NOISE IMPACT ASSESSMENT

LEVEL 2/1 SKYLINE PLACE
FRENCHS FOREST NSW 2086

PREPARED FOR

F45 Training

CONTRACT NO C24 9353
REPORT NO EMS24 1972

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Revision No	Date Issued	Reason/ Comments
0	21.11.2024	Version one

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1	0	F45 Training
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1 INTRODUCTION

1.1 Project Description

Environmental Monitoring Services (EMS) was engaged by F45 Training to provide a Noise Impact Assessment for the gymnasium located at Level 2/1 Skyline Place, Frenchs Forest NSW (the site).

The hours of operation for the proposal are:

Monday to Thursday:	5am to 7:15pm
Friday:	5am to 10:15am
Saturday:	6am to 9:10am
Sunday:	7:30am to 9:05am

The maximum number of people within the gym at one time is 36.

The current nature of the use is based on group high performance training. The gym has a sound system with Sonos loudspeakers; however, amplified coaches are not proposed.

The purpose of this Noise Impact Assessment is to investigate the predicted noise emissions from the gymnasium facility at the surrounding noise receivers and to compare these noise levels against an established Noise Criteria.

1.2 Site Location and Surrounding

The subject property is located within the 1 Skyline Place building complex, zoned SP4 Enterprise, which contains 7 separate tenancies with the northern side of the building containing two to three storey office spaces and the southern side comprising of 4 warehouses with roller door entry.

The existing gym is located on the highest floor (Level 2) in the north-western corner of the building. Separate standalone commercial premises are located to the east, south and southwest of the site. To the west across Skyline Place is the newly built mixed-use development 7 Skyline Pl with ground floor commercial under residential apartments and 5 Skyline Pl, which has an approved DA for the demolition of the existing building onsite and the construction of a mixed-use commercial/residential building (modelling predictions were done at the new development). To the north across Frenchs Forest Road E is the R2 Low Density Residential housing zone.

Table 1.1 below lists the nearest residential and commercial receivers to the proposal.

Table 1.1 – Surrounding noise receivers

Receiver	Address	Orientation	Description
R1	7 Skyline Pl	West	6 storey mixed-use residential/commercial building
R2	66 Frenchs Forest Rd E	Northwest	2 storey residential dwelling
R3	64 Frenchs Forest Rd E	North	1 storey residential dwelling
R4	62 Frenchs Forest Rd E	North	1 storey residential dwelling
R5	5 Skyline Pl	Southwest	Approved 8 storey new mixed-use development for senior housing and commercial (Mod2024/0472)
C1	1/1 Skyline Pl	Below	2 storey commercial tenancy (Adec Preview Solutions)
C2	2A/1 Skyline Pl	East	Commercial tenancy (Qbt Consulting)
C3	Building 2/ 49 Frenchs Forest Rd E	East	3 storey commercial tenancy (each floor a separate tenancy)
C4	3 Skyline Pl	South	2 storey commercial tenancy with warehouse area closest to the gym site

Figure 1.1 on the following page displays the proposed gymnasium's location and surrounding noise receivers.

Figure 1

Map provided by Google Maps

Legends

The Site (F45 Training)

R1, R2,.. Residential Noise Receiver Locations

C1, C2,.. Commercail Noise Receiver Locations

Noise Monitoring Location

Site: Level 2/1 Skyline Place, Frenchs Forest NSW

Report No.: EMS24 1972

Contract No.: C24 9353

2 GLOSSARY OF ACOUSTIC TERMS RELEVANT TO THE ASSESSMENT

Table 2.1 below displays a glossary of acoustic terms and acronyms that are relevant to this assessment.

Table 2.1 – Glossary of Relevant Acoustic Terms

Term/Acronym	Description
SPL	Sound Pressure Level based on the decibel scale (dB)
SWL	The Sound Power Level of a noise source is the rate at which energy is emitted from the source per unit time.
SLM	Sound Level Meter
A-weighted dB(A)	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 Hertz). The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds i.e. low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear) or dB(Z). The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
L_{max}	The maximum sound pressure level measured over a given period. L_{max} is often used as a measure of the most obtrusive facet of the noise, even though it may only occur for a very short time.
Time Weighting (Fast and Slow)	Both the Fast (F) and Slow (S) time weightings (a.k.a time constants) dampen the reaction of the displayed level on the SLM against sudden changes in the sound level. The Fast time constant is 125 ms and the Slow time constant is 1000 ms (1 second). In one time constant the Fast meter must rise within 2 dB of the steady state level, and the slow meter response will be between 3 to 5 dB of the steady state level. The rise time for Fast and Slow response is about the same as the fall time.
L_{Aeq}	Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
L_{A90}	Statistical descriptor of the A-weighted Sound Pressure Level exceeded for 90% of the time of the measurement period.
L_{A10}	Statistical descriptor of the A-weighted Sound Pressure Level exceeded for 10% of the time of the measurement period.
RBL	The Rating Background Level (RBL) is the overall single figure background level representing each day, evening and nighttime period. The rating background level is the 10th percentile L_{A90} noise level measured over all day, evening and nighttime monitoring periods.

3 NOISE MONITORING

3.1 Site Visit and Unattended Background Noise Measurement

Unattended noise monitoring was conducted between the 1st and 7th of November 2024, using the ARL EL-215 Noise Logger. The unit was field calibrated prior to and after monitoring, and no significant drift was found. The noise logger was installed on the roof of the 1 Skyline building above the northern façade at a distance of 43 metres from the gym with the microphone approximately 1.3 m above the roof level.

Note 3 from the NSW EPA NPfI under *Table A1: Methods for determining background noise* states:

> *Where it is impractical or not possible to monitor at the reasonably most- or potentially most-affected location(s), the location selected should be fully justified as being representative of background noise levels.*

Due to the existing gym operating during the background noise measurement the noise monitor was moved far away from the subject site to the east. During the installation and collection of the noise monitor no rooftop mechanical plant was observed to be operating within 39 metres of the noise monitor.

The northern boundary of the rooftop was chosen because at the southern boundary of the rooftop the noise emissions from Warringah Road were observed to be louder than those coming from Frenchs Forest Road E which is adjacent to the northern boundary of the site.

The noise logger was set to record 'A' weighted statistical sound pressure levels (SPL) with 15-minute intervals using a 'fast response.'

The L_{A90} will be used to determine the Rating Background Level (RBL) for the zone immediately surrounding the proposal and will be used for the establishment of a relevant noise criterion. The L_{A90} statistical measurement is the sound pressure level measurement that is exceeded for 90% of the measurement period.

The noise logger also collected the L_{Aeq}; this represents the level of noise equivalent to the energy average of varying noise occurring over a measurement period. The L_{A10} was also obtained; this is the sound pressure level that is exceeded from 10% of the measurement period.

3.2 Rating Background Level (RBL)

As all periods of the day have different background noise levels, the Environment Protection Authority's (EPA) publication *Noise Policy for Industry* (NPfI) 2017 defines each period for assessment.

Below is the time category for the noise assessment extracted from the NPfI:

- **Day:** the period from 07:00 am to 06:00 pm Monday to Saturday; or 08:00 am to 06:00 pm on Sundays and public holidays.
- **Evening:** the period from 06:00 pm to 10:00 pm.
- **Night:** the remaining periods 10:00 pm to 07:00 am Monday to Saturday; or 10:00 pm to 08:00 am Sundays and public holidays.

The Rating Background Level (RBL) is described in the NPfI as "*the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period".*

Table 3.1 displays the Rating Background Levels and Existing Noise Levels from the external unattended noise monitoring (1st – 7th November 2024) conducted at the monitoring locations.

Table 3.1 – Summary of the Existing Noise Level (L_{Aeq}) and RBL (L_{A90}) in dB

Time of Day	Monitoring Location	Rating Background Level (RBL)	Existing Average Noise Levels (L_{Aeq})
Day Time (07:00 – 18:00)	4/1 Skyline Place (rooftop)	50	59
Evening Time (18:00 – 22:00)		44	57
Night-Time (22:00 – 07:00)		39	54

Noise data affected by rain and wind was filtered from the background noise monitoring results as determined by the *Bureau of Meteorology (BOM)* – TERRY HILS AWS (Station No. 66059). The wind speeds at the microphone height were calculated from the BOM weather station data using the method described in a paper titled *Converting Bureau of Meteorology wind speed data to local wind speeds at 1.5m above ground level*.

The dominant noise source affecting the background monitoring results is road traffic noise from Frenchs Forest Road E and rooftop mechanical plant, however, no plant was strongly noticeable at the monitoring location.

3.3 'Shoulder' Period

The applicant wishes to provide classes at the gymnasium during the night-time period from 5am to 7am on all days. The *Noise Policy for Industry* (NPfI) acknowledges (Fact Sheet A3) that it may be unduly stringent to expect such operations to be assessed against the night-time criteria.

For 'shoulder' period RBLs for intrusive noise criteria the NPfI recommends taking the lowest 10th percentile of $L_{AF90,\ 15\ min}$ dB measurements of the equivalent of one weeks' worth of valid data taken over the shoulder period.

Table 3.2 displays the Rating Background Levels and Existing Noise Levels from the external unattended noise monitoring during the 'shoulder' periods conducted at the monitoring locations.

