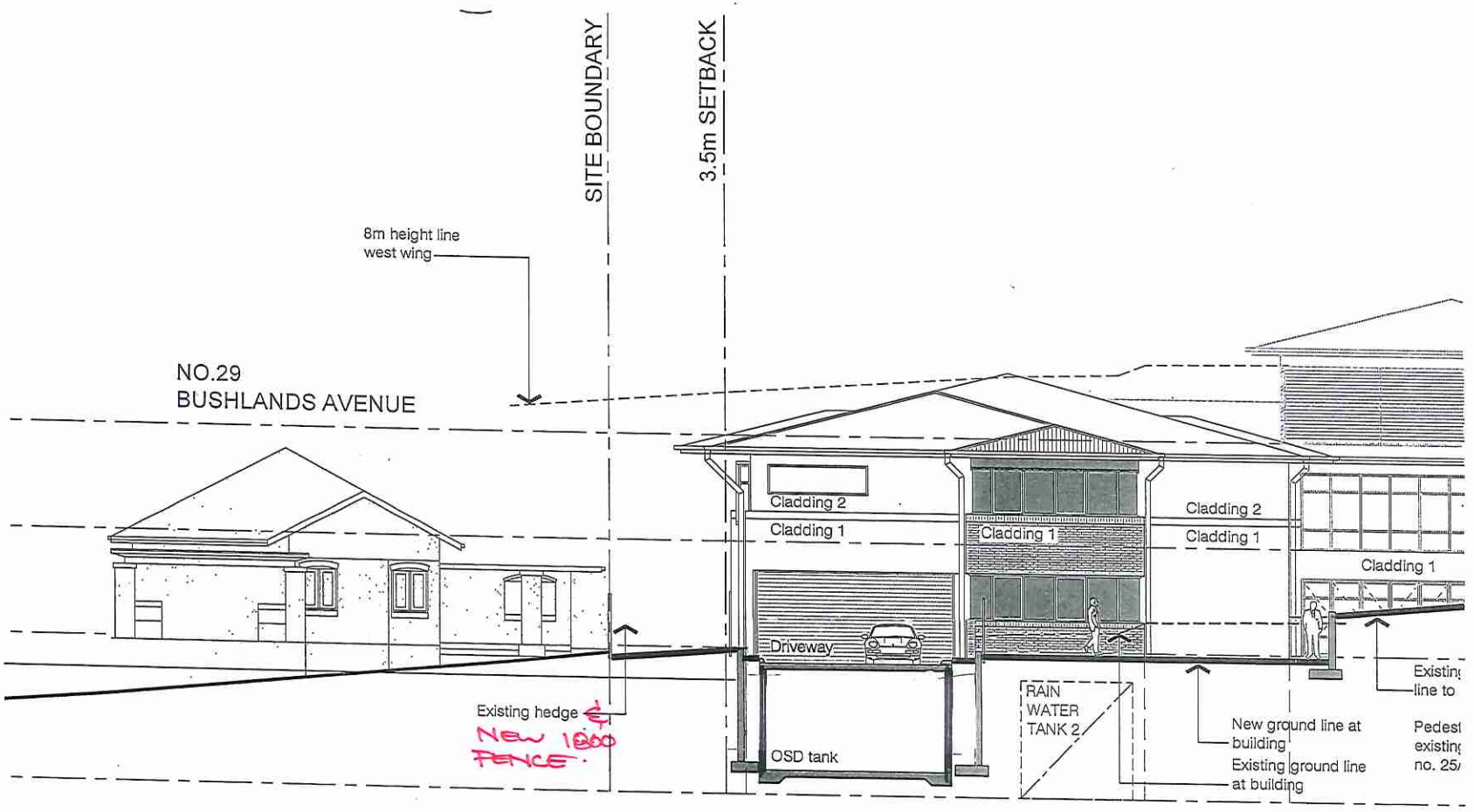

SOUTH ELEVATION

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ANHF RCF BUSHLAND AVE

SECTION C

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