

# Noise and Vibration Assessment (SSP Study No. 3.2)

Redfern North-Eveleigh - Paint Shop Sub-Precinct

JULY 2022  
Redfern North-Eveleigh Precinct Renewal  
Doc No. 60660346-RP-IU-02

## Noise and Vibration Assessment (SSP Study No. 3.2)

Redfern North-Eveleigh - Paint Shop Sub-Precinct

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## Table of Contents

Executive Summary		i
1.0	Introduction	1
	1.1 Purpose of report	1
	1.2 Redfern North Eveleigh Precinct	2
	1.3 Redfern North Eveleigh Paint Shop Sub-Precinct	3
	1.4 Renewal vision	4
	1.5 Project description	4
2.0	Study References	7
	2.1 Policies and Guidelines	7
	2.2 Definitions	7
3.0	Existing Ambient Noise Environment	8
	3.1 Source	8
	3.2 Receivers	8
	3.3 Ambient noise monitoring	8
	3.3.1 Instrumentation	8
	3.3.2 Background noise monitoring results	9
	3.3.3 Attended monitoring	11
	3.4 Operational rail traffic noise and vibration	12
	3.4.1 Rail traffic noise monitoring results	12
	3.4.2 Attended vibration measurements	12
	3.5 Site constraints and opportunities	13
	3.5.1 Site constraints	13
	3.5.2 Site opportunities	13
4.0	Construction Noise and Vibration Criteria	14
	4.1 Interim Construction Noise Guideline	14
	4.1.1 Construction noise management levels	14
	4.1.2 Construction traffic noise criteria	16
	4.2 Construction vibration criteria	17
	4.2.1 Structural damage, including heritage	17
	4.2.2 Human comfort	18
	4.3 Construction noise and vibration assessment	19
	4.3.1 Potential impact on adjacent rail infrastructure and heritage buildings	19
	4.3.2 Recommendations	19
5.0	Operational Emission Assessment Criteria	20
	5.1 Operational noise emissions - EPA Noise Policy for Industry	20
	5.1.1 Project intrusiveness noise levels	20
	5.1.2 Project noise amenity	21
	5.1.3 Project noise trigger levels	22
	5.1.4 Maximum noise level event assessment	23
	5.1.5 Building services plant	24
	5.2 Operational Vibration emissions	24
	5.3 Operational traffic noise criteria	25
	5.3.1 Traffic noise emission assessment	26
	5.4 Outdoor functions	26
6.0	Noise Intrusion Assessment Criteria	27
	6.1 Rail noise and vibration intrusion	27
	6.1.1 Rail traffic vibration	27
	6.1.2 Rail traffic ground-borne and airborne noise	27
	6.2 Mechanical and commercial noise intrusion (airborne noise)	30
	6.3 Event noise intrusion	31
	6.4 Aircraft noise intrusion criteria	31
7.0	Noise Intrusion and Vibration Assessment	32
	7.1 Existing ground-borne rail noise assessment	32
	7.1.1 Ground-borne noise	32
	7.1.2 Ground-borne vibration	32

7.2	Airborne rail noise modelling	33
7.2.1	Methodology	33
7.2.2	Modelling inputs and assumptions	33
7.2.3	Predicted airborne rail noise levels	34
7.2.4	Rail noise Intrusion recommendations	35
7.3	Aircraft noise assessment	36
7.4	Road traffic noise intrusion assessment and recommendations	36
7.5	Noise mitigation recommendation summary	36
7.5.1	Ground-borne rail noise measurements	37
7.5.2	Air-borne rail noise	37
7.5.3	Outdoor events	37
8.0	Conclusion and Recommended Development Controls	38
8.1	Conclusion	38
8.2	Recommended Development Controls	38
8.2.1	Construction noise and vibration assessment	38
8.2.2	Noise and vibration intrusion	38
8.2.3	Noise emission	38
8.2.4	Outdoor events	39
Appendix A		
	Acoustic Terminology	A
Appendix B		
	Logger Graphs	B
Appendix C		
	Noise Contour Maps	D
Appendix D		
	Predicted rail noise levels	E
Appendix E		
	Attended Rail noise measurements	D

### List of Figures

Figure 1	Location Plan of Redfern North Eveleigh Precinct (Source: Ethos Urban)	3
Figure 2	Redfern North Eveleigh and Sub-Precincts (Source: Ethos Urban)	4
Figure 3	Indicative Concept Proposal (Source: Bates Smart and Turf)	6
Figure 4	Noise Catchment Areas (NCAs) and Logger Locations	10
Figure 5	Vibration Measurement Locations	13
Figure 6	Floor Vibration criterion for human comfort for residential areas	25
Figure 7	Measured Acceleration Levels and the Threshold of Perception (Black)	33

### List of Tables

Table 1:	State Significant Precincts Study Requirements	1
Table 2	Breakdown of Land Allocation within the Paint Shop Sub-precinct	6
Table 3	Unattended Noise Monitoring Details	9
Table 4	Ambient ( $L_{Aeq}$ ) and Existing Background ( $L_{A90}$ ) Noise Levels	9
Table 5	Attended Noise Measurements	11
Table 6	Construction Noise Management Levels – Residential Receivers	15
Table 7	Construction Noise Management Levels – Residential Receivers	16
Table 8	Construction Noise Management Levels – Non-residential Receivers	16
Table 9	Standards/Guidelines used for Assessing Construction Vibration	17
Table 10	Structural Damage Safe Limits (DIN 4150) for Building Vibration (Peak Particle Velocity)	18
Table 11	Preferred and Maximum Vibration Dose Values for Intermittent Vibration ( $m/s^{1.75}$ )	19
Table 12	Intrusiveness Noise Level	21
Table 13	Project Amenity Noise Level	22

Table 14	Project Noise Trigger Levels	23
Table 15	Night-time Sleep Disturbance Noise Trigger Levels	24
Table 16	Ranges of Multiplying Factors used in Several Countries to Specify Satisfactory Magnitudes of Building Vibration with Respect to Human Response	24
Table 17	Road Traffic Noise Assessment Criteria for Residential Land Uses	25
Table 18	Relative Increase Criteria for Residential Land Uses	26
Table 19	Preferred and Maximum Vibration Dose Values for Intermittent Vibration (m/s <sup>1.75</sup> )	27
Table 20	Airborne and Ground-borne (Internal) Noise Trigger Levels	29
Table 21	Airborne rail noise trigger levels applicable to heavy and light rail developments for sensitive land uses other than residential	30
Table 22	Recommended Mechanical and Commercial Design Sound Levels for Internal Areas	30
Table 23	Internal Aircraft Noise Criteria	31
Table 24	Calculated Regenerated Noise Levels (dB(A) L <sub>Amax</sub> , (slow)) from Train Movements	32
Table 25	Estimated VDV at the Three Vibration Monitoring Locations	32
Table 26	Summary of Predicted Airborne Rail Noise Levels in Accordance with <i>Rail Infrastructure Noise Guideline</i>	34
Table 27	418 Wilson Street, Eveleigh Traffic Noise Monitoring Details	36

## Executive Summary

The NSW Government is investing in the renewal of the Redfern North Eveleigh Precinct to create a unique mixed-use development, located within the important heritage fabric of North Eveleigh. The strategic underpinning of this proposal arises from the Greater Sydney Region Plan and District Plan. These Plans focus on the integration of transport and land use planning, supporting the creation of jobs, housing and services to grow a strong and competitive Sydney.

The Redfern North Eveleigh Precinct is one of the most connected areas in Sydney, and will be a key location for Tech Central, planned to be Australia's biggest technology and innovation hub. Following the upgrading of Redfern station currently underway, the Precinct's renewal is aimed at creating a connected destination for living and working, and an inclusive, active and sustainable place around the clock.

The Redfern North Eveleigh Precinct comprises three Sub-Precincts, each with its own distinct character:

- The Paint Shop Sub-Precinct which is the subject of this rezoning proposal;
- The Carriageworks Sub-Precinct, reflecting the cultural heart of the Precinct where current uses will be retained; and
- The Clothing Store Sub-Precinct which is not subject to this rezoning proposal.

This State Significant Precinct (SSP) Study proposes amendments to the planning controls applicable to the Paint Shop Sub-Precinct to reflect changes in the strategic direction for the Sub-Precinct. The amendment is being undertaken as a State-led rezoning process, reflecting its status as part of a State Significant Precinct located within the *State Environmental Planning Policy (Precincts - Eastern Harbour City) 2021*.

The amended development controls will be located within the City of Sydney Local Environmental Plan. Study Requirements were issued by NSW Department of Planning and Environment (DPE) in December 2020 to guide the investigations to support the proposed new planning controls.

### Purpose of report

This report provides a detailed noise and vibration assessment of the proposed masterplan, and considers the potential impacts that may result within and around the Paint Shop Sub-precinct. The assessment was undertaken in the context of various relevant policies and guidelines, with the State Significant Precincts Study Requirements and other related planning guidelines and NSW noise and vibration technical guidelines forming the baseline (refer to Section 2 of this report).

### Development context

As part of this study, the existing surroundings were assessed in the context of noise and vibration.

- The Redfern North Eveleigh Precinct is located within an urban environment. The site is situated adjacent to a rail corridor and surrounded by an existing road network.
- The Project is directly surrounded by a mix of residential, commercial and industrial developments.
- The closest residential units are located adjacent to the Carriageworks around 20 metres from the Project on Wilson Street and also on Holdsworth Street. The nearest affected residences to the site are located to the north, adjacent to the site at 501 Wilson Street, Darlington.
- A number of residential/mixed use developments are under construction around the Project.
- There are a number of heritage listed items located in the vicinity of the Project.

Key acoustic opportunities and constraints/ risks across the site are summarised in the following table.

Key issues	Responses
<ul style="list-style-type: none"> <li>• Potential adverse noise impact due to the close proximity of the precinct site to the railway corridor.</li> </ul>	<ul style="list-style-type: none"> <li>• Masterplan has been developed to locate non sensitive buildings e.g. commercial, retail, etc, to act as 'noise barriers' to protect</li> </ul>

Key issues	Responses
<ul style="list-style-type: none"> <li>Limited opportunities available to minimise railway noise levels at the source, or using noise barriers.</li> </ul>	<p>noise sensitive developments including recreational outdoor areas.</p> <ul style="list-style-type: none"> <li>For residential developments, noise sensitive internal areas, e.g. bedrooms and living areas can be located away from railway corridor.</li> <li>Manage noise mitigation at receiver end through floor plan layout design and typical façade treatments in similar areas.</li> <li>Use of placement of living areas, i.e. locate natural ventilation openings to protect living areas facing rail and road corridors.</li> </ul>
<ul style="list-style-type: none"> <li>Potential vibration impacts on heritage items within, and in close proximity to, the precinct, especially during construction phase of the project, i.e. demolition, excavations and construction.</li> <li>Potential construction vibration impacts on existing rail related structures and infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Preparation of Construction Noise and Vibration Management Plan prior to construction to quantify and manage risks</li> </ul>

## Ambient noise

Long term unattended and short term attended noise measurements were taken to assist with determination of existing ambient noise levels for the receivers surrounding the Project site - a mix of existing residential, commercial and industrial developments. The closest residential receivers are located adjacent to Carriageworks, around 20 metres from the Project on Wilson Street and Holdsworth Street.

The following observations and recommendations followed:

- The ambient noise measurements were deemed to be representative of an urban buildup area in close proximity to transport corridors, i.e. rail and road.
- Train pass-by noise measurements ranged from 68 to 89 dB(A) approximately 15 metres from the nearest rail line to the site. Similarly, train pass-by vibration measurements were taken for 39 trains.
- Noise measurements were conducted during COVID-19 restrictions. Since COVID-19 restrictions forces change in behaviour (especially within the CBD). Reduced activity during COVID-19 restrictions will result in lower background noise levels at affected receivers, which will result in lower and more stringent noise emission criteria where increases are measured against these levels. Benchmarking against noise levels without COVID-19 restriction is recommended during detailed design.
- It is therefore recommended that additional measurements be conducted prior to detail design to confirm appropriate baseline rail and road ambient noise levels related to road and rail sources.

## Construction noise and vibration

### a. Construction noise

Construction of the proposed development has the potential to temporarily contribute to the existing external noise environment.

Where construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

This report provides guidance for setting construction noise management levels for residential receivers and other sensitive land uses (refer to Section 4.1.1). The report also recommends undertaking an



initial screening test by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A) with the added construction traffic, in line with the *Road Noise Policy*.

#### **b. Construction vibration**

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. The greatest potential impact to rail infrastructure and heritage items from the Project is the construction activities associated with the Project (e.g. demolition, excavations and construction activities).

#### **c. Recommendations for construction**

It is recommended that prior to construction commencement a construction noise and vibration impact assessment be prepared that identifies potential vibration impacts on heritage items, rail infrastructure and sensitive receivers.

In addition, a construction noise and vibration management plan (CNVMP) must be prepared in consultation with the contractor that identifies noise and vibration mitigation techniques to reduce and manage the impact on the rail infrastructure, heritage items and nearby sensitive receivers.

### **Noise and vibration intrusion**

Various noise sources (mostly external to the Sub-precinct) have the potential to impact on the Paint Shop Sub-precinct buildings. The following approach is recommended to reduce the impact of noise intrusion into the Paint Shop Sub-precinct buildings.

#### **a. Aircraft noise**

The precinct lies outside of the Sydney Airport 2039 ANEF 20 contours and is therefore unlikely to be significantly impacted by aircraft noise. Standard construction methods are likely to achieve internal aircraft noise level criteria. No further assessment is considered necessary.

The Aeronautical Report prepared for the site dated November 2021 states that emergency helicopters travelling to and from the Royal Prince Alfred Hospital and the Harbour Bridge will pass nearby the site. Given that the emergency helicopter movements are likely to be infrequent, it is not considered appropriate to treat the building façade to reduce noise from emergency helicopters.

#### **b. Rail noise and vibration intrusion**

Based on the air-borne and ground-borne noise levels presented in this report, it is likely that internal noise levels criteria for commercial and residential premises can be achieved with appropriate façade treatment.

External rail noise levels to residential buildings P1 and P2 are in excess of 20 dB of the internal noise criteria. As the noise level from rail varies across the site – the dwellings in the second row of buildings (E2 and F1) are expected to achieve the internal noise criteria with natural ventilation with typical building construction and appropriate layouts. Based on the Apartment Design Guide aligned designs by Bates Smart internal noise amenity standards can be met. For the buildings adjacent to the rail line this will require careful consideration of internal floor layout, room usage, the size of the windows and locations of natural ventilation openings. The following design considerations should be considered to achieve the requirements of the DoPE's document *Development near Rail Corridors and Busy Roads – Interim Guidelines*:

- Treatment to residential premises and commercial areas may consist of measures consistent with typical treatment measures for high density residential buildings adjacent to rail corridors. A review of this approach is included in Section 6.0.

A detailed acoustic assessment should be developed through subsequent stages of design of the internal layouts of the buildings and specification of room usages.

#### **c. Road traffic noise**

Noise from traffic movements to and from the site including truck and car movements has been assessed using the EPA's document *NSW Road Noise Policy* (RNP). The nearest road with the potential to have a traffic noise impact on the development is Wilson Street, which is located along the northern boundary of the site.

This report finds that the traffic volumes projected within the *Transport Strategy and Impact Assessment for the Paint Shop Sub-precinct* (SCT Consulting, April 2022) are not likely to significantly impact on the proposed new residential buildings.

Standard construction methods are likely to achieve internal road traffic noise level criteria. No further assessment is considered necessary.

#### **d. Outdoor events**

The masterplan for the Paint Shop Sub-precinct will provide public space which may be used for outdoor functions, the specifics to be determined at a later stage of design.

The potential land use for the Paint Shop Precinct includes facilities to host outdoor entertainment events. To understand the potential noise generation associated with such events, event noise emanating from the existing facilities in the adjacent Carriageworks development can be used as a benchmark. It is understood that based on the noise restrictions for Carriageworks, outdoor event noise levels should not exceed 5 dB above background ( $L_{90}$ ) noise levels. AECOM understands that Carriageworks have advised that no noise complaints are issued under current use. It is expected that similar events hosted in the Paint Shop Sub-precinct would be covered under the City of Sydney's *Live Music and Performance Action Plan* and would be individually assessed based on the details of the specific size and scale outdoor events as the development is delivered. Anticipated controls to facilitate outdoor events are summarised further in Section 5.4.

### **Noise emission and mitigation**

Aside from noise and vibration intrusion, the development also has the potential to emit noise.

#### **a. Noise emission**

In relation to the Paint Shop Sub-precinct, industrial noise sources include mainly building services plant equipment, i.e. carpark/kitchen/toilet exhaust fans, air-conditioning units, chillers, cooling towers, carpark and loading dock activities.

#### **b. Vibration**

The level of vibration from typical mechanical plant is unlikely to produce vibration level that will affect human comfort levels or building damage in heritage buildings or impact the stability of existing rail related structures and infrastructure.

#### **c. Mitigations**

Typical treatments to these items of plant include barriers, silencers, attenuators, lined duct and enclosures. All external mechanical plant should be assessed following detailed design to ensure compliance with the acoustic criteria established in Section 5.0, including impacts that will have cumulative noise generated by the site.

Overall – with consideration of the appropriate noise control measures as detailed in this report (during construction and operation) it is considered there are no atypical constraints to development of a project of this type adjacent to a rail corridor.

## 1.0 Introduction

The NSW Government is investing in the renewal of the Redfern North Eveleigh Precinct to create a unique mixed-use development, located within the important heritage fabric of North Eveleigh. The strategic underpinning of this proposal arises from the Greater Sydney Region Plan and District Plan. These Plans focus on the integration of transport and land use planning, supporting the creation of jobs, housing and services to grow a strong and competitive Sydney.

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The amended development controls will be located within the City of Sydney Local Environmental Plan. Study Requirements were issued by NSW Department of Planning and Environment (DPE) in December 2020 to guide the investigations to support the proposed new planning controls.

### 1.1 Purpose of report

The purpose of this report is to provide a detailed noise and vibration assessment of the proposed changes, and consider any potential impacts that may result within and surrounding the Paint Shop Sub-precinct. This report addresses Study Requirement 3.2. The relevant Study Requirements, considerations and consultation requirements, and location of where these have been responded to is outlined in Table 1.

**Table 1: State Significant Precincts Study Requirements**

The State Significant Precincts	
3.2 Prepare a Noise and Vibration Assessment for the proposal that meets the following:	
Study Requirements	Where addressed
<ul style="list-style-type: none"> <li>• Identifies the existing situation, both within the Precinct and in affected adjacent areas, showing constraints, opportunities and key issues and maps any sensitive receptors;</li> </ul>	<p>Existing noise environment is discussed in Section 3.0, Page 8</p> <p>Site constraints and opportunities and key issues is discussed in Section 3.5, Page 12.</p> <p>Maps identifying nearby noise sensitive receptors is presented in <b>Figure 4</b></p>
<ul style="list-style-type: none"> <li>• Assesses the likely noise and vibration impacts on future development, particularly in relation to both the rail operations and events held within the Precinct;</li> </ul>	<p>Noise and vibration impacts are discussed in Section 4.3.1, page 19</p>

<ul style="list-style-type: none"> <li>Assesses the likely vibration impacts on heritage items within, and in proximity to, the precinct and recommended mitigation measures to reduce vibration impacts, where appropriate;</li> </ul>	Vibration impacts are discussed in Section 4.2.1, page 17
<ul style="list-style-type: none"> <li>Models and assesses the efficacy of the likely future noise, and vibration measures to minimise negative impacts on comfort and to minimise harm to people or property;</li> </ul>	Noise and vibration assessments are discussed in Section 7.0, pages 32 - 36.
<ul style="list-style-type: none"> <li>Ensures there that the proposal does not impact the stability of any existing rail related structures and infrastructure; and</li> </ul>	Controls to maintain stability of existing structures are discussed in Section 4.2.1 and 4.3.2, pages 17 and 19
<ul style="list-style-type: none"> <li>Recommends appropriate noise, vibration and pollution development standards to be applied to subsequent development stages.</li> </ul>	Recommendations for noise and vibration criteria are presented in Section 8.1, page 38  Pollution impacts are presented in <i>Pollution Assessment 60660346-RP-IU-03</i> (AECOM, November 2021).
<b>Considerations</b>	<b>Where addressed</b>
<ul style="list-style-type: none"> <li>Identify, map and describe current and approved sensitive receptors</li> </ul>	Maps identifying nearby noise sensitive receptors is presented in <b>Figure 4</b>
<ul style="list-style-type: none"> <li>Identify map and describe current and likely future noise and vibration affecting the precinct, including sources nature and impact, including potential cumulative impacts</li> </ul>	Noise and vibration assessments are discussed in Section 7.0, page 32.
<ul style="list-style-type: none"> <li>Include 3D mapping to clearly communicate these impacts; and</li> </ul>	3D façade noise maps are presented in Appendix C
<ul style="list-style-type: none"> <li>Include noise monitoring results the adjacent roads and rail corridor, as well as the railyards area within the precinct.</li> </ul>	Existing acoustic environment is discussed in Section 3.0, page 8. The noise logging results are presented in Appendix B.

## 1.2 Redfern North Eveleigh Precinct

The Redfern North Eveleigh Precinct is located approximately 3 kilometres south-west of the Sydney CBD in the suburb of Eveleigh (refer to Figure 1). It is located entirely within the City of Sydney local government area (LGA) on government-owned land. The Precinct has an approximate gross site area of 10.95 hectares and comprises land bounded by Wilson Street and residential uses to the north, an active railway corridor to the south, residential uses and Macdonaldtown station to the west, and Redfern station located immediately to the east of the Precinct. The Precinct is also centrally located close to well-known destinations including Sydney University, Victoria Park, Royal Prince Alfred Hospital, the University of Technology Sydney, and South Eveleigh, forming part of the broader Tech Central District.

The Precinct is located within the State Heritage-listed curtilage of Eveleigh Railway Workshops and currently comprises the Platform Apartments with 88 private dwellings, Sydney Trains infrastructure and key state heritage buildings including the Paint Shop, Chief Mechanical Engineer's Building, and the Carriageworks and Blacksmith Shop which provide shared community spaces for events including the Carriageworks Farmers Markets.

A map of the Precinct and relevant boundaries is illustrated in Figure 2.

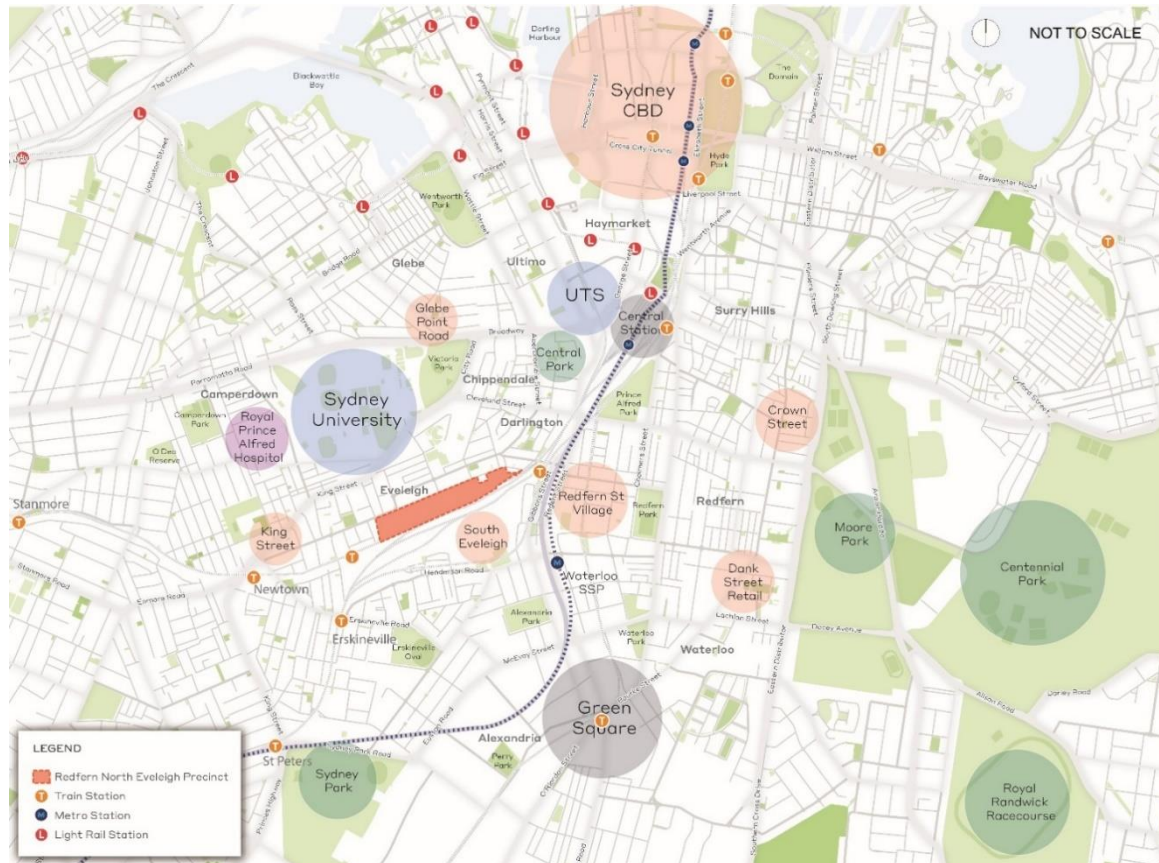


Figure 1 Location Plan of Redfern North Eveleigh Precinct (Source: Ethos Urban)

### 1.3 Redfern North Eveleigh Paint Shop Sub-Precinct

The Redfern North Eveleigh Paint Shop Sub-Precinct is approximately 5.15 hectares and is bounded by Wilson Street to the north, residential terraces and Redfern station to the east, the Western Line rail corridor to the south and the Carriageworks Sub-Precinct to the west. The Sub-Precinct has a significant level change from a Reduced Level (RL) height of RL25 metres to RL29 metres on Wilson Street.

The Paint Shop Sub-Precinct currently hosts a number of items of heritage significance, including the Paint Shop Building, Fan of Tracks, Science Lab Building, Telecommunications Building, and Chief Mechanical Engineer’s Building. The Sub-Precinct has a number of disused spaces adjacent to the rail corridor as well as functioning Sydney Trains’ infrastructure, offices and operational space. Vehicle and pedestrian access to this area is used by Sydney Trains. The site has a clear visual relationship to South Eveleigh and the Eveleigh Locomotive Workshops across the active rail corridor.

A map of the Paint Shop Sub-Precinct and relevant boundaries is illustrated in Figure 2 .

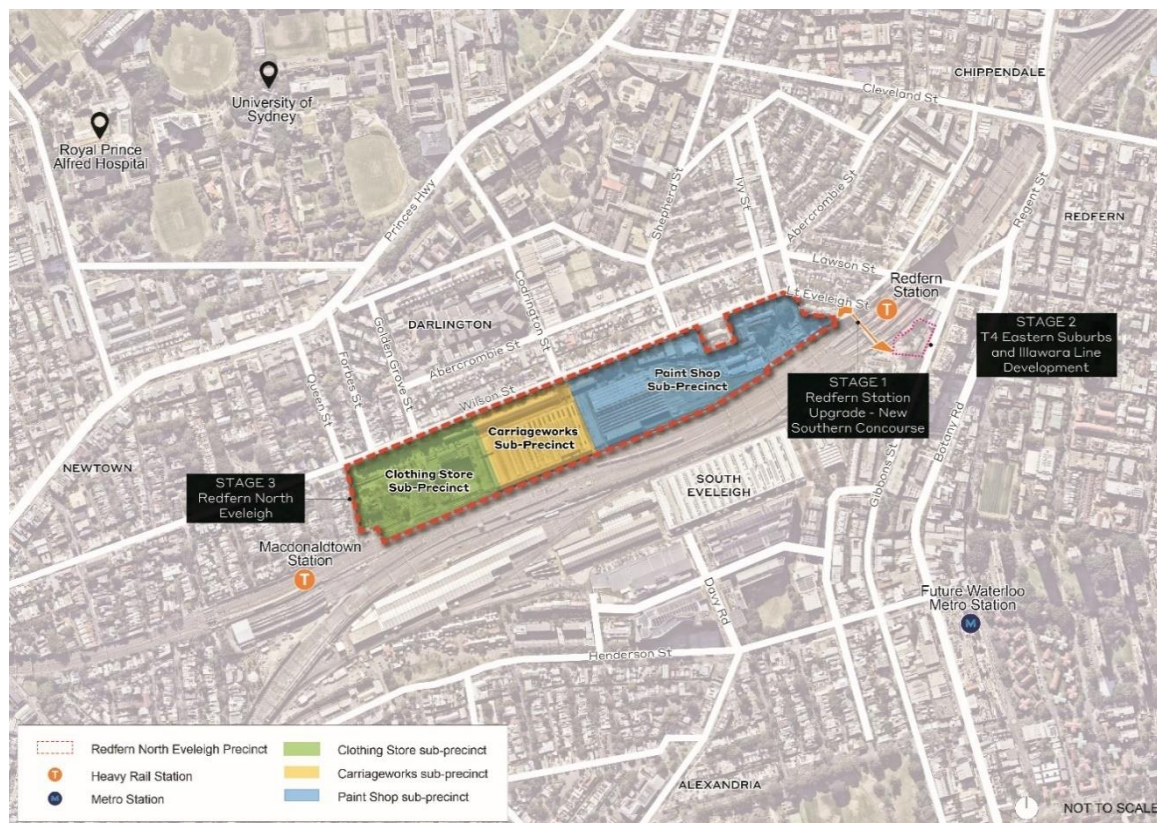


Figure 2 Redfern North Eveleigh and Sub-Precincts (Source: Ethos Urban)

## 1.4 Renewal vision

The Redfern North Eveleigh Paint Shop Sub-Precinct will be a connected centre for living, creativity and employment opportunities that support the jobs of the future, as well as providing an inclusive, active and sustainable place for everyone, where communities gather.

Next to one of the busiest train stations in NSW, the Sub-Precinct will comprise a dynamic mix of uses including housing, creative and office spaces, retail, local business, social enterprise and open space. Renewal will draw on the past, adaptively re-using heritage buildings in the Sub-Precinct and will acknowledge Redfern's existing character and particular significance to Aboriginal peoples, culture and communities across Australia. The Sub-Precinct will evolve as a local place contributing to a global context.

## 1.5 Project description

An Urban Design and Public Domain Study has been prepared to establish the urban design framework for the Redfern North Eveleigh Paint Shop Sub-Precinct. The Urban Design and Public Domain Study provides a comprehensive urban design vision and strategy to guide future development of the Sub-Precinct and has informed the proposed planning framework of the SSP Study.

The Urban Design Framework for the Paint Shop Sub-Precinct comprises:

Approximately 1.4 hectares of publicly accessible open space, comprising:

- A public square – a 7,910 square metre public square fronting Wilson Street;
- An eastern park – a 3,871 square metre park located adjacent to the Chief Mechanical Engineer's Building and the new eastern entry from Platform 1 of the Redfern station; and
- Traverser No1 - a 2,525 square metre public square edged by Carriageworks and the Paint Shop.

Retention of over 90% of existing high value trees.

An overall greening coverage of 40% of the Sub-Precinct.

A maximum of 142,650 square metre gross floor area (GFA), comprising:

- between 103,700 - 109,550 square metres of gross floor area (GFA) for employment and community facility floor space (minimum 2,500 square metres). This will support approximately 6,200 direct jobs on the site across numerous industries including the innovation, commercial and creative sectors.
- between 33,100 - 38,950 square metres of GFA for residential accommodation, providing for between 381 and 449 new homes (including 15% for the purposes of affordable housing).

New active transport infrastructure and routes to better connect the Paint Shop Sub-Precinct with other parts of Tech Central and the surrounding localities.

Direct pedestrian connections to the new Southern Concourse at Redfern station.

Residential parking rates, comprising:

- Studio at 0.1 per dwelling
- 1 Bed at 0.3 per dwelling
- 2 Bed at 0.7 per dwelling
- 3 Bed at 1.0 per dwelling

Non-residential car parking spaces (including disabled and car share) are to be provided at a rate of 1 space per 700 square metres of GFA.

66 car spaces are designated for Sydney Trains maintenance and operational use.

The key features of the Urban Design Framework, include:

The creation of a new public square with direct pedestrian access from Wilson Street to provide a new social and urban hub to promote outdoor gatherings that will accommodate break out spaces and a pavilion structure.

An eastern park with direct access from Redfern station and Little Eveleigh Street, which will provide a high amenity public space with good sunlight access, comfortable wind conditions and community character.

Upgraded spatial quality of the Traverser No1 yard, retaining the heritage setting, and incorporating complementary uses and good access along Wilson Street to serve as a cultural linkage between Carriageworks and the Paint Shop Building.

The establishment of an east-west pedestrian thoroughfare with new public domain and pedestrian links.

A range of Water Sensitive Urban Design (WSUD) features.

Activated ground level frontages with commercial, retail, food and beverage and community and cultural uses.

Adaptive reuse of heritage buildings for employment, cultural and community uses.

New buildings for the Sub-Precinct, including:

- Commercial buildings along the rail corridor that range between 3 and 26 occupied storeys;
- Mixed use buildings along the rail corridor, comprising a three-storey non-residential podium with residential towers ranging between 18 to 28 occupied storeys;
- Mixed use buildings (commercial and residential uses) along Wilson Street with a four-storey street wall fronting Wilson Street and upper levels at a maximum of 9 occupied storeys that are set back from the street wall alignment;
- A commercial building on the corner of Wilson Street and Traverser No.1 with a four-storey street wall fronting Wilson Street and upper levels at a maximum of 8 occupied storeys that are set back from the street wall alignment. There is flexibility to allow this building to transition to a mixed-use building with active uses at ground level and residential uses above; and
- Potential options for an addition to the Paint Shop Building comprising of commercial uses. These options (all providing for the same GFA) include:
  - o A 5-storey commercial addition to the Paint Shop Building with a 3m vertical clearance, with the adjacent development site to the east comprising a standalone 3-storey commercial building (represented in Figure 3);
  - o A 3-storey commercial addition to the Paint Shop Building with a 3m vertical clearance which extends and connects to the commercial building on the adjacent development site to the east; and
  - o No addition to the Paint Shop Building, with the adjacent development site to the east comprising a standalone 12-storey commercial building.

Commitment to a 5 Star Green Star Communities rating, with minimum 5 Star Green Star Buildings rating.

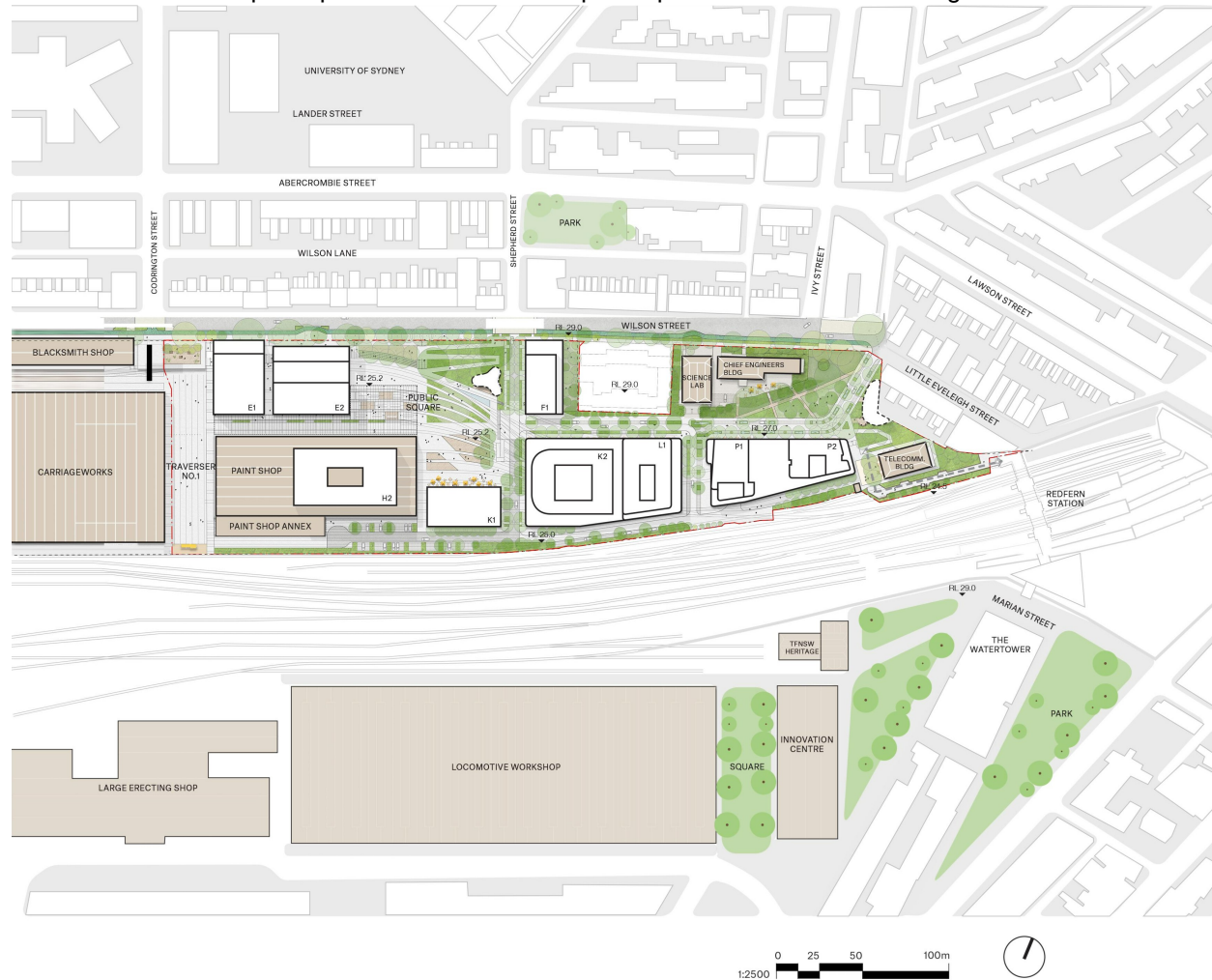
All proposed buildings are below the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) to ensure Sydney Airport operations remain unaffected.

The proposed land allocation for the Paint Shop Sub-precinct is described in Table 2.

**Table 2 Breakdown of Land Allocation within the Paint Shop Sub-precinct**

Land allocation	Existing	Proposed
Developed area	15,723 sqm / 30% of total site area	20,824 sqm / 40% of total site area
Public open space	Area not publicly accessible	14,306 sqm / 28% of total site area
Other public domain areas (including streets, shared zones, pedestrian paths and vehicular zones)	Area not publicly accessible	15,149 sqm / 29% of total site area (Excludes privately accessible public links and private spaces ~ 3% of total site area)

The Indicative Concept Proposal for the Paint Shop Sub-precinct is illustrated in Figure 3.



**Figure 3 Indicative Concept Proposal (Source: Bates Smart and Turf)**



## 2.0 Study References

### 2.1 Policies and Guidelines

The following policies and guidelines are relevant for this assessment:

- State Significant Precincts – Study Requirements – Redfern North Eveleigh Precinct, December 2020 (Department of Planning, Industry and Environment, 2020)
- Sydney Development Control Plan 2012
- State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
- Draft Central Sydney Planning Strategy and draft DCP
- State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP 2021)
- State Environmental Planning Policy No 65—Design Quality of Residential; Apartment Development
- Assessing Vibration: A Technical Guideline (AVATG), Department of Environment and Conservation, 2006
- NSW Road Noise Policy (RNP), Department of Environment, Climate Change and Water, 2011
- Noise Policy for Industry, Environment Protection Authority, 2017
- Noise Guide for Local Government, Environment Protection Authority, 2013a
- Rail Infrastructure Noise Guideline, Environment Protection Authority, 2013b
- Transport for NSW's Standard for Airspace and External Developments, 2021
- Development Near Rail Corridors and Busy Roads – Interim Guideline, Department of Planning, 2008
- DIN Standard 4150: Part 3 2016 Vibration in Buildings - Effects on Structures, 1999
- British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings, 1993
- British Standard 6472: Evaluation of human exposure to vibration in buildings (1-80 Hz), 1992
- Australian New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2021:2015 Acoustics—Aircraft noise intrusion— Building siting and construction
- Australian Standard AS 1055-2018 – Acoustics—Description and measurement of environmental noise, 2018
- International Standard ISO 9613-2:1996 - Acoustics -- Attenuation of sound during propagation outdoors - Part 2: General method of calculation
- Australia Standard AS IEC 61672.1-2019 - Electroacoustics – Sound level meters Specifications

### 2.2 Definitions

Definitions for acoustic terminology used within this report can be found in Appendix A.

## 3.0 Existing Ambient Noise Environment

As part of this study, the existing surroundings were assessed in the context of noise and vibration.

- The Redfern North Eveleigh Precinct is located within an urban environment.
- The site is situated adjacent to a rail corridor and surrounded by an existing road network.
- The Project site is directly surrounded by a mix of existing residential, commercial and industrial developments.