Table 3.2 – Summary of the RBL (L_{A90}) and Existing Noise Level (L_{Aeq}) in dB (1st – 7th November 2024)

Time of Day	Monitoring Location	Rating Background Level (RBL)	Existing Average Noise Levels (L_{Aeq})
Night-time (5am – 7am) 'shoulder' period	4/1 Skyline Place (rooftop)	42	56

4 NOISE CRITERIA

4.1 Northern Beaches City Council

D3 Noise in Part D Design from the Warringah Development Control Plan (DCP) 2011 has the following requirement:

> *Noise from combined operation of all mechanical plant and equipment must not generate noise levels that exceed the ambient background noise by more than 5dB(A) when measured in accordance with the NSW Industrial Noise Policy at the receiving boundary of residential and other noise sensitive land uses.*
>
> **Note 3. Waste collection and delivery vehicles are not to operate in the vicinity of residential uses between 10pm and 6am.**

EMS is unaware of any other specific acoustic criteria for gymnasiums/fitness centres given by Northern Beaches Council in their DCP or other documents. In absence of a site-specific acoustic criteria EMS will adopt the criteria outlined in the NSW EPA *Noise Policy for Industry* (2017) and the AAAC *Guideline for Acoustic Assessment of Gymnasium ad Exercise Facilities* Version 1.0 February 2022.

4.2 The NSW EPA *Noise Policy for Industry* 2017

The NSW EPA publication *Noise Policy for Industry* (NPfI) 2017 provides guidelines for noise assessment and noise mitigation strategies for levels that exceed noise thresholds. The main aims for this policy are:

- To establish noise criteria that will protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To outline a range of mitigation measures that could be used to minimise noise impacts.

The Noise Policy for Industry implements an Intrusive Noise Criteria and an Amenity Noise Criteria for residential receivers, the more stringent of the two is utilised.

When defining Intrusive noise, the NPfI states 'The intrusiveness of an industrial source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold.'

The Amenity Criteria is used to limit continuing increases in noise by industrial developments.

4.2.1 Residential Noise Receivers

The evaluated Intrusive and Amenity Noise Criteria for the residential noise receivers surrounding the site are displayed below in Table 4.1 for the noise monitoring location (shown in Figure 1.1).

Table 4.1 – NPfI Noise Emission Criteria dB(A) for Residential Receivers

Location	Time of Day	Recommended amenity noise level (Urban)	Rating Background Level (RBL) L_{A90}	Existing Noise Level L_{Aeq}	NPfI Criteria	
					Intrusive $L_{Aeq,15minute}$ Noise Criterion	Project Amenity $L_{Aeq,15minute}$ Noise Criterion
Surrounding Residential Receivers	Day (7:00 – 18:00)	60[1]	50	59	**55**	58[2]
	Evening (18:00 – 22:00)	50[1]	44	57	**49**	50[3]
	Night (22:00 – 7:00)	45[1]	39	54	44	**47[3]**
	'Shoulder' period (05:00 – 07:00)		44	56	**51**	

1. The residential receivers surrounding the site were determined to be in an Urban environment in accordance with the NPfI.
2. The resultant project amenity noise level [recommended amenity noise level – 5 dB] was not more than 10 dB(A) below the existing noise level therefore the project amenity noise level remained [recommended amenity noise level – 5 dB]. 3 dB(A) was added to convert from a period level to a 15-minute level as per the NPfI.
3. The resultant project amenity noise level [recommended amenity noise level – 5 dB] was 10 dB(A) or more below the existing noise level therefore the project amenity noise level became [existing level – 10 dB(A)]. 3 dB(A) was added to convert from a period level to a 15-minute level as per the NPfI.
4. EMS notes compliance with the morning 'shoulder' period will result in compliance with the noisier Daytime and Evening periods.

4.2.2 Commercial Noise Receivers

The recommended amenity noise level, reproduced from Table 2.2 in the NPfI, is relevant to the industrial receivers near the gymnasium and is displayed below in Table 4.2. The NSW EPA NPfI states that industrial areas are *an area defined as an industrial zone on a local environment plan.*

Table 4.2 – Noise Emission Criteria – Industrial

Type of Receiver	Indicative Noise Amenity	Time of Day	Recommended $L_{Aeq,}$ Noise Level dB(A)	
			Acceptable (external)	Project Amenity Level (external)
Industrial	All	When in use	65	**63[1]**

1. The resultant daytime project amenity noise level [recommended amenity noise level – 5 dB] was not 10 dB(A) or more below the existing daytime nor evening noise level therefore the project amenity noise level remained [recommended amenity noise level – 5 dB]. 3 dB(A) was added to convert from a period level to a 15-minute level as per the NPfI. It is unlikely the surrounding commercial/industrial premises will be operational during the night-time periods and therefore the daytime noise levels were used to establish the noise criterion.

4.3 The NSW EPA Maximum Noise Level Event Assessment

The NSW EPA raises the assessment of sleep disturbance in a number of its publications, most recently in Section 2.5 of the *Noise Policy for Industry* – 2017 (NPfI) it is addressed, stating:

> *The potential for sleep disturbance from maximum noise level events from premises during the night-time period needs to be considered. Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.*
>
> *Where the subject development/premises night-time noise levels at a residential location exceed:*
> - *L_{Aeq},15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - *L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken.*
>
> *The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.*
>
> *Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy. Other factors that may be important in assessing the extent of impacts on sleep include:*
>
> - *how often high noise events will occur*
> - *the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development*
> - *whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods)*
> - *current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.*
>
> *Maximum noise level event assessments should be based on the L_{AFmax} descriptor on an event basis under 'fast' time response. The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.*

The EPA's publication Road Nosie Policy gives a conclusion on sleep disturbance when integrating numerous studies on the subject:

- *Maximum internal noise levels below 50–55 dBA are unlikely to cause awakening reactions.*
- *One or two noise events per night, with maximum internal noise levels of 65–70 dBA, are not likely to affect health and wellbeing significantly.*

Assuming a 10 dB noise reduction across an open façade (e.g open window) the awakening reactions will likely occur when the external noise level is 60 – 65 L_{Amax}.

In summary, a detailed maximum noise level event assessment for sleep disturbance should be undertaken if the noise levels in Table 4.3 below are exceeded:

Table 4.3 - Maximum Noise Level Event Assessment in dB(A)

Residential Receivers	Assessment Period	Screening Level $L_{Amax, 15minute}$ RBL + 15 dB (outdoor level)	Awakening Reaction L_{Amax} (indoor level)
Surrounding Residential Receivers	Night-time Shoulder (5am to 7am)	**57**	**50 – 55**

4.4 AAAC Guideline for Acoustic Assessment of Gymnasiums and Exercise Facilities (V1.0)

As stated by the AAAC the Guideline is for the assessment of sensitive receivers within the same building structure:

This Guideline has been prepared by members of the Association of Australasian Acoustical Consultants (AAAC) to assist proponents and operators, architects, planners, Local Government or regulatory authority officers, or acoustical consultants to assess the noise and vibration impact resulting from the use and operation of both existing and proposed gymnasiums and exercise facilities consistently, accurately and fairly.

This Guideline is advisory in nature and is not a statutory document, but provides guidance in relation to the assessment and management of noise associated with exercise facilities including gymnasiums. The AAAC recommends the use of this Guideline, to inform decision-making on the environmental regulation and management of noise and vibration from exercise facilities. It sets out noise mitigation and management measures which should be considered and a process for measuring and predicting noise levels and determining achievable noise limits for development consents.

The objectives of this Guideline are:

- *To protect the reasonable acoustic amenity of nearby residential and other sensitive receivers;*
- *To provide guidance on appropriate considerations, along with noise objectives and criteria to ensure that a gymnasium or exercise facility does not generate unacceptable noise or vibration emission to adversely impact on residential and other sensitive receivers within close proximity; and*
- *To provide guidance on appropriate noise control and management that can be incorporated into the operation of a gymnasium or exercise facility.*

*A sensitive receiver may include any residential dwelling, commercial or other premises located **within** the same structure as a proposed gymnasium or other exercise facility. For a commercial or other premises, the activities carried out within that commercial or other premises and operating hours should be considered when determining the noise and vibration criteria.*

Non-Residential Receiver Noise Criteria

4.4.1 General Noise Emission to Non-Residential Receivers

The acceptable noise level in non-residential receivers will vary depending on the use of the space. For example a higher level of noise intrusion would be acceptable for an industrial receiver, compared to a school or office. Australian Standard AS2107 *Acoustics - Recommended design sound levels and reverberation times for building interiors* provides design sound level ranges for a variety of different areas of occupancy in buildings.

The AAAC recommends that the $L_{Aeq,15min}$ noise emission level resulting from the operation of the gymnasium or exercise facility should not exceed the lower extent of the design sound level range for the use given in Table 1 of AS2107, at the assessment location, as defined above, at all times. This includes both airborne and structure-borne noise from general noise sources such as music, patrons and staff associated with the operation.

Note should be made that "General Noise" does not include the occasional impulsive noise from activities such as weight drops. Such noise sources are assessed under "Impulsive Noise".

Table 4.4 displays the most affected rooms/areas, being the board room and open plan office, in the Level 1 tenancy directly below the gym. These two areas from Level 1 are the most affected due to them being closest to the indoor atrium/void area which rises into the Level 2 gym and is separated by double glazing shown in Figure 2 and Image 4.1.

Table 4.4 – Most Affected Sensitive Receiver Rooms/Areas in (Level 1) 1/1 Skyline Place (C2)

Type of Occupancy/Activity	Design sound level ($L_{Aeq,t}$) range dB(A)
OFFICE INDUSTRIAL BUILDINGS	
Executive office	**35** to 40
Board and conference rooms	**30** to 40
Open plan office	**40** to 45

Figure 2 – Level 1 Evacuation Diagram (not to scale) 1/1 Skyline Pl (C2)

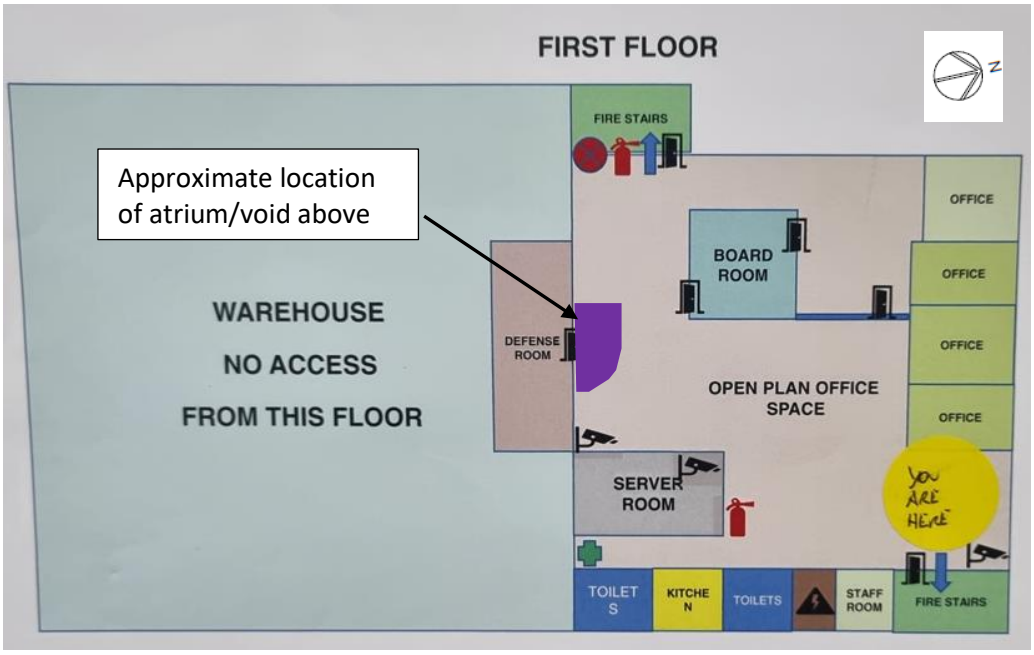


Image 4.1 – Atrium/Void Double Glazing seen from Level 2 Gym

4.4.2 Impulsive Noise Emission to Non-Residential Receivers

The following criteria applies to impulsive noise from weight-drops or other similar sources. Overall contributed L_{AFmax} within octave bands of interest (octave bands containing the impulse energy, generally 31.5 Hz to 250 Hz, as determined by the acoustic consultant) should not exceed the following levels:

L_{AFmax}(ΣOct,31.5-250Hz) ≤ 40 dB for general uses[1]
L_{AFmax} (ΣOct,31.5-250Hz) ≤ 35 dB for sensitive uses[2]
L_{AFmax} (ΣOct,31.5-250Hz) ≤ 30 dB for critically sensitive uses[3]

Notes:
1. General uses may include office spaces and general working areas
2. Sensitive uses may include private offices, classrooms, childcare and movie cinemas
3. Critically sensitive uses may include noise sensitive laboratories and board rooms
4. Justification would be required of the acoustician for the objective criteria adopted

5 NOISE ASSESSMENT

The noise predictions were carried out in SoundPLAN (version 9.0). The ground absorption surrounding the SP4 Enterprise area was given a reflective surface of 0.05 and the residential areas was given an absorptive surface of 1.

Receiver locations were modelled at the most affected façade of the residential and commercial receiver buildings at 1.5 metres above each floor, including the approved (DA Mod2024/0472) 5 Skyline Pl (R5) in accordance with the PA Studio architectural plans Issue H dated 23.05.24. The most affected receiver heights and locations were used for the assessment within the SoundPLAN model.

The noise predictions were based on the assumptions detailed below. The main noise sources from the proposed development that may potentially affect the nearby noise receivers are as follows:

- Mechanical Plant
    - Rooftop Air Conditioning Plant
    - Rooftop Exhaust or Intake Plant
- Gym Equipment
- Sound System Music
- Unamplified Instructor Vocal Noise Emissions
- Parking Lot
- External Building Envelope

5.1 Mechanical Plant Noise Emissions

During the rooftop site inspection EMS observed numerous plant items above the existing gym including 6 x condenser units and 2 x exhaust/intake fans.

The condenser units were observed to be Temperzone 2 x OSA 150RA, OSA 221R, OSA 250RA, OSA 260RA and OSA 410RA and the exhaust or intake fans were by Fantech.

5.1.1 Rooftop Air Conditioning Plant

The technical data sheet Sound Power Levels from the rooftop air conditioner condenser units is shown below in Table 5.1. At least 6 condenser plant items were identified, and it is unknown which of the plant belongs to the Level 2 gym and which belongs to the Ground Floor and Level 1 commercial tenancy below it. As a worst-case scenario all rooftop condenser plant was modelled to be operating.

Table 5.1 – Rooftop Air Conditioner Unit

Temperzone Model	Fan Speed	SWL dB(Z)						Broadband SWL dB(A)
		125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	
OSA 150RA	High	69	68	64	63	58	51	68
OSA 221R	High	77	75	68	65	60	56	71
OSA 250RA	High	78	76	72	70	66	60	75
OSA 260RA	High	82	78	74	71	66	60	76
OSA 410RA	High	88	82	79	78	77	71	83

5.1.2 Rooftop Exhaust or Intake Plant

The measured SPL from 2 x exhaust or intake fans which are located at the eastern side of the rooftop of the premises are shown below in Table 5.2 and displayed Image 5.1 and Image 5.2.

Table 5.2 – Rooftop Exhaust/Intake Fans

Rangehood Exhaust	Broadband SPL dB(A)	
	$L_{Aeq, 20sec}$	L_{Amax}
Eastern fan (assumed to be bathroom exhaust) @ 2m	65	66
Western fan (assumed to be fresh air intake) @ 2m	66	68

Image 5.1 – Eastern fan (assumed to be bathroom exhaust)

Image 5.2 – Western fan (assumed to be a fresh air intake)

5.2 Gym Equipment

The following gym equipment was observed onsite

- Rubber Flooring
- 3x3 cage squat rig/ rack
- Barbells, weight plates, rubber dumbbells, power bag/sang bag weights, kettlebells and med balls
- Some free-standing machines
    - 4 x Skiing machines
    - Benches
    - 3 x Rowing Machines
    - 3 x Bikes

5.3 Sound System Music

EMS observed the existing gym has 3 x Sonos loudspeaker (2 on a floating wall shelfs and 1 ceiling mounted).

EMS measured the spectral noise emissions from the Sonos loudspeaker system during a class which had a spatially averaged broadband level of 80 dB(A) L_{Aeq}, as seen below in Table 5.3.

Table 5.3 – Internal Spatially Averaged SPL Sound System Noise Emissions

Noise Source	Octave Band Frequency dB(A)									Broadband SPL
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Existing Sonos Loudspeaker System ($L_{Aeq, 7secs}$)	29	59	69	72	72	72	72	71	69	**80**
Existing Sonos Loudspeaker System (L_{Amax})	36	69	78	81	83	81	80	79	75	**90**

A JBL Partybox 710 was also observed onsite however EMS was informed by the instructor that this sound system is no longer used due to complaints from 7 Skyline Pl (R1).

5.4 Unamplified Instructor Vocal Noise Emissions

EMS observed a number of classes taking place whilst onsite at the existing gym and the vocal noise emissions from the trainers were infrequent and at a raised voice level at their highest. Under the worst-case conditions of the trainer talking with a loud voice for 25% of a 15 minute period (very unlikely) having a SWL of 85 dB(A) according to *Prediction of Noise from Small to Medium Sized Crowds* (Hayne, Taylor, Rumble and Mee, 2011) this would not raise the spatially averaged Sound Pressure Level within the room above that of the amplified music, displayed in Table 5.3.

5.5 Parking Lot Vehicle Noise Emissions

EMS has not been provided with any Traffic Assessment report for the site. The building complex has onsite site parking to the north and south with more than 60 spaces.

For the assessment EMS assumed the worst-case scenario of 36 gym patrons entering and egressing the parking lot area once within 1 hour.

EMS calculated the parking lot noise emissions in SoundPLAN using ISO 9613-2: 1996 which includes the LFU Bayern 2007 Parking Lot Study algorithm to calculate the Sound Power Level (SWL) of the vehicles within the parking lot. The spectra of a vehicle starting used in the study is seen below in Table 5.4. In accordance with the LFU Bayern 2007 Parking Lot Study a car door slam for a number of cars (Ford Ka, Ford Mondero, Renault Clio, Volvo V 40) has a L_{Amax} from 69-71 dB(A) which results in a logarithmic average SWL of 95 dB(A). This SWL was used for the Maximum Noise Level Event Assessment.