### 3.1 Source

To assist in determining noise management levels for the receivers surrounding the Project, five noise catchment areas (NCAs) were identified. For the purposes of undertaking a noise impact assessment the noise environment at each of the residential receivers within a NCA is considered to have a similar noise environment, considering the proximity to existing major noise sources. Each NCA is shown in **Figure 4**.

Key characteristics related to the NCAs are listed below:

- The acoustic environment in NCA 1 is dominated by rail noise.
- The acoustic environment in NCA 2, 3, 4 and 5 are generally dominated by local vehicle traffic with receivers also affected by rail noise depending on proximity to the rail corridor.
- All NCAs are impacted by noise from commercial and industrial activities.
- Natural sounds, including bird calls, are also audible throughout all NCAs.
- These characteristics are typical of an urban environment.

### 3.2 Receivers

A mix of residential, commercial and industrial receivers are situated around to the development site. The closest residential receivers are located adjacent to the Carriageworks around 20 metres from the Project and on Wilson Street (NCA 1 and NCA 3 respectively).

A number of residential/mixed use developments are under construction around the Project.

The nearest affected residences to the site are located to the north, adjacent to the site at 501 Wilson Street, Darlington. The Project area and the surrounding environment are shown in **Figure 4**.

There are a number of heritage listed items located in the vicinity of the Project. These heritage items are listed in the New South Wales State Heritage Register and include the Eveleigh Chief Engineers Building, Eveleigh Railway Workshops and Machinery, and Redfern Railway Station Group.

### 3.3 Ambient noise monitoring

#### 3.3.1 Instrumentation

Long term unattended and short term attended noise measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers around the Project. Measurements were made using noise loggers at five locations. The locations of the five noise loggers are shown in **Figure 4**.

The acoustic instrumentation employed during unattended and attended noise measurements comply with the requirements of *AS IEC 61672.1-2019 Electroacoustics – Sound level meters Specifications* and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

The noise loggers were placed at representative locations around the Project area as listed in Table 3 and shown in **Figure 4**. The noise loggers were calibrated prior to the monitoring period with a drift in calibration not exceeding  $\pm 0.5$  dB(A).

**Table 3 Unattended Noise Monitoring Details**

Logger	Location	Period	Logger model	Logger serial number
1 (NCA1)	245 Wilson Street, Eveleigh (Carriageworks)	16 June to July 7 2021	Rion NL52	175537
2 (NCA2)	28 Holdsworth Street, Newtown	16 June to July 7 2021	Rion NL52	175550
3 (NCA3)	418 Wilson Street, Eveleigh	16 June to July 7 2021	Rion NL52	164393
4 (NCA4)	154 Lawson Street, Redfern	16 June to July 7 2021	Rion NL52	164396
5 (NCA5)	5 Wyndham Street, Alexandria	16 June to July 7 2021	Rion NL52	164395

### 3.3.2 Background noise monitoring results

**Table 4** presents the existing overall representative  $L_{Aeq}$  ambient noise level and the background  $L_{A90}$  noise levels for the day, evening and night-time periods, in accordance with the EPA's *Noise Policy for Industry*. The overall representative  $L_{Aeq}$  noise levels were determined by logarithmically averaging each assessment period for the entire monitoring period. The noise logging results are also presented graphically in **Appendix B**.

**Table 4 Ambient ( $L_{Aeq}$ ) and Existing Background ( $L_{A90}$ ) Noise Levels**

Logger	Log average $L_{Aeq}$ , dB(A)			RBL $L_{A90}$ , dB(A)		
	Day <sup>1</sup>	Evening <sup>1</sup>	Night <sup>1</sup>	Day <sup>1</sup>	Evening <sup>1</sup>	Night <sup>1</sup>
1 (NCA1)	64	62	59	47	44	41
2 (NCA2) <sup>2</sup>	54	51	46	37	38	35
3 (NCA3)	54	51	46	39	37	33
4 (NCA4)	63	61	58	43	41	37
5 (NCA5)	65	63	61	55	51	48

**Notes:**

- Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.
- The logger was positioned 15 m from the closest rail line.

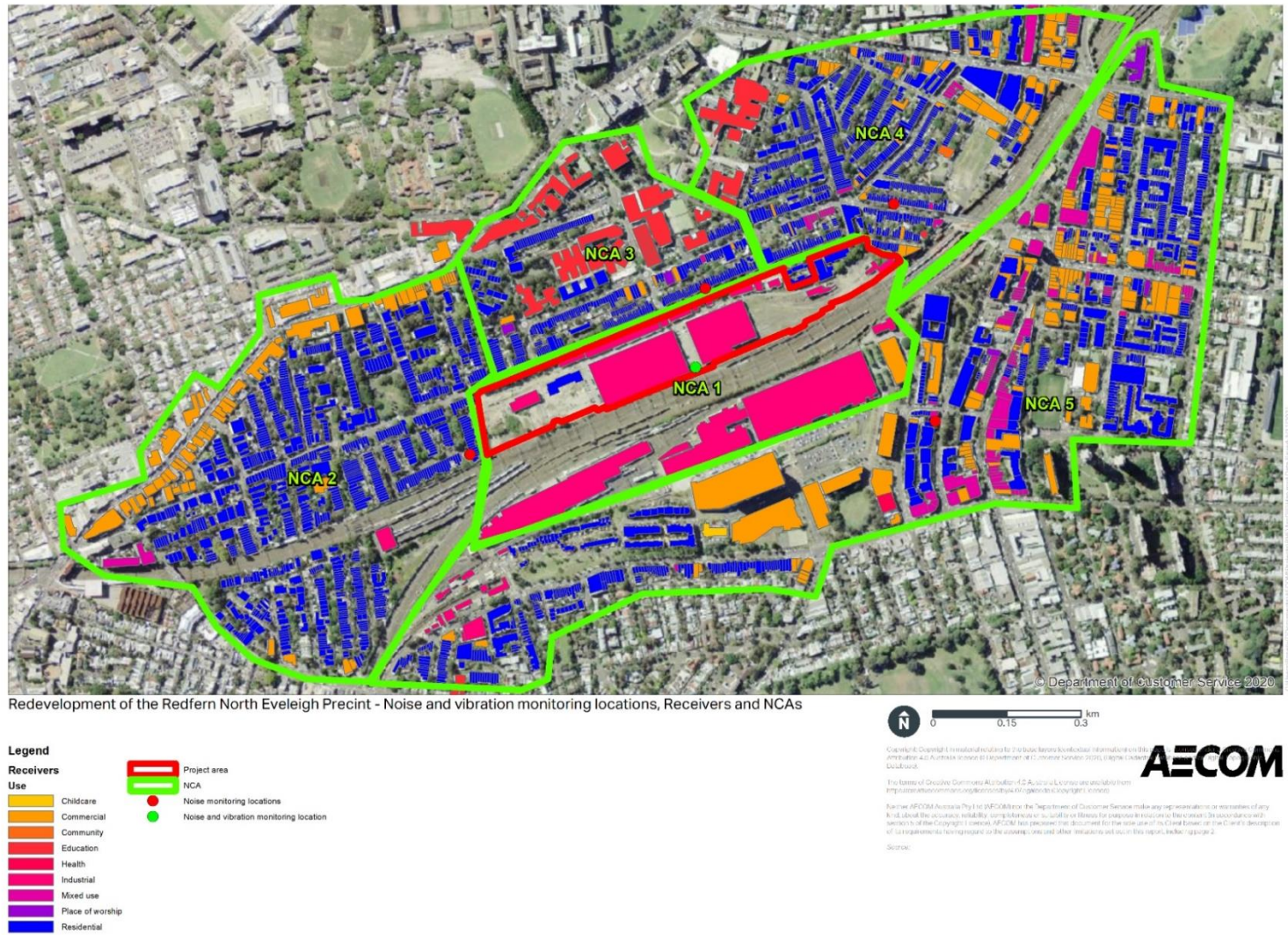


Figure 4 Noise Catchment Areas (NCAs) and Logger Locations

The above results were compared with results for unattended Noise Monitoring Results recorded by Acoustic Dynamics (Preliminary Acoustic Report – Rail Traffic Noise and Vibration Acoustic Design Considerations). While recording locations were not identical location Acoustic Dynamics location BG3 provides the closest equivalent to NCA 1). Results for daytime and night-time during those measurements (Table 4.2.1 in the 2008 report) are 4dB and 6dB higher respectively – though generally within the expected range for similar developments.

It should be noted that the noise measurements were conducted during a period when the effects of moderate COVID-19 restriction were still evident, and directly prior to hard lockdown being imposed in NSW. Given that COVID-19 restrictions forces change in behaviour, particularly within the CBD (i.e. significantly reduced traffic movements, less people outside, some businesses shut down for the period etc.), existing environmental noise monitoring would not be representative of the ordinary noise environment within the study area. Therefore, it is recommended that additional measurements be conducted prior to detailed design to further confirm existing noise levels (in a scenario not affected by COVID-19 restrictions), noting that using the measured results as a baseline in this report represents a conservative approach. Despite the recommendation for additional measurements it is noted that lockdown would not impact on baseline noise and vibration readings for rail, since services continued on the Sydney Trains public transport system. Only noticeable impacts would be on cars/ road traffic volumes and associated vehicle counts and baseline noise levels from the road.

### 3.3.3 Attended monitoring

Attended noise measurements were also conducted at the five noise monitoring locations on 16 June 2021. The attended measurements were conducted over 15 minute periods. Weather conditions were sunny on the days of monitoring, with no wind.

Attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Class 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated before and after the measurements with no drift in calibration exceeding  $\pm 0.5$  dB(A).

The results of the attended noise monitoring are presented in Table 5.

**Table 5 Attended Noise Measurements**

Location	Date	Time	L <sub>Aeq</sub> , dB(A)	L <sub>A90</sub> , dB(A)	Comments
1	16/06/2021	11:29	70	59	Noise environment dominated by rail noise. Sunny weather.
2	16/06/2021	10:38	50	40	Noise environment dominated by road traffic noise and rail noise. Construction noise audible from a distance. Trains pass by 56 to 59 dB(A). Background with no rail or local traffic 45 to 48 dB(A). Aircraft overhead 58 dB(A). Car pass by 63 dB(A). Bird calls audible occasionally. Sunny weather.
3	16/06/2021	11:32	62	41	Background dominated by distant road traffic noise 44 to 47 dB(A). Motorbike pass by 86 dB(A). Distant rail noise audible 47 dB(A). Local road traffic 62 to 75 dB(A). Aircraft pass by 50 dB(A). Bird calls 52 dB(A). Sunny weather.
4	16/06/2021	11:26	60	45	Background dominated by road traffic noise. Busy street with cafes and station on either ends.

Location	Date	Time	L <sub>Aeq</sub> , dB(A)	L <sub>A90</sub> , dB(A)	Comments
					Background with no traffic 42 to 44 dB(A). Local road traffic car pass by 65 to 72 dB(A). Distant rail noise audible. Bird calls audible occasionally. Sunny weather.
5	16/06/2021	11:03	66	57	Background dominated by Road traffic noise on Wyndham Street 64 to 66 dB(A). Bus pass by 69 dB(A). Fire truck pass by 84 dB(A). Motorbike pass by 70 dB(A). Children playing in the park opposite the property audible. Bird calls audible 57 dB(A) when no traffic. Sunny weather.

The attended measurements presented in Table 5 are considered to be representative of an urban buildup area in close proximity to transport corridors, i.e. rail and road.

Based on the noise environment observed on site and discussed above in Section 3.1, the site is affected by rail noise within levels that can be mitigated through appropriate design of the building facades and individual apartments.

Observations at the NCAs located further from the site indicate that rail noise is less of a feature compared to the site and therefore the existing environment is characterised by lower background noise levels and nature sounds.

Lower background noise levels impact the noise emission criteria from the site and result in more stringent noise criteria compared to the residences affected by rail noise.

### 3.4 Operational rail traffic noise and vibration

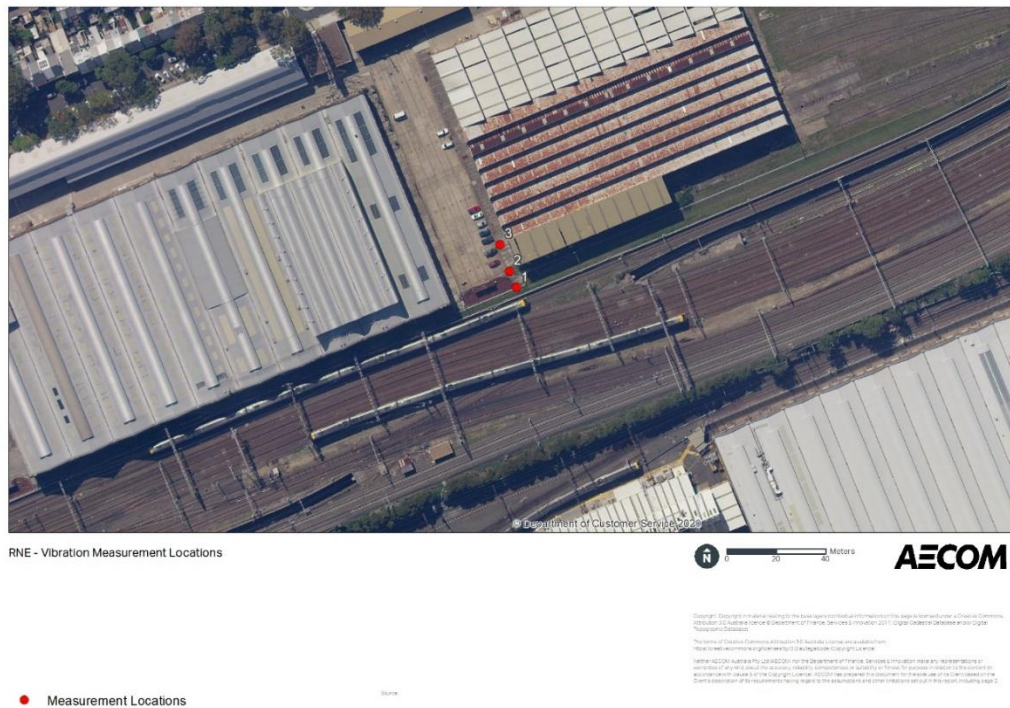
#### 3.4.1 Rail traffic noise monitoring results

Train pass-by noise measurements were conducted from 12 pm until 1 pm on Wednesday 16 June 2021. The noise levels were measured at 15 metres from the nearest rail line. Trains towards Sydney have been indicated as being “Up”, while those moving away from Sydney are labelled “Down”. Rail noise measurements were conducted using a Brüel & Kjær Type 2270. The measured noise levels range from 68 to 89 dB(A) and are presented in Appendix E. These noise levels are representative of a typical urban build-up area in close proximity to transport corridors, i.e. rail and road.

#### 3.4.2 Attended vibration measurements

Train pass-by vibration measurements were conducted from 12 pm until 1 pm on Wednesday 16 June 2021. The measurements were carried out at 5.9 metres, 13 metres, and 24.6 metres from the closest train line. For context, the Masterplan shows a distance of 18m from the railway to the residential towers' nearest façade.

A total of 39 trains were measured. The measurement locations are presented in **Figure 5**. A mixture of passenger, XPT and TIV trains were measured on both the up and down tracks. Estimated vibration dose values based on attended vibration measurements are presented in Section 7.1.2.



**Figure 5 Vibration Measurement Locations**

## 3.5 Site constraints and opportunities

Based on the site visits, attended measurements and unattended long-term monitoring presented in Section 3.3, the following site constraints and opportunities were identified.

### 3.5.1 Site constraints

The key acoustic constraints and risks across the sites are as follows:

- Requirement to mitigate noise impact due to the close proximity of the precinct site to the railway corridor.
- Given the height of the buildings within the site, limited opportunities are available to minimise railway noise levels at the source, or using noise barriers.
- Given the proximity of the works to heritage items, potential vibration impacts on heritage items within, and in close proximity to, the precinct will need to be mitigated. The greatest impacted is expected during construction phase of the project, i.e. demolition, excavations and construction (discussed further in Section 4.3).
- Given the proximity of the works to existing rail related structures and infrastructure, potential construction vibration impacts on existing rail related structures and infrastructure (discussed further in Section 4.0).

### 3.5.2 Site opportunities

The key acoustic opportunities across the sites are as follows:

- Opportunity for non-sensitive uses in buildings to be strategically located to act as 'noise barriers' to protect noise sensitive developments including recreational outdoor areas.
- For residential developments, noise sensitive internal areas, e.g. bedrooms and living areas can be located away from railway corridor.

## 4.0 Construction Noise and Vibration Criteria

### 4.1 Interim Construction Noise Guideline

The potential risk of adverse impact of construction noise on a receiver is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise.

Construction of the proposed development has the potential to temporarily contribute to the existing external noise environment. This section will establish management levels to address these issues.

#### 4.1.1 Construction noise management levels

The *Interim Construction Noise Guideline* (ICNG) is the principal guideline for the assessment and management of construction noise in NSW.

Where an exceedance of the noise management levels is predicted, the *Interim Construction Noise Guideline* advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as provide contact details to facilitate feedback from affected residents during construction.

Where construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

##### 4.1.1.1 Construction hours

The recommended standard hours as defined by the ICNG as follows:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sunday and Public Holidays: No works

##### 4.1.1.2 Residential receivers

Guidance for setting construction noise management levels for residential receivers presented in the *Interim Construction Noise Guideline* are summarised in **Table 6**.



**Table 6 Construction Noise Management Levels – Residential Receivers**

Time of day	NML, $L_{Aeq,15min}$ , dB(A) <sup>1</sup>	How to apply
<b>Recommended standard hours<sup>2</sup>:</b> Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm  No work on Sundays or public holidays	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured <math>L_{Aeq (15 min)}</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>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.</p>
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>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:</p> <ol style="list-style-type: none"> <li>1. 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)</li> <li>2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol>
<b>Outside recommended standard hours</b>	Noise affected RBL + 5 dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p> <p>For guidance on negotiating agreements see section 7.2.2 (ICNG).</p>

**Notes:**

1. 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.
2. Except where NSW Government mandates.

The *Interim Construction Noise Guideline* defines what is considered to be feasible and reasonable as follows:

- Feasible - a work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

- Reasonable - selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.

**Table 7** presents the Noise Management Levels (NMLs) applicable to residential receivers nearby to the Project.

**Table 7 Construction Noise Management Levels – Residential Receivers**

Location of residential receivers	Recommended standard hours RBL	Recommended standard hours noise management levels $L_{Aeq,15min}$ , dB(A)	Outside recommended standard hours noise management levels $L_{Aeq,15min}$ , dB(A)	Highly noise affected level $L_{Aeq,15min}$ , dB(A)
NCA1	47	57	52	75
NCA2	37	47	42	75
NCA3	39	49	44	75
NCA4	43	53	48	75
NCA5	55	65	60	75

Justification should be provided for work conducted outside of recommended standard hours.

#### 4.1.1.3 Other sensitive land uses and commercial receiver noise management levels

Table 8 presents the NMLs applicable to other noise sensitive receivers such as educational facilities, places of worship and commercial receivers.

**Table 8 Construction Noise Management Levels – Non-residential Receivers**

Land use	External noise levels, $L_{Aeq,15min}$ , dB(A) (applies when properties are in use)
Classrooms at schools and other educational institutions	65 <sup>1</sup>
Places of worship	65
Childcare centre	65 <sup>1</sup>
Active recreation areas	65
Passive recreation areas	60
Commercial premises (including cafes, bars, restaurants, retail stores and hotels)	70
Industrial premises	75 dB(A)

**Notes:**

- This external noise management level is based upon a 45 dB(A) internal noise management level and a 20 dB(A) reduction from outside to inside through a closed window

#### 4.1.2 Construction traffic noise criteria

To assess noise impacts from construction traffic an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A), in line with the EPA's *NSW Road Noise Policy*.

Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion, then noise mitigation should be considered for those receivers affected. The *NSW Road Noise Policy* does not require assessment of noise impact to commercial or industrial receivers.

## 4.2 Construction vibration criteria

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

**Continuous vibration** continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities

**Impulsive vibration** is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities

**Intermittent vibration** occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

The relevant standards and guidelines for the assessment of construction vibration are summarised in **Table 9**.

**Table 9 Standards/Guidelines used for Assessing Construction Vibration**

Item	Standard/guideline
Structural damage	German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)
Human comfort (tactile vibration)	Assessing Vibration: A Technical Guideline (AVATG) <sup>1</sup>

**Notes:**

1. This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. However the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.

### 4.2.1 Structural damage, including heritage

At present, no Australian Standards exist for the assessment of buildings, including heritage items, damage caused by construction-related vibration.

DPE often references *German Standard DIN 4150-3 Vibration in Buildings – Part 3: Effects on structures* in Secretary's Environmental Assessment Requirements (SEARs) issued for major projects. DIN 4150 (adopted as Australian industry practice) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 10.

DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. In this assessment of DIN 4150 structural damage safe limits have been adopted for residential and non-residential structures.

**Table 10 Structural Damage Safe Limits (DIN 4150) for Building Vibration (Peak Particle Velocity)**

Group	Type of structure	At foundation – Less than 10 Hz	At foundation – 10 Hz to 50 Hz	At foundation – 50 Hz to 100 Hz <sup>1</sup>	Vibration at the horizontal plane of the highest floor for all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

**Notes:**

- At frequencies above 100 Hz, the values given in this column may be used as minimum values

Construction vibration levels below the levels presented in Table 10, are unlikely to cause existing buildings damage from vibration. Construction noise and vibration impact assessments should consider the above and implement controls that limit the vibration levels to those noted in Table 10. Furthermore it is recommended that separate structural assessments be undertaken for the heritage buildings to identify specific controls that should be implemented during construction.

#### 4.2.2 Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline *Assessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 11. The VDV criteria are based on the likelihood that a person would comment adversely on the level of vibration over the entire assessment period.

**Table 11 Preferred and Maximum Vibration Dose Values for Intermittent Vibration (m/s<sup>1.75</sup>)**

Location	Day-time (7am – 10pm)		Night-time (10pm – 7am)	
	Preferred	Maximum	Preferred	Maximum
Critical areas <sup>1</sup>	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops <sup>2</sup>	0.8	1.6	0.8	1.6

**Notes:**

1. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are undertaken require more stringent criteria than the residential criteria specified above.
2. Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are undertaken but do not require sensitive or delicate tasks.

### 4.3 Construction noise and vibration assessment

The greatest potential impact to rail infrastructure and heritage items from the Project is the construction activities associated with the Project (e.g. demolition, excavations and construction activities).

#### 4.3.1 Potential impact on adjacent rail infrastructure and heritage buildings

Construction vibration levels below the levels presented in Table 10, are unlikely to cause existing buildings damage from vibration.

The Structural Issues Report (Robert Bird Group, 2008) provided commentary on the potential impact of construction at the RNE development site on the adjacent rail corridor. This assessment considered the 2008 masterplan documentation, which included buildings expected to have basement structures (residential, commercial and retail) were situated at a minimum of 7m from the proposed site boundary, and approximately 9m to the centreline of the nearest adjacent railway track. The current (2021) masterplan shows similar offsets.

The 2008 Structural Assessment Report inferred that the deepest foundations or basements would be founded in the underlying shale bedrock. It is therefore envisaged that the proposed development can be designed and constructed in a way that will maintain the stability of the existing railway facilities and corridor. An anchored pile retention system is likely to be the most feasible retention system where basements are required in the design.

Depending on the equipment proposed for excavation, monitoring of vibrations at the commencement of excavation may be necessary. Where critical, specialist excavation equipment (e.g. rock saw in lieu of hydraulic impact breaker) may need to be used.

#### 4.3.2 Recommendations

A construction noise and vibration assessment should be conducted prior to the commencement of site works. The assessment should identify affected heritage buildings and rail infrastructure, assess the impact of major noise and vibration emitting plant to heritage buildings and rail infrastructure and recommend mitigation measures to achieve construction noise and vibration criteria.

In addition, a construction noise and vibration management plan (CNVMP) must be prepared in consultation with the contractor that identifies noise and vibration mitigation techniques to reduce and manage the impact on the rail infrastructure, heritage items and nearby sensitive receivers. This should consider project specific controls such as plant size, duration of works, vibration monitoring during works and distance from heritage buildings. As noted in Section 4.2.1 it is anticipated that construction activities that limit vibration to within the range noted in Table 10 are unlikely to cause structural damage.

## 5.0 Operational Emission Assessment Criteria

### 5.1 Operational noise emissions - EPA Noise Policy for Industry

The *Noise Policy for Industry* provides guidance in relation to acceptable noise limits for industrial noise emissions, which includes, but is not limited to, noise emissions from mechanical plant.

The assessment procedure in the *Noise Policy for Industry* has two components:

controlling **intrusiveness** noise impacts in the short term for residences

maintaining **noise level amenity** for residences and other land uses.

Both components are assessed at the boundary of the noise sensitive receiver site. These criteria apply to environmental noise emissions from any plant installed as part of the Project, and for residential receivers represent the lower of the intrusive and amenity criteria.

#### 5.1.1 Project intrusiveness noise levels

The *Noise Policy for Industry* states that the noise from any single noise source should not be greatly above the prevailing background noise level. Industrial noise sources are generally considered acceptable if the A-weighted equivalent continuous sound pressure level of noise from the source, measured over a 15 minute period ( $L_{Aeq,15\text{ min}}$ ) does not exceed the Rating Background Level (RBL) by more than 5 dB(A) for the period under consideration.

The RBL, as presented in **Table 12**, is the background noise level to be used for assessment purposes and is determined by the methods given in in Fact Sheet B of the *Noise Policy for Industry*.

The RBL and the respective intrusiveness noise level for the day, evening and night periods are provided in **Table 12**.

**Table 12 Intrusiveness Noise Level**

Location	Period	RBL ( $L_{A90}$ ), dB(A)	Intrusiveness noise level (RBL + 5), $L_{Aeq,15min}$ , dB(A)
<b>NCA1 Residential receivers</b>	Day	47	52
	Evening	44	49
	Night	41	46
<b>NCA2 Residential receivers</b>	Day	37	42
	Evening	38	43 (42) <sup>1</sup>
	Night	35	40
<b>NCA3 Residential receivers</b>	Day	39	44
	Evening	37	42
	Night	33	38
<b>NCA4 Residential receivers</b>	Day	43	48
	Evening	41	46
	Night	37	42
<b>NCA5 Residential receivers</b>	Day	55	60
	Evening	51	56
	Night	48	53

**Notes:**

1. The community generally expects a greater control of noise during the evening and night as compared to the daytime. Therefore, the intrusiveness noise level for the evening is set to no more than that for the daytime and the night-time intrusiveness noise level to no more than the evening.

**5.1.2 Project noise amenity**

To limit continuing increase in noise levels, the maximum ambient noise level within an area from all industrial noise sources should not normally exceed the recommended amenity noise levels specified in Table 2.1 of the *Noise Policy for Industry* and presented in column four of **Table 13**. That is, the noise level should not exceed the level appropriate for the particular locality and land use. As per the definitions of receiver types in Table 2.2 of the NPfI, residences within the NCAs are classified as being in an 'Urban' area.

In relation to the Paint Shop Sub-precinct, industrial noise sources include mainly building services plant equipment, i.e. carpark/kitchen/toilet exhaust fans, air-conditioning units, chillers, cooling towers, carpark and loading dock activities.

The project amenity level is equal to the recommended amenity noise level minus 5 dB(A). Therefore, the relevant noise amenity level from **Table 13** is assigned as the project amenity noise level. The project amenity level is then converted to a 15 minute period by adding 3 dB(A).

NCA1, NCA4 and NCA5 are subject to high traffic levels during the evening and night-time period and therefore the Project amenity level of these periods have been adjusted in accordance with the *Noise Policy for Industry*.

Table 13 Project Amenity Noise Level

Type of receiver	Indicative noise amenity area	Time of day	Recommended amenity noise level <sup>1</sup> , dB(A)	Project amenity noise level, dB(A)		
				L <sub>Aeq, period</sub>	L <sub>Aeq, period</sub>	L <sub>Aeq, 15min</sub>
<b>NCA1 Residential receivers</b>	Urban	Day	60	55	58	
		Evening	50	47 <sup>3</sup>	50	
		Night	45	44 <sup>3</sup>	47	
<b>NCA2 Residential receivers</b>	Urban	Day	60	55	58	
		Evening	50	45	48	
		Night	45	40	43	
<b>NCA3 Residential receivers</b>	Urban	Day	60	55	58	
		Evening	50	45	48	
		Night	45	40	43	
<b>NCA4 Residential receivers</b>	Urban	Day	60	55	58	
		Evening	50	46 <sup>3</sup>	49	
		Night	45	43 <sup>3</sup>	46	
<b>NCA5 Residential receivers</b>	Urban	Day	60	55	58	
		Evening	50	48 <sup>3</sup>	51	
		Night	45	46 <sup>3</sup>	49	
<b>School classroom<sup>2</sup></b>	All	When in use	45	40	43	
<b>Childcare<sup>2</sup></b>	All	When in use	45	40	43	
<b>Place of worship<sup>2</sup></b>	All	When in use	50	45	48	
<b>Active recreation area</b>	All	When in use	55	50	53	
<b>Commercial premises</b>	All	When in use	65	60	63	

**Notes:**

- Specified in Table 2.2 of the Noise Policy for Industry
- External noise levels are based on internal criteria with a 10 dB(A) reduction from outside to inside through an open window.
- Area dominated by high levels of rail traffic noise, therefore project amenity level = existing L<sub>Aeq(period, traffic)</sub> minus 15 dB

**5.1.3 Project noise trigger levels**

A summary of the intrusiveness and amenity noise levels is presented in Table 14. These noise levels apply to environmental noise emissions from any activity undertaken or plant installed as part of the Project.

The project noise trigger level is the lower (that is, the more stringent) value of the intrusiveness and amenity noise levels, highlighted in grey in Table 14.



Table 14 Project Noise Trigger Levels

Type of receiver	Indicative noise amenity area	Time of day	Intrusiveness noise level $L_{Aeq, 15min}$ , dB(A)	Amenity noise level $L_{Aeq, 15min}$ , dB(A)	Project noise trigger level ( $L_{Aeq, 15 minutes}$ ), dB(A)
<b>NCA1 Residential receivers</b>	Urban	Day	52	58	52
		Evening	49	50	49
		Night	46	47	46
<b>NCA2 Residential receivers</b>	Urban	Day	42	58	42
		Evening	42	48	42
		Night	40	43	40
<b>NCA3 Residential receivers</b>	Urban	Day	44	58	44
		Evening	42	48	42
		Night	38	43	38
<b>NCA4 Residential receivers</b>	Urban	Day	48	58	48
		Evening	46	49	46
		Night	42	46	42
<b>NCA5 Residential receivers</b>	Urban	Day	60	58	58
		Evening	56	51	51
		Night	53	49	49
<b>School classroom<sup>1</sup></b>	All	When in use	-	43	43
<b>Childcare<sup>1</sup></b>	All	When in use	-	43	43
<b>Place of worship<sup>1</sup></b>	All	When in use	-	48	48
<b>Active recreation area</b>	All	When in use	-	53	53
<b>Commercial premises</b>	All	When in use	-	63	63

**Notes:**

- External noise levels are based on internal criteria with a 10 dB(A) reduction from outside to inside through an open window.

**5.1.4 Maximum noise level event assessment**

Noise emissions from the use of the Project has the potential to adversely affect surrounding noise sensitive receivers, particularly nearby residents.

The *Noise Policy for Industry* requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq, 15min}$  40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is the greater, and/or
- $L_{AFmax}$  52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is the greater,

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.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 15.

**Table 15 Night-time Sleep Disturbance Noise Trigger Levels**

Location	Measured night-time RBL, L <sub>A90, 15mins</sub> , dB(A)	Sleep disturbance screening levels, dB(A)	
		L <sub>Aeq, 15min</sub>	L <sub>AFmax</sub>
<b>NCA1 Residential receivers</b>	41	46	56
<b>NCA2 Residential receivers</b>	35	40	52
<b>NCA3 Residential receivers</b>	33	40	52
<b>NCA4 Residential receivers</b>	37	42	52
<b>NCA5 Residential receivers</b>	48	53	63

### 5.1.5 Building services plant

The major items of plant to serve the proposed new buildings will likely consist of cooling towers, heat exchangers, ventilation fans and emergency generators.

Typical treatments to these items of plant include barriers, silencers, attenuators, lined duct and enclosures.

All external mechanical plant should be assessed design develops to ensure compliance with the acoustic criteria established in Section 5.0, including impacts that will have cumulative noise generated by the site.

## 5.2 Operational Vibration emissions

The Australian Standard AS 2670.2-1990 "Evaluation of human exposure to whole-body vibration, Part 2: Continuous and shock-introduced vibration in buildings (1-80 Hz)" offers guidance on how to assess to human response to building vibration. In the AS 2670.2-1990 maximum allowable vibration levels are specified in terms of multiples of the "baseline curve". Baseline curves mark the threshold of human perception and specify maximum allowable vibration levels in critical working areas. Baseline curves are stipulated in one-third octave bands and cover the frequency bandwidth of 1 Hz to 80 Hz.

Recommended multipliers for different occupation types are listed in Table 16. The residential criterion for continuous vibration during the day (multiplier 4, velocity domain) is shown in Figure 6.

**Table 16 Ranges of Multiplying Factors used in Several Countries to Specify Satisfactory Magnitudes of Building Vibration with Respect to Human Response**

Place	Time	Continuous or Intermittent Vibration	Transient vibration excitation with several occurrences per day
Residential	Day	2 to 4	30 to 90
	Night	1,4	1,4 to 20
Office	Day	4	60 to 128
	Night		

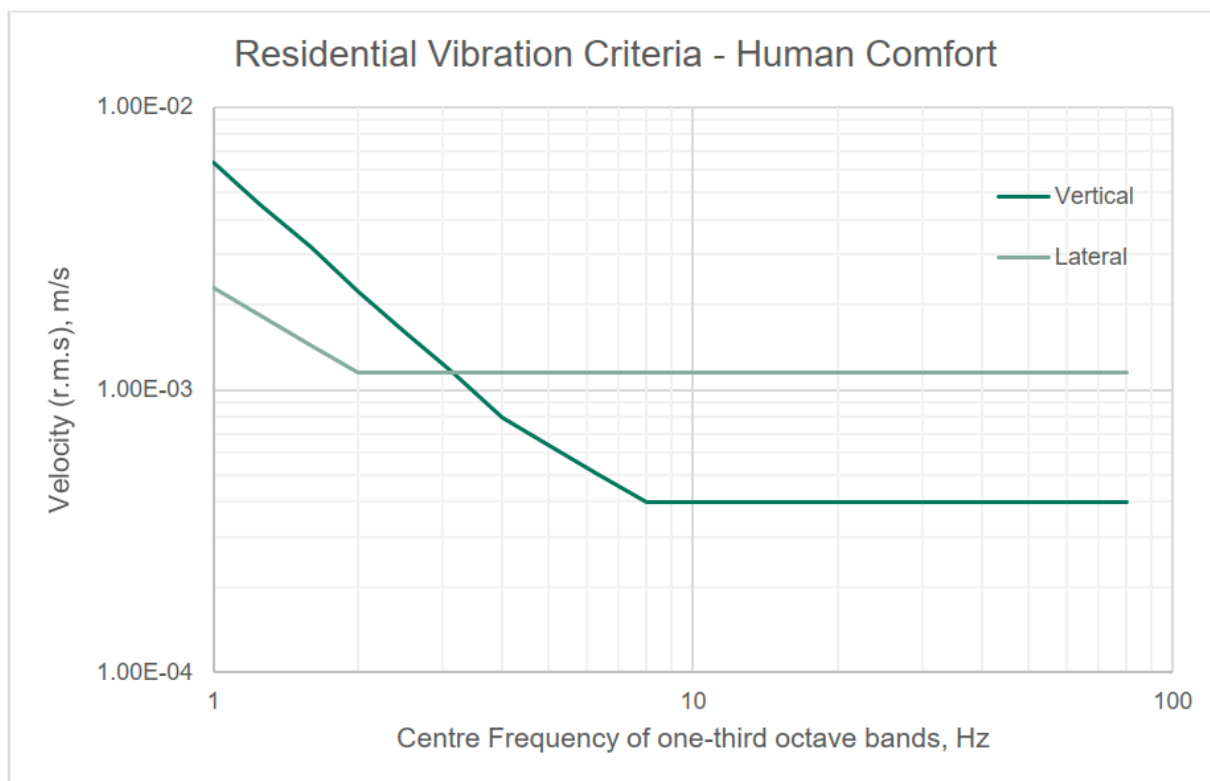


Figure 6 Floor Vibration criterion for human comfort for residential areas

The level of vibration from typical mechanical plant is unlikely to produce vibration level that will affect human comfort levels or building damage in heritage buildings or impact the stability of existing rail related structures and infrastructure. Typical vibration treatment to mechanical plant includes isolation mountings or inertia bases. Vibration isolation mountings or inertia bases should be considered where appropriate for human comfort within the proposed new buildings.

### 5.3 Operational traffic noise criteria

Noise from traffic movements to and from the site including truck and car movements has been assessed using the EPA’s document *NSW Road Noise Policy* (RNP).

Table 17 presents the RNP road traffic noise assessment criteria for residential land use developments with potential to create additional traffic on existing roads. The external criteria are assessed at 1 metre from the affected residential building façades and at a height of 1.5 metres from the floor.

Table 17 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/Land use	Assessment criteria - dB(A)	
		Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by <b>additional traffic</b> on existing freeways/arterial/sub-arterial roads generated by land use developments	L <sub>Aeq</sub> , (15 hour) 60	L <sub>Aeq</sub> , (9 hour) 55
Local roads	Existing residences affected by <b>additional traffic</b> on existing local roads generated by land use developments	L <sub>Aeq</sub> , (1 hour) 55	L <sub>Aeq</sub> , (1 hour) 50

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

In addition to the above assessment criteria, the RNP requires any increase in the total traffic noise level at a location due to a proposed project or traffic-generating development to be considered. The relative increase criteria outlined in the RNP is presented in **Table 18**.

**Table 18 Relative Increase Criteria for Residential Land Uses**

Road Category	Type of project/Land use	Assessment criteria - dB(A)	
		Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment or existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq, (15 \text{ hour})} + 12 \text{ dB}$ (external)	Existing traffic $L_{Aeq, (9 \text{ hour})} + 12 \text{ dB}$ (external)

### 5.3.1 Traffic noise emission assessment

A Transport Strategy and impact Assessment for the Paint Shop Sub-precinct was prepared by SCT Consulting dated November 2021.

The assessment concluded that the Paint Shop Sub-precinct would generate approximately 520 peak AM peak hour trips, with up to 190 trips using Wilson Street.

Due to Covid-19 restrictions, current traffic surveys were not undertaken. We have assumed that no less than 350 existing vehicle trips during the AM peak hour on Wilson Street. Given the volumes of existing traffic, traffic due to the development would have a negligible impact, increasing road traffic noise levels by significantly less <2 dB(A). This complies with RNP requirements.

It should be noted that the Transport Strategy and Impact Assessment states that the peak hour vehicles trips from the site are lower than the original 2008 masterplan.

## 5.4 Outdoor functions

The masterplan for the Paint Shop Sub-precinct has the potential to provide public space for outdoor functions to be defined at a later stage of design

The City of Sydney's *Live Music and Performance Action Plan*, dated March 2014 identifies the Protection of the Environment Operations Act 1997, the Environmental Planning and Assessment Act 1979 and the Liquor Act 2007 as governing the impacts of live music and performance activity. Which of these legislations are applicable to outdoor functions will depend on the type of events conducted within the site.

An outdoor event noise management policy should be developed at an appropriate later stage to mitigate the impact of events within the Pain Shop Sub-Precinct to existing residential receivers and commercial and residential buildings proposed within the Precinct.

## 6.0 Noise Intrusion Assessment Criteria

### 6.1 Rail noise and vibration intrusion

#### 6.1.1 Rail traffic vibration

The NSW EPA's *Assessing Vibration: a technical guideline* (AVATG) has been designed to be used in evaluating and assessing the effects on amenity of vibration emissions from industry, transportation and machinery. The guideline is used in assessments of vibration impacts caused by the construction and operation of new developments.

Vibration criteria are set primarily according to whether the particular activities of interest are continuous in nature or intermittent, whether they occur during the daytime or night-time and the type of receiver to be assessed e.g. commercial or residential.

British Standard 6472-1992 *Evaluation of Human Exposure to Vibration in Buildings* (1 Hz to 80 Hz) and AVATG provide guidance on human response to vibration and are used to set guideline vibration levels for this Project. BS 6472-1992 has been superseded by BS 6472-2008 however the EPA still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time and accordingly the 1992 version is referred to in this document.

The EPA guideline is based on Vibration Dose Values (VDVs). VDVs can be directly related to vibration discomfort experienced by a person and can be used to assess intermittent vibration. The VDV is a cumulative measure and increases as the exposure duration increases.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values given in **Table 19**.

**Table 19 Preferred and Maximum Vibration Dose Values for Intermittent Vibration (m/s<sup>1.75</sup>)**

Location	Daytime (7 am – 10 pm)		Night-time (10 pm – 7 am)	
	Preferred	Maximum	Preferred	Maximum
Critical areas	0.1	0.2	0.1	0.2
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

A widely accepted analytical procedure has been used to predict rail related vibration and regenerated noise levels at sensitive receivers. All calculations are implemented in one-third octave bands. For regenerated noise a frequency bandwidth of 20 Hz to 1000 Hz has been considered and for tactile vibration the frequency bandwidth of 1 Hz to 80 Hz has been considered.

#### 6.1.2 Rail traffic ground-borne and airborne noise

Vibration may be felt directly ('tactile' vibration) and this may cause discomfort and annoyance. Vibration may also be heard as vibrating surfaces radiate noise. This noise is commonly referred to as structure-borne, ground-borne noise or regenerated noise. Ground-borne noise is low frequency and if audible is perceived as a 'rumble'.

Vibration generated in the rail wheel interface enters the track-bed and continues to propagate through the ground to nearby buildings' foundations and throughout the buildings. This causes the floors, walls and ceilings to vibrate.

### 6.1.2.1 City of Sydney Development Control Plan 2012

Section 4 of The City of Sydney Development control Plan states the following with regard to internal noise levels within residential developments:

- (7) *The repeatable maximum LAeq (1 hour) for residential buildings and serviced apartments must not exceed the following levels:*
  - (a) *for closed windows and doors:*
    - (i) *35dB for bedrooms (10pm-7am); and*
    - (ii) *45dB for main living areas (24 hours).*
  - (b) *for open windows and doors:*
    - (i) *45dB for bedrooms (10pm-7am); and*
    - (ii) *55dB for main living areas (24 hours).*
- (8) *Where natural ventilation of a room cannot be achieved, the repeatable maximum LAeq (1hour) level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:*
  - (a) *38dB for bedrooms (10pm-7am); and*
  - (b) *48dB for main living areas (24 hours).*
- (9) *These levels are to include the combined measured level of noise.*

### 6.1.2.2 Transport for NSW Standard for Airspace and External Developments

Section 6.2 of Transport for NSW's Standard for Airspace and External Development reference T HR CI 12090 ST, dated 01 June 2021 states the following with regards to noise:

#### 6.2 Noise and vibration

*The effects of noise and vibration from railway operations shall be taken into account in the design of developments.....*

*An acoustic and vibration report shall be prepared to determine how the proposed development can minimise noise and vibration from the railway corridor....*

*Prior to the issue of an occupation certificate, a report shall be prepared certifying that the completed development meets the requirements of the ISEPP and Development Near Rail Corridors and Busy Roads - Interim Guidelines. The report shall include external and internal noise levels to ensure that the external noise levels during the test are representative of the typical maximum levels that can occur at this development. The developer shall ensure that noise levels meet the required dB(A) levels.*

### 6.1.2.3 The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP(2021)) provides internal noise level criteria for residential developments impacted by rail noise. The following rail internal noise criteria were extracted from the SEPP (2021):

#### 2.99 Impact of rail noise or vibration on non-rail development

- (1) *This section applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:*
  - (a) *residential accommodation,*
  - (b) *a place of public worship,*
  - (c) *a hospital,*
  - (d) *an educational establishment or child care centre.*
- (2) *Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Secretary for the purposes of this section and published in the Gazette.*

- (3) *If the development is for the purposes of a building for residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following  $L_{Aeq}$  levels are not exceeded:*
- (a) *in any bedroom in the residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,*
  - (b) *anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

#### 6.1.2.4 Development Near Rail Corridors and Busy Roads – Interim Guideline

The NSW Government Department of Planning guideline, the *Development Near Rail Corridors and Busy Roads – Interim Guideline* will be referred to for assessing the impact of airborne and ground-borne (regenerated) noise. The airborne and ground-borne (regenerated) noise trigger levels contained within the guideline are provided in **Table 20** and should form part of future design guidelines.

**Table 20 Airborne and Ground-borne (Internal) Noise Trigger Levels**

Receiver	Time of day	Ground-borne	Airborne
		Noise Criteria, $L_{Amax}$ (slow) dB(A)	Noise Criteria, $L_{Aeq}$ dB(A)
Residential	Day (7 am – 10 pm)	40	40
	Night (10 pm – 7 am)	35	35
Schools, educational institutions, places of worship	When in use	40	40
Places of Worship	When in use	40	40
Hospitals- Wards	When in use	35	35
Hospitals - Other noise sensitive areas	When in use	45	45

The guideline also states the following with regard to natural ventilation:

*“If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.”*

Assuming a reduction of 10 dB from external noise levels to indoors with windows and doors open, mechanical ventilation must be provided when external noise levels exceed 60 dB(A) during the day and 55 dB(A) at night.

For commercial/retail spaces a value of 45 to 50  $L_{Amax}$  (slow) is typically adopted for ground-borne noise. Airborne noise is calculated as  $L_{Aeq}$  (9h) (night) and  $L_{Aeq}$  (15h) (day). Ground-borne noise is calculated as  $L_{max}$  (slow) for 95% of rail pass-by events.

Given that the criteria for residences in the *Development Near Rail Corridors and Busy Roads – Interim Guideline* is more stringent than the *City of Sydney DCP, the Development Near Rail Corridors and Busy Roads – Interim Guideline* criteria will be adopted for this project.

#### 6.1.2.5 Rail noise to recreation areas

In the absence of specific noise trigger levels applicable to new recreational areas (open outdoor space) impacted by rail noise, the EPA’s *Rail Infrastructure Noise Guideline* (RING) has been reviewed. The RING provides the following noise trigger levels, refer to Table 21, applicable to heavy and light rail developments for sensitive land uses other than residential.

**Table 21 Airborne rail noise trigger levels applicable to heavy and light rail developments for sensitive land uses other than residential**

Other sensitive land uses	Noise trigger levels dB(A) (when in use)	
	New rail line development	Redevelopment of existing rail line
Open space – passive use (e.g. parkland, bush reserves)	60 L <sub>Aeq(15h)</sub> external	65 L <sub>Aeq(15h)</sub> external
Open space – active use (e.g. sports field, golf course)	65 L <sub>Aeq(15h)</sub> external	65 L <sub>Aeq(15h)</sub> external

Therefore, the noise trigger levels applicable to new recreational outdoors areas for the Paint Shop Sub-precinct has been set at 65 L<sub>Aeq(15h)</sub> external, when in use.

## 6.2 Mechanical and commercial noise intrusion (airborne noise)

The internal noise levels in the commercial and residential premises of the development will be defined by noise from the air conditioning and mechanical ventilation plant servicing the development, rail traffic and external general ambient noise intrusion.

Internal noise levels due to traffic noise, for residential receivers, must comply with the State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP 2021) and the DoPE's document *Development near Rail Corridors and Busy Roads – Interim Guidelines*.

In addition, internal noise levels due to mechanical and commercial noise should be controlled to meet the 3 dB below AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* criteria presented in **Table 22** for all other areas of the development. The 3 dB reduction in the criteria accounts for contribution from mechanical services and traffic noise within the development.

**Table 22 Recommended Mechanical and Commercial Design Sound Levels for Internal Areas**

Type of occupancy/Activity	Recommended design sound level, dB(A)
<b>Residential spaces (houses and apartments in inner city areas or entertainment districts or near major roads)</b>	
Living areas	32-42
Sleeping areas	32-37
Work areas	32-42
Apartment common areas	42-47
<b>Retail spaces</b>	
Cafeterias and food courts	37-47
Coffee shops	37-47
Restaurants	37-47
Small retail stores (general)	< 47
Specialty shops (where detailed discussion is necessary in transactions)	< 42

**Notes:**

- The recommended noise levels are given in terms of equivalent continuous A-weighted noise levels (L<sub>Aeq</sub>).



### 6.3 Event noise intrusion

AECOM has also evaluated the potential impacts from the use of outdoor spaces within Paint Shop Sub-precinct and the adjacent Carriageworks on residential premises. To understand the potential noise generation associated with events in these public spaces, event noise emanating from the existing facilities in the adjacent Carriageworks development can be used as a benchmark.

It is understood from consultation with Carriageworks that their events have not received noise complaints from adjacent residences.

It is understood that based on the noise restrictions for Carriageworks, outdoor event noise levels should not exceed 5 dB above background ( $L_{90}$ ) noise levels at the edge of the residential property between 7 am and midnight. It is expected that events in the Paint Shop Sub-precinct would be covered under similar noise controls. AECOM notes the use of outdoor spaces is currently unplanned at this stage of design. Depending on the number and size of events proposed within the Paint Shop Sub-precinct and the adjacent Carriageworks, AECOM expects façade treatments to mitigate rail noise adequately reduce outdoor events noise.

Proposed new residential receivers within the Paint Shop Sub-precinct site are located a similar distance from Carriageworks as existing residences impacted by Carriageworks events. Therefore, event noise impact from the Carriageworks at the proposed new residential buildings will be similar to the event noise impact at existing residential receivers.

### 6.4 Aircraft noise intrusion criteria

The Australian Standard AS 2021-2015 *Acoustics - Aircraft Noise Intrusion-Building Siting and Construction* specifies recommended internal noise levels for a variety of internal spaces based on their function and use.

The aircraft indoor design levels extracted from AS 2021:2015 are provided in **Table 23**.

**Table 23 Internal Aircraft Noise Criteria**

Building type and activity	Indoor design level, $L_{Amax}$ (slow) dB(A)
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Public buildings	
Court houses, libraries, galleries	50
Commercial buildings, offices and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75

## 7.0 Noise Intrusion and Vibration Assessment

### 7.1 Existing ground-borne rail noise assessment

Train vibrations levels experienced outside the rail corridor vary from train to train, depending on speed, length of train, type of train, distance from receiver to trainline, etc. For this reason, the ground-borne noise level goals are typically expressed in terms of the “5% exceedance level” which represents the loudest one in twenty train events. Generally, this is accounted for by processing the measured source vibration and basing the analysis on the 95<sup>th</sup> percentile train event.

#### 7.1.1 Ground-borne noise

The sound pressure levels at receiver locations are calculated from following simplified relationship:

$$L_{\max} = L_{V_{\max}} - 27 \text{ [dB]},$$

where  $L_{V_{\max}}$  is the maximum vibration velocity of the radiating surface in decibels relative to  $10^{-9}$  m/s. The regenerated noise,  $L_{A_{\max}}$ , is calculated by A-weighting  $L_{\max}$ .

The calculations are based on maximum vibration velocities since the corresponding criteria are given in terms of maximum sound pressure levels.

The frequency bandwidth used to calculate the regenerated noise levels is 20 Hz to 1000 Hz.

Predicted ground-borne noise levels are presented in **Table 24** for the three locations that were monitored, refer to **Figure 5**. It should be noted that the  $L_{A_{\max}}$  (slow) response was assessed.

**Table 24** Calculated Regenerated Noise Levels (dB(A)  $L_{A_{\max}}$ , (slow)) from Train Movements

Location	Predicted regenerated noise level, $L_{A_{\max}}$ (slow) dB(A)
1	38
2	34
3	34

It can be seen that the ground-borne noise levels at locations 2 and 3 comply with the residential criteria in Section 6.1.1.

As discussed above in Section 3.4.2, locations 1, 2 and 3 were measured 5.9, 13 and 25 metres from the rail line respectively.

It is expected that residential sleeping areas will be located at distances greater than location 2 from the rail line and are therefore likely to be acceptable.

Given that the internal layout of the buildings is yet to finalised, we recommend that additional measurements be conducted at locations representative of residential areas at detailed design.

#### 7.1.2 Ground-borne vibration

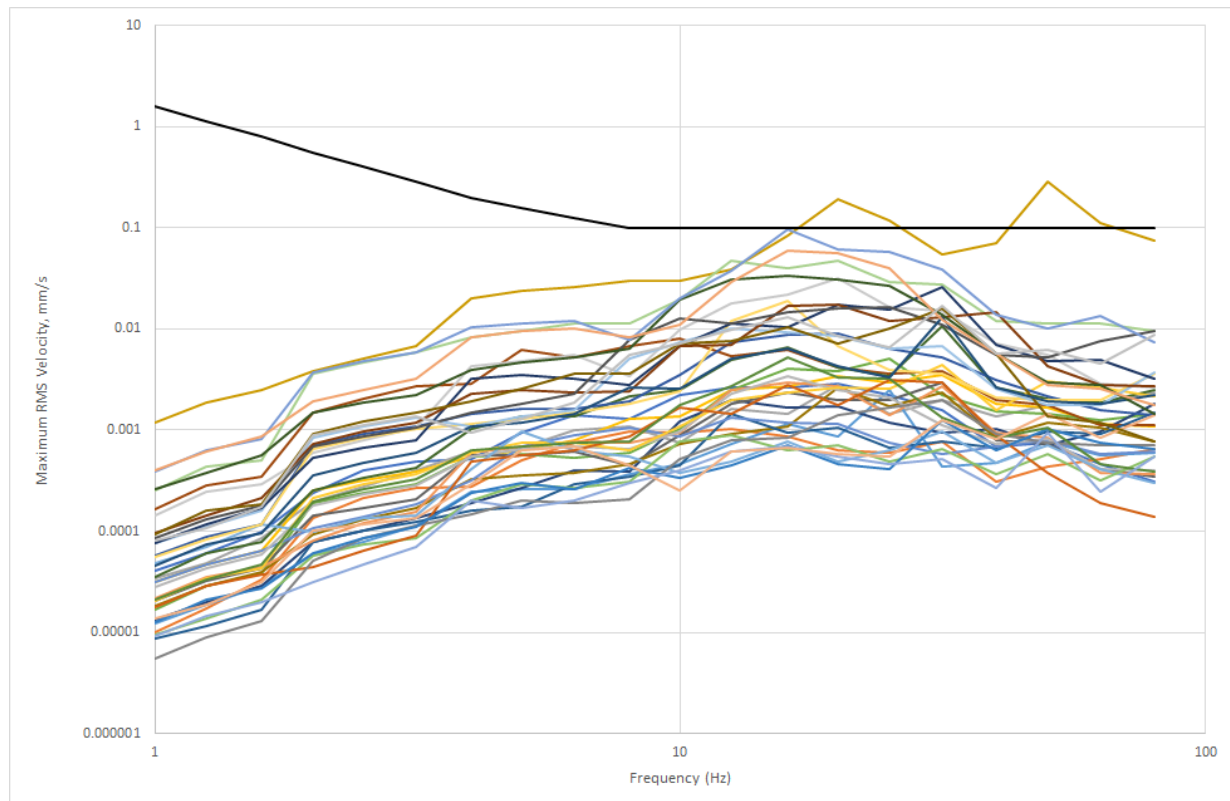
The eVDVs (estimated vibration dose value), assuming 1575 trains during the day and 385 during the night, are presented in **Table 25**.

**Table 25** Estimated VDV at the Three Vibration Monitoring Locations

eVDV	Day	Night
<b>Location 1</b>	0.13	0.09
<b>Location 2</b>	0.07	0.05
<b>Location 3</b>	0.07	0.05

Location 1, in **Figure 5** experiences the most vibration from the trains. At this location, the vibration dose value is below the preferred daytime and night-time values as presented in Section 6.2.

The measured maximum acceleration values are mostly (with Indian Pacific being the exception) below the threshold of perception, as indicated in **Figure 7**. Vibration caused by passing trains is unlikely to be perceptible within the proposed development, and there is a low likelihood of adverse comment.



**Figure 7 Measured Acceleration Levels and the Threshold of Perception (Black)**

## 7.2 Airborne rail noise modelling

### 7.2.1 Methodology

Airborne rail noise levels were modelled using SoundPLAN v8.2 environmental noise modelling software. Rail noise sources were modelled using the implementation of the Nordic Rail Prediction Method, Kilde Report 67/130 *Noise from railway traffic*.

In accordance with the *Rail Infrastructure Noise Guideline*, noise levels were predicted at 1 metre from the façade of each building, at a height of 1.5 metres above each floor.

### 7.2.2 Modelling inputs and assumptions

The following features were included in the noise model:

- Ground topography
- Ground absorption and reflection
- Proposed new residential and commercial receivers
- Existing terrain elevation contours
- Train movement number, lengths, speeds and rolling stock type. These movements have been taken from existing train movements passenger movements.
- Rail noise source reference levels derived from TfNSW's *Rail Noise Database (RNDB)*, 2014.
- Track conditions including the following corrections:
  - Turnouts and crossing in the existing and proposed future designs (+ 6 dB(A))

- Radii where noise from wheel squeal and flanging could occur (+3 dB(A) where  $R > 300\text{m} < 500\text{m}$ , and +8 where  $R < 300\text{m}$ ).

### 7.2.3 Predicted airborne rail noise levels

Noise levels from rail traffic have been predicted to the façade of commercial and residential buildings and to passive recreational receivers. The predictions of rail traffic noise were found to be within 2 dB of the long term unattended noise measurements conducted in proximity to the rail corridor in NCA 1.

The predicted noise level at commercial, residential and passive recreational receivers are presented in Table 26.

A graphical representation of predicted noise results is provided in Appendix C.

**Table 26 Summary of Predicted Airborne Rail Noise Levels in Accordance with Rail Infrastructure Noise Guideline**

Scenario	Maximum daytime $L_{Aeq,15hr}$ noise level	Maximum night-time $L_{Aeq,9hr}$ noise level	Maximum $L_{Amax}$ noise level
<b>Residential</b>			
E2 Residential	52	48	67
F1 Residential	50	47	63
P1 Residential	62	58	78
P2 Residential	62	58	77
<b>Commercial</b>			
E1 Commercial	56	52	71
E2 Commercial	51	48	66
E3 Commercial	45	42	58
E4 Commercial	48	45	62
H2 Commercial	60	57	75
K1 Commercial	61	58	77
K2 Commercial	62	59	82
L1 Commercial	63	59	83
P2 Commercial	62	58	79
<b>Passive Recreation</b>			
East Garden	42-52	39-48	59-66
Paint Shop Square	44-46	41-42	57-59
Plaza	53-63	50-59	68-79

Based on the predicted external rail noise levels, it is likely that the acoustic treatment will be required to the commercial and residential buildings to achieve the internal noise level criteria in Section 6.1.2.

It can be seen in Table 26 that the noise level outside the worst affected façade of residential buildings P1 and P2 are 62 dB(A) during the daytime and 58 dB(A) at night. Given that the internal noise criteria is 40 dB(A) for living spaces and 35 dB(A) bedrooms, 22 dB(A) reduction will be required from the living space facades and 23 dB(A) reduction will be required from the bedroom facades.

The internal rail noise level within the residential buildings has been modelled using the predicted rail noise levels from SoundPLAN v8.2 software and based on generic floor plans to determine typical construction requirements.

Assuming a maximum of 12 m<sup>2</sup> for bedroom facades and 20 m<sup>2</sup> for living rooms for apartments affected by 62 dB(A) during the daytime and 58 dB(A) at night, the internal noise level criteria can be achieved with double glazing.

Given that the noise level outside residential buildings P1 and P2 exceed 60 dB(A) during the daytime or 55 dB(A) at night, assessment of the natural ventilation will be required during future design phases to confirm the outcomes of Section 7.2.3.1 are being achieved. Noise mitigations measures to achieve natural ventilation are discussed below.

It can be seen in the graphical representation of the noise transmission across the site in Appendix C that the rail noise levels are below the rail trigger levels for recreational outdoors areas.

### 7.2.3.1 Natural ventilation investigation

In order to determine the impact across the entire building footprints of the residential buildings E2, F1, P1 and P2, external noise levels were predicted to all facades of the buildings.

Architectural floor plans for low rise and high-rise layouts were provided for both P1 and P2. It is assumed that the residential floor plate of buildings E2 and F1 are consistent across all floors.

The assessed facades and the predicted noise levels at representative floors are presented in Appendix D.

To demonstrate the extent of the facades affected by rail noise levels in excess of the night-time criteria 55 dB(A) for natural ventilation, the predicted rail noise level at each of the low rise and high-rise were also overlaid on Bates Smart floor plates per level. The rail noise level at each façade of the low rise and high-rise for buildings P1 and P2 are presented in Appendix D.

It can be seen in Appendix D, that external rail noise levels are in excess of the night-time criteria for natural ventilation on the majority of the southern and sections of the eastern and western façade of the low rise and high-rise of Building P1 and P2. However sections of the eastern and western within balconies achieve the day time and night-time criteria for natural ventilation. With the proper placement of sleeping and living areas and locations of natural ventilation opening, internal noise levels within residential buildings can be met without the use of winter gardens, screening or mechanical ventilation.

Natural ventilation opening will be required to be treated to achieve the internal rail noise level criteria. Balconies may also require absorptive treatment to reduce reverberant noise within the balconies. These treatments are typical for similar developments.

### 7.2.4 Rail noise intrusion recommendations

Based on the air-borne and ground-borne noise levels presented in Sections 7.1 and 7.2, it is likely that internal noise levels criteria for commercial and residential premises presented in Section 6.1.2 can be achieved with façade treatments typical for similar developments.

A specific acoustic assessment will be required prior to detailed design to evaluate the appropriate mitigation measures for each building. Residential buildings P1 and P2 (adjacent the rail corridor) will require appropriate placement of living and sleeping areas to achieve the internal noise criteria with natural ventilation.

As the noise level from rail varies across the site – the dwellings in the second row of buildings (E2 and F1) are expected to achieve the internal noise criteria with natural ventilation with typical building construction and appropriate layouts.

A 23 dB noise reduction is required on bedroom facades of Buildings P1 and P2 to achieve internal noise levels. This can be achieved with double glazing with a maximum of 12 m<sup>2</sup> for bedroom facades. A 22 dB noise reduction is required on living facades of Buildings P1 and P2 to achieve internal noise levels. This can be achieved with double glazing with a maximum of 20 m<sup>2</sup> for bedroom facades.

Alternative standard façade treatments such as masonry and cladding facades and fixed glazing may also be implemented alongside double glazing to achieve internal noise levels. The extent of these

treatments will depend on the area of each material, orientation of facades and the distance from the rail line. The selection of construction materials will be determined as the design develops.

The treatment to commercial premises may consist of double-glazed windows and doors.

These measures are consistent with similar mitigation measures for high density residential and commercial buildings adjacent to rail corridors.

Glazing systems to meet the requirements for all disciplines should be coordinated as the design progresses.

A detailed acoustic assessment should be conducted once internal layouts have been finalised and room usages have been confirmed at a subsequent stage of design.

### 7.3 Aircraft noise assessment

The precinct lies outside of the Sydney Airport 2039 ANEF 20 contours and is therefore unlikely to be significantly impacted by aircraft noise.

$L_{max}$  (slow) noise level measurements of airplanes passing the site were conducted during the site visit and found to be less than 65 dB(A).

Standard construction methods are likely to achieve internal aircraft noise level criteria. No further assessment is considered necessary.

The Aeronautical Report prepared for the site dated April 2022 states that emergency helicopters travelling to and from the Royal Prince Alfred Hospital and the Harbour Bridge will pass nearby the site. Given that the emergency helicopter movements are likely to be infrequent, it is not considered appropriate to treat the building façade to reduce noise from emergency helicopters.

### 7.4 Road traffic noise intrusion assessment and recommendations

The nearest road with the potential to have a traffic noise impact on the development is Wilson Street, which is located along the northern boundary of the site.

Road traffic noise level along Wilson Street were captured at noise monitoring location 3, 418 Wilson Street, Eveleigh during the unattended noise monitoring presented in Section 3.0. The traffic noise levels at 418 Wilson Street are presented in Table 27.

**Table 27 418 Wilson Street, Eveleigh Traffic Noise Monitoring Details**

Location	Period	Measured noise level, dB(A)	
		Daytime, $L_{Aeq, 15hr}$	Night time, $L_{Aeq, 9hr}$
<b>418 Wilson Street, Eveleigh</b>	June 16 2021 – July 7 2021	53	46

According to *Transport Strategy and Impact Assessment for the Paint Shop Sub-precinct* (SCT Consulting November 2021) approximately 520 AM peak hour vehicle trips will be generated by the Paint Shop Sub-precinct. It is likely that these vehicles will pass the residential buildings within the Precinct. This volume of traffic is not likely to significantly impact the proposed new residential buildings.

Standard construction methods are likely to achieve internal road traffic noise level criteria. No further assessment is considered necessary.

### 7.5 Noise mitigation recommendation summary

As discussed in Section 6.0, many noise sources have the potential to impact on the Paint Shop Sub-precinct buildings. The following approach is recommended to reduce the impact of noise intrusion into the Paint Shop Sub-precinct buildings. It is expected that implementation of a combination of all or some of the measures will appropriately mitigate the noise levels within new sensitive receivers to their required levels.

### 7.5.1 Ground-borne rail noise measurements

Given that the internal layout of the building is yet to be finalised, we recommend that additional measurements be conducted at locations representative of residential areas at detailed design.

### 7.5.2 Air-borne rail noise

Residential buildings P1 and P2 (adjacent the rail corridor) will require appropriate placement of living and sleeping areas to achieve the internal noise criteria with natural ventilation.

The dwellings in the second row of buildings (E2 and F1) are expected to achieve the internal noise criteria with natural ventilation with typical building construction and appropriate layouts. Living and sleeping areas cannot be located on façades with rail noise levels that exceed 60 dB(A) during the daytime or 55 dB(A) at night to achieve natural ventilation.

The treatment to commercial and residential premises may be resolved via standard noise mitigation construction methodology applied across the sector. These measures are consistent with similar mitigation measures for high density residential buildings adjacent to rail corridors.

A detailed acoustic assessment should be conducted once internal layouts have been finalised and room usages have been confirmed.

### 7.5.3 Outdoor events

The masterplan for the Paint Shop Sub-precinct provides the potential for public space to be utilised for outdoor functions. These events, where infrequent should be evaluated on a case by case basis at an appropriate time, and the impact reduced through the use of a noise management plan (with specific controls relevant to the size and duration of the event).

To assess the potential noise generation associated with such events, event noise emanating from the existing facilities in the adjacent Carriageworks development can be used as a benchmark. It is understood from consultation with Carriageworks that their events have not received noise complaints from adjacent residences.

A detailed acoustic assessment should be conducted once outdoor events are planned to be held and the scale and size of events held within the Carriageworks can be confirmed. This should consider design elements within the proposed public domain that mitigate impacts from outdoor events (including landscape treatments, proximity to dwellings and appropriate time limits for public events).

## 8.0 Conclusion and Recommended Development Controls

### 8.1 Conclusion

This study has identified existing noise and vibration controls and established the existing ambient noise environment. The sensitive noise receivers have been defined and the potential risks associated with construction and operation noise and vibration sources have been identified. Finally – the limits and criteria for noise mitigation during the construction and operation phase of the Project have been identified. It is anticipated that with the appropriate controls the impacts of the existing environment and the proposed works on existing and new receptors can be mitigated to within prescribed levels. A recommendation of development controls and next steps is provided below.

### 8.2 Recommended Development Controls

The following Development Controls are recommended to mitigate the noise and vibration impacts of and on the Paint Shop Sub-precinct.

#### 8.2.1 Construction noise and vibration assessment

It is recommended that a construction noise and vibration assessment be conducted post detailed design and prior to the commencement of site works. The assessment should identify affected heritage buildings and rail infrastructure, assess the impact of major noise and vibration emitting plant to heritage buildings and rail infrastructure and recommend mitigation measures to achieve construction noise and vibration criteria.

#### 8.2.2 Noise and vibration intrusion

The report finds that residential buildings can be treated to achieve internal noise criteria through typical strategies such as double glazing employed at similar developments. Residential buildings P1 and P2 (adjacent the rail corridor) will require appropriate placement of living and sleeping areas to achieve the internal noise criteria with natural ventilation.

These aspects can be coordinated with other disciplines to verify that cross-ventilation requirements and other design requirements are met.

A 23 dB noise reduction is required on bedroom facades of Buildings P1 and P2 to achieve internal noise levels. This can be achieved with double glazing with a maximum of 12 m<sup>2</sup> for bedroom facades. A 22 dB noise reduction is required on living facades of Buildings P1 and P2 to achieve internal noise levels. This can be achieved with double glazing with a maximum of 20 m<sup>2</sup> for bedroom facades.

Alternative standard façade treatments such as masonry and cladding facades and fixed glazing may also be implemented alongside double glazing to achieve internal noise levels. The extent of these treatments will depend on the area of each material, orientation of facades and the distance from the rail line. The selection of construction materials will be determined as the design develops.

It is also recommended that additional site measurement be conducted to further benchmark noise and vibration levels impacting the proposed new buildings at detailed design

Finally – it is recommended that a detailed acoustic assessment including noise and vibration be conducted once internal layouts have been finalised. The noise intrusion assessment should identify all major source of noise impacting the development, determine internal noise criteria for applicable spaces within the development and identify façade treatments to achieve internal noise criteria.

#### 8.2.3 Noise emission

It is recommended that an operational noise and vibration assessment be conducted once the design of plant servicing the development progresses. The assessment should identify the extent of affected sensitive receivers including residential, heritage buildings and rail infrastructure, assess the impact of major noise and vibration emitting plant to noise sensitive receivers and recommend mitigation measures to achieve operational noise and vibration criteria. These mitigation treatments would be consistent with similar developments of this type.



#### **8.2.4 Outdoor events**

It is recommended that an outdoor event management plan be developed to mitigate the noise impacts from proposed outdoor events held within the Sub-precinct at nearby sensitive receivers and at proposed new buildings within the Sub-precinct. The noise management plan should identify the number of events to be held each year, the expected attendance at each event, operating hours of outdoor events and the mitigation measures implemented to reduce the impact of outdoor events.

# Appendix A

## Acoustic Terminology

## Abbreviations

Term	Meaning
<b>AADT</b>	Annual Average Daily Traffic
<b>ABL</b>	Assessment Background Level
<b>AVATG</b>	<i>Assessing Vibration: A Technical Guideline</i>
<b>CNVMP</b>	Construction Noise and Vibration Management Plan
<b>CNVS</b>	<i>Construction Noise and Vibration Strategy</i>
<b>dB</b>	Decibel
<b>DECC</b>	Department of Environment and Climate Change
<b>DECCW</b>	Department of Environment, Climate Change and Water
<b>DPE</b>	Department of Planning and Environment
<b>EPA</b>	Environment Protection Authority
<b>EP&amp;A Act</b>	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
<b>EP&amp;A Regulation</b>	<i>Environmental Planning and Assessment Regulation 2000 (NSW)</i>
<b>Heritage Act</b>	<i>Heritage Act 1977 (NSW)</i>
<b>ICNG</b>	<i>Interim Construction Noise Guideline</i> (Department of Environment and Climate Change, 2009).
<b>NATA</b>	National Association of Testing Authorities
<b>NSW</b>	New South Wales
<b>NCA</b>	Noise Catchment Area
<b>NML</b>	Noise Management Level
<b>NPfi</b>	<i>Noise Policy for Industry</i>
<b>OEH</b>	NSW Office of the Environment and Heritage
<b>OOHW</b>	Out-of-Hours Works
<b>POEO Act</b>	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
<b>RBL</b>	Rating Background Level
<b>RNP</b>	<i>Road Noise Policy</i>
<b>SEARS</b>	Secretary's Environmental Assessment Requirements
<b>TAP</b>	Transport Access Program
<b>TfNSW</b>	Transport for NSW
<b>VDV</b>	Vibration Dose Value

## Definitions

Term	Meaning																						
<b>A-weighted decibels [dB(A)]</b>	The A-weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
<b>Airborne noise</b>	Airborne noise is sound transmitted through the air/atmosphere, e.g. conversation between people.																						
<b>Ambient noise</b>	The all-encompassing noise at a point composed of sound from all sources near and far.																						
<b>Ancillary facility area</b>	Areas required for temporarily storing materials, plant and equipment and providing space for other ancillary facilities, such as site offices, during construction.																						
<b>Assessment background level [ABL]</b>	The overall background level for each day, evening and night period for <b>each day</b> of the noise monitoring.																						
<b>Background noise</b>	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L <sub>90</sub> sound pressure level is used to quantify background noise.																						
<b>Community</b>	A group of people living in a specific geographical area or with mutual interests that could be affected by the Project.																						
<b>Concept design</b>	Broadly refers to the process that the Construction Contractor undertakes (should the Project proceed) to refine the scoping design to a design suitable for construction (subject to Transport for New South Wales acceptance).																						
<b>Construction</b>	Includes all physical work required to construct the Project and also includes construction planning such as the development of construction management plans.																						
<b>Day</b>	The period from 7:00 am to 6:00 pm Monday to Saturday and 8:00 am to 6:00 pm Sundays and public holidays.																						
<b>Decibel [dB]</b>	The measurement unit of sound.																						
<b>Decibel scale</b>	<p>The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:</p> <table border="0"> <tbody> <tr> <td>0dB(A)</td> <td>Threshold of human hearing</td> </tr> <tr> <td>30dB(A)</td> <td>A quiet country park</td> </tr> <tr> <td>40dB(A)</td> <td>Whisper in a library</td> </tr> <tr> <td>50dB(A)</td> <td>Open office space</td> </tr> <tr> <td>70dB(A)</td> <td>Inside a car on a freeway</td> </tr> <tr> <td>80dB(A)</td> <td>Outboard motor</td> </tr> <tr> <td>90dB(A)</td> <td>Heavy truck pass-by</td> </tr> <tr> <td>100dB(A)</td> <td>Jackhammer/subway train</td> </tr> <tr> <td>110 dB(A)</td> <td>Rock concert</td> </tr> <tr> <td>115dB(A)</td> <td>Limit of sound permitted in industry</td> </tr> <tr> <td>120dB(A)</td> <td>747 plane take off at 250 metres</td> </tr> </tbody> </table>	0dB(A)	Threshold of human hearing	30dB(A)	A quiet country park	40dB(A)	Whisper in a library	50dB(A)	Open office space	70dB(A)	Inside a car on a freeway	80dB(A)	Outboard motor	90dB(A)	Heavy truck pass-by	100dB(A)	Jackhammer/subway train	110 dB(A)	Rock concert	115dB(A)	Limit of sound permitted in industry	120dB(A)	747 plane take off at 250 metres
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Term	Meaning
<b>Detailed design</b>	Detailed design broadly refers to the process that the Construction Contractor undertakes (should the Project proceed) to refine the concept design to a design suitable for construction (subject to Transport for New South Wales acceptance).
<b>Down-side</b>	Down-side refers to the direction of travel away from Central Station.
<b>Equivalent continuous sound level [<math>L_{eq}</math>] and A-weighted equivalent continuous [<math>L_{Aeq(15min)}</math>]</b>	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy. The INCG defines $L_{Aeq(15min)}$ as 'the A-weighted equivalent continuous (energy average) A-weighted sound pressure level of the construction works under consideration over a 15-minute period and excludes other noise sources such as industry, road, rail and the community.
<b>Evening</b>	The period from 6:00 pm to 10:00 pm Monday to Sunday and public holidays.
<b>Feasible and reasonable</b>	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. 'Feasible' relates to engineering considerations and what is practical to build. 'Reasonable' relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements.
<b>Frequency [f]</b>	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
<b>Ground-borne noise</b>	Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, e.g. tunnelling works affected residential building above.
<b>Heavy vehicle</b>	A vehicle what has a gross vehicle mass (GVM) or aggregate trailer mass (ATM) of more than 4.5 tonnes.
<b>Impact</b>	Influence or effect exerted by a project or other activity on the natural, built and community environment.
<b><math>L_{10}</math></b>	The sound pressure level exceeded for 10 per cent of the measurement period. For 10 per cent of the measurement period it was louder than the $L_{10}$ .
<b><math>L_{90}</math></b>	The sound pressure level exceeded for 90 per cent of the measurement period. For 90 per cent of the measurement period it was louder than the $L_{90}$ .
<b>Light vehicle</b>	A vehicle up to a B99 in size. A B99 vehicle is the 99 <sup>th</sup> percentile vehicle size.
<b><math>L_{max}</math></b>	The maximum sound pressure level measured over the measurement period.
<b><math>L_{min}</math></b>	The minimum sound pressure level measured over the measurement period.
<b>Methodology</b>	The method for analysis and evaluation of the relevant subject matter.
<b>Night</b>	The period from 10:00 pm to 7:00 am Monday to Saturday and 10:00 pm to 8:00 am Sundays and public holidays.
<b>Noise intensive works</b>	Works which include the use of power saws for the cutting of timber, masonry and steel; grinding of metal, concrete or masonry; rock/line drilling; bitumen milling and profiling; jack hammering, rock hammering and rock breaking; or impact piling.
<b>Opal card</b>	The integrated ticketing smartcard introduced by Transport for New South Wales.
<b>Out-of-hours works</b>	Defined as works outside standard construction hours (i.e. outside of 7:00 am to 6:00 pm Monday to Friday, 8:00 am to 1:00 pm Saturday and no work on Sundays/public holidays).

Term	Meaning
<b>Project area</b>	The Project area comprises the overall potential area of direct disturbance by the Project, which may be temporary (for construction) or permanent (for operational infrastructure) and extend below the ground surface.
<b>Proponent</b>	A person or body proposing to carry out an activity under Division 5.1 of the <i>Environmental Planning and Assessment Act 1979</i> - in this instance, Transport for New South Wales.
<b>Rating background level [RBL]</b>	The overall background level for each day, evening and night period for the <b>entire length</b> of noise monitoring.
<b>Secretary's Environmental Assessment Requirements (SEARs)</b>	Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning, Industry and Environment under section 5.16 of the EP&A Act.
<b>Sensitive receiver/receptor</b>	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises).
<b>Sound power level</b>	The total sound emitted by a source.
<b>Sound pressure level</b>	The amount of sound at a specified point.
<b>Special audible characteristics</b>	Noise with characteristics that can cause annoyance and disturbance, containing noticeable factors such as tonality, low frequency noise, impulsive or intermittent noise events
<b>Sydney Trains</b>	The provider of metropolitan train services for Sydney.
<b>The Project</b>	The construction and operation of the Redfern Station Upgrade – New Southern Concourse.
<b>Track possession</b>	Track possession means the temporary closure of part of the railway network for a specified period of time for the purposes of carrying out repair, maintenance or upgrading work on or adjacent to the railway network, during which no trains operate.
<b>Traffic noise</b>	The total noise resulting from road traffic. The $L_{eq}$ sound pressure level is used to quantify traffic noise.
<b>Up-side</b>	Up-side refers to the direction of travel towards Central Station.
<b>Vibration intensive works</b>	Works which use vibration intensive equipment such as jack hammers, piling rigs and rock breakers.

The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound

A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
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Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.																						
Equivalent continuous sound level [Leq]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
Lmax	The maximum sound pressure level measured over the measurement period																						
Lmin	The minimum sound pressure level measured over the measurement period																						
L10	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L10.																						
L90	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L90.																						
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.																						
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L90 sound pressure level is used to quantify background noise.																						

Traffic noise	The total noise resulting from road traffic. The Leq sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.

\*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 "Acoustics – Glossary of terms and related symbols", the EPA's NSW Industrial Noise Policy and the EPA's NSW Road Noise Policy.



# Appendix B

## Logger Graphs

# Noise Logger Report

245 Wilson Street, Eveleigh



Item	Information
Logger Type	Rion NL52
Serial number	175537
Address	245 Wilson Street, Eveleigh
Location	Southern boundary of Carriage works
Facade / Free Field	Free Field
Environment	Background dominated by Rail noise.