Table 5.4 – Parking Lot L_{Aeq}, 1hour Sound Power Levels

Noise Source	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	SWL
Typical Spectrum of a "starting car" LFU Bayern 2007 Parking Lot	46.3	57.9	50.4	54.9	55.0	55.4	52.7	46.5	63

The LFU Bayern 2007 Parking Lot Study has a number of corrections based on variables used in the algorithm and are listed below.

- K_{PA} Parking Lot Type (Visitor and Staff) = 0 dB
- K_D Driving Lanes $K_D = 2.5\log_{10}(fB - 9)$ [dB(A)] for $fB > 10$

  KD = 0 for $fB \leq 10$

  (f = 1 and B = 36 depending on location) = 3.58 dB

- K_I Impulse = 4 dB
- K_{Stro} Road Surface Concrete paving, joints<= 3mm = 0.5 dB

5.6 External Building Envelope

The walls of the gymnasium are masonry. The façade glazing was assumed to be 8.38mm laminated. The gym ceiling has ceiling tiles, and the ceiling/roof system was assumed to be suspended light steel frame with minimum 60mm fibreglass insulation under the sheet metal roofing.

6 NOISE RESULTS

6.1 NBC & NSW EPA NPfI Predicted Noise Levels

6.1.1 Residential Receiver Predicted Noise Levels

Table 6.1 below shows the precited noise levels at the nearest residential noise receivers. EMS notes compliance with the night-time 'shoulder' period noise criterion results in compliance with the higher daytime and evening criteria.

Table 6.1 – Predicted Noise Emissions at Residential Receivers (Northern Beaches Council & NPfI Criteria)

Commercial Receiver Location (external)	Assessment Period	NSW EPA NPfI $L_{Aeq,15\ minute}$ Noise Criteria (dBA)	Noise Source	Predicted Noise Level ($L_{Aeq,\ 15\ min}$)	Complies
R1 7 Skyline Pl	Night-time Amenity Criteria	47	Gym (Sound system and instructor)	31.2	✓
			Parking Lot	44.1	
			Mechanical Plant	40.9	
			Cumulative Noise Level	46	
R2 66 Frenchs Forest Rd E			Gym (Sound system and instructor)	25	✓
			Parking Lot	41.1	
			Mechanical Plant	30.9	
			Cumulative Noise Level	42	
R3 64 Frenchs Forest Rd E			Gym (Sound system and instructor)	23	✓
			Parking Lot	34.7	
			Mechanical Plant	22	
			Cumulative Noise Level	35	
R4 62 Frenchs Forest Rd E			Gym (Sound system and instructor)	25.8	✓
			Parking Lot	41.7	
			Mechanical Plant	32	
			Cumulative Noise Level	42	
R5 5 Skyline Pl			Gym (Sound system and instructor)	28.9	✓
			Parking Lot	41.1	
			Mechanical Plant	33.5	
			Cumulative Noise Level	44	

6.1.2 Commercial Receiver Predicted Noise Levels

Table 6.2 below shows the precited noise levels at the surrounding commercial noise receivers. See Section 6.2 for the internal to internal noise transmission predicted results for C1 and C2.

Table 6.2 – Predicted Noise Emissions at Commercial Receivers (NPfI criteria)

Commercial Receiver Location (external)	Assessment Period	EPA's NPfI $L_{Aeq,15\ minute}$ Noise Criteria (dBA)	Noise Source	Predicted Noise Level ($L_{Aeq,\ 15\ min}$)	Complies
C3 Building 2/ 49 Frenchs Forest Rd E	When in use	63	Gym (Sound system and instructor)	22.3	✓
			Parking Lot	43.8	
			Mechanical Plant	32.5	
			Cumulative Noise Level	44	
C4 3 Skyline Pl			Gym (Sound system and instructor)	14.7	✓
			Parking Lot	27.5	
			Mechanical Plant	35.2	
			Cumulative Noise Level	36	

6.1.3 Maximum Noise Level Event Assessment (Sleep Disturbance) Predicted Noise Levels

The NSW EPA Sleep Disturbance Criteria is outlined in Table 4.3. Table 6.3 below gives the Maximum Noise Level Event Assessment at the nearest residential receivers. The dominant noise source for the Maximum Noise Level Event Assessment is the parking lot.

Table 6.3 – Predicted Noise Emissions at Residential Receivers (Sleep Disturbance)

Residential Receiver Location (external)	Assessment Period	NPfI L_{Amax} Noise Criteria (dBA)	Noise Source	Predicted Noise Level (L_{AMax})	Complies
R1 7 Skyline Pl	Night-time 'shoulder' period (5am – 7am)	57	All Sources (Sound system, instructors, mechanical plant and parking lot)	58[1]	✓
R2 66 Frenchs Forest Rd E				53	✓
R3 64 Frenchs Forest Rd E				53	✓
R4 62 Frenchs Forest Rd E				55	✓
R5 5 Skyline Pl				54	✓

1. EMS notes that an exceedance of 1 dB(A) is generally regarded as being acoustically insignificant. The Worked Case Study E3 from the NSW EPA *Noise Policy for Industry* (2017) gives an example where a 1 dB residual noise level is deemed to represent a negligible impact and adopted as an acceptable performance.

6.2 AAAC Gymnasium Predicted and Measured Noise Levels

6.2.1 General Noise Emission to Non-Residnetial Receiver Predicted Noise Levels

The airborne noise transmission through the atrium glazing shown in Figure 2 and Image 4.1 was measured between the gym to the open plan office below, with the results seen in Figure 3.

The relevant standards used for this assessment are the International Standard ISO 140-4 Acoustics – Measurement of sound insulation in buildings and of building elements – *Part 4 Field measurements of airborne sound insulation between rooms* and ISO 140-14 Acoustics – Measurement of sound insulation in buildings and of building elements – *Part 14: Guidelines for special situations in the field*.

The Brüel & Kjaer (B&K) Type 4292-L Omnidirectional Loudspeaker was used as the sound source for assessing airborne sound transmission through the atrium glazing. Pink noise was played through an amplifier and speaker for the source room measurement. The loudspeaker was placed in the corners of the room away from the atrium glazing to give as diffuse sound field as possible, as well as at a central location within the gym. In the receiver room, the background noise was at least 6 dB below the level of the signal and background noise combined in the frequency range of the measurement (third octaves 160Hz – 3150Hz), a 1.3 dB correction was used for bands 100Hz and 125Hz.

A B&K 2260 Sound Analyser was used to conduct the airborne noise measurement in the receiver rooms using the swept method for each receiver room; the background noise and reverberation time were also measured in the receiver room. In the source rooms, a B&K 2250 Sound Level Meter was used to measure sound pressure level also using the swept method.

The field test results were then analysed, and the acoustic performance of the test sample was determined using Australian Standard AS ISO 717.1 Acoustics-Rating of sound insulation in buildings and of building elements – Part 1: *Airborne sound insulation*.

Figure 3 – Airborne Noise Transmission Results

Receiving Room Volume	537.5	m^3	
Partition Surface Area	23.694	m^2	

	Source	Receiving Room											
f	Lp(sig)	Lp(sig)	Lp(noise)	T	A	D	R	Dn	DnT	D(oct)	R(oct)	Dn(oct)	DnT(oct)
50	64.5	50.9	51.1	1.1	79.4	13.6	8.4	4.6	17.0				
63	67.2	46.9	46.7	1.1	81.6	20.4	15.0	11.2	23.6	17.2	11.9	8.2	20.6
80	68.5	45.3	44.3	1.2	74.0	23.2	18.2	14.5	26.8				
100	69.6	46.2	46.7	0.9	99.5	23.4	17.2	13.5	25.8				
125	76.3	43.6	42.0	1.0	91.1	32.7	26.8	23.1	35.4	27.2	20.9	17.1	29.5
160	80.9	49.2	40.9	0.7	118.5	31.7	24.7	21.0	33.3				
200	84.1	52.8	36.8	0.8	108.2	31.3	24.7	21.0	33.4				
250	84.4	51.9	33.0	0.8	115.4	32.5	25.6	21.9	34.3	32.5	25.6	21.9	34.3
315	83.7	49.8	31.4	0.7	123.6	33.9	26.8	23.0	35.4				
400	83.8	45.9	30.2	0.6	137.4	37.9	30.3	26.5	38.9				
500	82.1	40.9	28.5	0.6	135.2	41.2	33.7	29.9	42.3	40.0	32.4	28.7	41.0
630	81.0	38.8	26.5	0.6	139.6	42.2	34.5	30.8	43.1				
800	80.0	35.7	26.2	0.5	160.3	44.3	36.0	32.3	44.7				
1000	78.9	34.7	27.6	0.5	169.7	44.2	35.7	31.9	44.3	44.5	36.2	32.4	44.8
1250	76.5	31.6	27.4	0.6	151.8	44.9	36.8	33.1	45.5				
1600	79.0	34.5	25.3	0.6	146.7	44.4	36.5	32.8	45.1				
2000	78.3	33.1	26.0	0.7	120.2	45.3	38.2	34.5	46.8	45.2	37.9	34.1	46.5
2500	77.5	31.2	24.6	0.8	113.9	46.2	39.4	35.7	48.1				
3150	76.5	30.6	23.1	0.8	106.8	45.9	39.4	35.6	48.0				
4000	75.1	27.9	21.2	0.8	103.0	47.2	40.8	37.0	49.4	46.8	40.4	36.6	49.0
5000	73.8	26.4	19.9	0.9	97.2	47.3	41.2	37.5	49.9				
6300	75.7	27.6	19.2	0.9	99.5	48.1	41.8	38.1	50.5				
8000	76.5	27.0	18.5	0.8	112.4	49.6	42.8	39.1	51.4	48.7	41.7	38.0	50.4
10000	70.3	21.8	17.2	0.6	141.9	48.6	40.8	37.1	49.4				

125Hz-4000Hz		100Hz-3150Hz		100Hz-3150Hz		100Hz-3150Hz		100Hz-3150Hz	
STC	35	Rw	35	Dw	43	Dnw	32	DnTw	44
Deficiencies		C	-1	C	-1	C	-1	C	-1
Sum	20	Ctr	-4	Ctr	-5	Ctr	-5	Ctr	-4
Max	4	Def.	22.2	Def.	29.4	Def.	31	Def.	26.2

Table 6.4 below displays the predicted noise levels in the adjoining commercial tenancies to the gym.

Table 6.4 – Predicted Noise Levels in Commercial Tenancy (Level 1) below Gym

	Octave Band Frequency dB(A)								AAAC Noise Criteria	Broadband SPL
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz		
C1 Level 1 1/1 Skyline Pl (Open Plan Office)	42	42	40	32	28	27	24	20	40	46
C1 Level 1 1/1 Skyline Pl (Conference Room)	32	33	17	2	0	0	0	0	30	35
C2 Level 1 2A/1 Skyline Pl	0	12	22	24	16	11	60	0	Unknown[1]	27

1. EMS does not have a floor plan for this tenancy and therefore assumptions were made regarding the volume of the receiver room and party wall construction. The party wall was observed to be masonry and assumed to be a single hollow concrete block wall. EMS notes that a plasterboard wall system separates the gym area with loudspeakers from the shared staff amenities area which has the common wall with the neighbouring commercial tenancy (C2). The sound lock provided by the staff amenities room was not included in the calculation and therefore the predicted noise levels are considered conservative.

6.2.2 Impulsive Noise Emission to Non-Residential Receivers

A weight drop assessment was conducted in the existing gym and most affected receiver to structural borne noise in the commercial tenancy below with the results displayed in Table 6.5. For each measurement a minimum of 4 drops were performed apart from the 60 kg barbell drop from 750mm where only one drop was carried out. The thickness of the concrete floor slab in unknown to EMS. The SPL measurements were taken directly below the drops. It should be noted that the $L_{A90,\ 25seconds}$ in meeting room, open plan (centre of the room) and open plan (rear eastern boundary) were 29, 35 and 41 dB(A) respectively.

Table 6.5 – Structural Borne Noise Transmission Assessment

Receiver Location	Receiver Room	Flooring System	Weight Dropped	Drop Height	Measured Noise Level $L_{AFmax(\sum Oct,31.5\text{-}250Hz)}$ dB(A)	Noise Criteria $L_{AFmax(\sum Oct,31.5\text{-}250Hz)}$ dB(A)dB(A)
C2 1/1 Skyline Place Level 1 (directly below gym)	Meeting Room	Existing approx. 12mm gym rubber mats on concrete slab	9 kg rubber coated dumbbell	450mm	61.0	30
				750mm	65.5	
			20 kg rubber coated dumbbell	450mm	68.8	
			30 kg rubber coated dumbbell	450mm	67.4	
	Open Plan Office (centre of room)		9 kg rubber coated dumbbell	450mm	63.2	40
				750mm	66.3	
			20 kg rubber coated dumbbell	450mm	67.6	
			60 kg barbell (30 kg on both sides)	Approx. 600mm (deadlift)	79.7	
				750mm	81.9	
	Open Plan Office (rear eastern boundary of room)	Concrete slab	9 kg rubber coated dumbbell	450mm	74.2	
		Regupol FX50 *Now known as Regupol Sonusfit M 513*	9 kg rubber coated dumbbell	450mm	49.4	
			20 kg rubber coated dumbbell	450mm	51.4	
			30 kg rubber coated dumbbell	450mm	53.4	
		Regupol FX75	9 kg rubber coated dumbbell	450mm	54.3	
			20 kg rubber coated dumbbell	450mm	49.2	
			30 kg rubber coated dumbbell	450mm	49.0	
		Regupol 4080 *Now known as Regupol Sonusfit M 517*	9 kg rubber coated dumbbell	450mm	48.4	
			20 kg rubber coated dumbbell	450mm	50.1	
			30 kg rubber coated dumbbell	450mm	50.1	

7 RECOMMENDATIONS

The Section 6.2 general and impulsive noise emission via the internal-to-internal noise transmission path to the commercial tenancy below was found to exceed the AAAC gymnasium and exercises facility guideline.

EMS was informed via email from National Operations Manager Daniel Brown from Adec Preview Solutions (C1 1/1 Skyline Pl) that their current hours of operation are 6am to 4pm Monday to Friday.

7.1 Sound System Recommendations

During the operational hours of the Level 1 commercial tenancy receiver below the gym the L_{Aeq} noise levels from the gym sound system shall not exceed an internal spatially averaged sound pressure level of **75 dB(A) L_{Aeq}** within the gymnasium. Sound Level Meter (SLM) measurements and the installation of a noise limiter may be needed to verify this level.

The JBL Partybox 710 nor any subwoofer should not be used onsite.

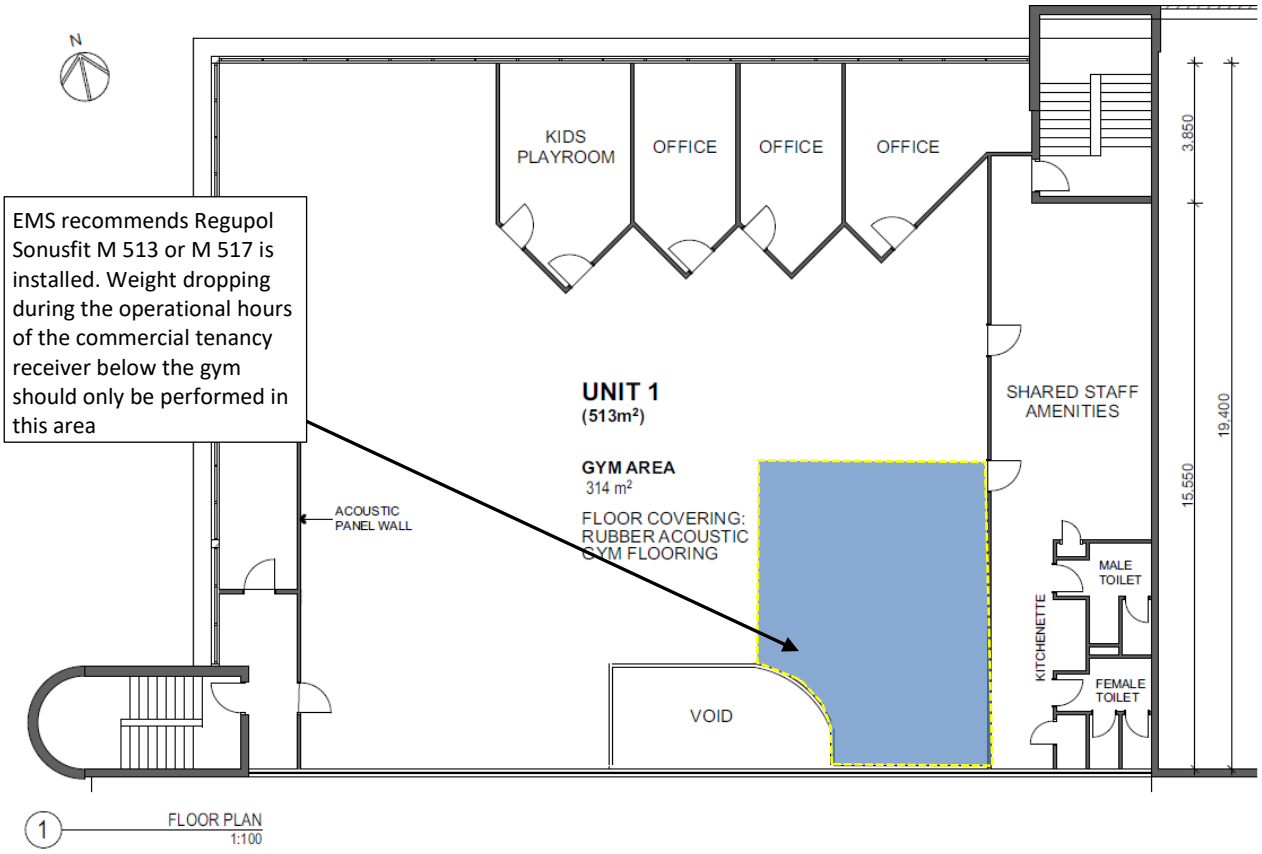
7.2 Weight Dropping Recommendations

Table 6.5 shows that with the existing approximate 12mm rubber matting and Regupol samples the AAAC gymnasium and exercises facility guideline criteria was exceeded. However, a notable reduction is provided by the Regupol samples when compared with the 12mm rubber matting of 14 to 19 dB(A) for the drops from 450mm for the 9 kg and 20 kg weights and a reduction of 26 to 30 dB(A) for the 30 kg weight.