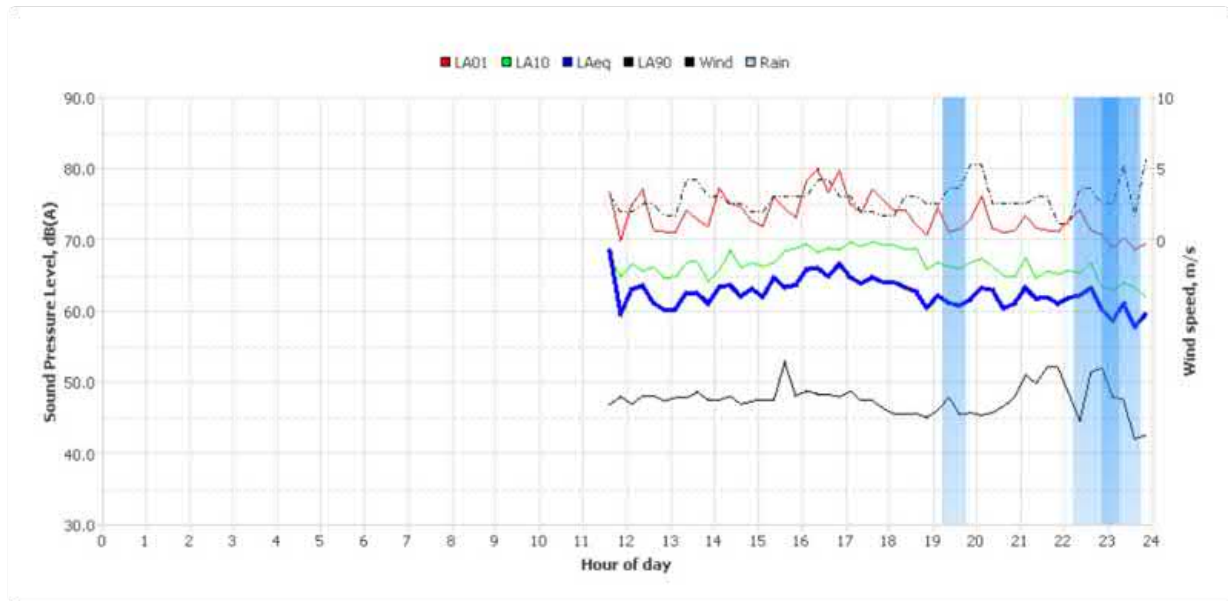
## Measured noise levels

Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq,15hr</sub>	L <sub>Aeq,9hr</sub>
Wed Jun 16 2021	64	62	60	-	-	-	63	60
Thu Jun 17 2021	64	61	59	-	43	-	63	59
Fri Jun 18 2021	64	60	58	-	-	-	64	58
Sat Jun 19 2021	-	-	-	-	-	-	-	-
Sun Jun 20 2021	61	61	59	-	-	-	61	59
Mon Jun 21 2021	64	61	60	-	43	-	63	60
Tue Jun 22 2021	63	61	60	45	42	-	62	60
Wed Jun 23 2021	64	61	58	-	-	43	63	58
Thu Jun 24 2021	64	61	59	-	44	41	63	59
Fri Jun 25 2021	65	61	58	-	44	39	64	58
Sat Jun 26 2021	62	61	58	-	42	39	62	58
Sun Jun 27 2021	62	62	58	47	45	39	62	58
Mon Jun 28 2021	63	62	59	-	43	-	63	59
Tue Jun 29 2021	63	62	60	-	-	-	63	60
Wed Jun 30 2021	64	63	60	47	-	-	64	60
Thu Jul 1 2021	64	63	59	47	-	-	64	59
Fri Jul 2 2021	64	62	59	50	-	46	63	59
Sat Jul 3 2021	60	61	59	-	49	-	60	59
Sun Jul 4 2021	60	60	56	-	43	-	60	56
Mon Jul 5 2021	63	62	60	-	-	-	63	60
Tue Jul 6 2021	63	62	60	-	44	-	63	60
Wed Jul 7 2021	62	-	-	-	-	-	62	-
<b>Summary</b>	<b>63</b>	<b>62</b>	<b>59</b>	<b>47</b>	<b>43</b>	<b>40</b>	<b>63</b>	<b>59</b>

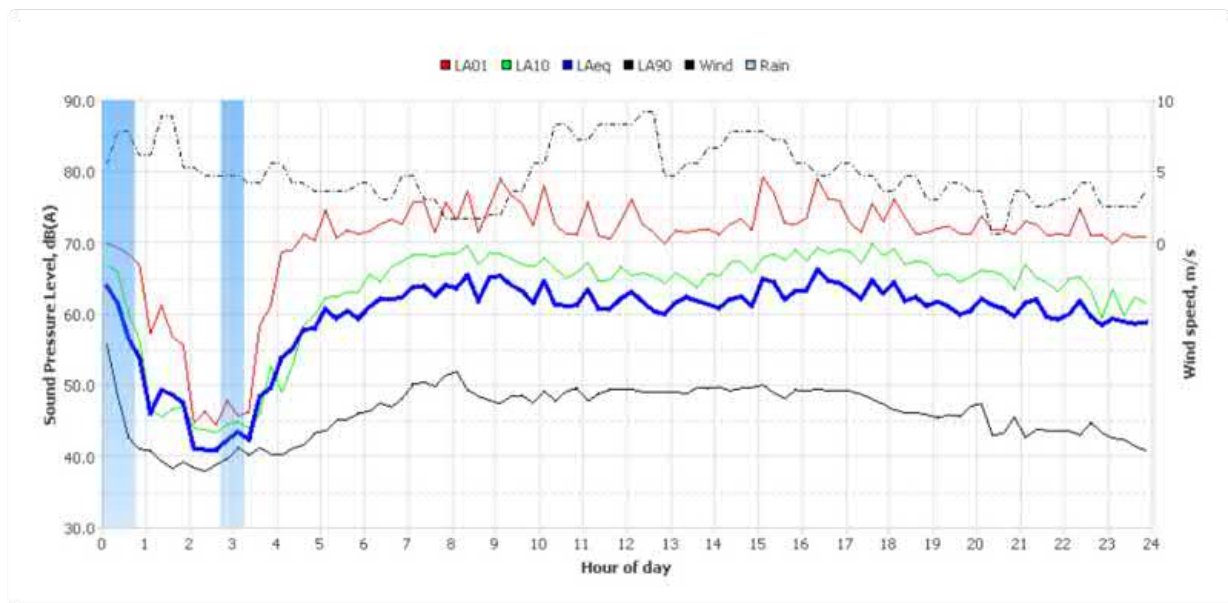
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