EMS recommends that during the operational hours of the commercial tenancy receiver below the gym weights should be dropped in the dedicated weight dropping area marked out in Figure 4. This area should be fully covered by Regupol Sonusfit M 513 or M 517. Weights should never be dropped directly above the Level 1 board room during operational hours of the commercial receiver below.

The AAS paper titled *Predicting impulsive noise emission and compliance with the AAAC gymnasium guideline criteria* (2024) by Sara McCafferty and Wilson Byrick from Pilteq Inc., Toronto Canda shows that the SPL measurements in a receiver room below the weight drops decrease by approximately 8, 13 and 17 dB(A) whilst moving away from the location directly below the drop by distances of 9, 17 and 26 metres respectively.

Figure 4 – Recommended Weight Dropping Area and Gym Flooring



7.3 Mitigation and Noise Management Measures

EMS recommends the following management and noise management measures taken from the AAAC gymnasium and exercise facility guidelines to ensure that noise emissions do not exceed the Noise Criteria:

- The erection of signage advising patrons not to generate excessive noise when entering or egressing the premises, particularly in the parking lot and stairwell.

- The implementation of an appropriate management policy regarding the dropping of weights, including:

    - Education and training of all gym staff, personal trainers and patrons/members, instructing how to place weights without dropping;
    - Erection of clearly visible signage throughout the gym advising patrons/members that they must not drop weights or allow weights to drop on the floor, or use weights outside the designated weight areas; and
    - Imposition of penalties (membership warnings, suspensions or lockout restrictions) on patrons/members identified dropping weights.

- The use of weights (dumbbells, barbell, kettlebells, plates and medicine balls) and pin/plate loaded machines is to be restricted to specific areas where appropriate impact isolating flooring has been installed;

- Include a condition of membership that management may reprimand a patron/member by way of fine, suspension or expulsion if they are found to repeatedly drop weights in a way contrary to that allowable;

- The Plan of Management for the facility should include a procedure to respond to any complaints. This should include recording and responding to all complaints. Discussions between the complainant and operator should be undertaken as quickly as possible, as cooperation can often resolve issues in a more timely manner. The records of complaints should include, as a minimum, the location of the complainant, the typical time of intrusion and nature of the complaint (noise/vibration/structure-borne/impulsive). The operator should investigate possible sources of complaint, for example by conducting representative testing and measurements. Additional noise mitigation and management measures may be required to reduce and manage the disturbance.

7. CONCLUSION

A Noise Impact Assessment was carried out for the gymnasium located at 2/1 Skyline Place, Frenchs Forest.

The Noise Impact Assessment gave the measured and predicted noise emissions generated from the proposal at the surrounding residential and commercial noise receivers. See Sections 5 and 6.

Recommended engineering controls and noise management are found in Section 7, which on the proviso the prosed gymnasium would implement, would see compliance with the Northern Beaches Council and NSW EPA *Noise Policy for Industry* noise criteria.

Recommendations are also given in Section 7 to see compliance with the AAAC Gymnasium and Exercise Facility general airborne noise emission to non-residential receiver criteria. Regarding the AAAC Guideline impulsive noise emission to non-residential receiver criteria the recommended flooring in this report for the weight drop area will greatly reduce the structural borne noise to the commercial tenancy below compared with the existing gym mats (by an attenuation of 14 to 19 dB(A) for the drops from 450mm for 9 kg to 20 kg weights and a attenuation of 26 to 30 dB(A) for the 30 kg weight), however, despite the reduction compliance with the AAAC Guideline will not be achieved in every location in the commercial receiver below. Areas within the commercial receiver closer to the weight drop area will be not compliant, whereas rooms and areas further away will be compliant in accordance with the data presented from the AAS paper in Section 7.2.

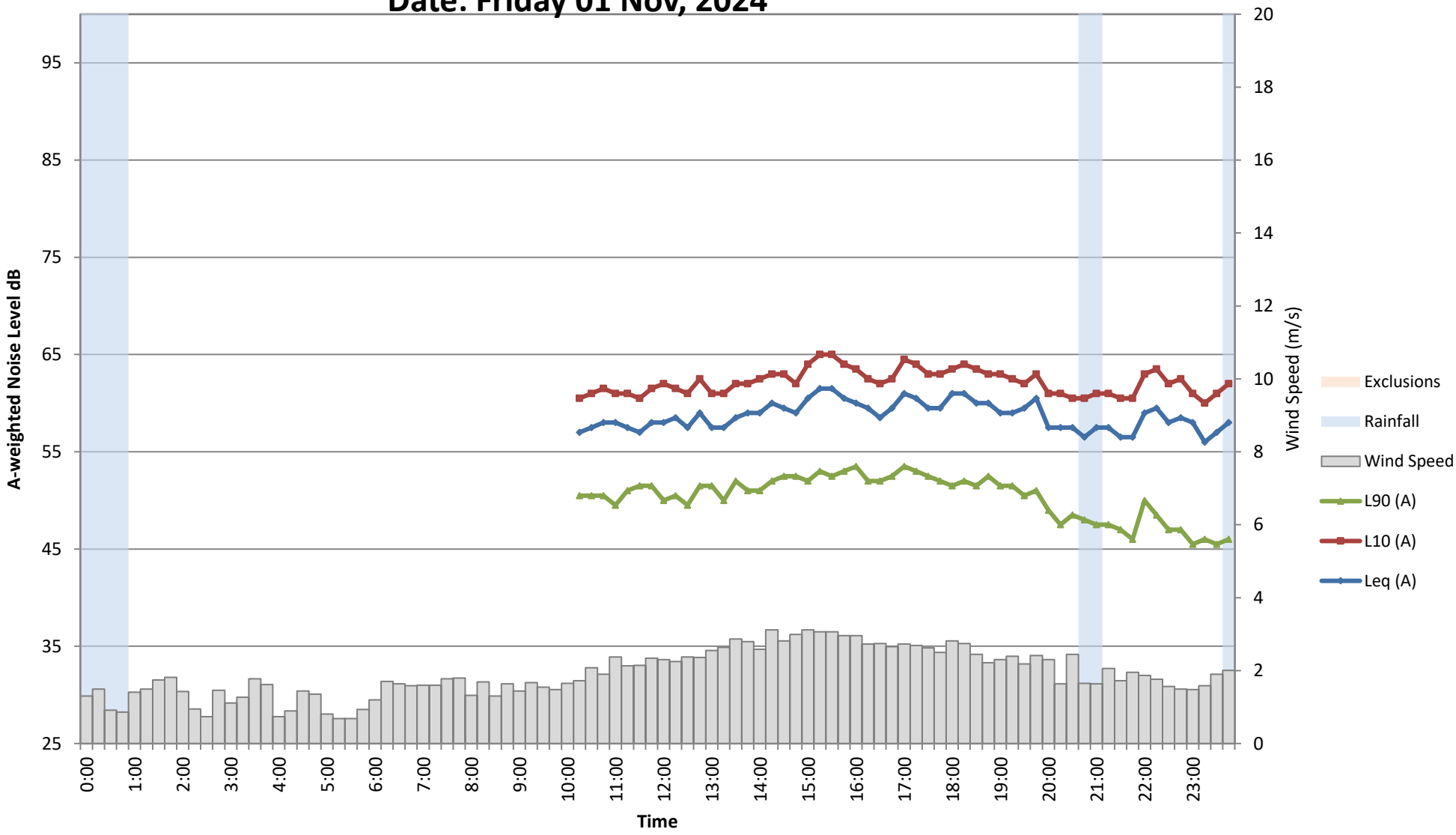
EMS notes AAAC gymnasium and exercise facility guideline is advisory in nature and is not a statutory document, but provides guidance in relation to the assessment and management of noise associated with exercise facilities including gymnasiums.

REFERENCES

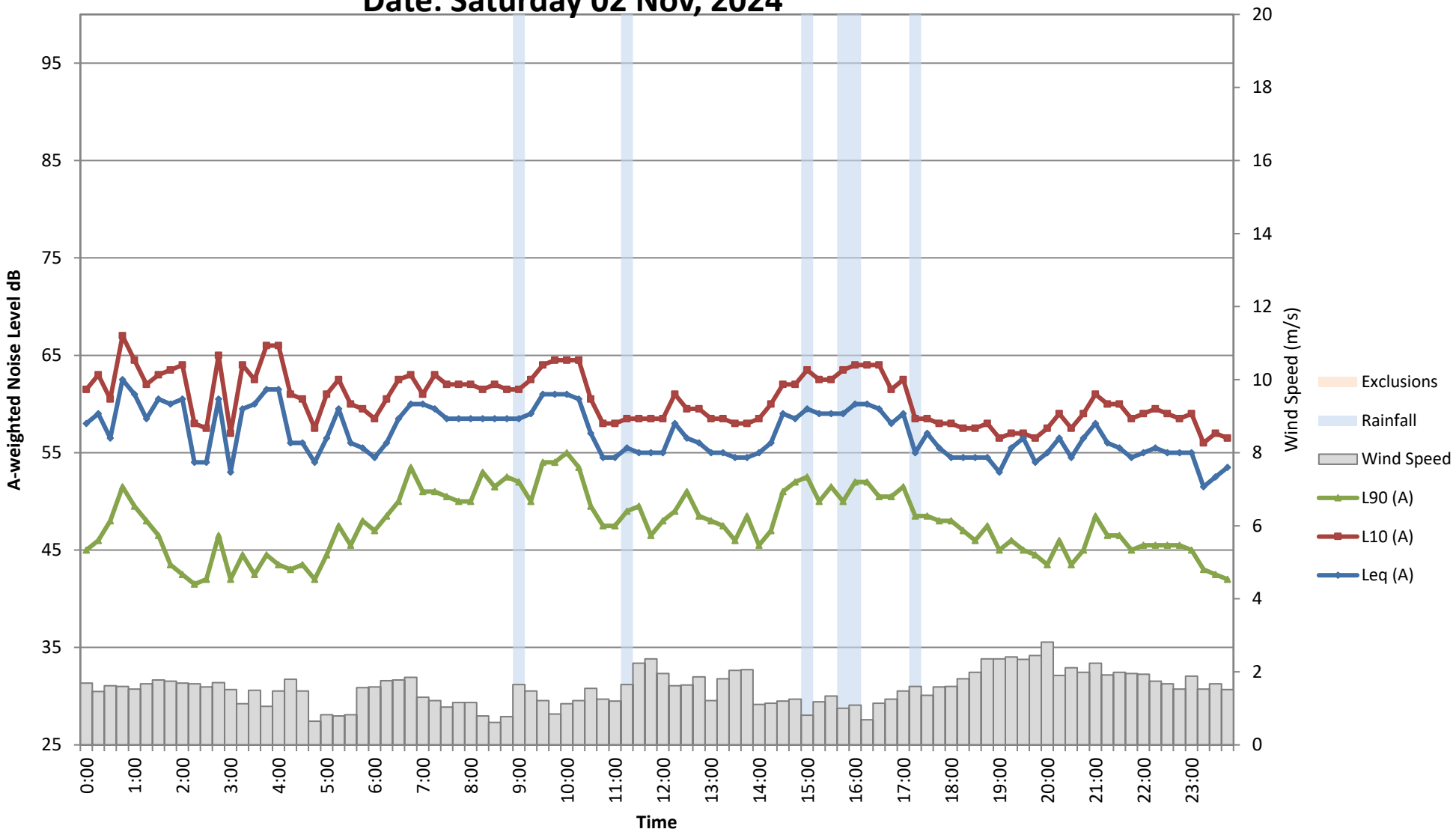
- NSW EPA Publication – *Noise Policy for Industry* – 2017
- AAAC *Guideline for Acoustic Assessment of Gymnasium ad Exercise Facilities* Version 1.0 February 2022
- M. Long, *Architectural Acoustics Second Edition*, Academic Press, 2014.
- D. A. Bies and C. H. Hansen, *Engineering Noise Control: Theory and Practice* 4th Edition, Spon Press, 2009.
- *Converting Bureau of Meteorology wind speed data to local wind speeds at 1.5m above ground level* – Tracy Gowen, Peter Karantonis & Tony Rofail, 2004
- Architectural plans provided by PA Studio dated 18.07.204 (Issue A, Original Issue) File: SKYY1 DA F45.pin

APPENDIX A – BACKGROUND NOISE MONITORING

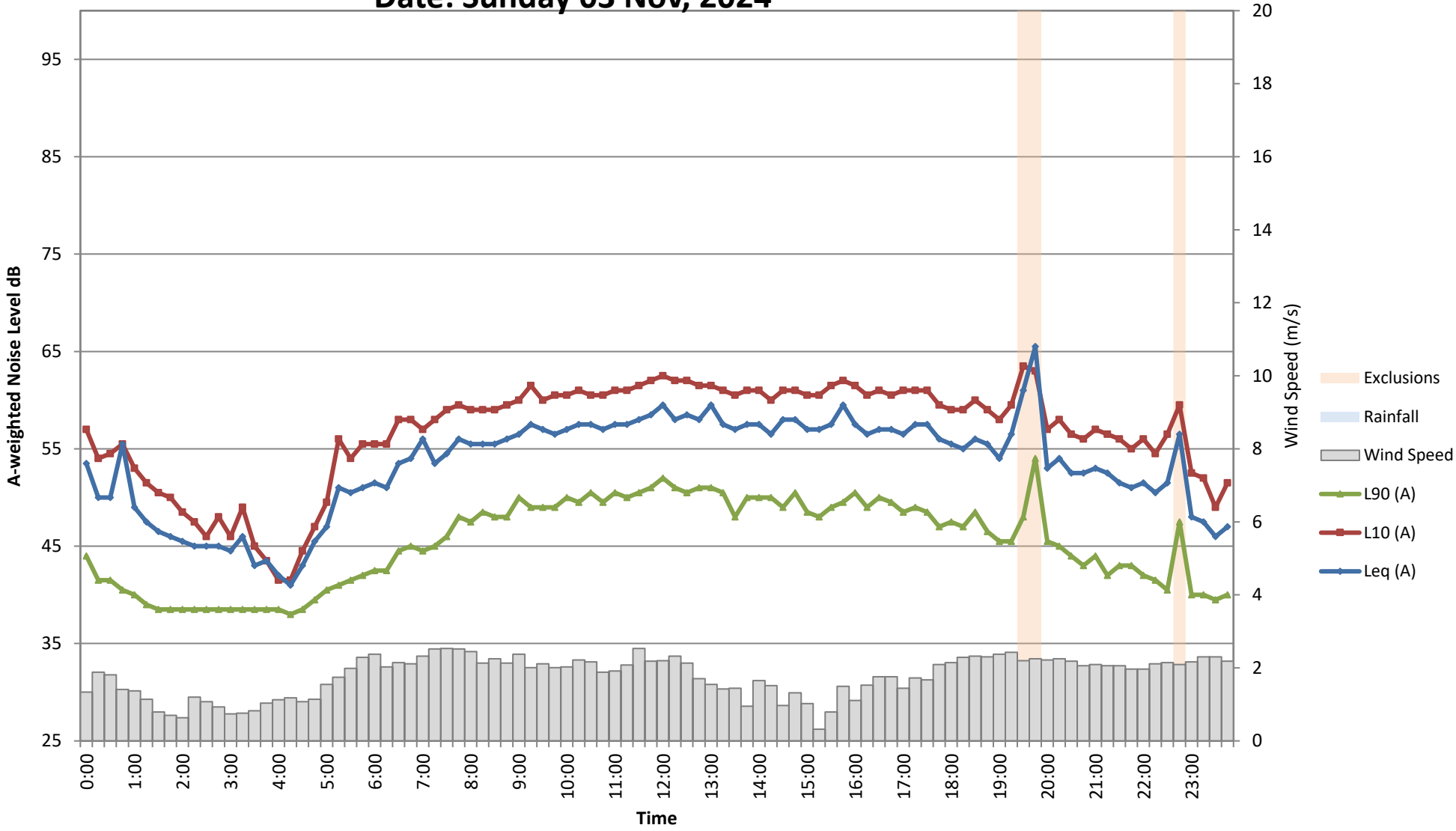
Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Friday 01 Nov, 2024



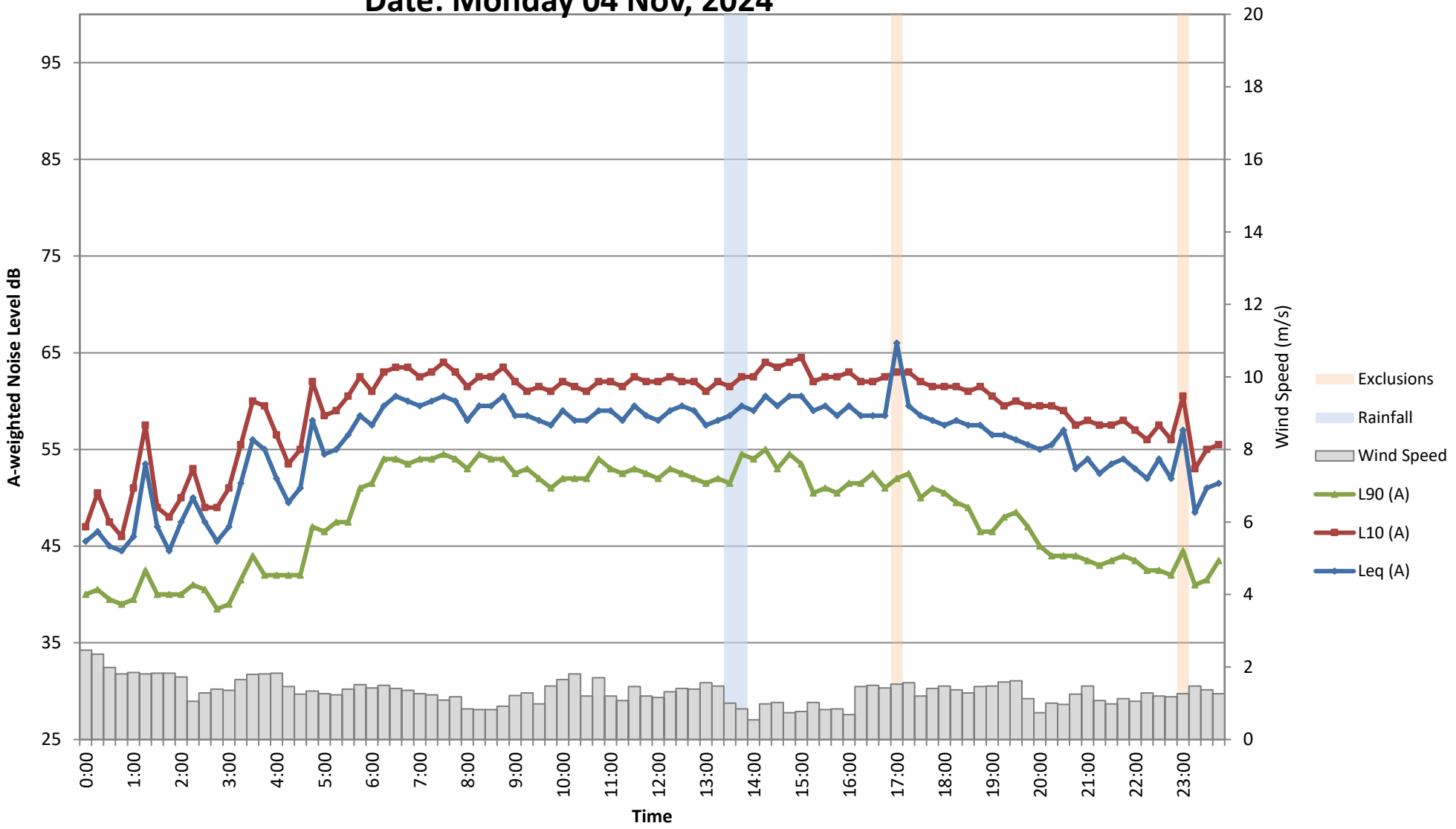
Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Saturday 02 Nov, 2024