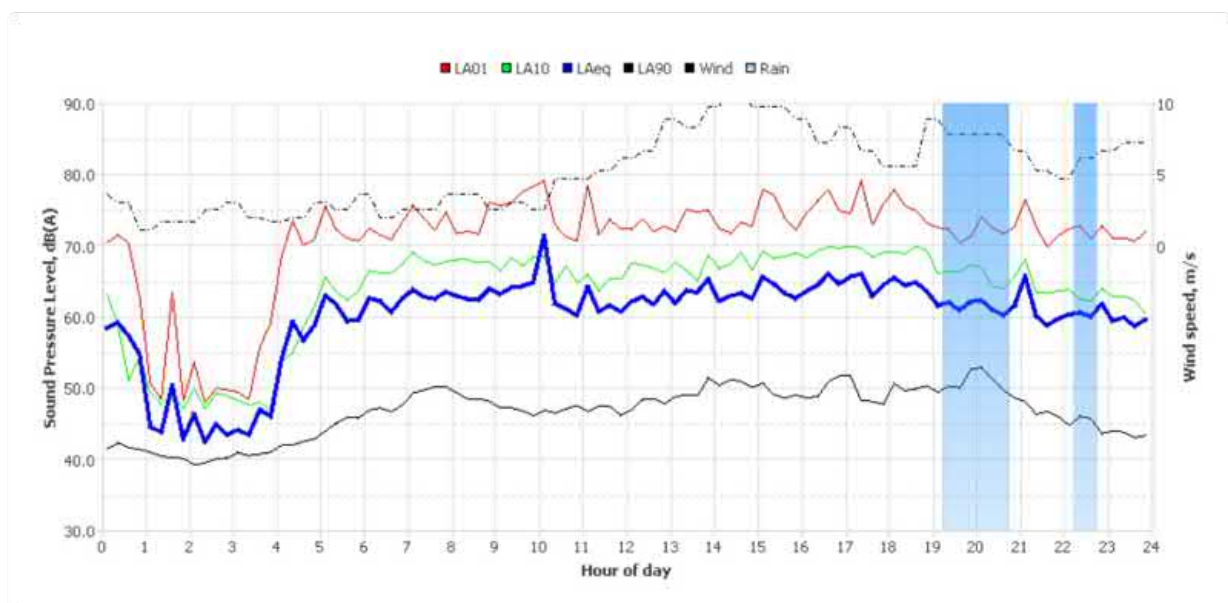
Wednesday, 16 Jun 2021



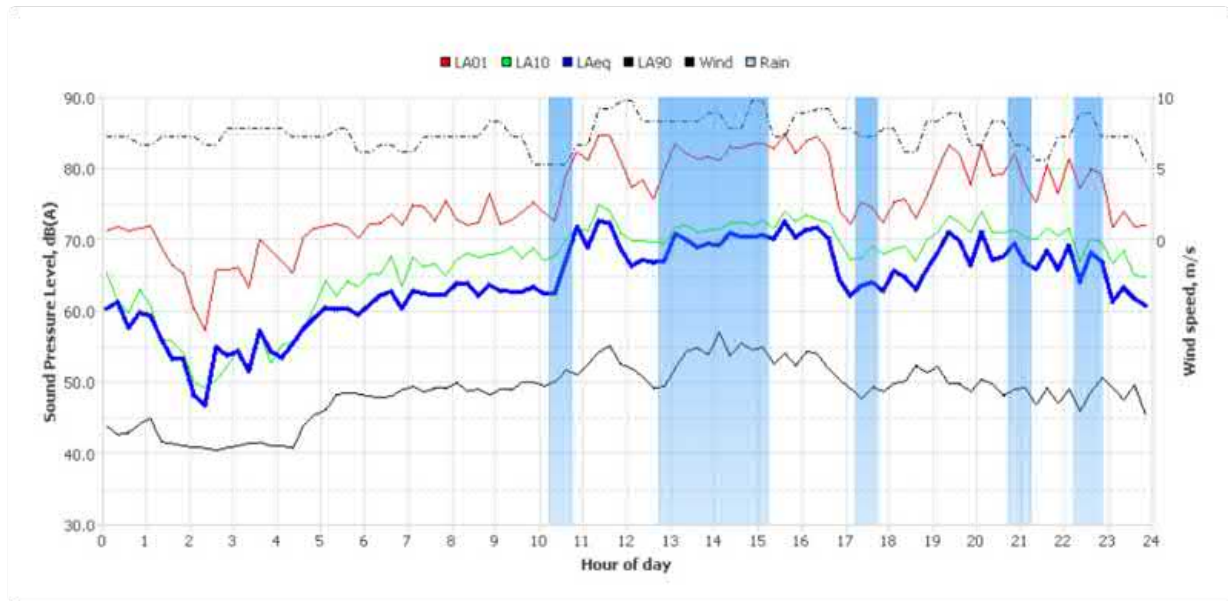
Thursday, 17 Jun 2021



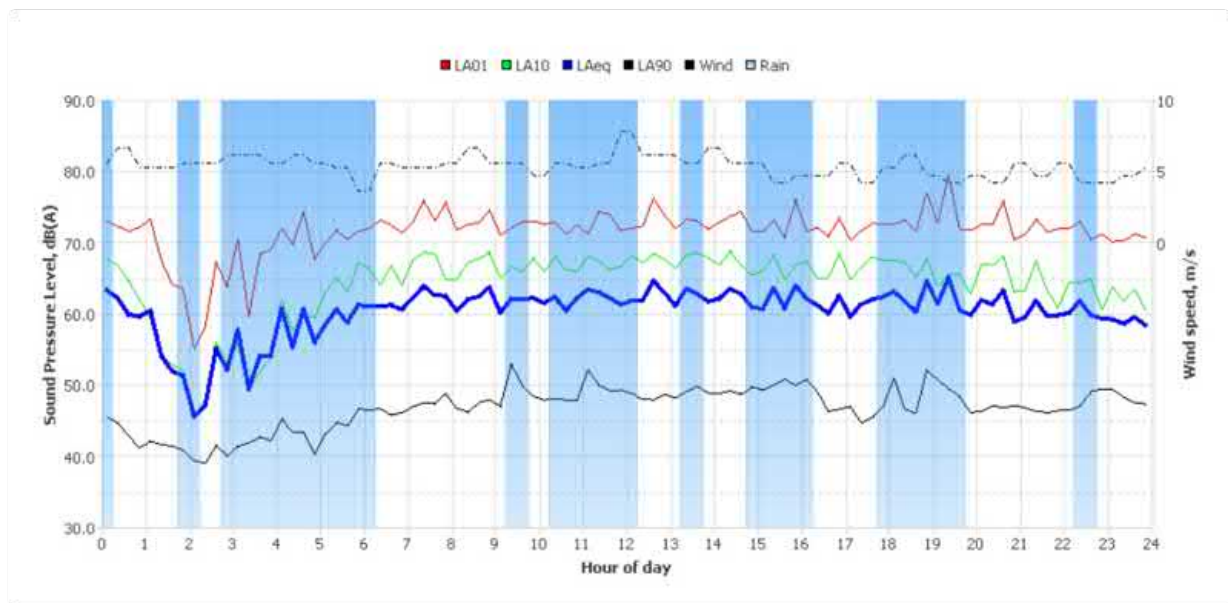
Friday, 18 Jun 2021



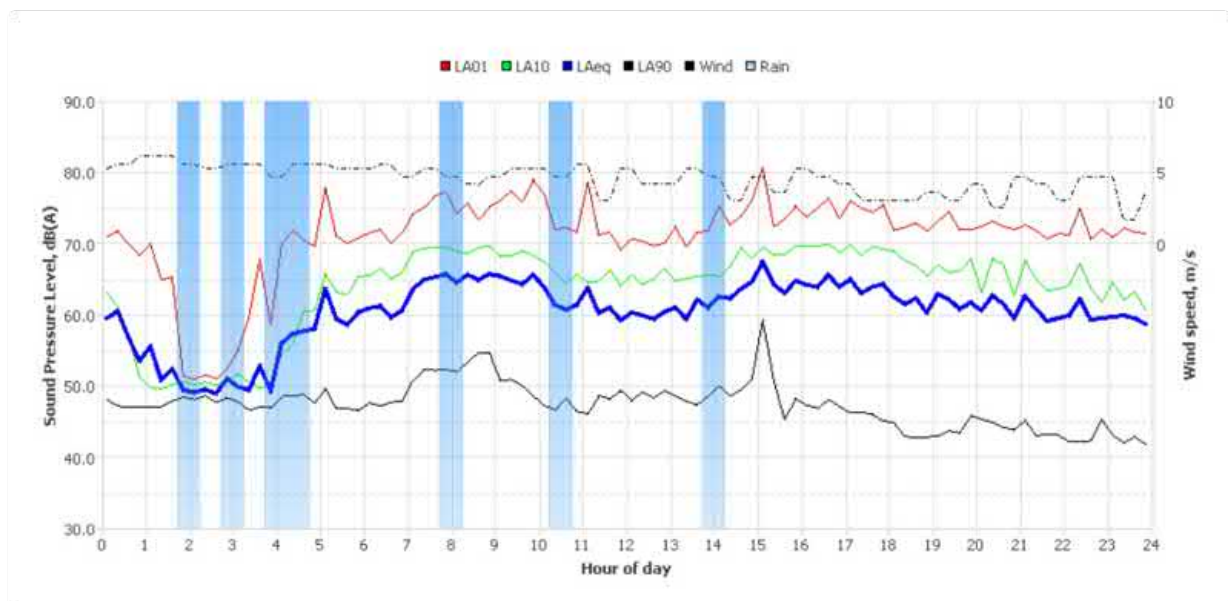
Saturday, 19 Jun 2021



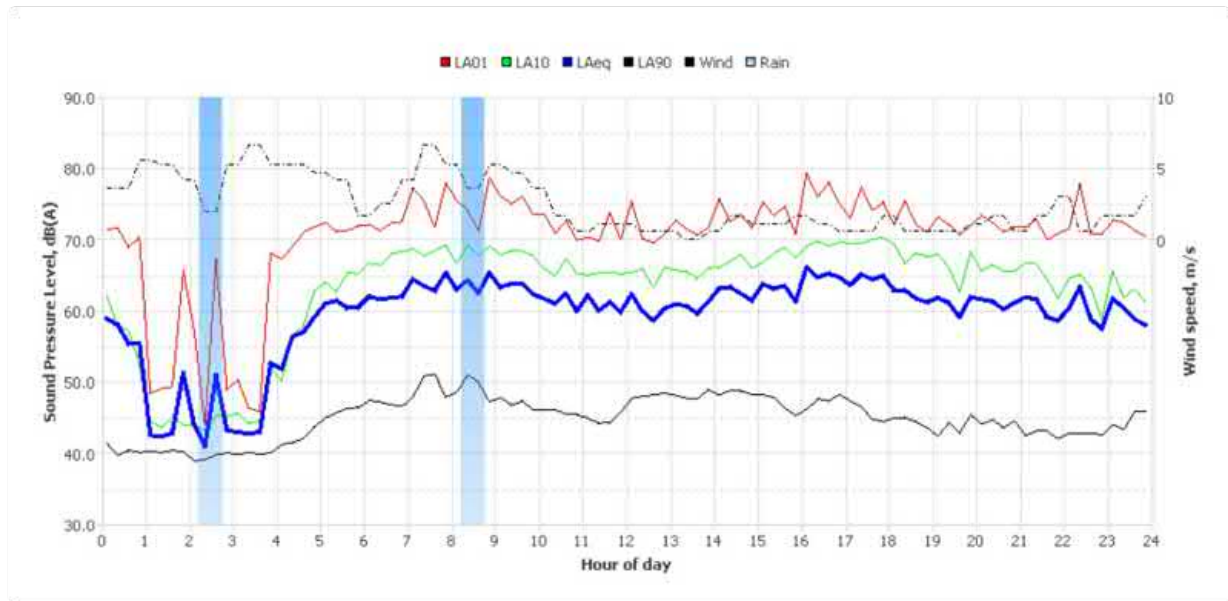
Sunday, 20 Jun 2021



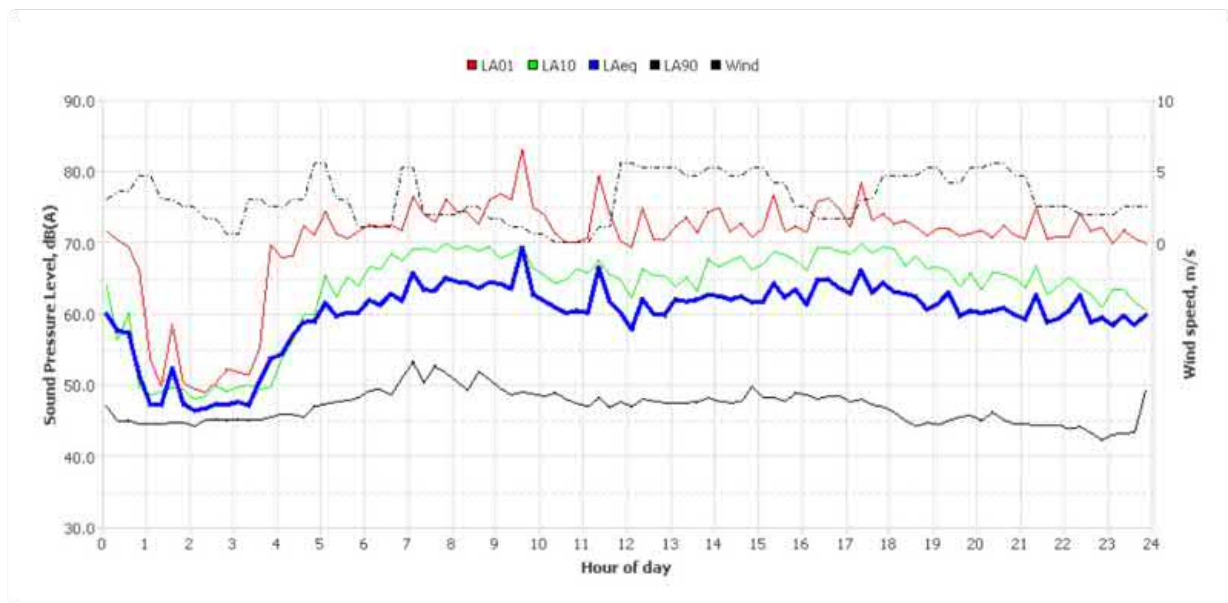
Monday, 21 Jun 2021



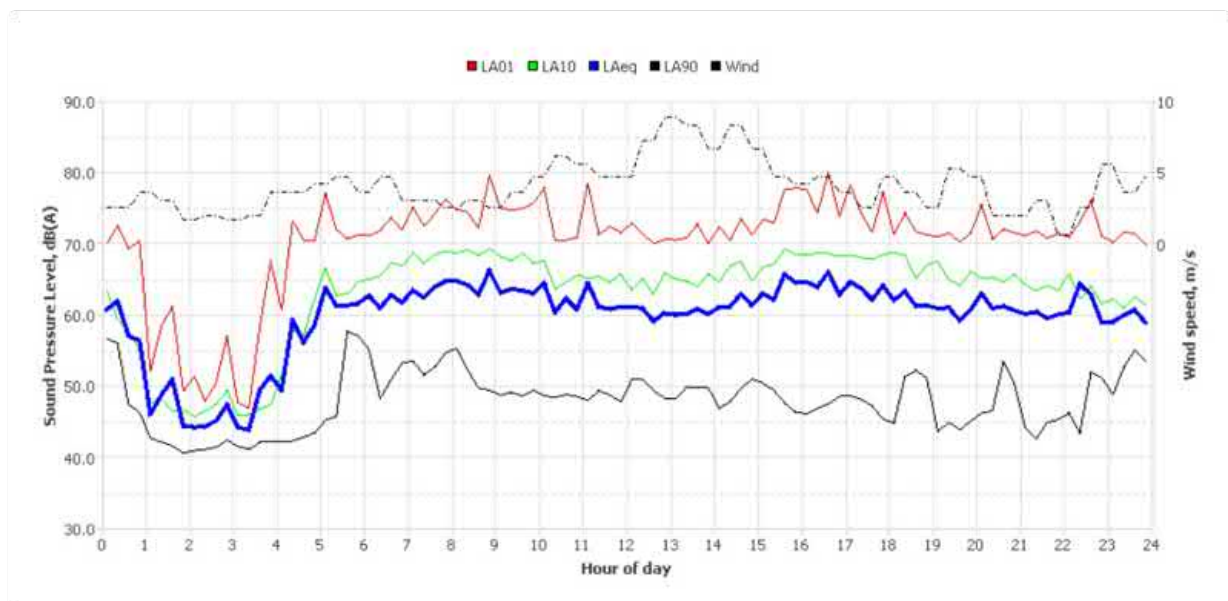
Tuesday, 22 Jun 2021



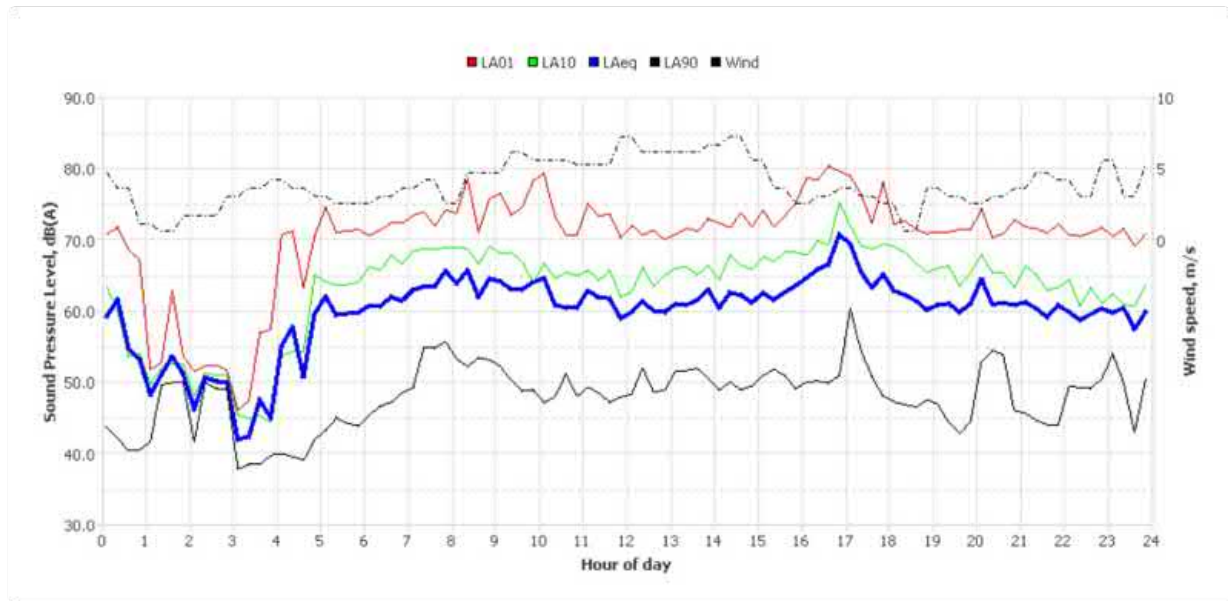
Wednesday, 23 Jun 2021



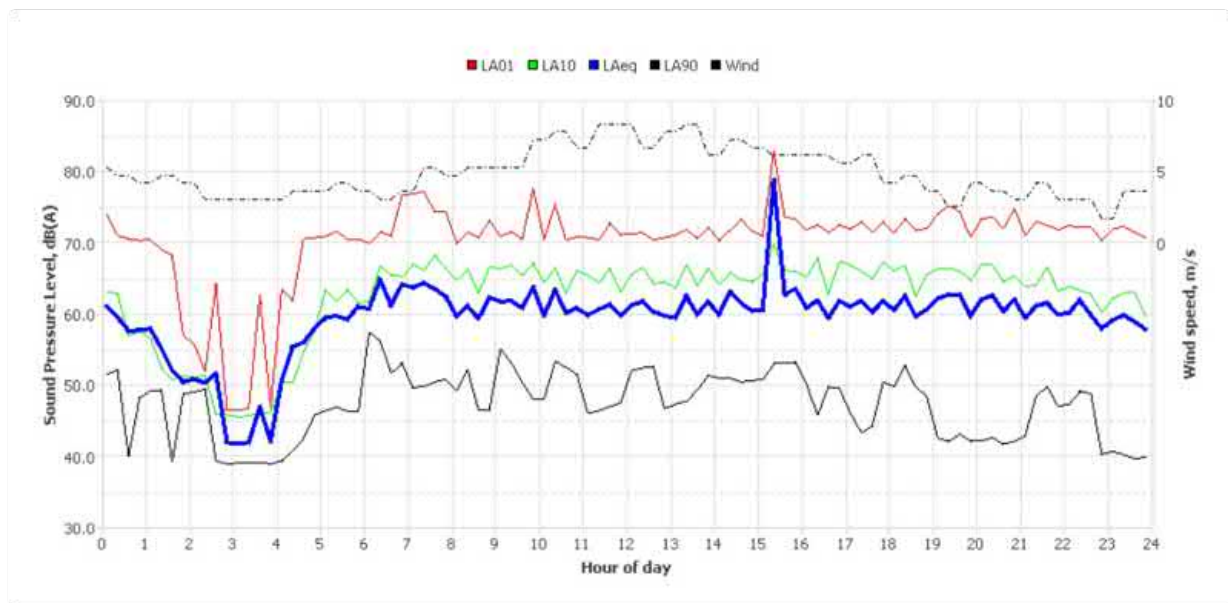
Thursday, 24 Jun 2021



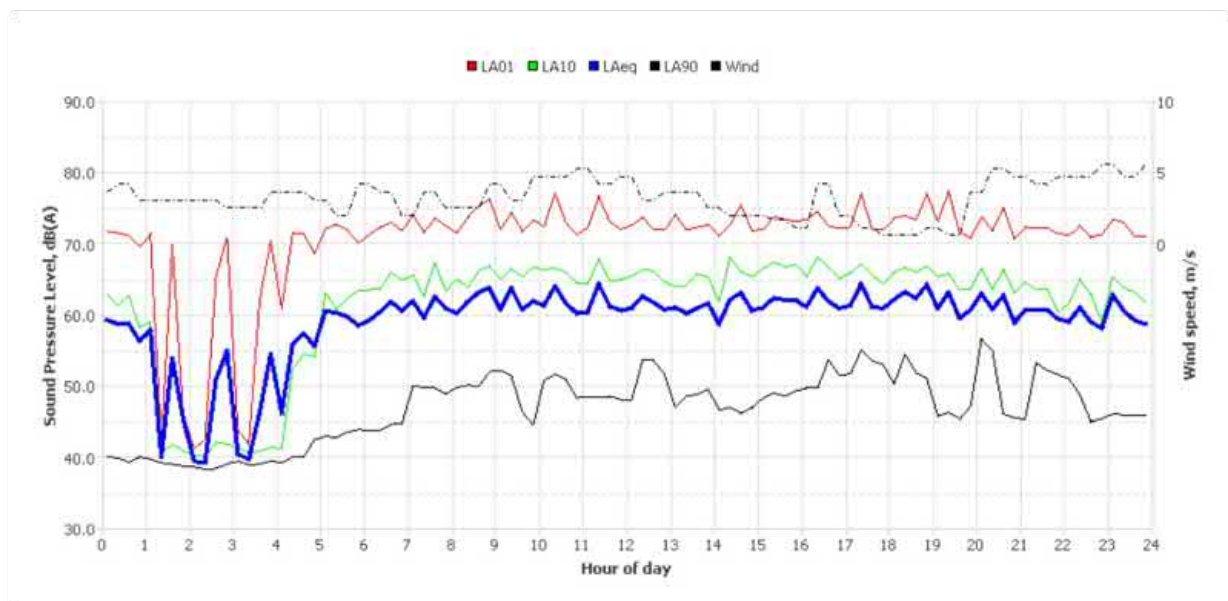
Friday, 25 Jun 2021



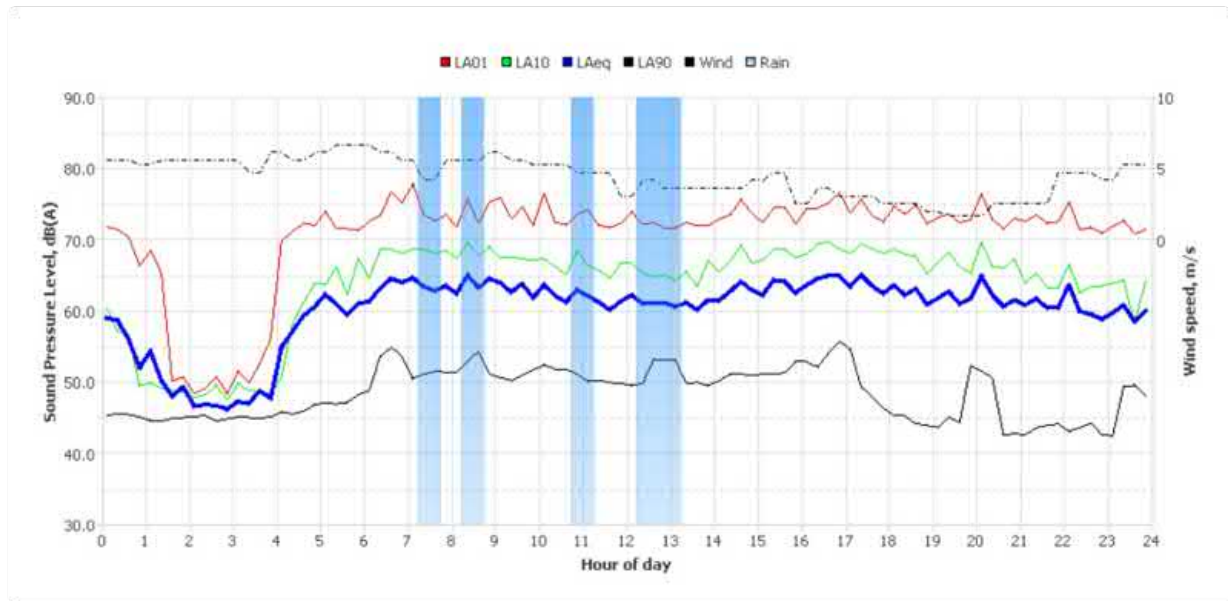
Saturday, 26 Jun 2021



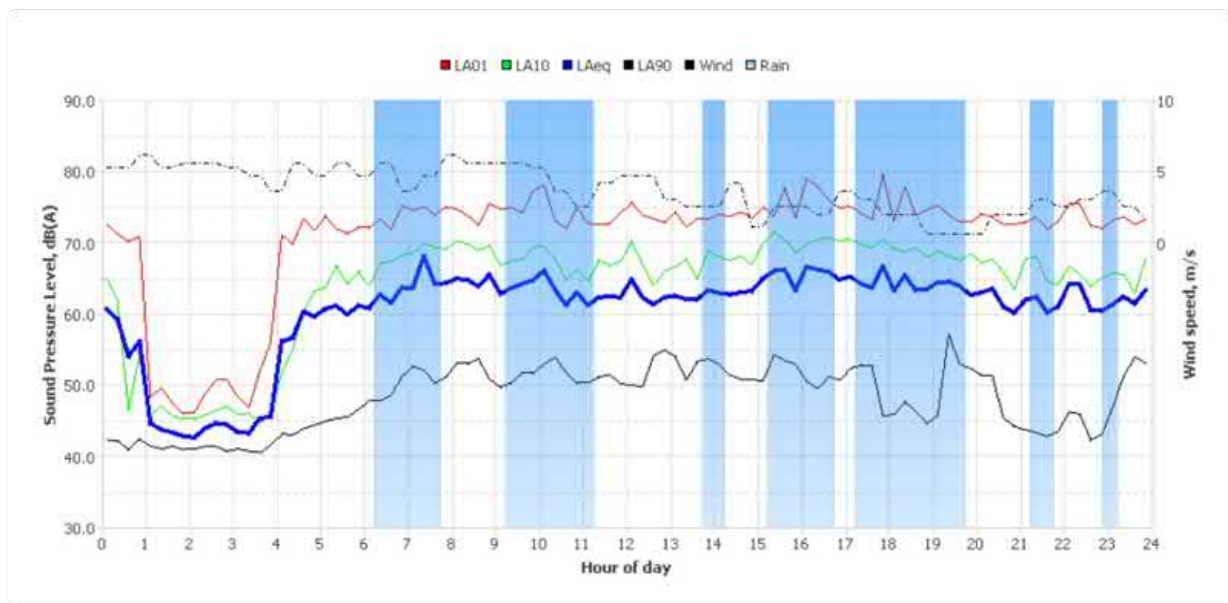
Sunday, 27 Jun 2021



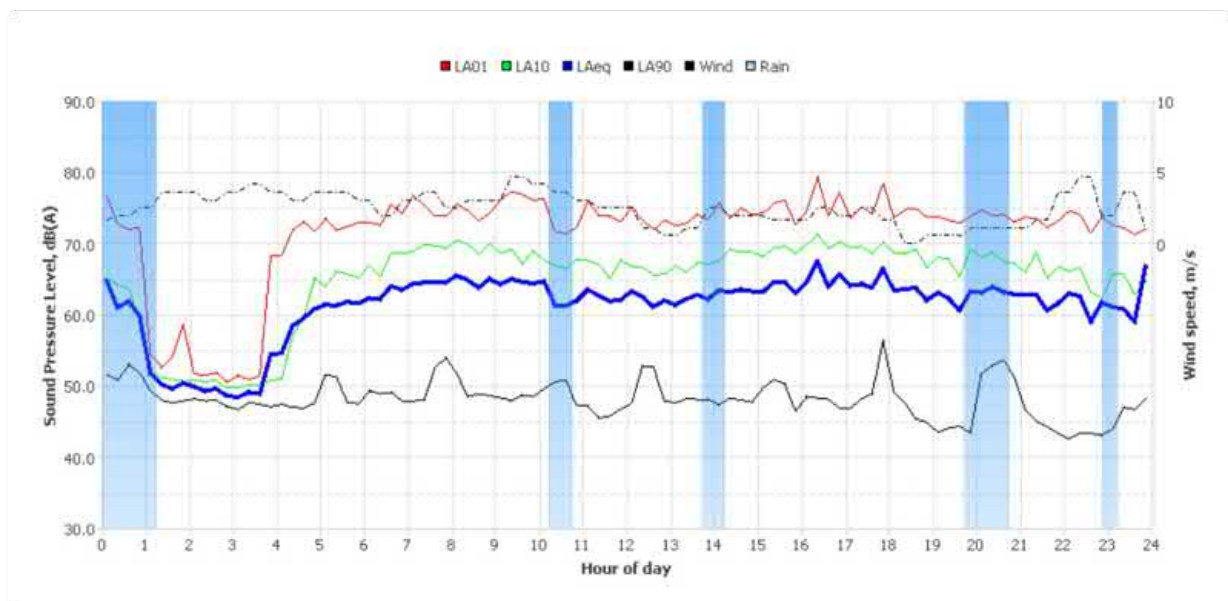
Monday, 28 Jun 2021



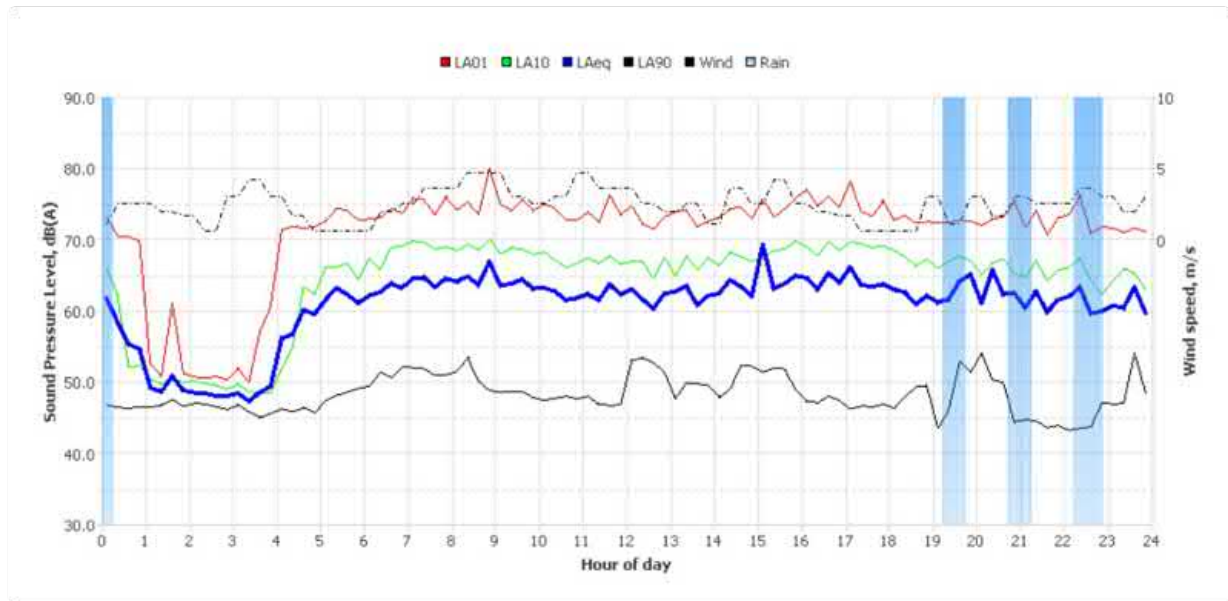
Tuesday, 29 Jun 2021



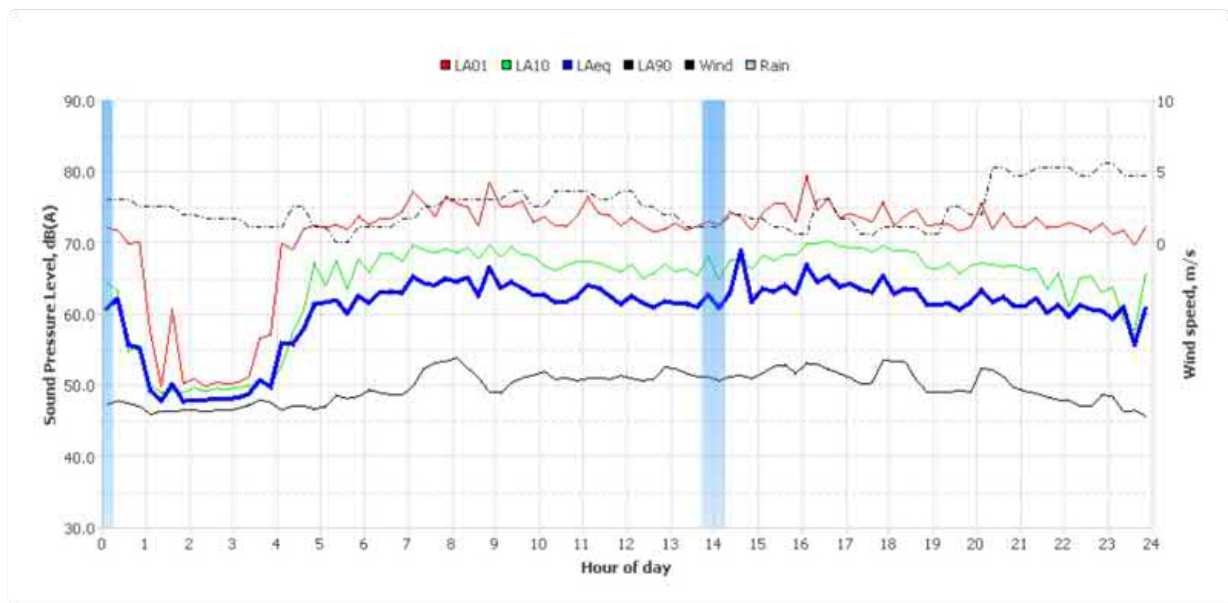
Wednesday, 30 Jun 2021



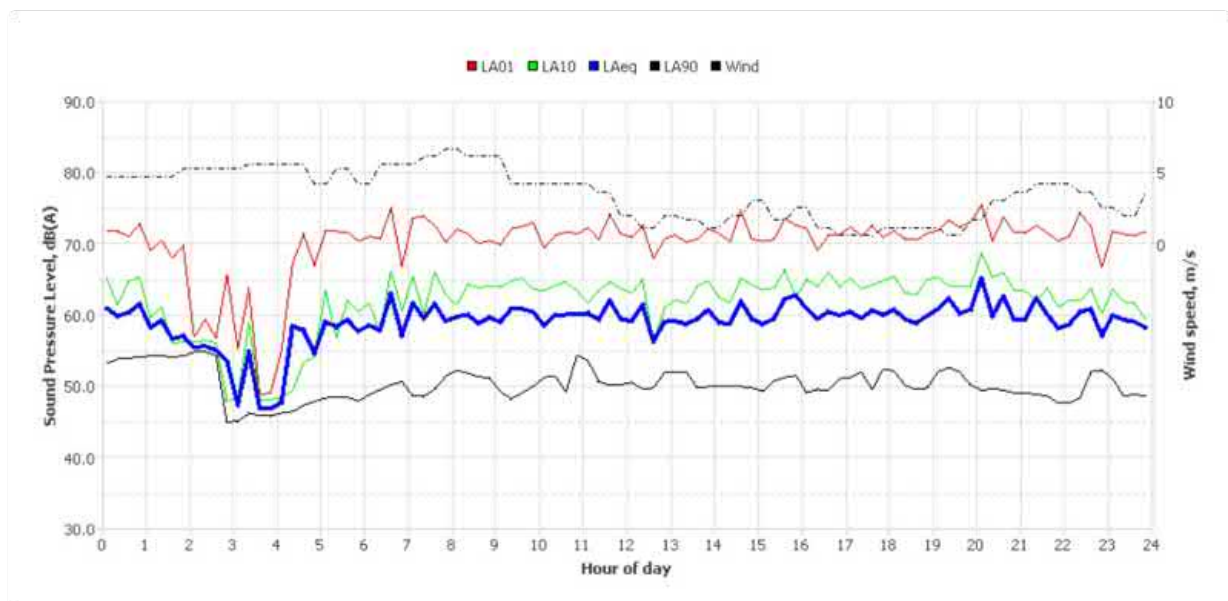
Thursday, 01 Jul 2021



Friday, 02 Jul 2021

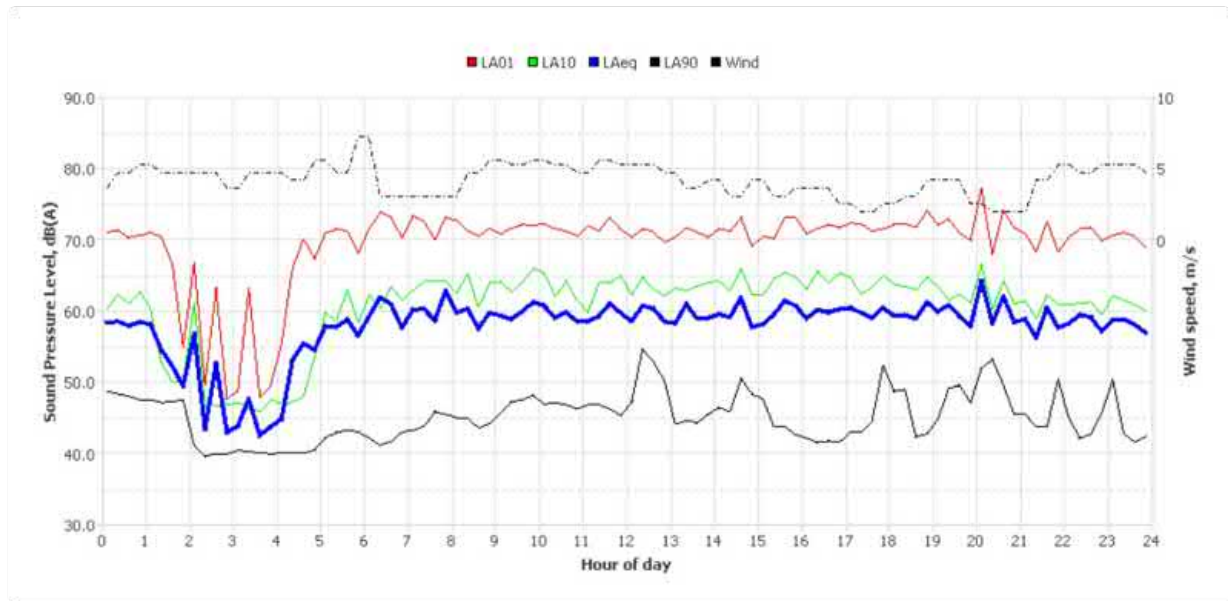


Saturday, 03 Jul 2021

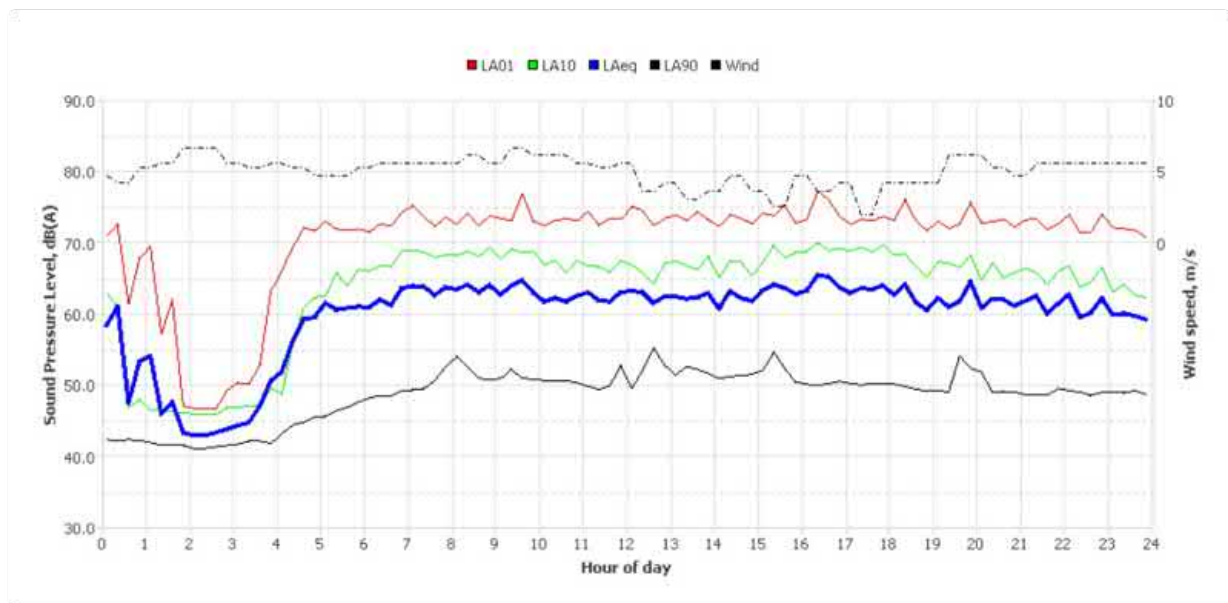




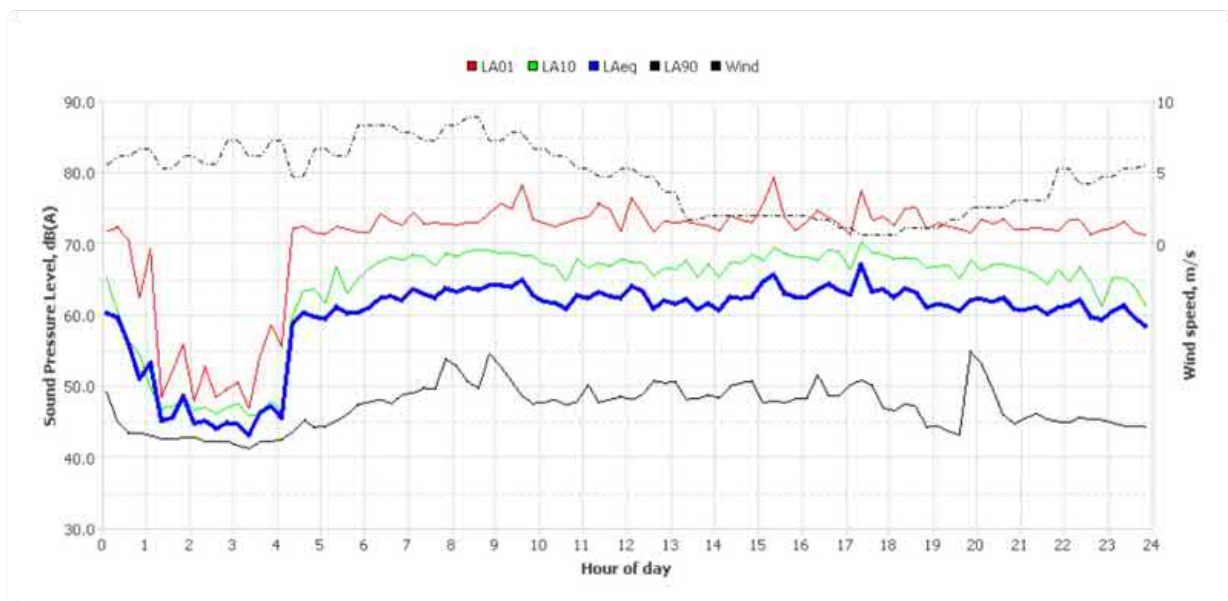
Sunday, 04 Jul 2021



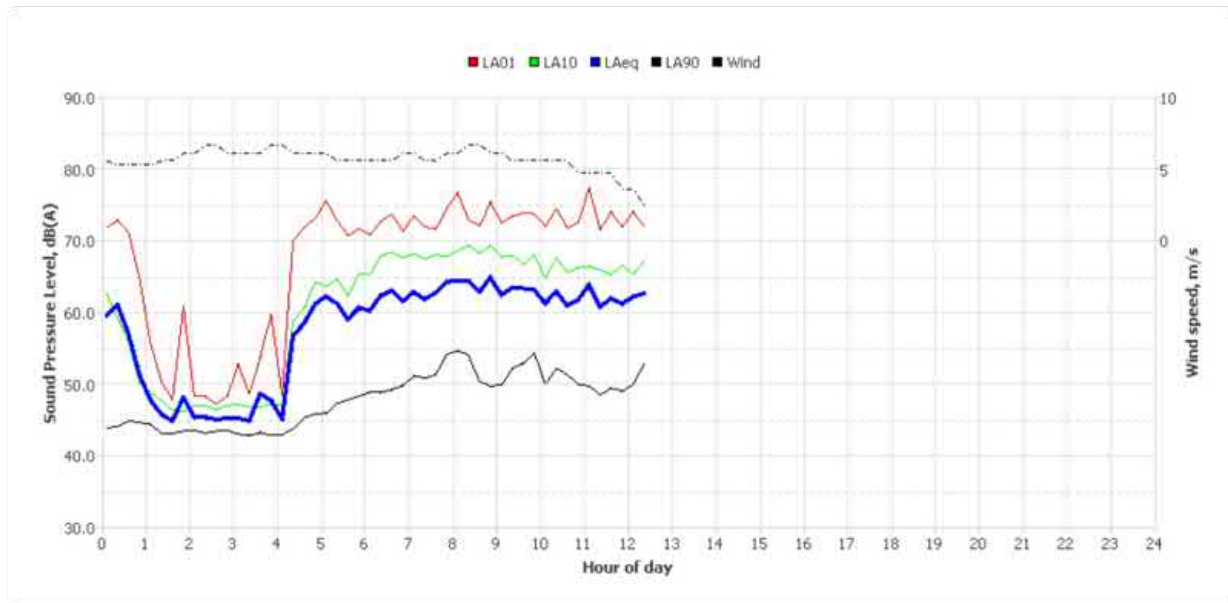
Monday, 05 Jul 2021



Tuesday, 06 Jul 2021



Wednesday, 07 Jul 2021



# Noise Logger Report

26-28 Holdsworth Street, Newtown



Item	Information
Logger Type	Rion NL52
Serial number	175550
Address	26-28 Holdsworth Street, Newtown
Location	Front Yard
Facade / Free Field	Free Field
Environment	Background dominated by road traffic noise and rail noise when trains pass by 56 to 59 dBA. Background with no rail or local traffic 45 to 48 dBA. Aircraft overhead 58 dBA. Car pass by 63 dBA. Bird calls audible occasionally.

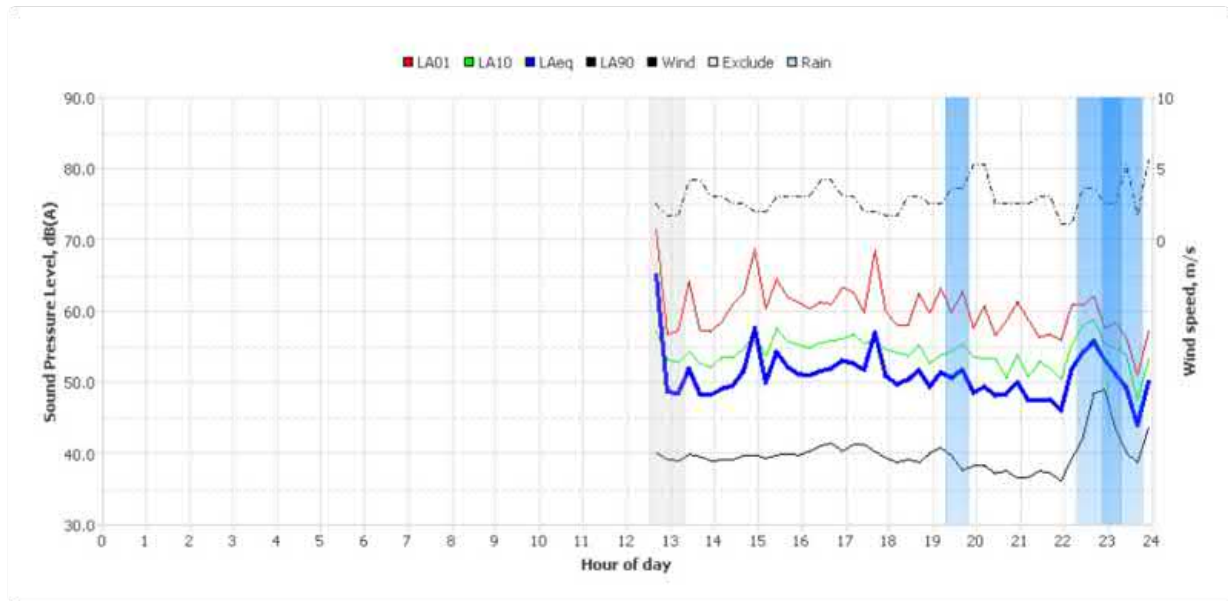
## Measured noise levels

Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq</sub> 15hr	L <sub>Aeq</sub> 9hr
Wed Jun 16 2021	52	49	49	-	-	-	51	49
Thu Jun 17 2021	53	54	52	-	40	-	54	52
Fri Jun 18 2021	54	54	46	-	-	-	54	46
Sat Jun 19 2021	-	-	-	-	-	-	-	-
Sun Jun 20 2021	54	50	45	-	-	-	52	45
Mon Jun 21 2021	55	50	48	-	41	-	53	48
Tue Jun 22 2021	53	50	48	39	36	-	52	48
Wed Jun 23 2021	54	50	45	-	-	35	53	45
Thu Jun 24 2021	51	51	46	-	36	34	51	46
Fri Jun 25 2021	54	51	46	-	38	34	53	46
Sat Jun 26 2021	49	51	44	-	38	32	50	44
Sun Jun 27 2021	49	49	45	35	38	33	49	45
Mon Jun 28 2021	51	49	45	-	38	-	50	45
Tue Jun 29 2021	52	48	47	-	-	-	51	47
Wed Jun 30 2021	51	50	46	37	-	-	50	46
Thu Jul 1 2021	54	49	44	36	-	-	53	44
Fri Jul 2 2021	52	49	46	36	-	33	52	46
Sat Jul 3 2021	56	50	47	-	35	-	55	47
Sun Jul 4 2021	49	49	43	-	38	-	49	43
Mon Jul 5 2021	50	48	46	-	-	-	50	46
Tue Jul 6 2021	51	50	46	-	37	-	51	46
Wed Jul 7 2021	51	-	-	-	-	-	51	-
<b>Summary</b>	<b>53</b>	<b>50</b>	<b>47</b>	<b>36</b>	<b>38</b>	<b>34</b>	<b>52</b>	<b>47</b>

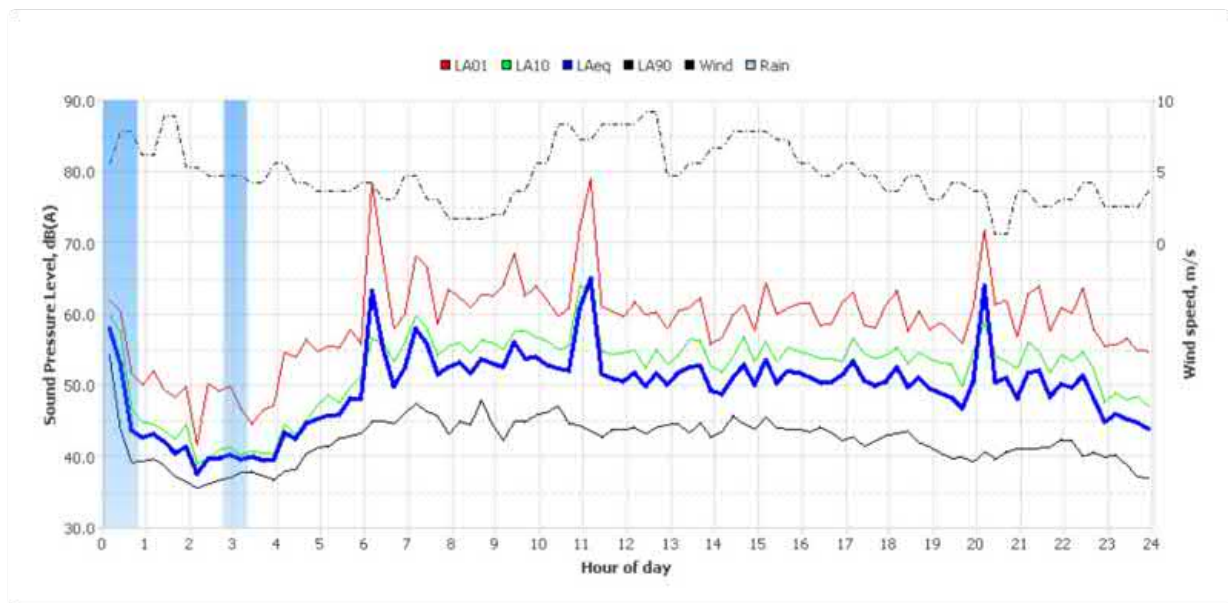
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

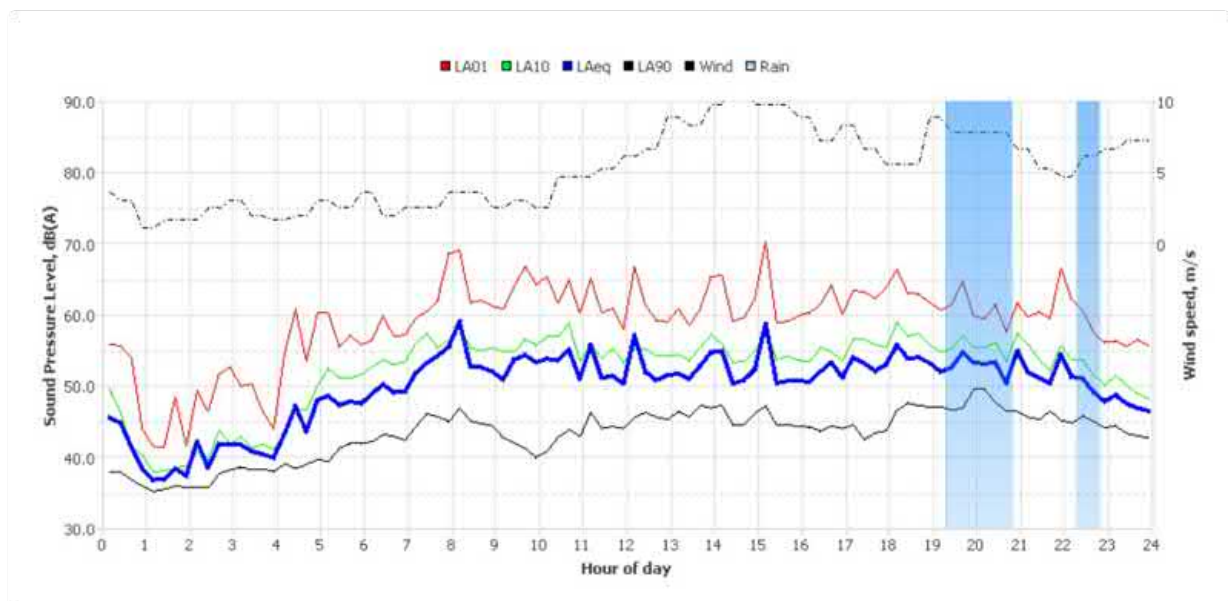
Wednesday, 16 Jun 2021



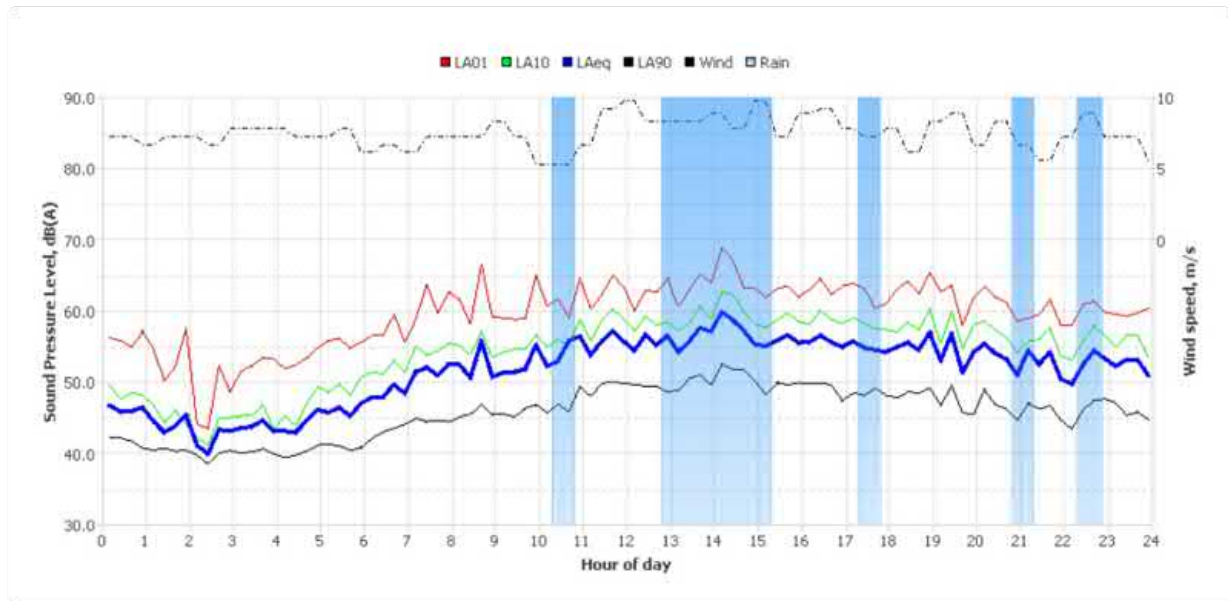
Thursday, 17 Jun 2021



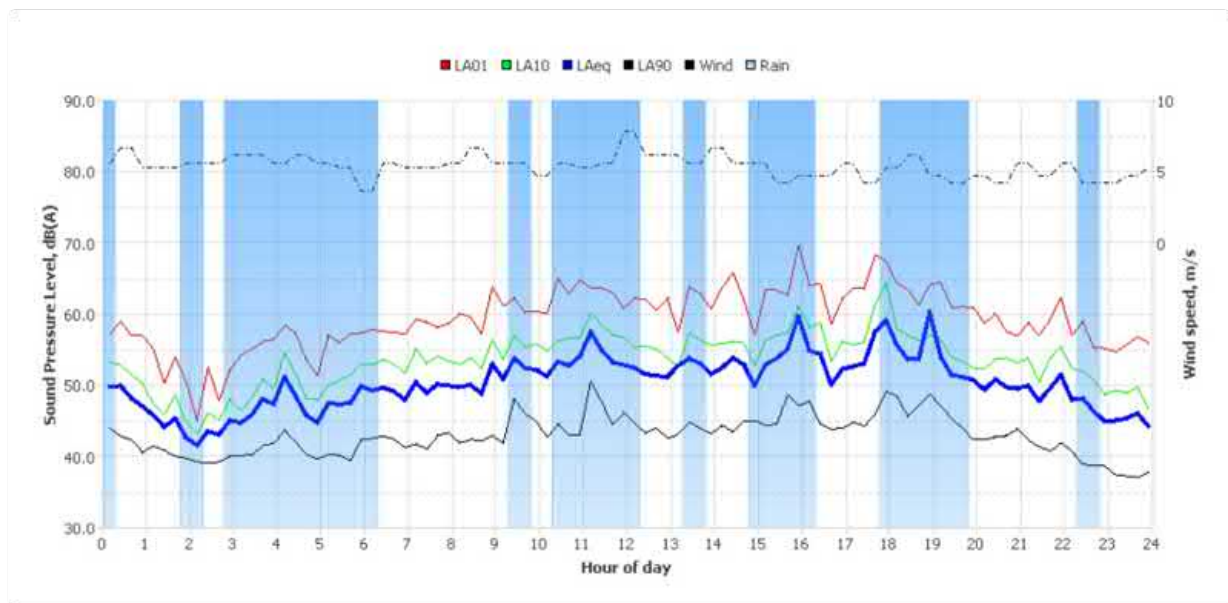
Friday, 18 Jun 2021



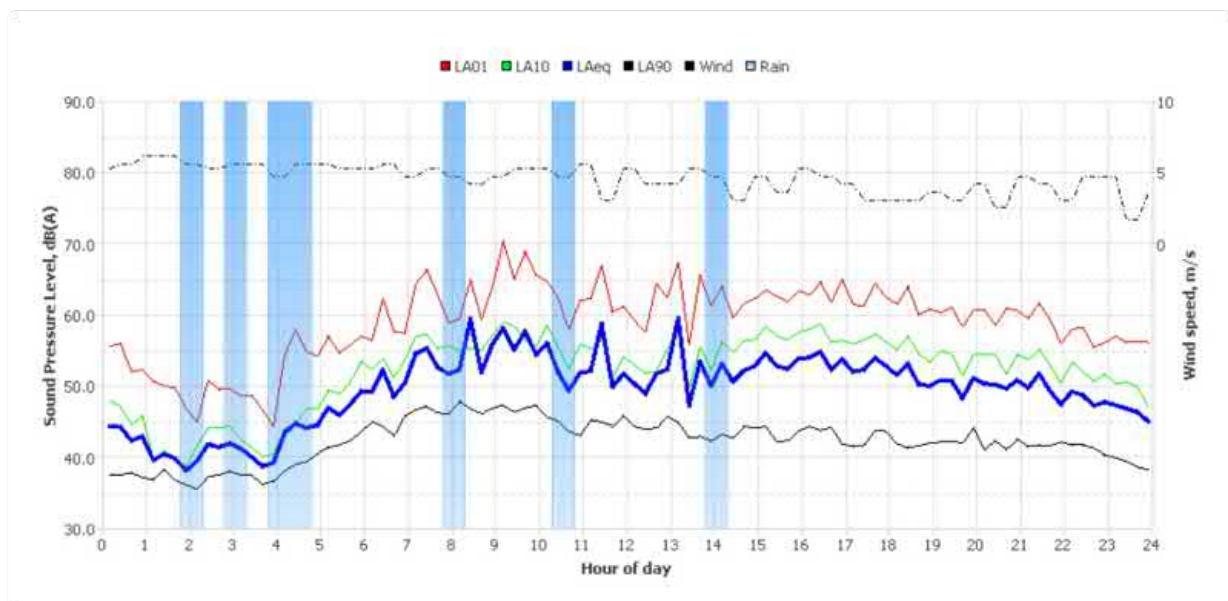
Saturday, 19 Jun 2021



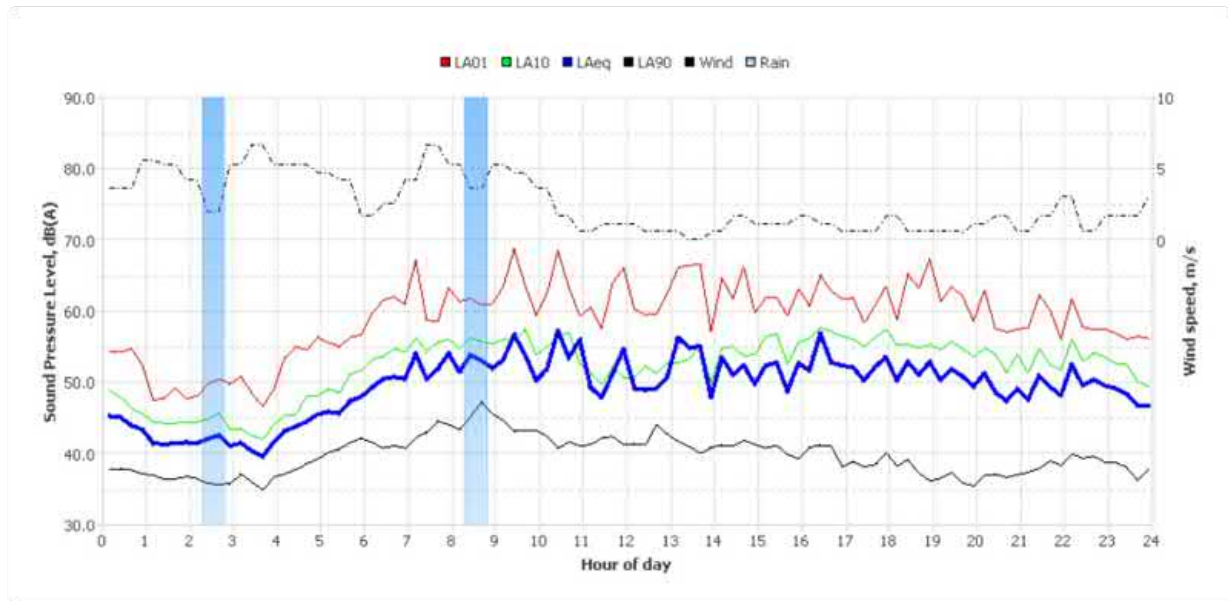
Sunday, 20 Jun 2021



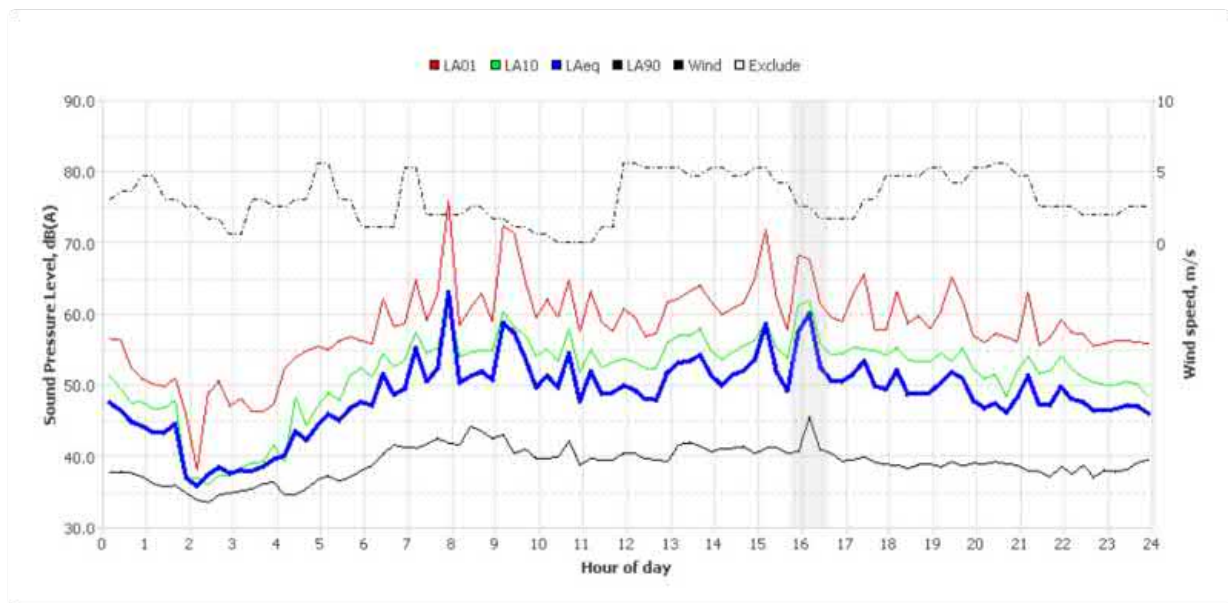
Monday, 21 Jun 2021



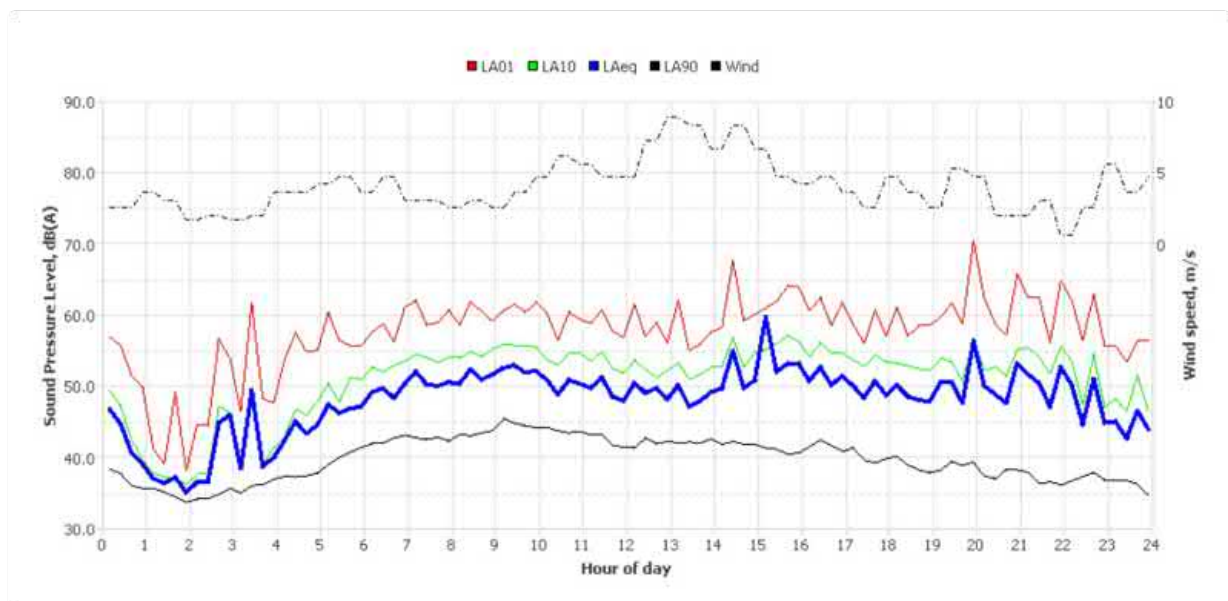
Tuesday, 22 Jun 2021



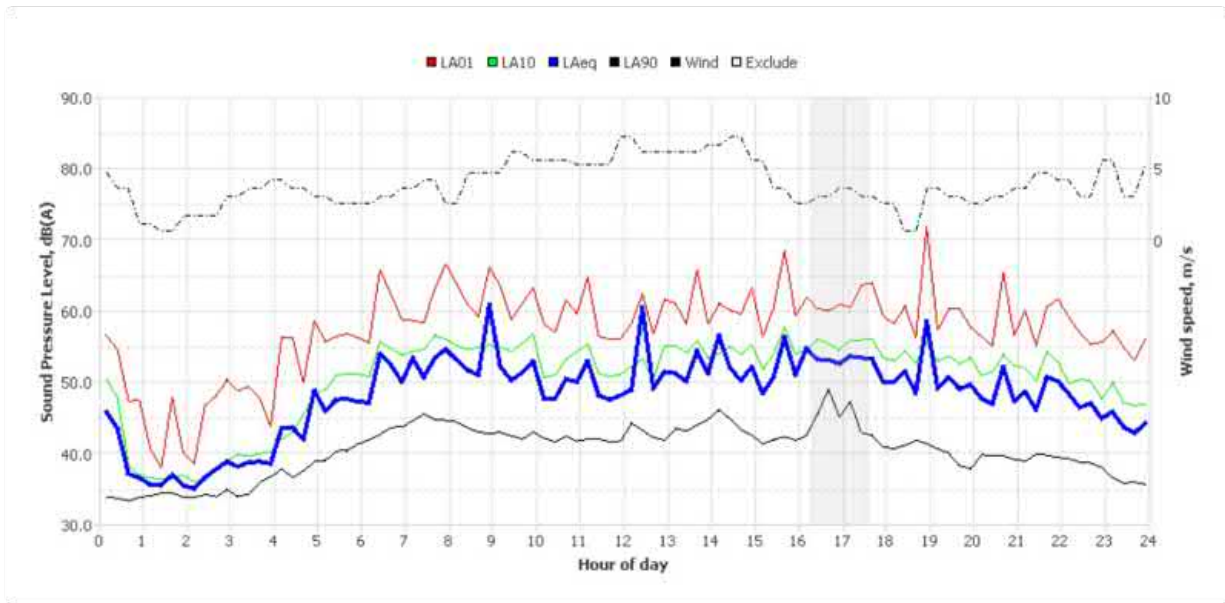
Wednesday, 23 Jun 2021



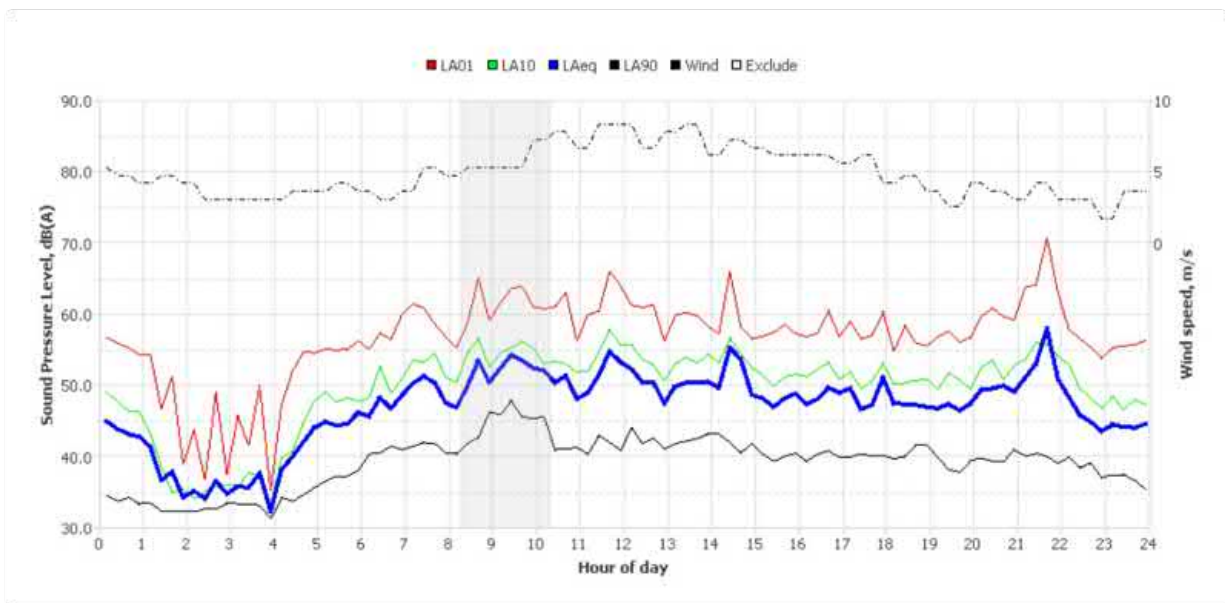
Thursday, 24 Jun 2021



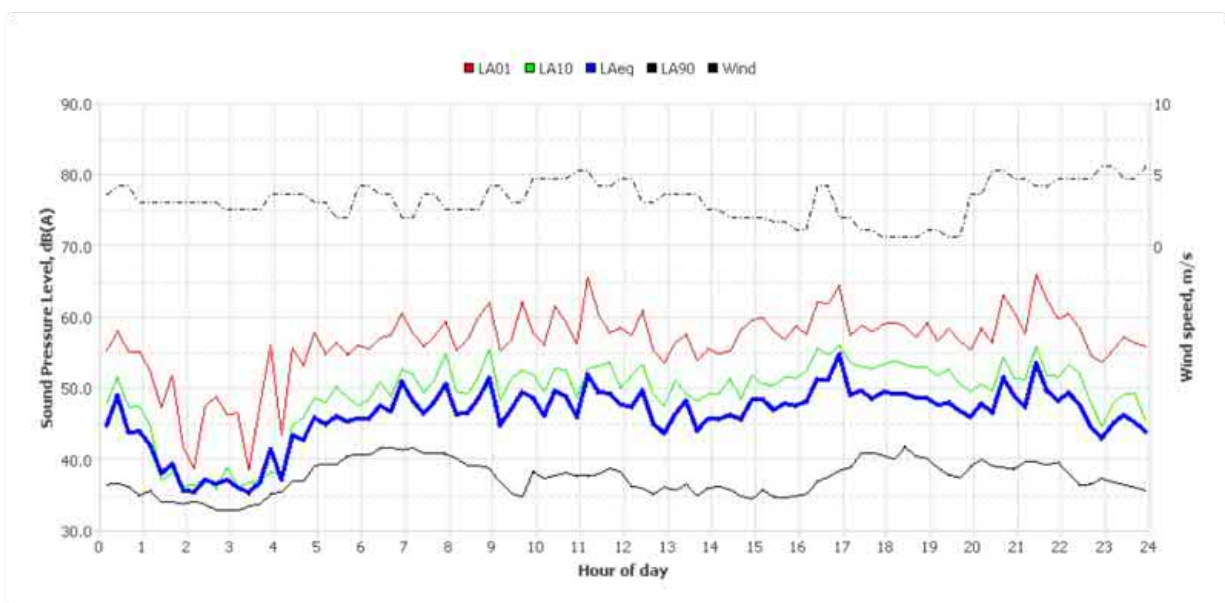
Friday, 25 Jun 2021



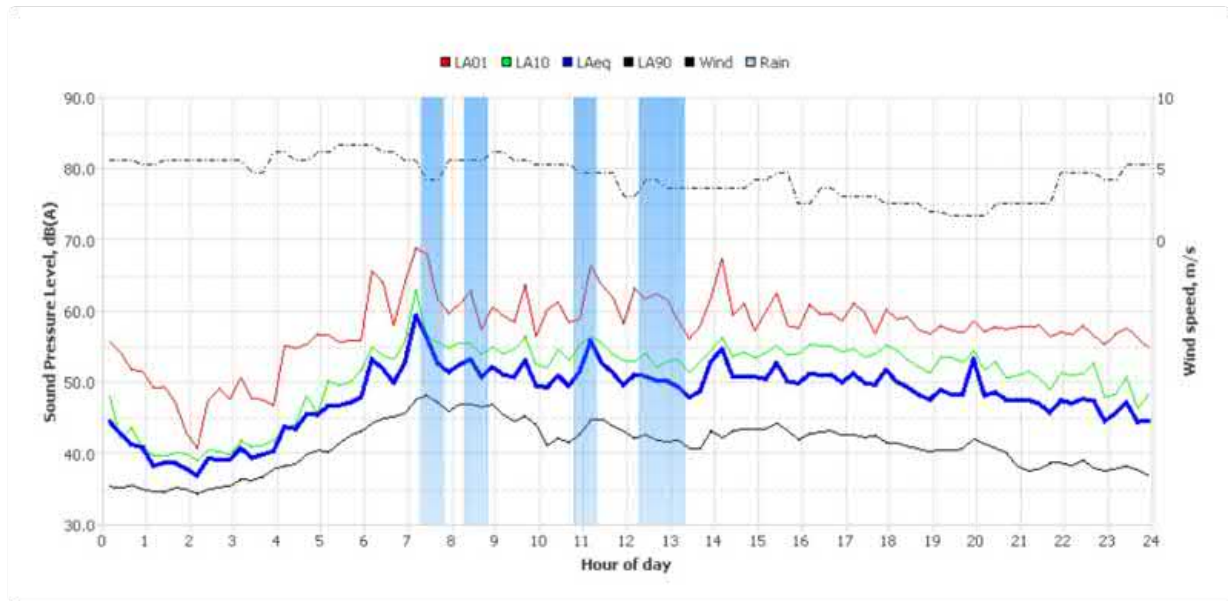
Saturday, 26 Jun 2021



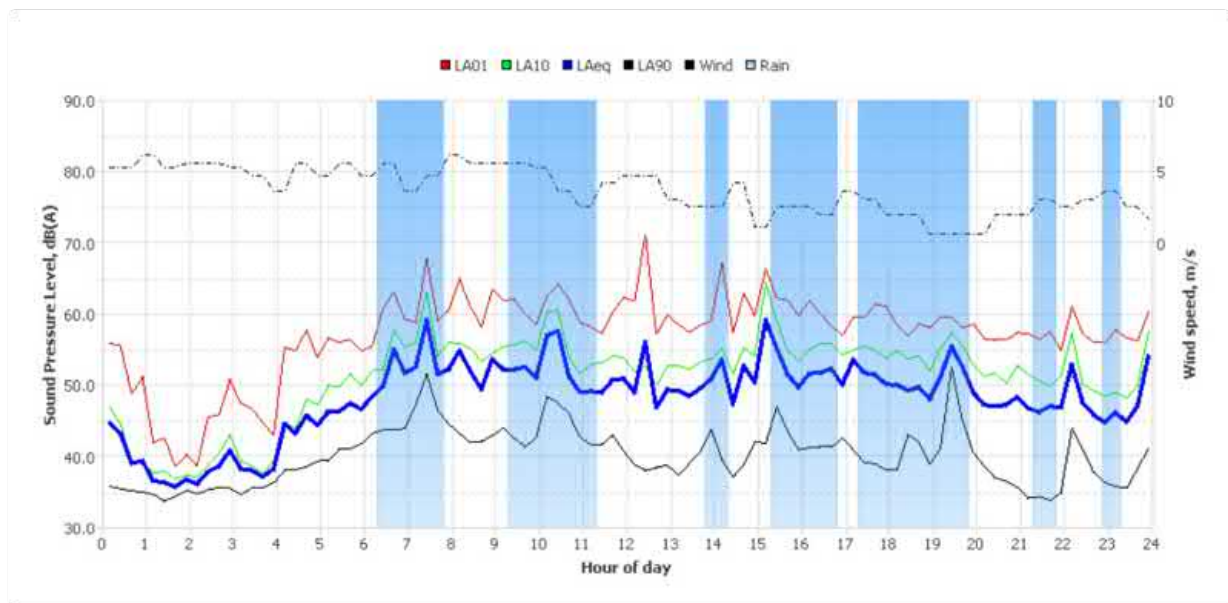
Sunday, 27 Jun 2021



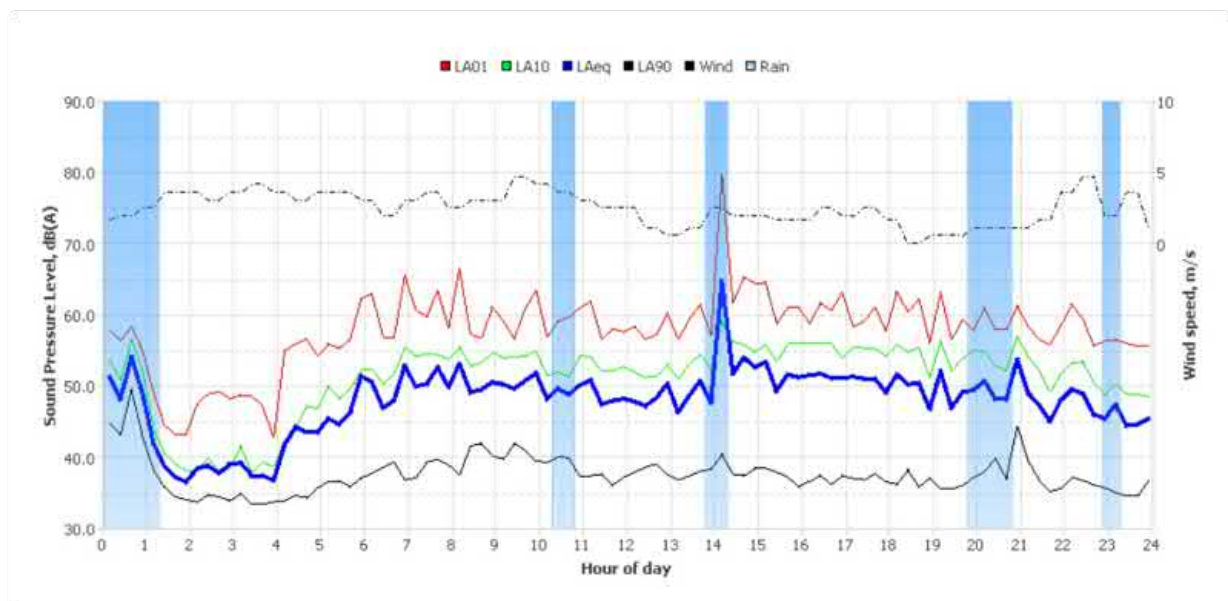
Monday, 28 Jun 2021



Tuesday, 29 Jun 2021

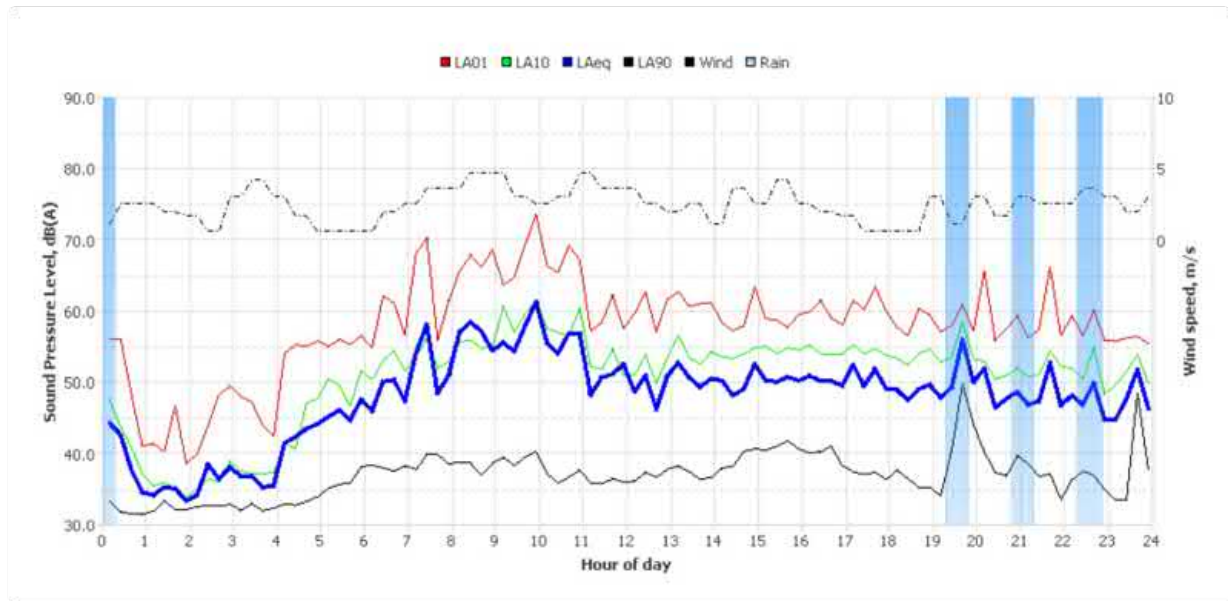


Wednesday, 30 Jun 2021

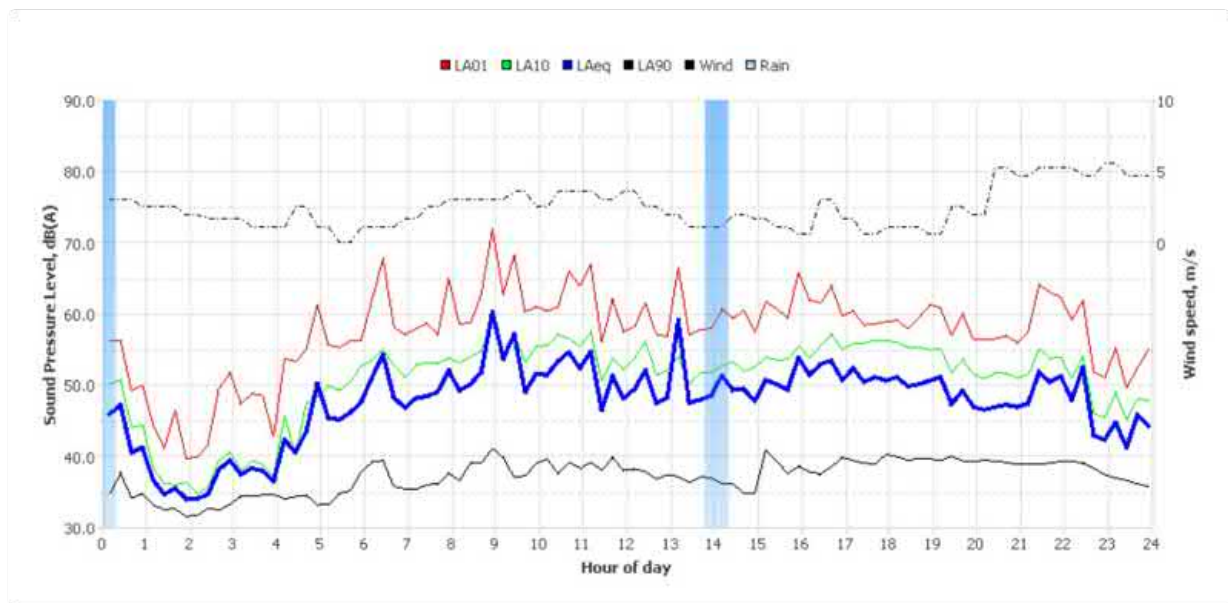




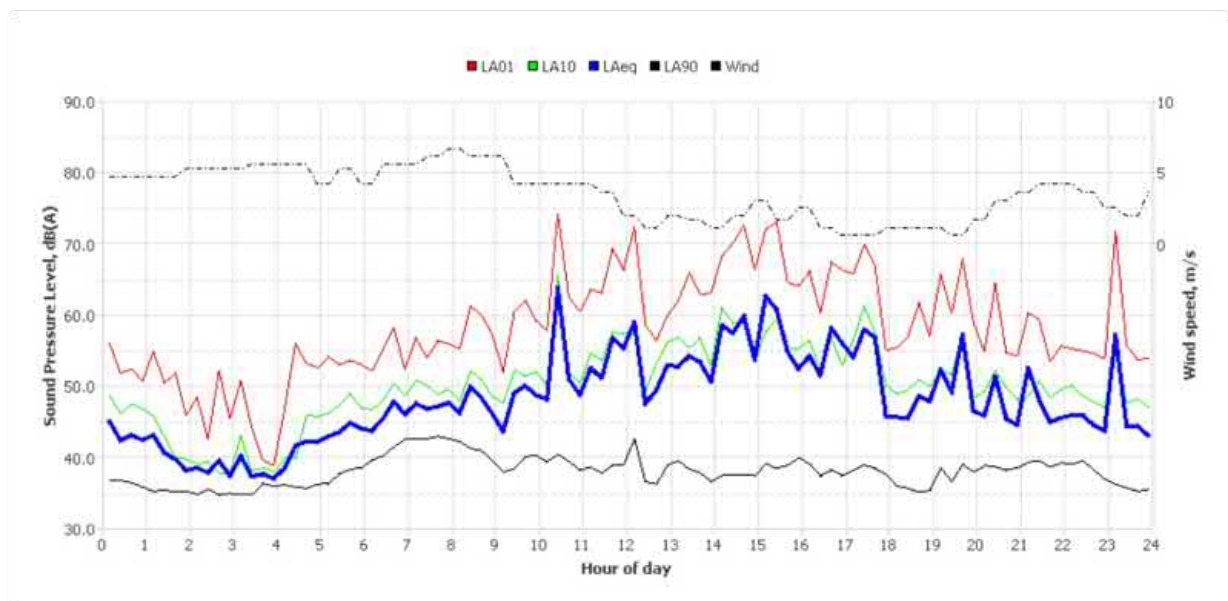
Thursday, 01 Jul 2021



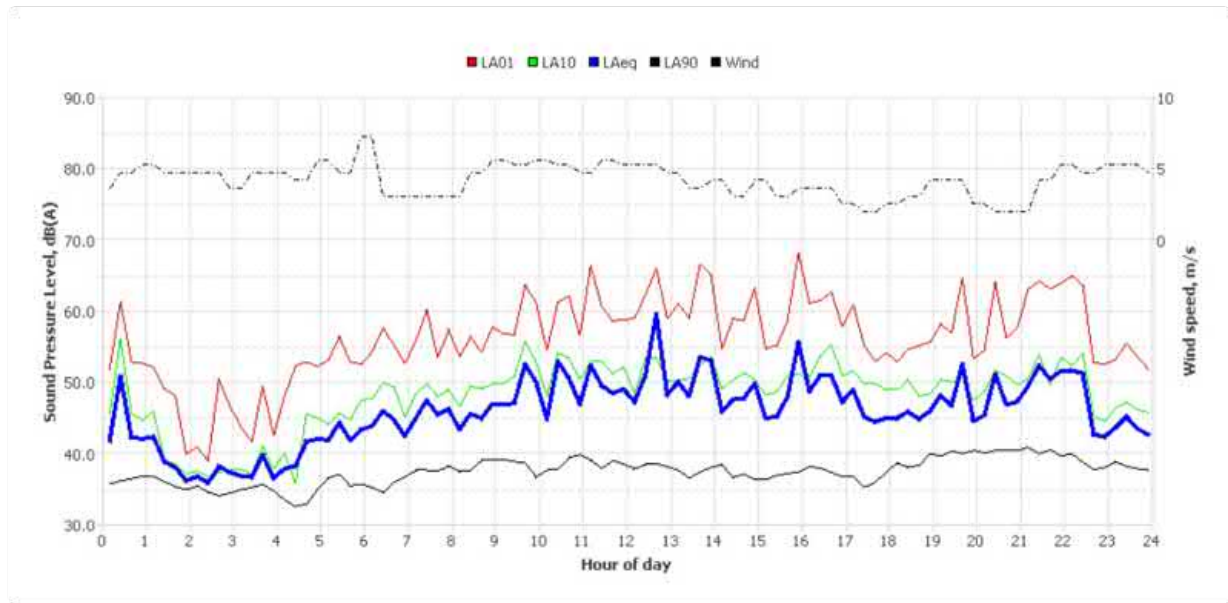
Friday, 02 Jul 2021



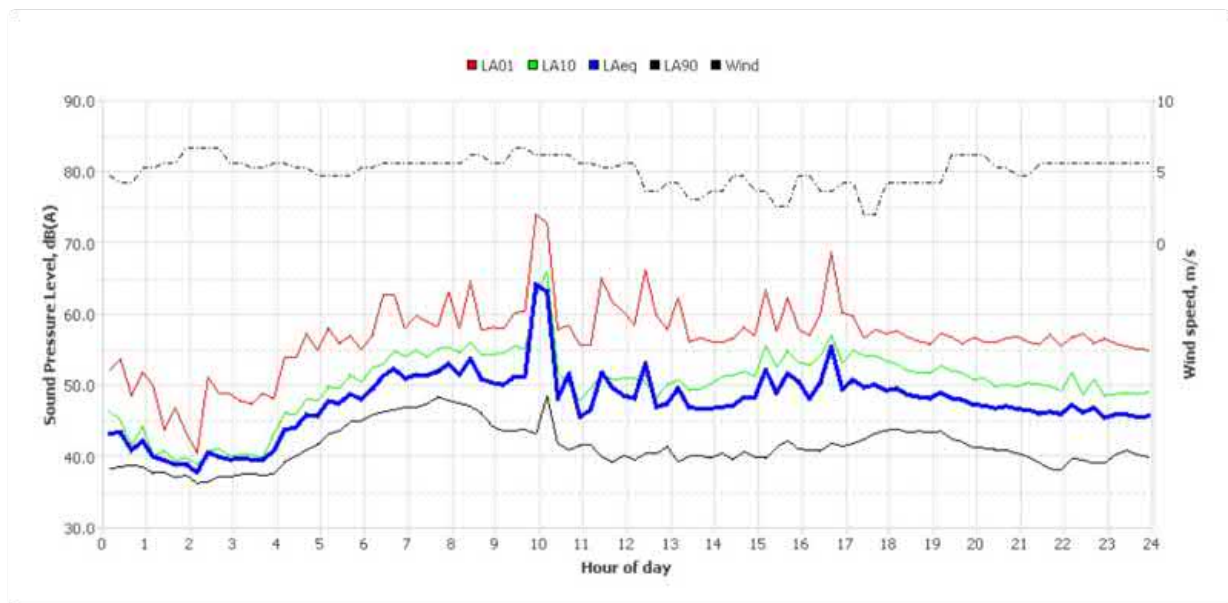
Saturday, 03 Jul 2021



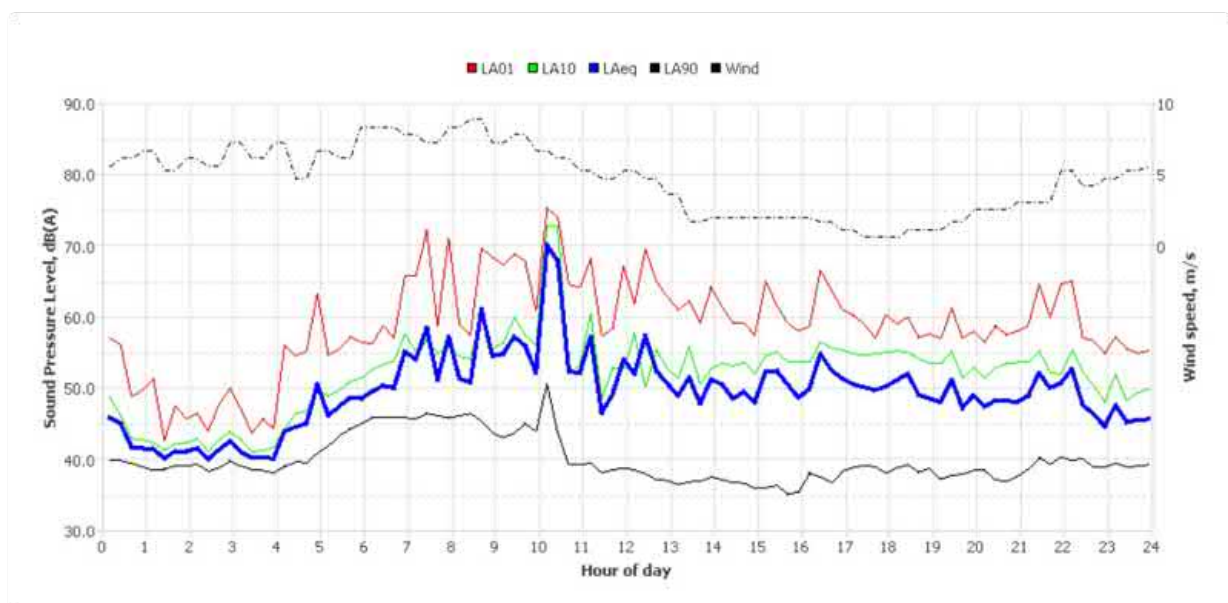
Sunday, 04 Jul 2021

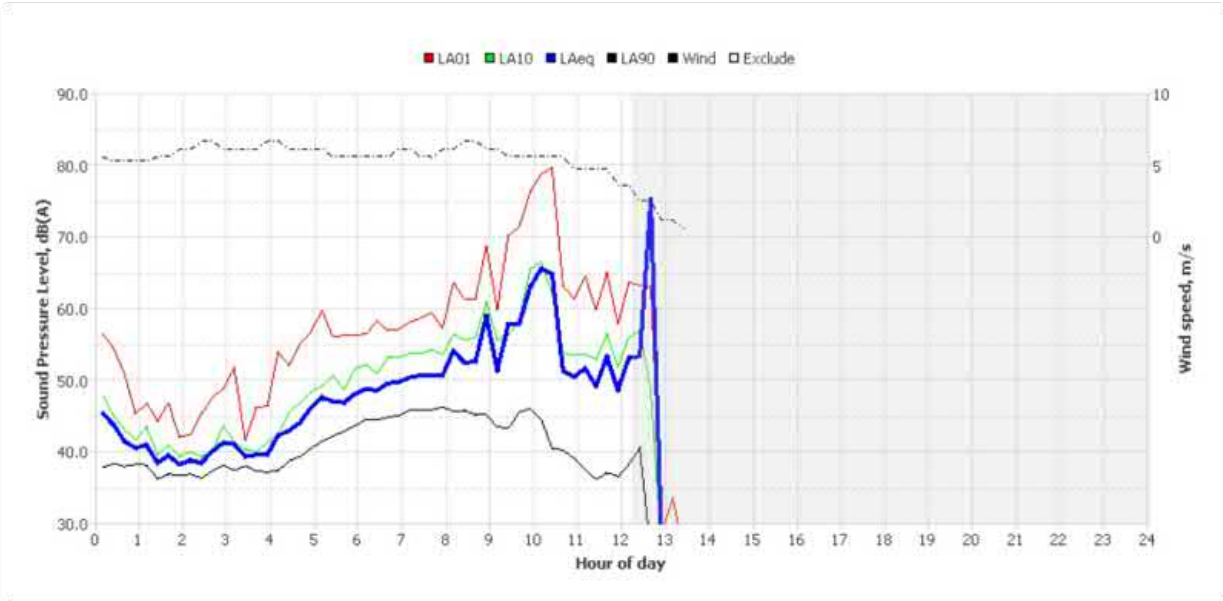


Monday, 05 Jul 2021



Tuesday, 06 Jul 2021





# Noise Logger Report

418 Wilson Street, Darlington



Item	Information
Logger Type	Rion NL52
Serial number	164393
Address	418 Wilson Street, Darlington
Location	Front Yard
Facade / Free Field	Free Field
Environment	Motorbike pass by 85.6 dBA. Background dominated by distant road traffic noise 44 to 47 dBA. Distant rail noise audible 47 dBA Local road traffic 62 to 75 dBA. Aircraft pass by 50 dBA. Bird calls 52 dBA.

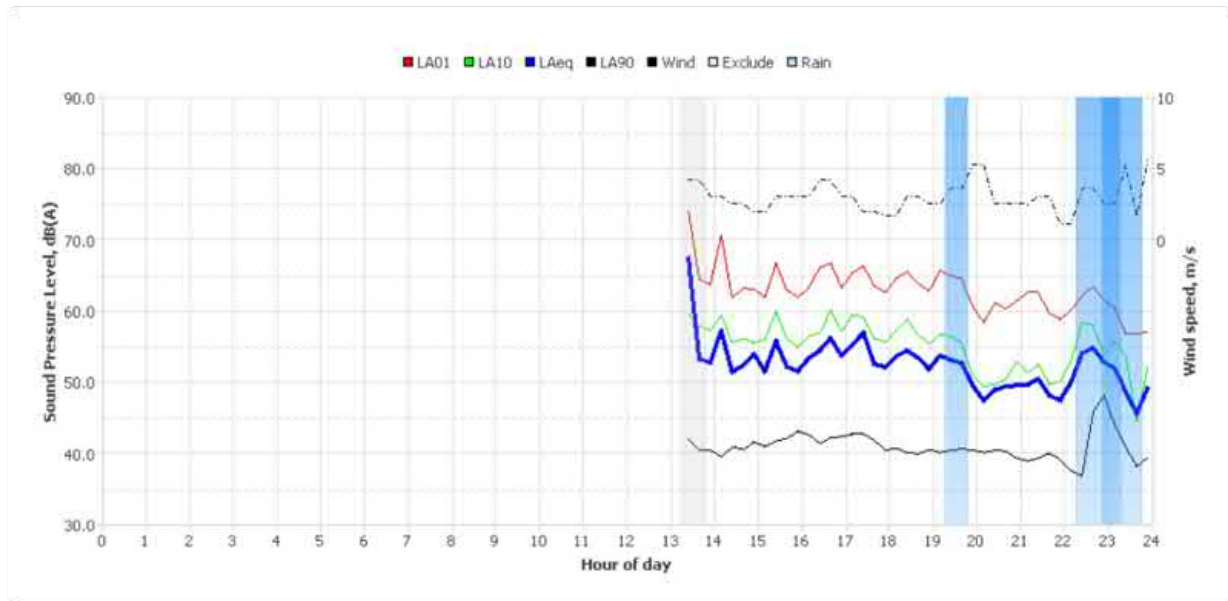
## Measured noise levels

Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq</sub> 15hr	L <sub>Aeq</sub> 9hr
Wed Jun 16 2021	54	51	48	-	-	-	53	48
Thu Jun 17 2021	55	51	48	-	36	-	54	48
Fri Jun 18 2021	57	52	47	-	-	-	57	47
Sat Jun 19 2021	-	-	-	-	-	-	-	-
Sun Jun 20 2021	53	49	46	-	-	-	52	46
Mon Jun 21 2021	54	50	48	-	42	-	53	48
Tue Jun 22 2021	56	50	47	40	35	-	55	47
Wed Jun 23 2021	54	50	45	-	-	33	53	45
Thu Jun 24 2021	60	51	45	-	36	34	59	45
Fri Jun 25 2021	54	52	44	-	35	33	53	44
Sat Jun 26 2021	50	48	43	-	36	32	49	43
Sun Jun 27 2021	49	47	42	-	-	34	49	42
Mon Jun 28 2021	52	50	46	-	42	-	51	46
Tue Jun 29 2021	53	49	45	-	-	-	52	45
Wed Jun 30 2021	52	49	45	39	-	-	51	45
Thu Jul 1 2021	51	50	45	37	-	-	51	45
Fri Jul 2 2021	52	48	45	37	-	32	52	45
Sat Jul 3 2021	53	48	47	-	37	-	52	47
Sun Jul 4 2021	52	46	42	-	35	-	51	42
Mon Jul 5 2021	51	50	49	-	-	-	51	49
Tue Jul 6 2021	52	49	44	-	41	-	51	44
Wed Jul 7 2021	53	-	-	-	-	-	53	-
<b>Summary</b>	<b>54</b>	<b>50</b>	<b>46</b>	<b>38</b>	<b>36</b>	<b>33</b>	<b>53</b>	<b>46</b>

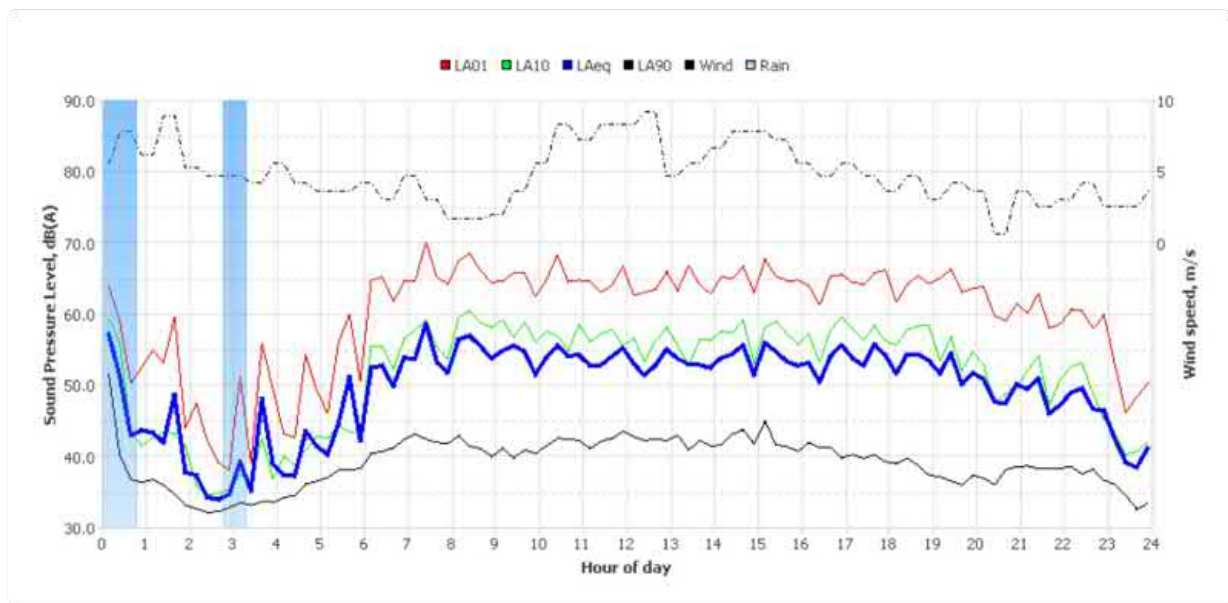
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