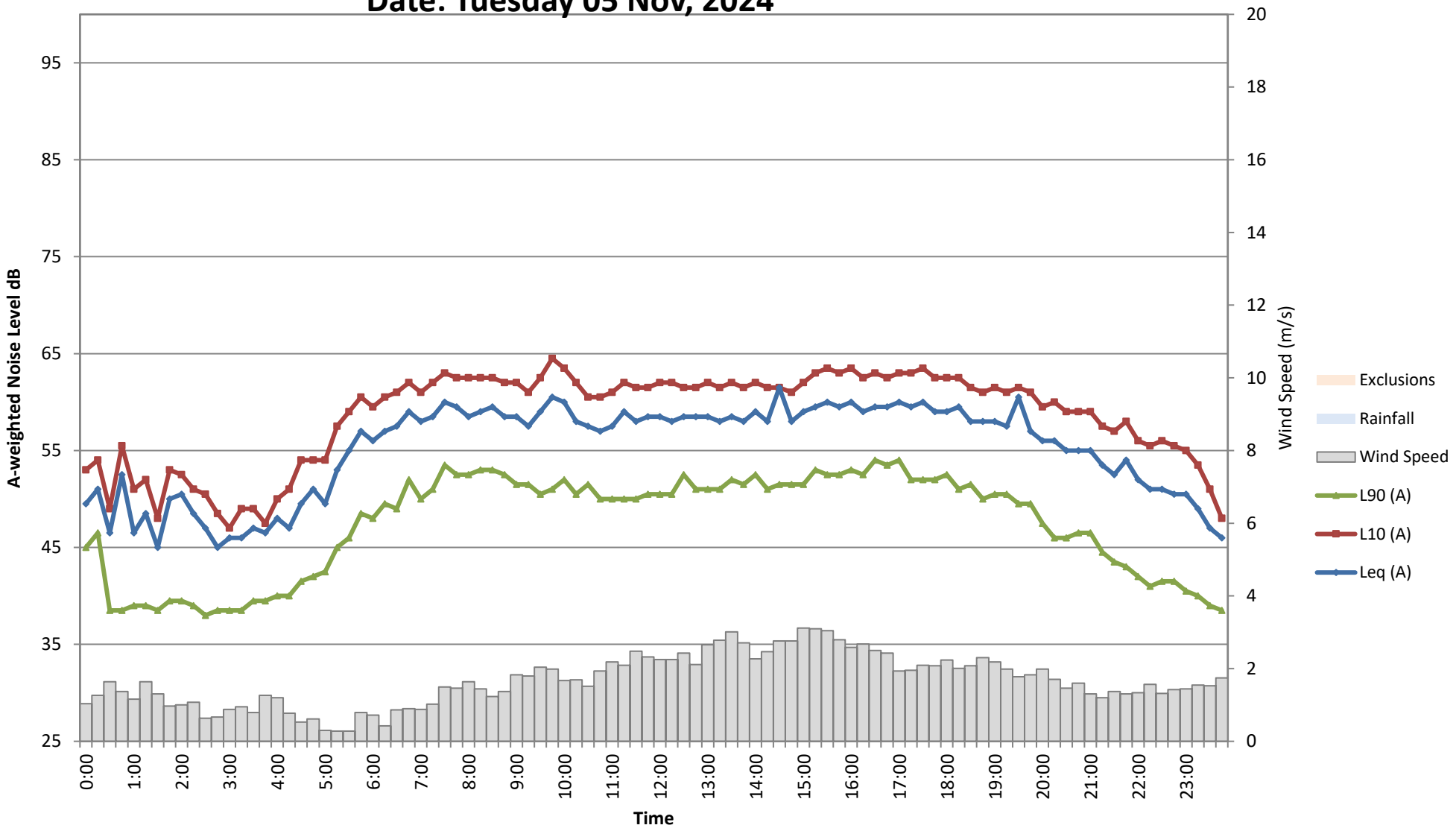
Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Sunday 03 Nov, 2024



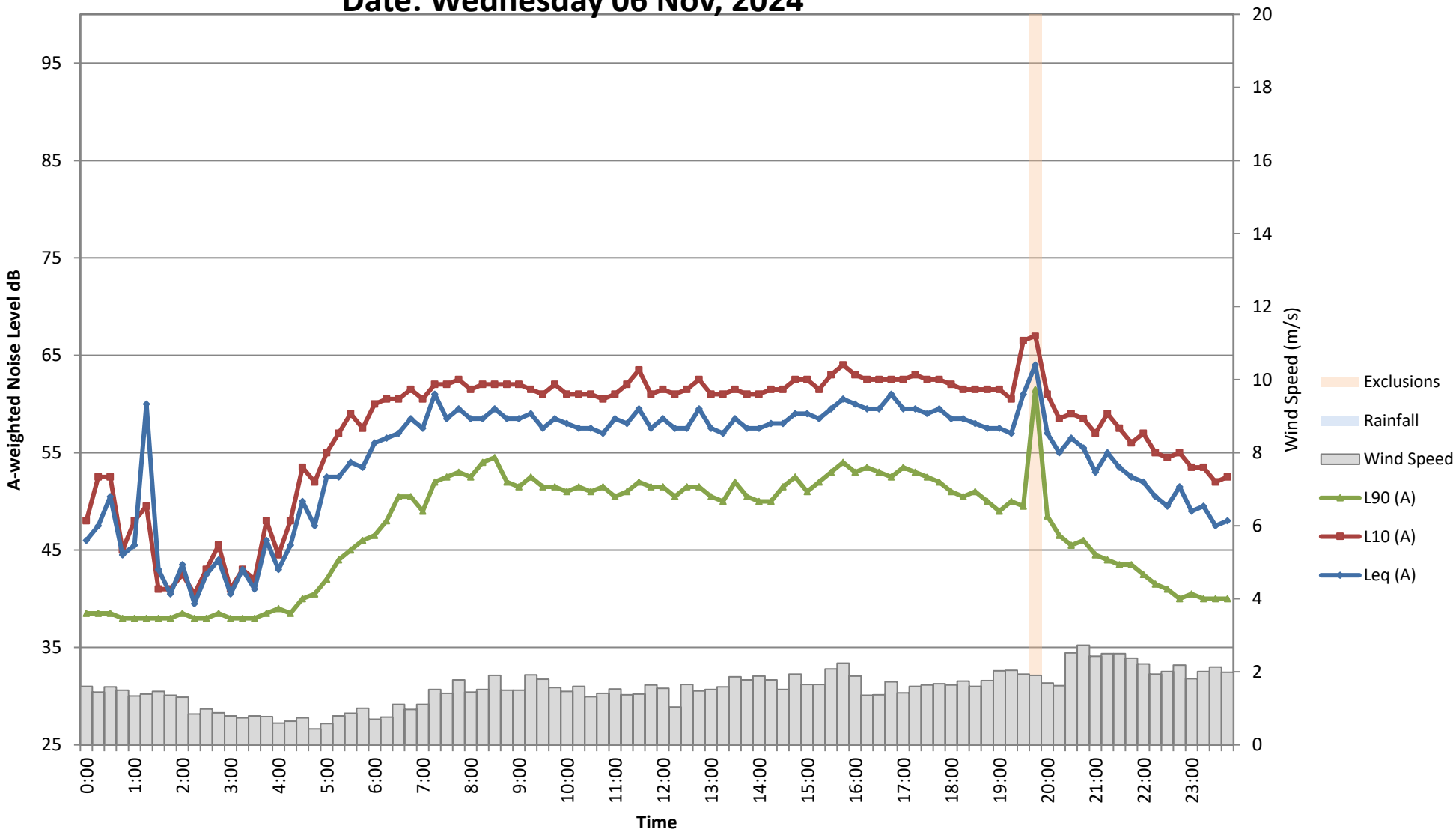
Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Monday 04 Nov, 2024



Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Tuesday 05 Nov, 2024



Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Wednesday 06 Nov, 2024



Noise Level Measurements
Monitor Location: 1 Skyline Pl, Frechs Forest - Rooftop
Date: Thursday 07 Nov, 2024