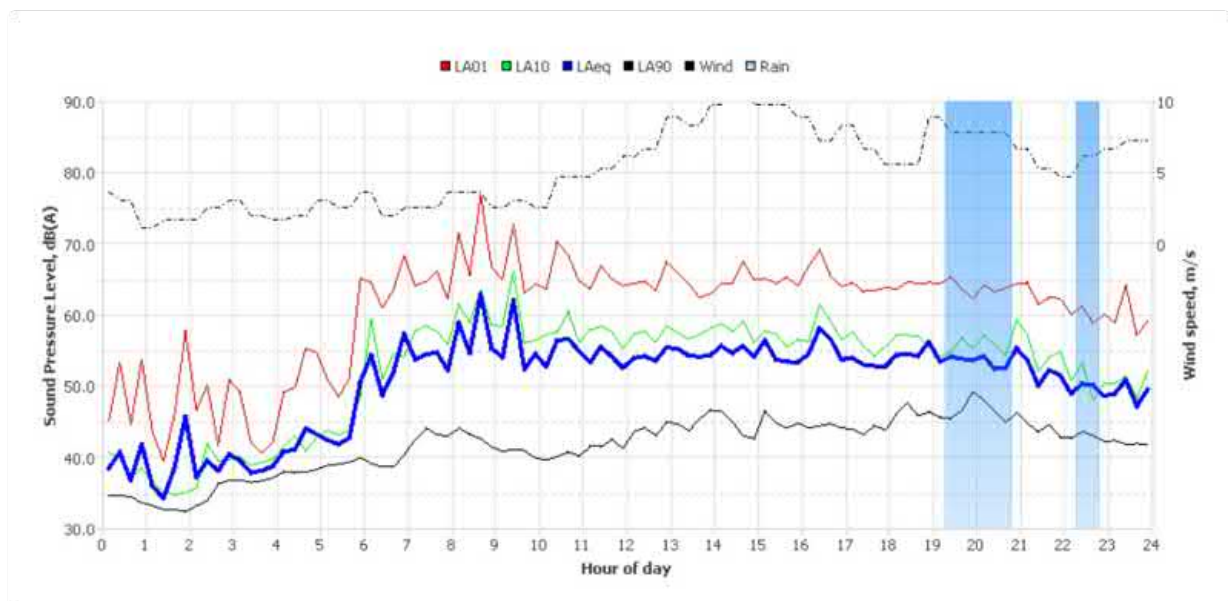
Wednesday, 16 Jun 2021



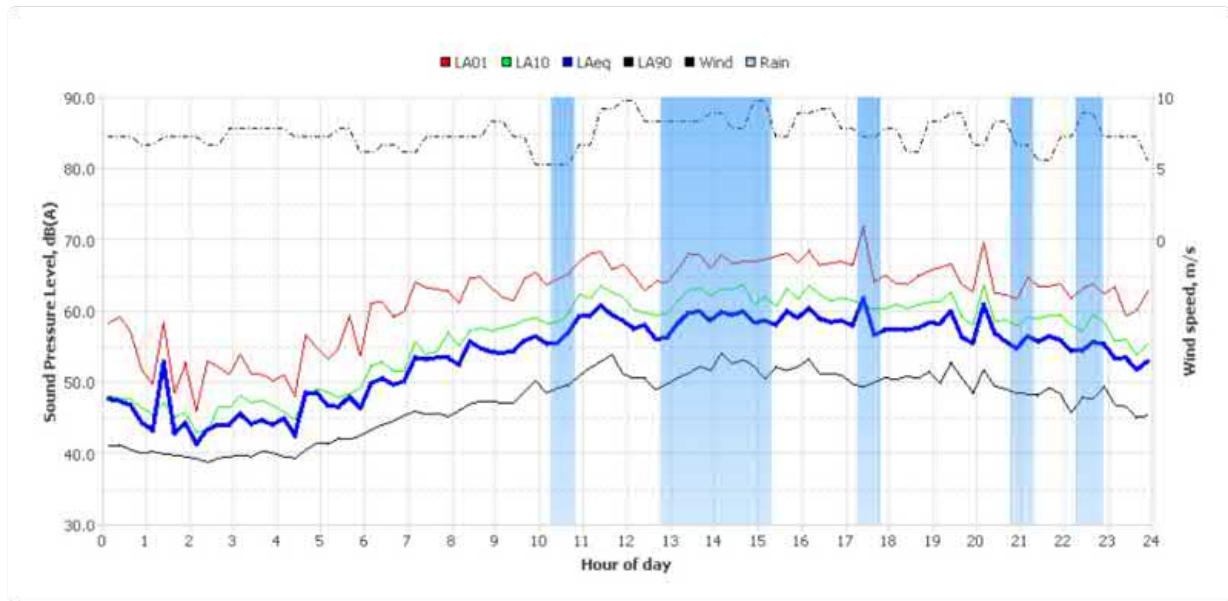
Thursday, 17 Jun 2021



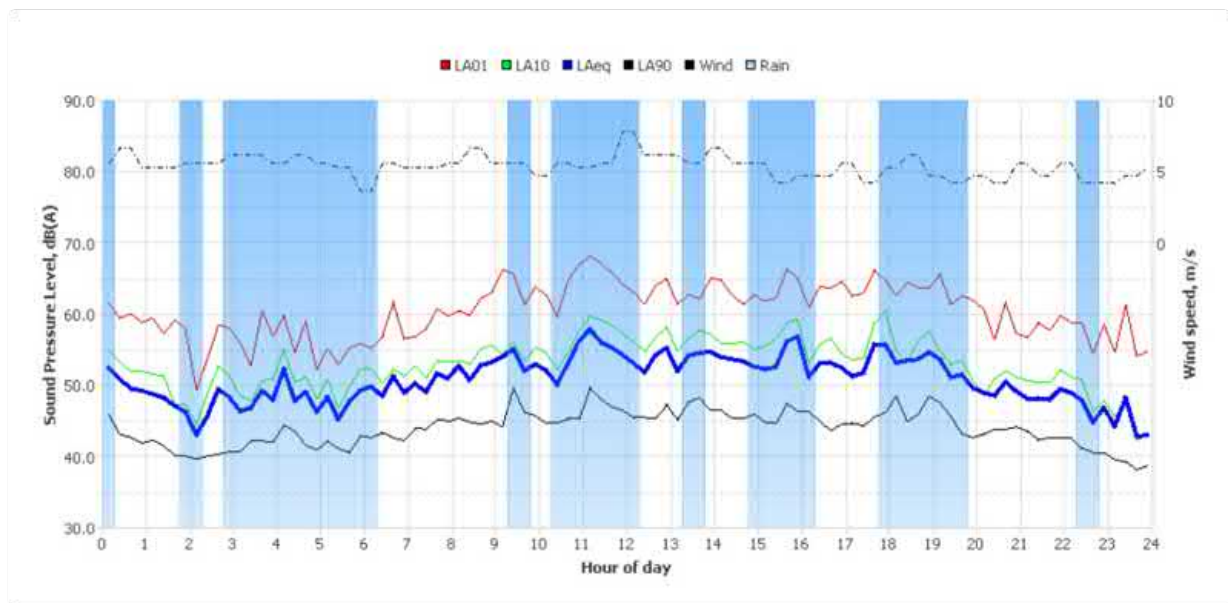
Friday, 18 Jun 2021



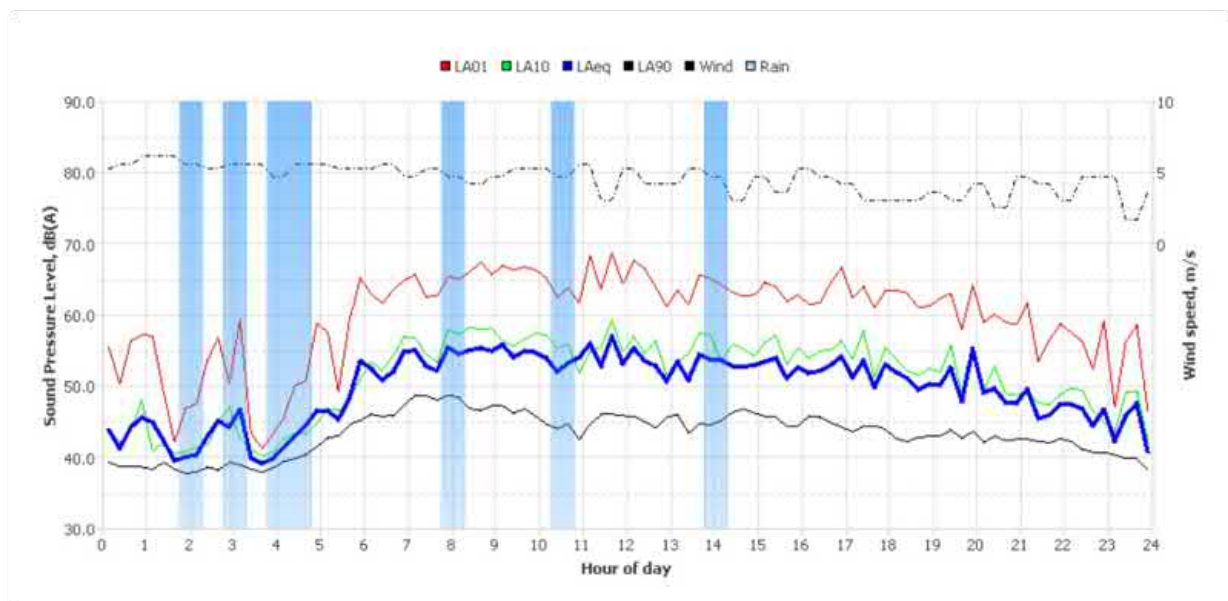
Saturday, 19 Jun 2021



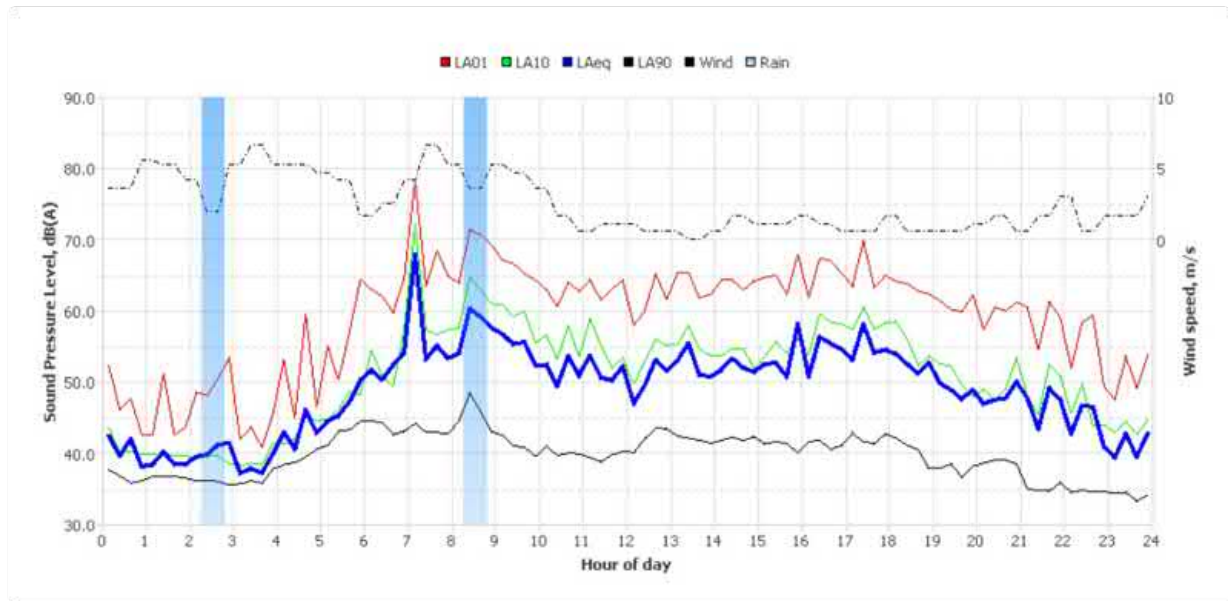
Sunday, 20 Jun 2021



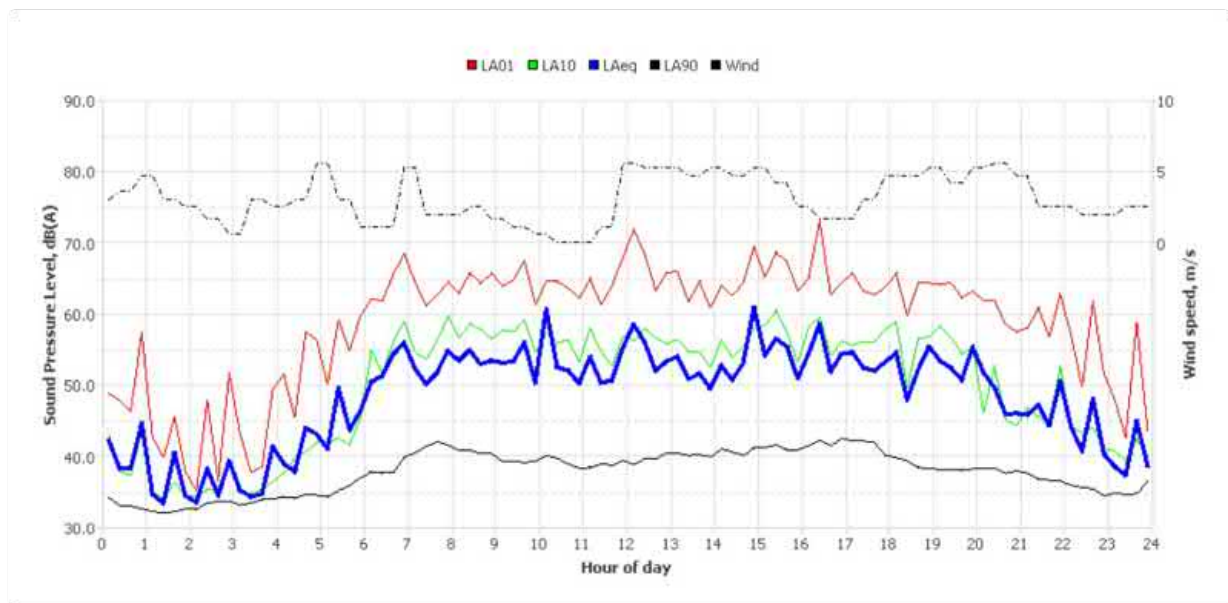
Monday, 21 Jun 2021



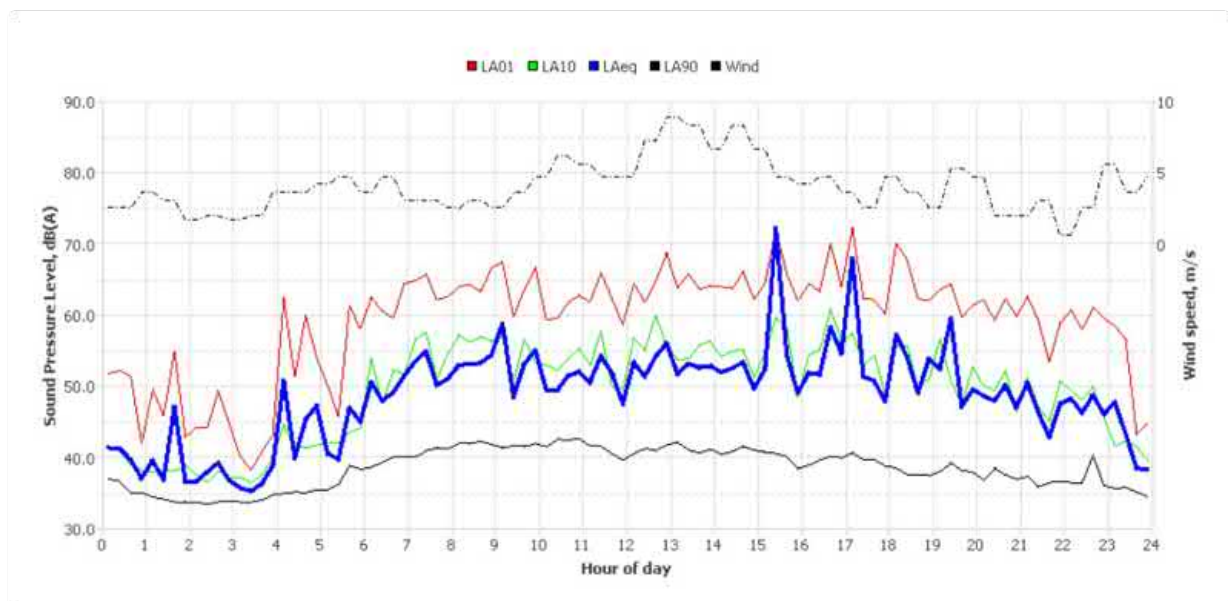
Tuesday, 22 Jun 2021



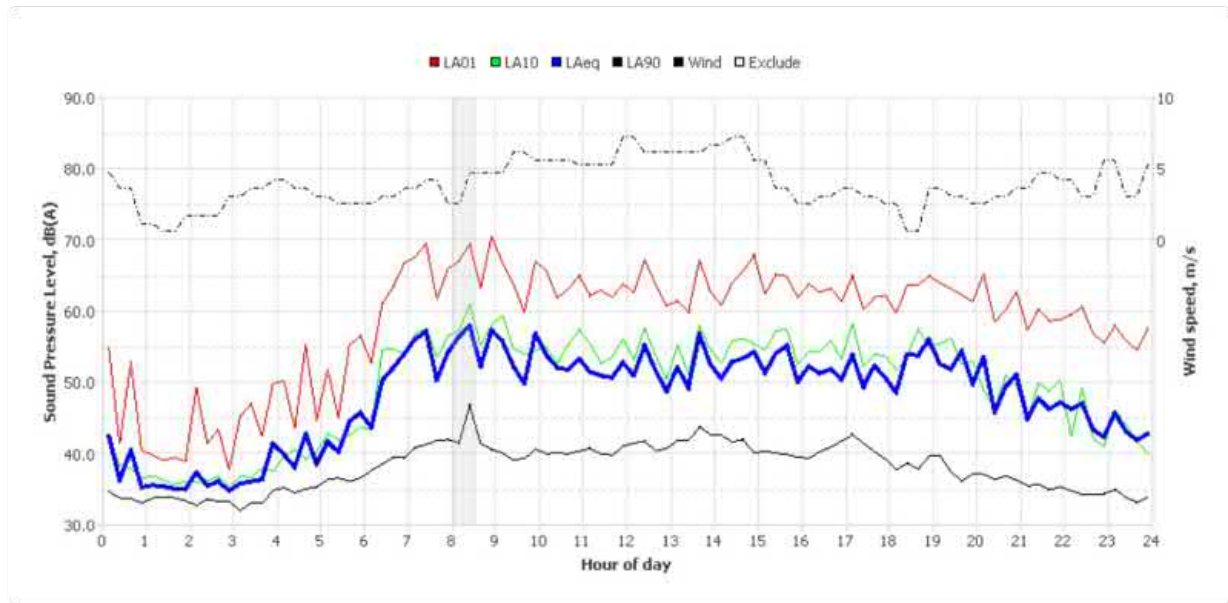
Wednesday, 23 Jun 2021



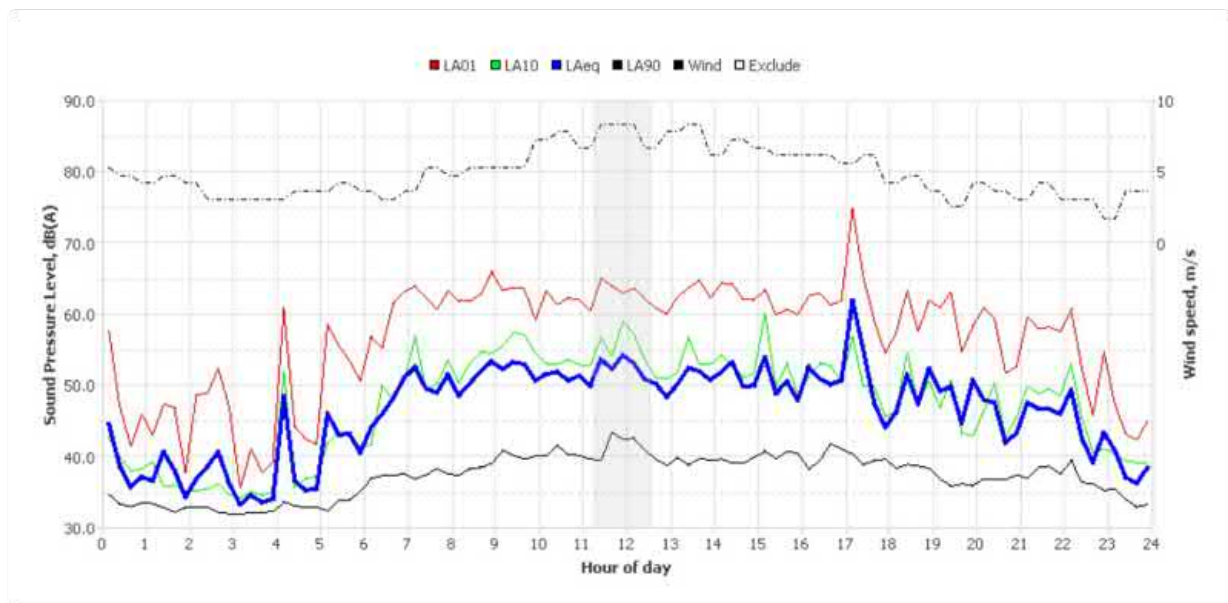
Thursday, 24 Jun 2021



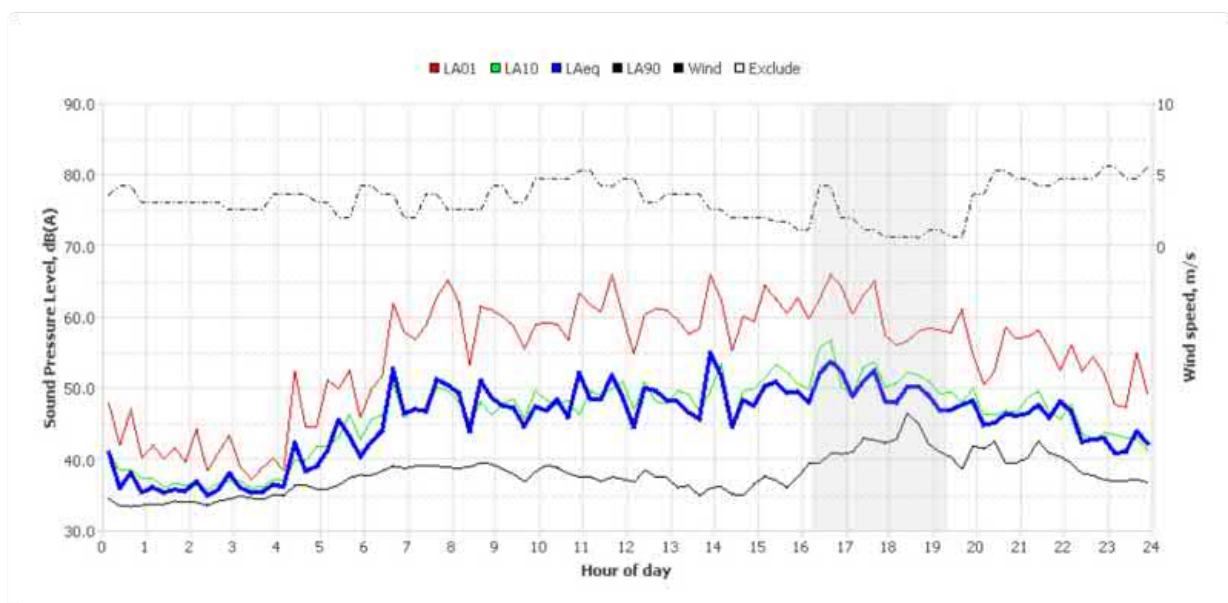
Friday, 25 Jun 2021



Saturday, 26 Jun 2021

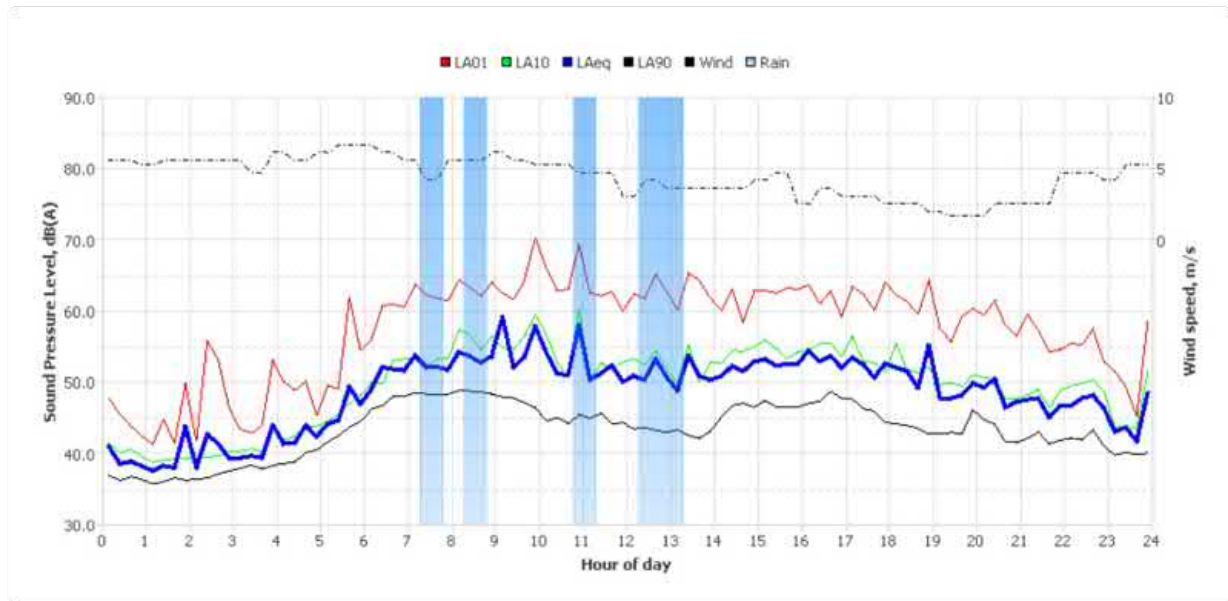


Sunday, 27 Jun 2021

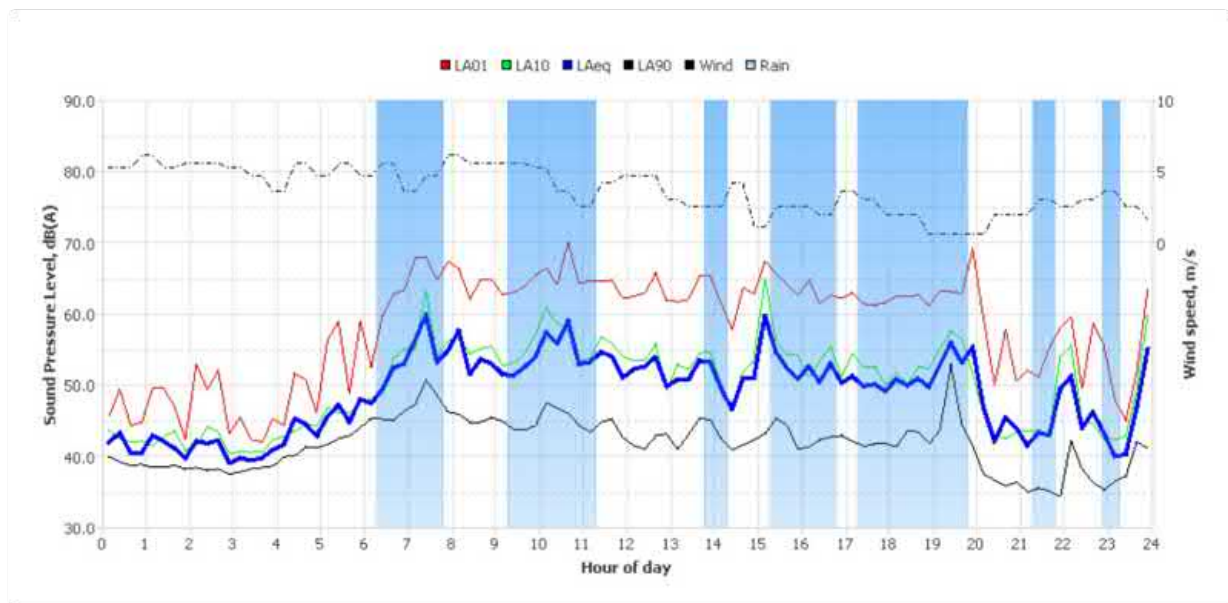




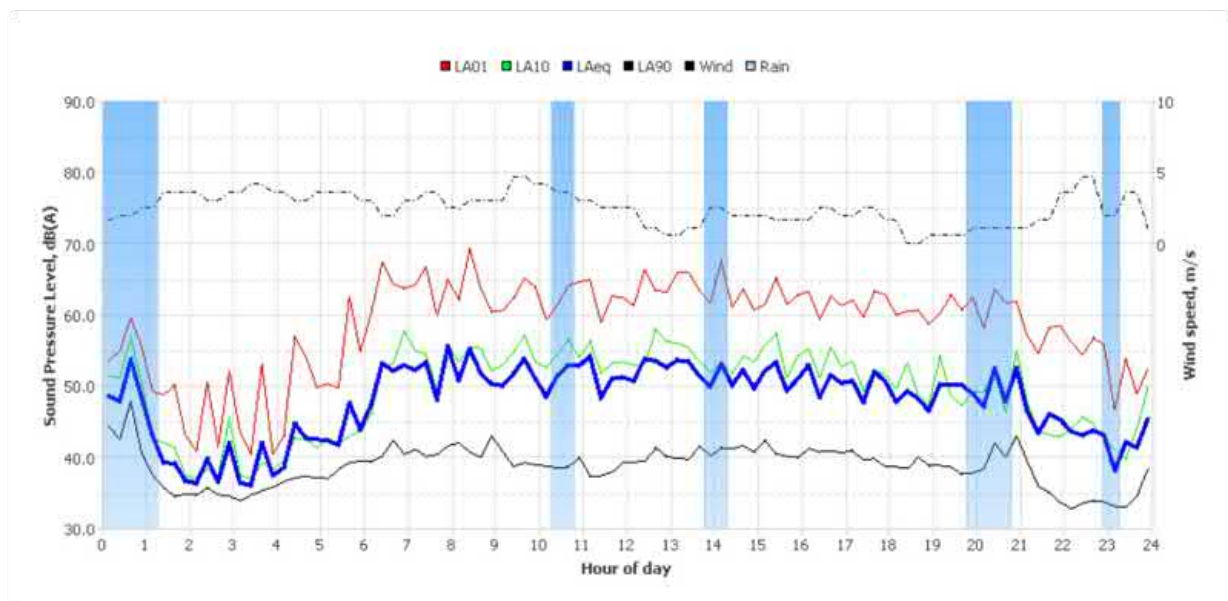
Monday, 28 Jun 2021



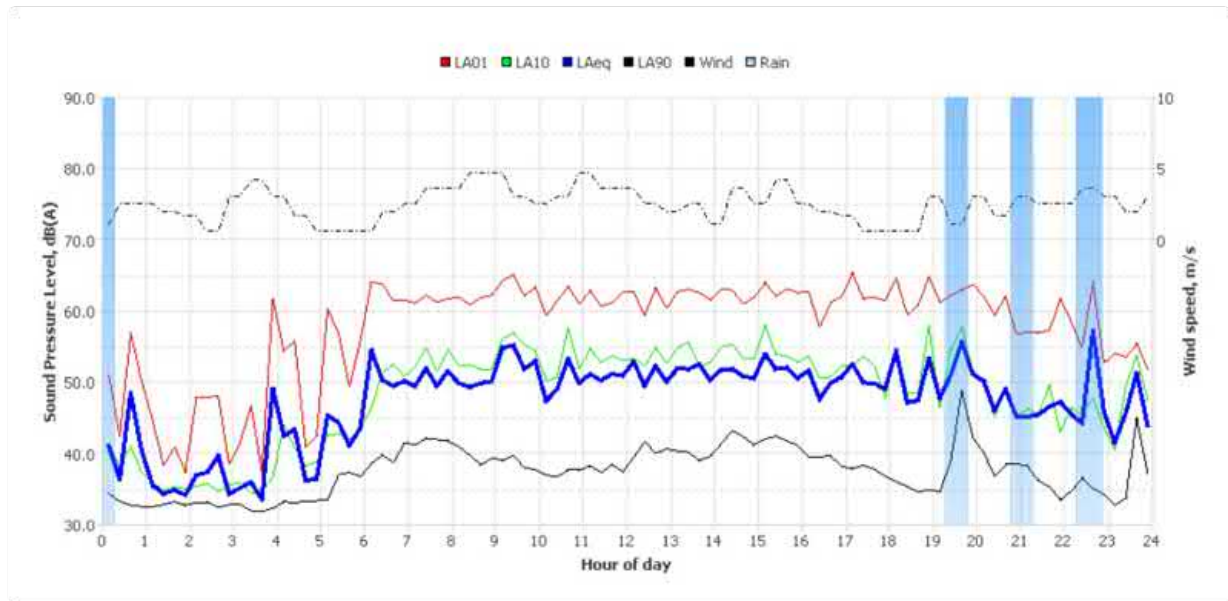
Tuesday, 29 Jun 2021



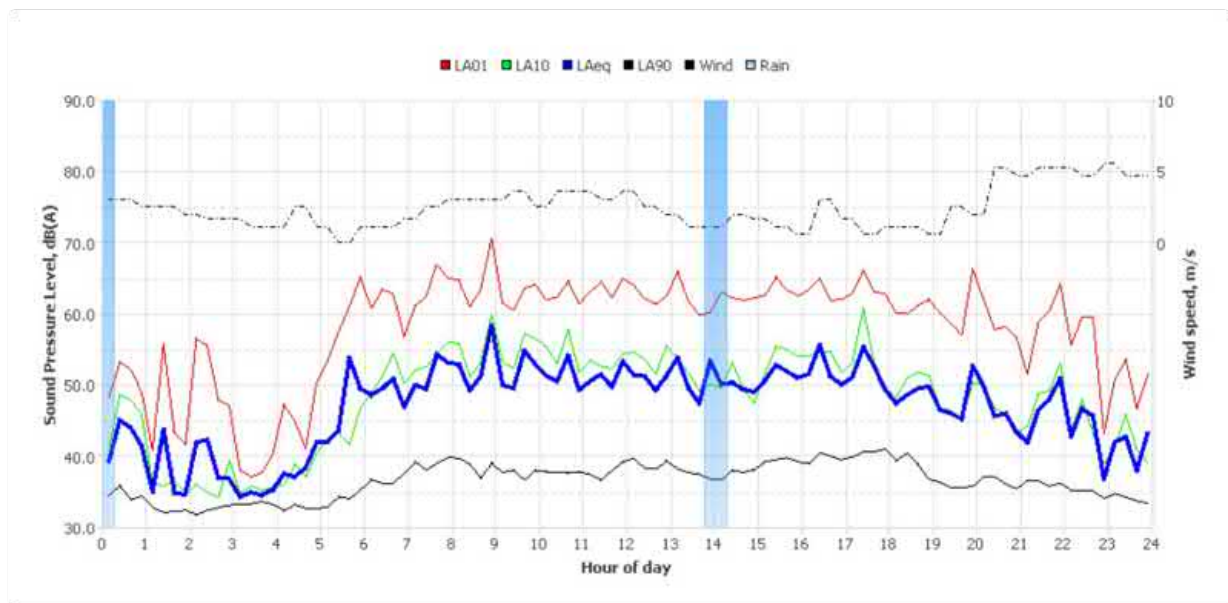
Wednesday, 30 Jun 2021



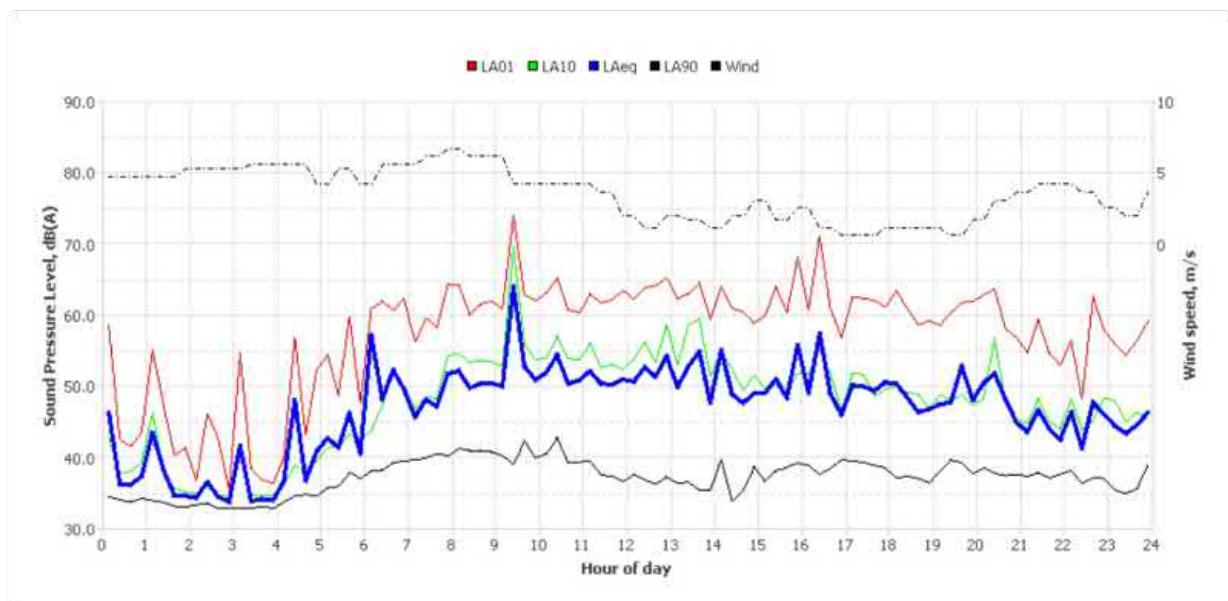
Thursday, 01 Jul 2021



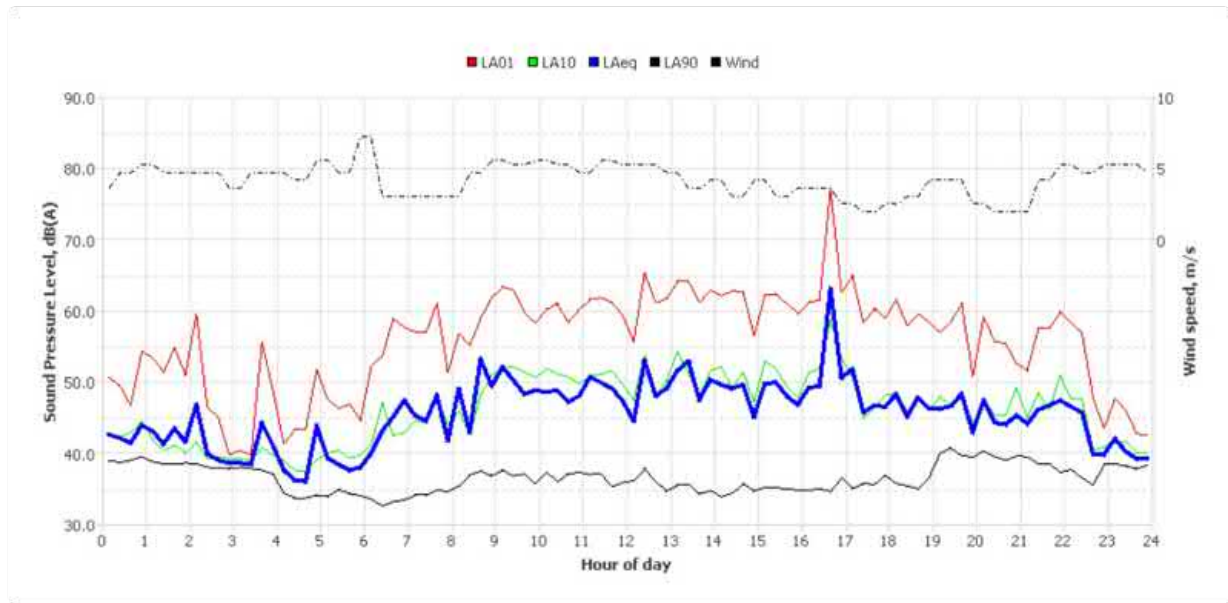
Friday, 02 Jul 2021



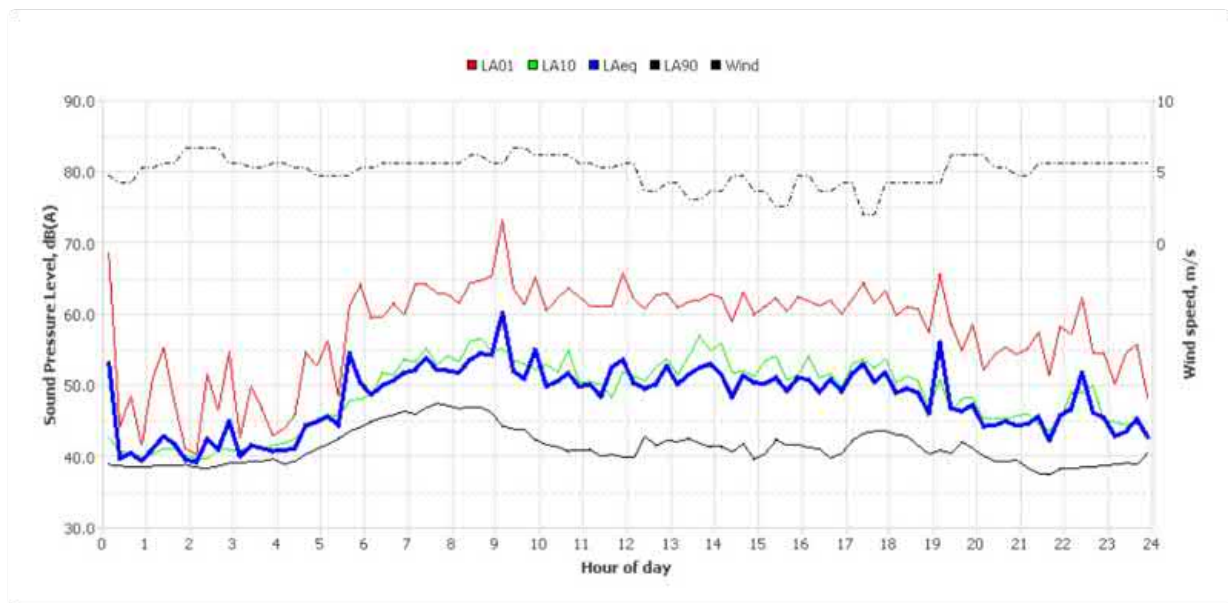
Saturday, 03 Jul 2021



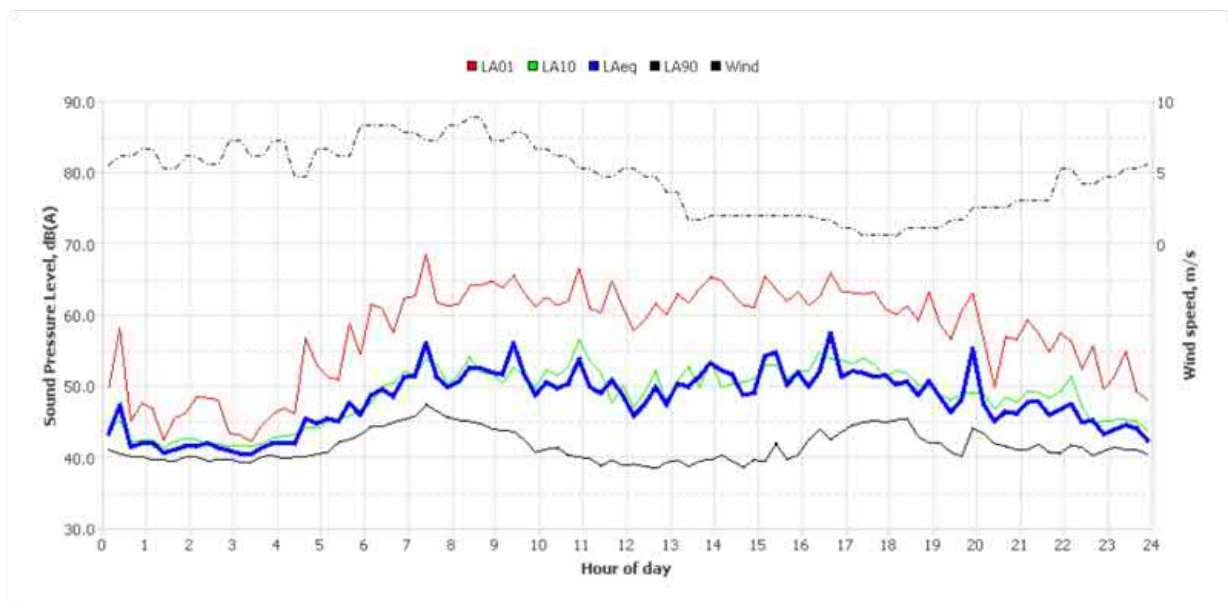
Sunday, 04 Jul 2021

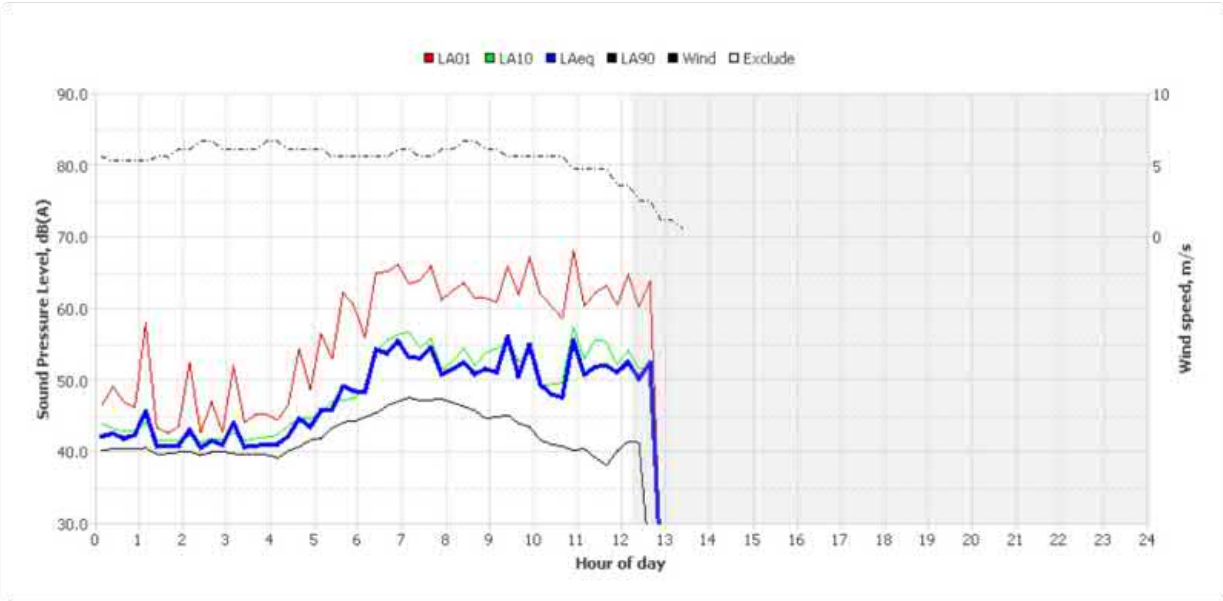


Monday, 05 Jul 2021



Tuesday, 06 Jul 2021





# Noise Logger Report

154 Lawson Street, Redfern



Item	Information
Logger Type	Rion NL52
Serial number	164396
Address	154 Lawson Street, Redfern
Location	Front Yard
Facade / Free Field	Free Field
Environment	Background dominated by road traffic noise. Background with no traffic 42 to 44 dBA. Busy street with cafes and station on either ends. Local road traffic car pass by 65 to 72 dBA. Distant rail noise audible. Bird calls audible occasionally.

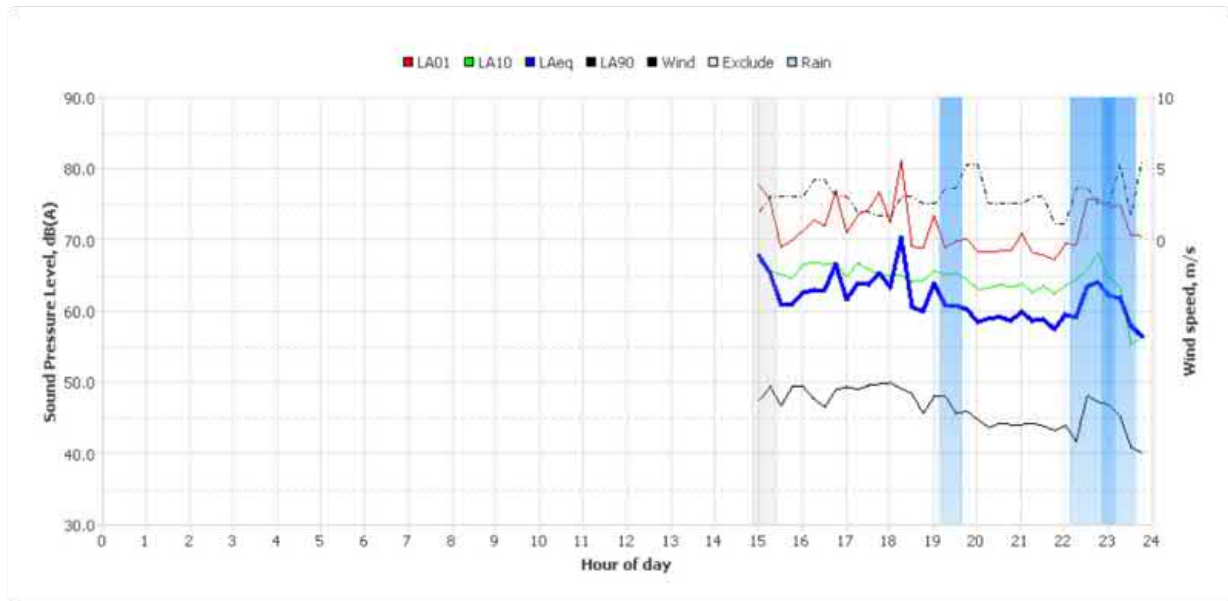
## Measured noise levels

Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq</sub> ,15hr	L <sub>Aeq</sub> ,9hr
Wed Jun 16 2021	63	63	59	-	-	-	63	59
Thu Jun 17 2021	63	60	59	-	42	-	62	59
Fri Jun 18 2021	63	59	56	-	-	-	63	56
Sat Jun 19 2021	-	-	-	-	-	-	-	-
Sun Jun 20 2021	64	62	54	-	-	-	62	54
Mon Jun 21 2021	64	60	57	-	41	-	63	57
Tue Jun 22 2021	62	61	58	44	42	-	61	58
Wed Jun 23 2021	62	60	55	-	-	-	62	55
Thu Jun 24 2021	61	60	56	-	41	37	61	56
Fri Jun 25 2021	63	65	57	-	42	35	64	57
Sat Jun 26 2021	59	57	65	-	40	36	57	65
Sun Jun 27 2021	58	56	52	40	38	37	58	52
Mon Jun 28 2021	62	60	54	-	39	-	61	54
Tue Jun 29 2021	68	58	56	-	-	-	67	56
Wed Jun 30 2021	63	62	57	43	-	-	63	57
Thu Jul 1 2021	61	59	57	43	-	-	61	57
Fri Jul 2 2021	61	67	58	43	-	35	63	58
Sat Jul 3 2021	63	64	54	-	39	-	63	54
Sun Jul 4 2021	56	-	53	-	-	-	56	53
<b>Summary</b>	<b>63</b>	<b>62</b>	<b>58</b>	<b>43</b>	<b>41</b>	<b>36</b>	<b>62</b>	<b>58</b>

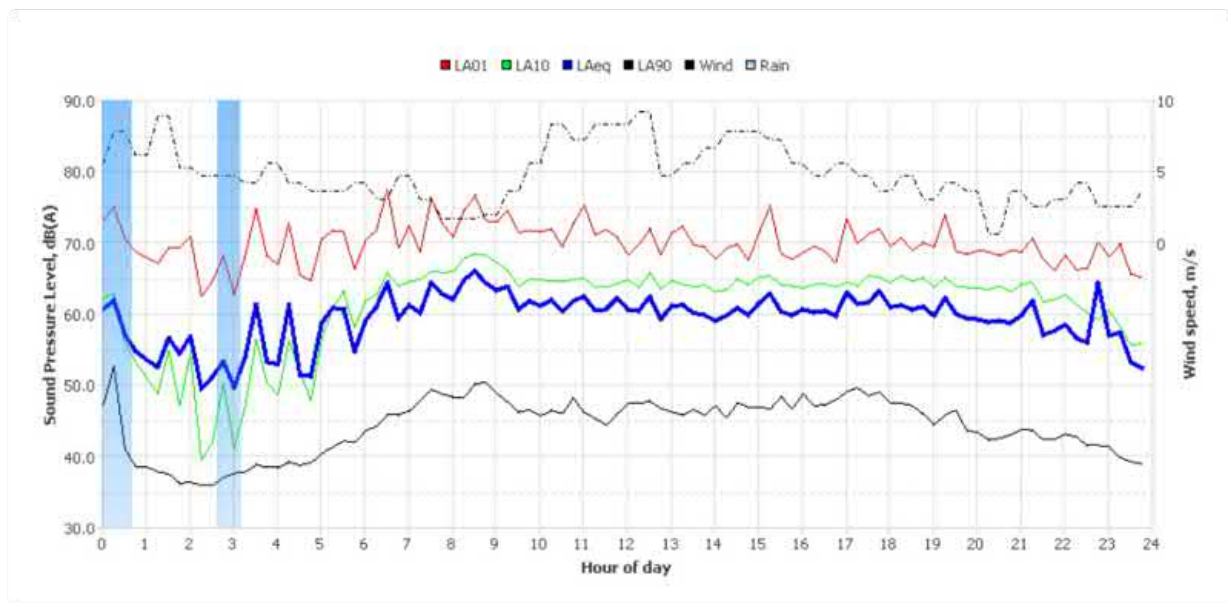
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

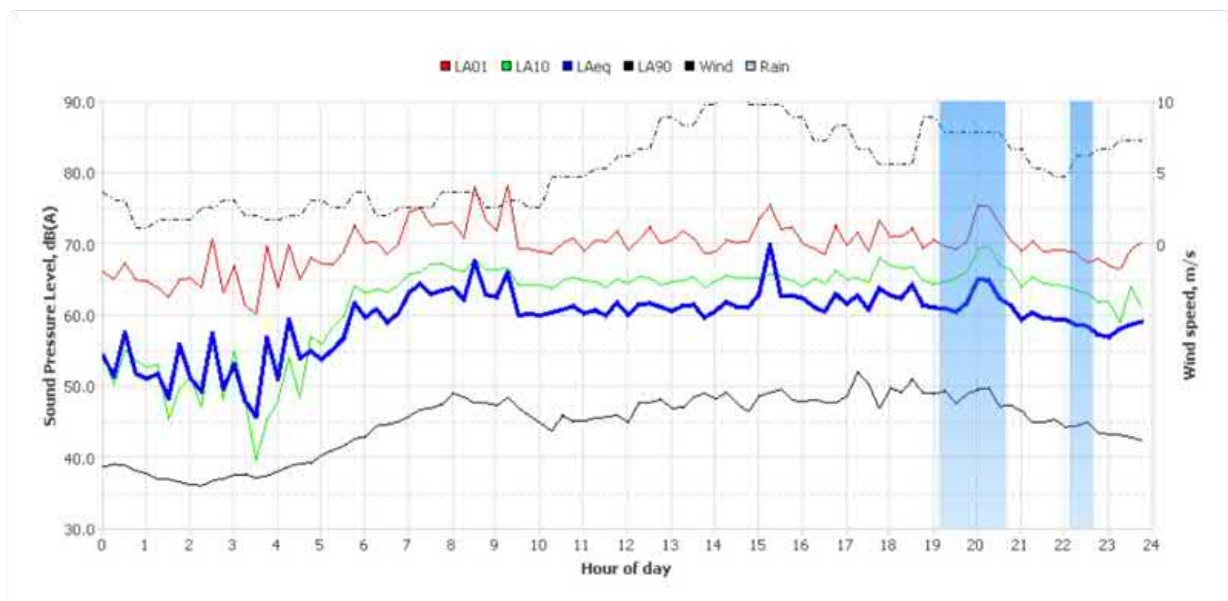
Wednesday, 16 Jun 2021



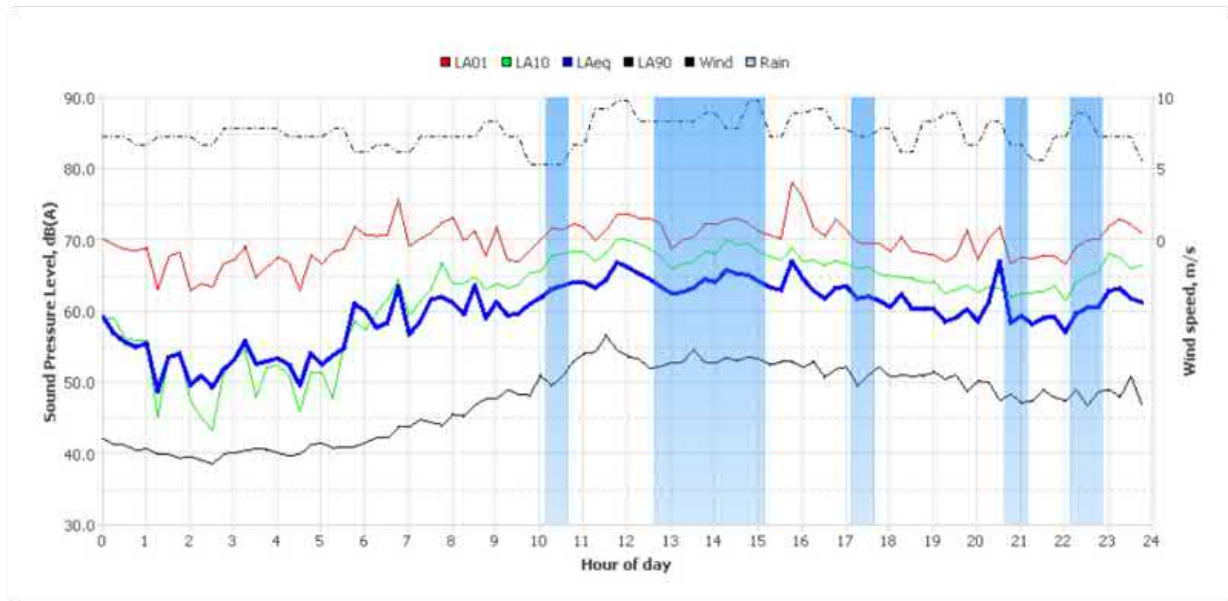
Thursday, 17 Jun 2021



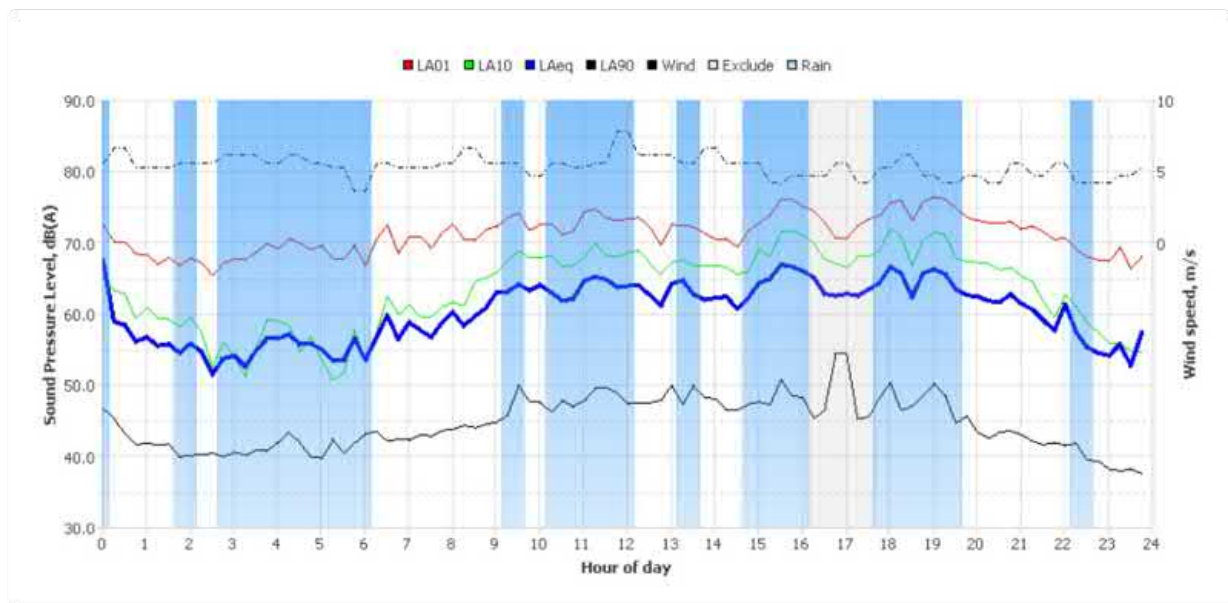
Friday, 18 Jun 2021



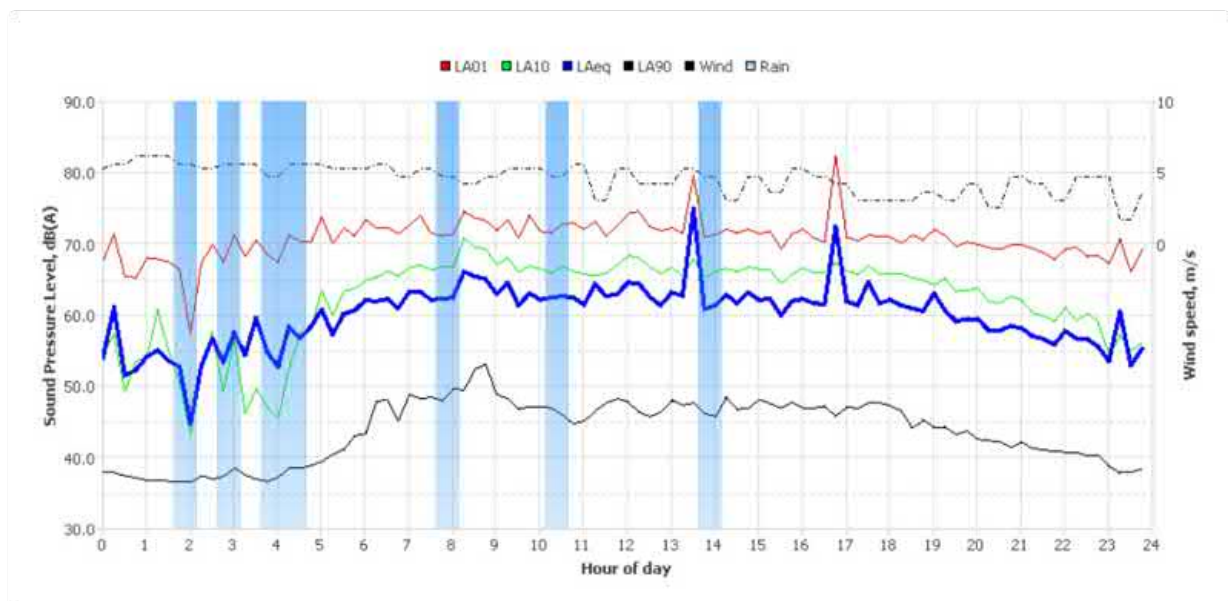
Saturday, 19 Jun 2021



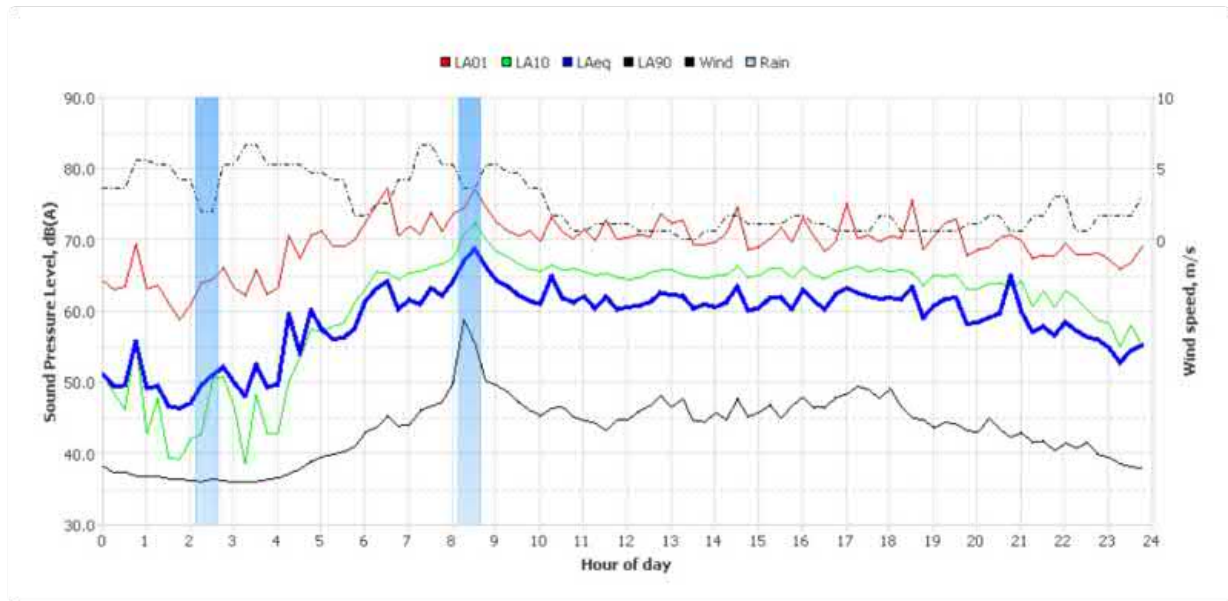
Sunday, 20 Jun 2021



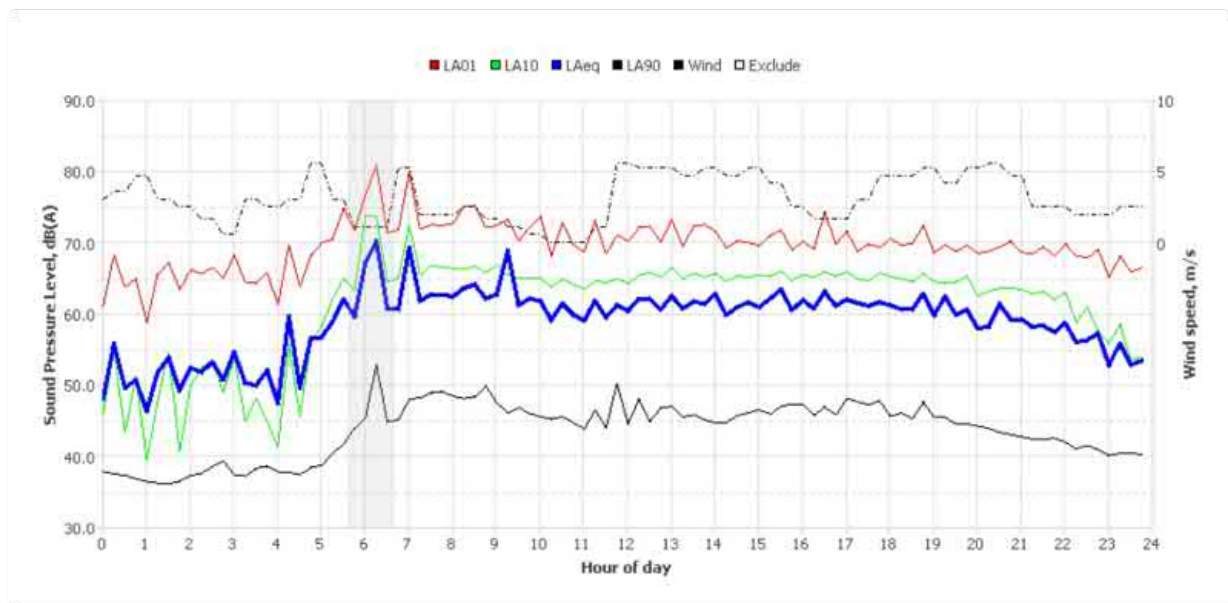
Monday, 21 Jun 2021



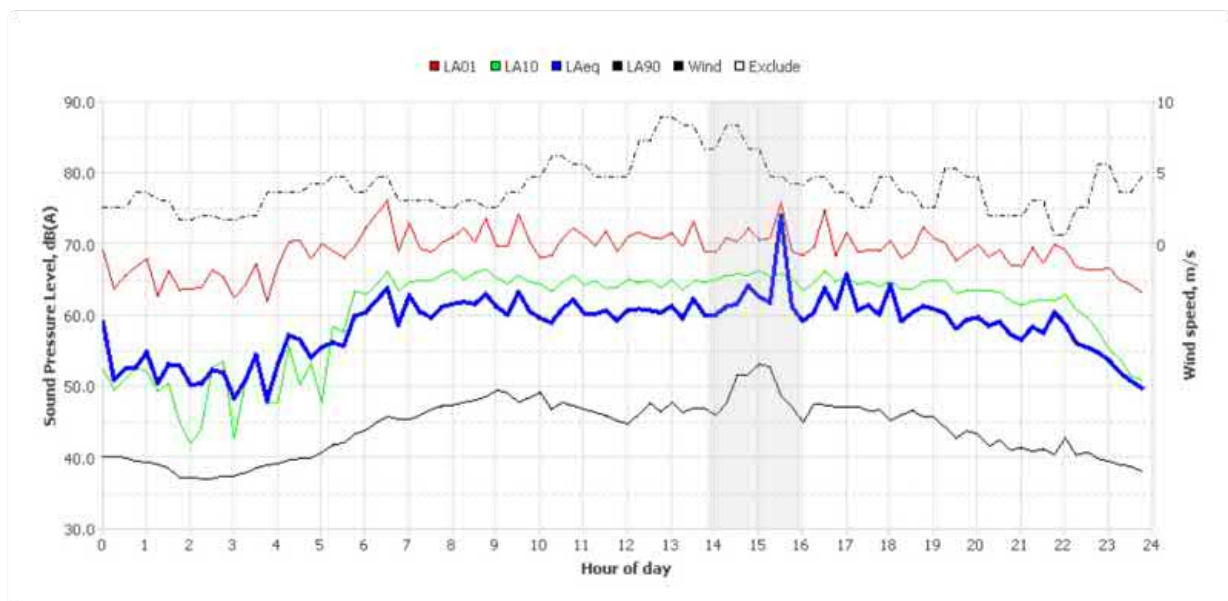
Tuesday, 22 Jun 2021



Wednesday, 23 Jun 2021

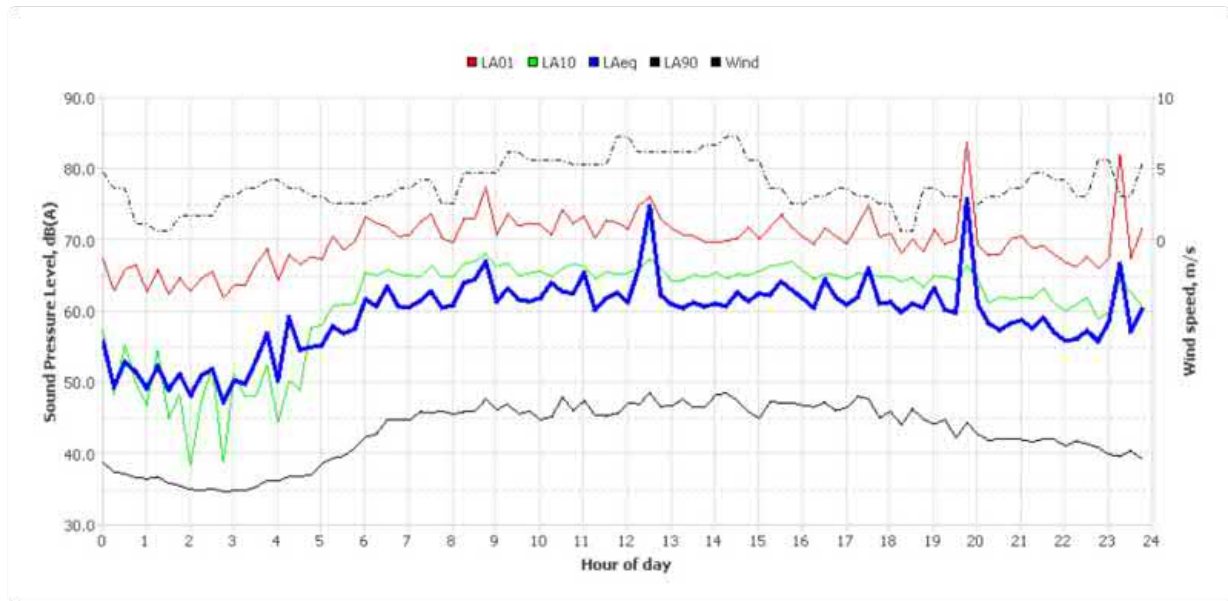


Thursday, 24 Jun 2021

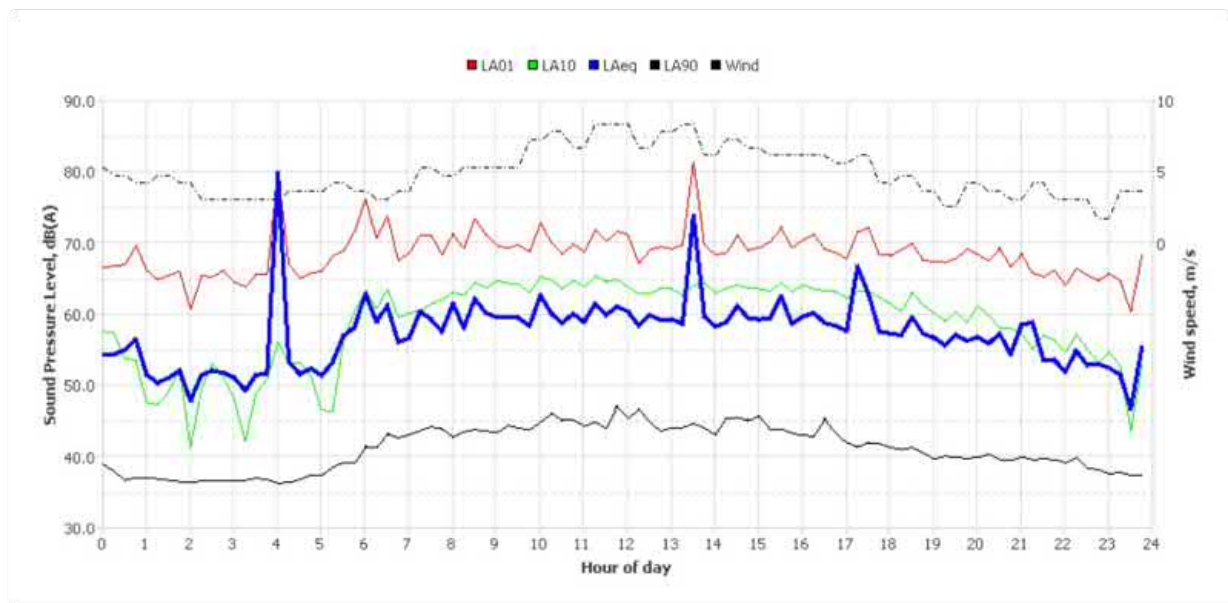




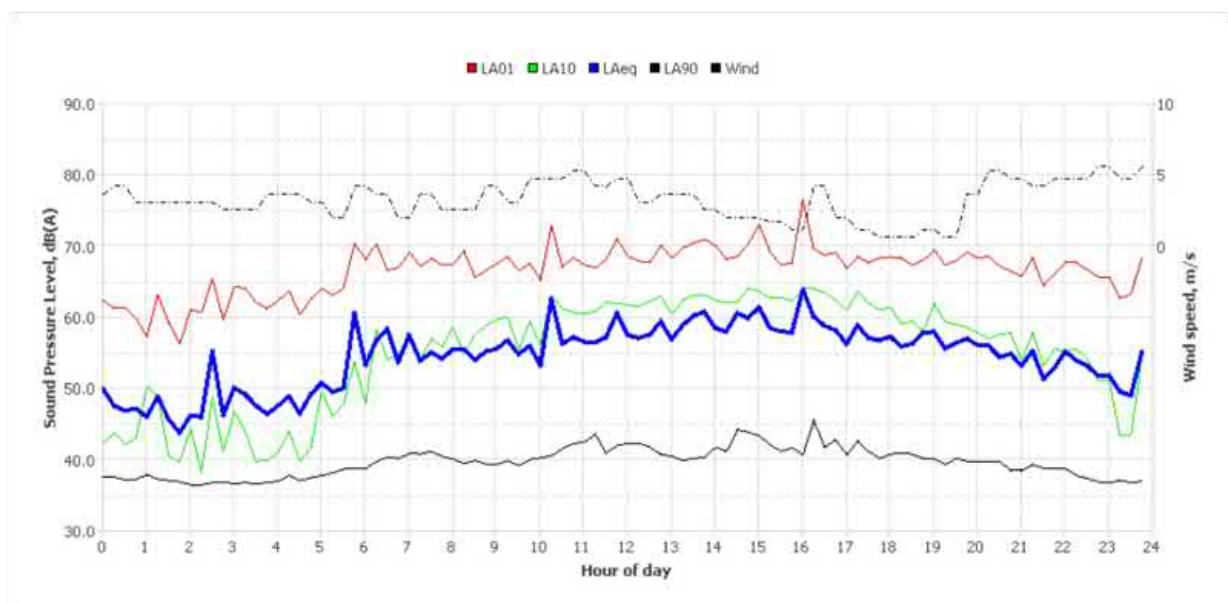
Friday, 25 Jun 2021



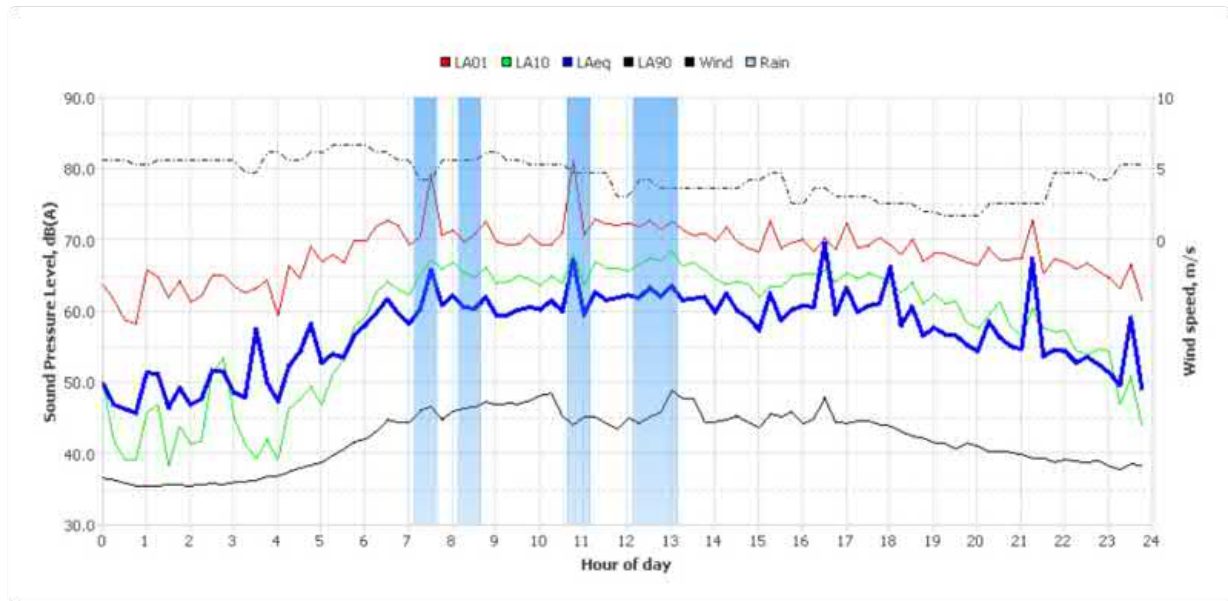
Saturday, 26 Jun 2021



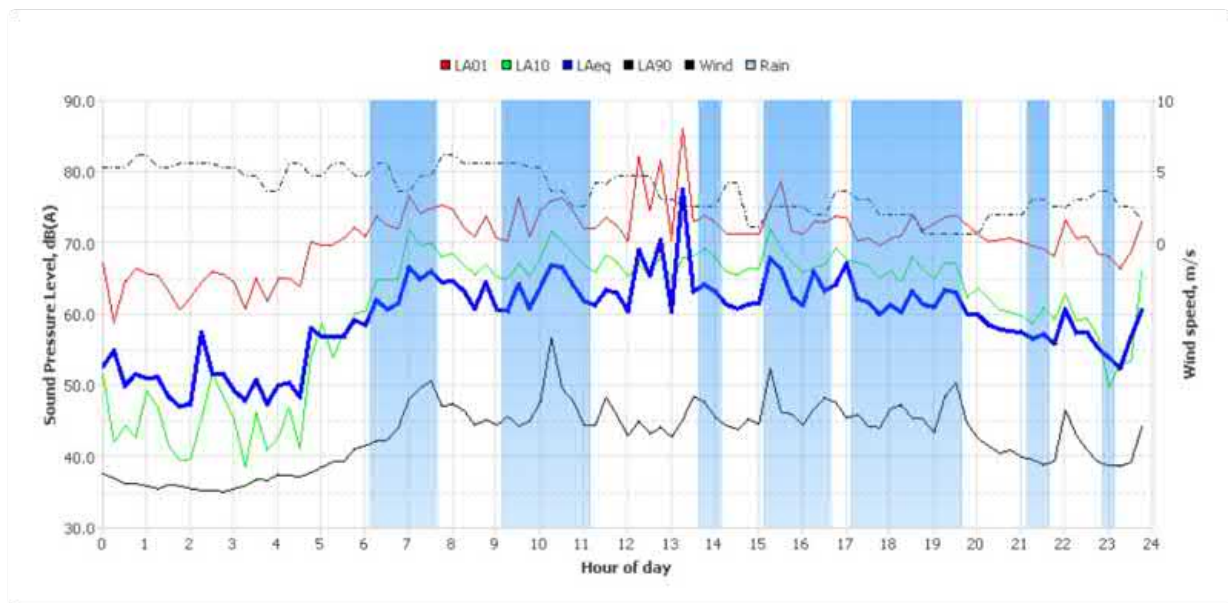
Sunday, 27 Jun 2021



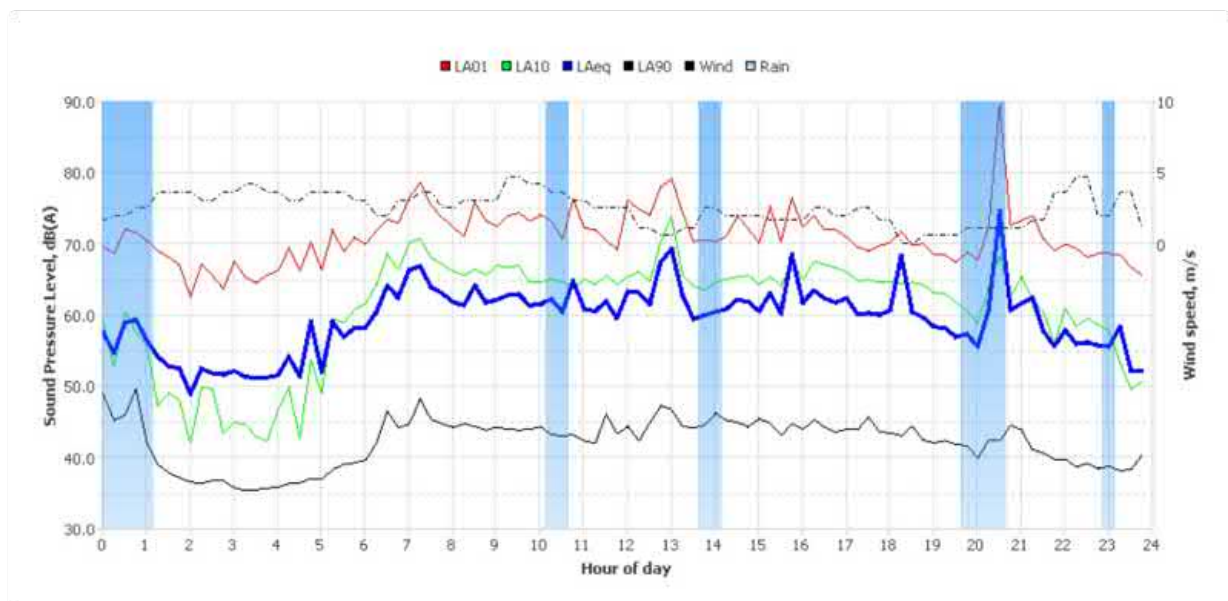
Monday, 28 Jun 2021



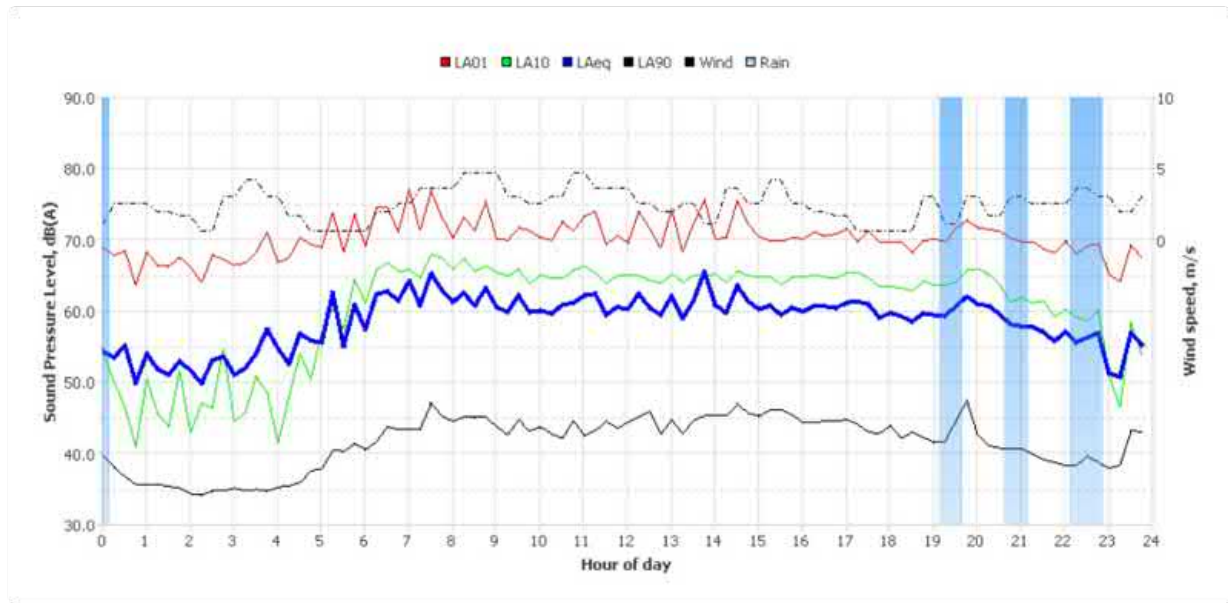
Tuesday, 29 Jun 2021



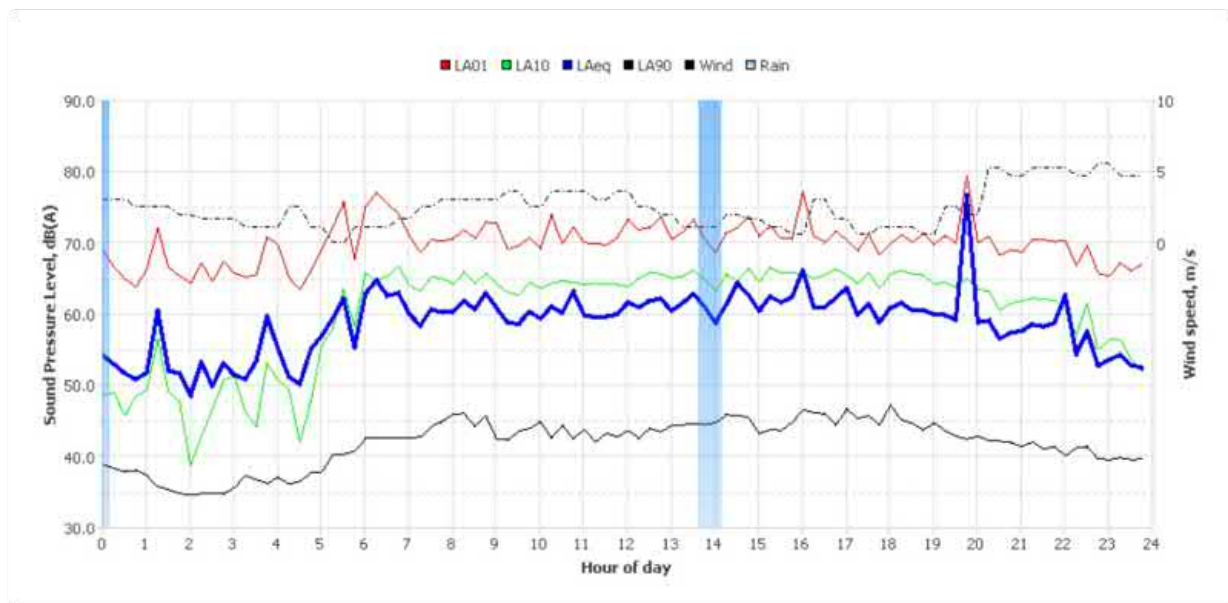
Wednesday, 30 Jun 2021



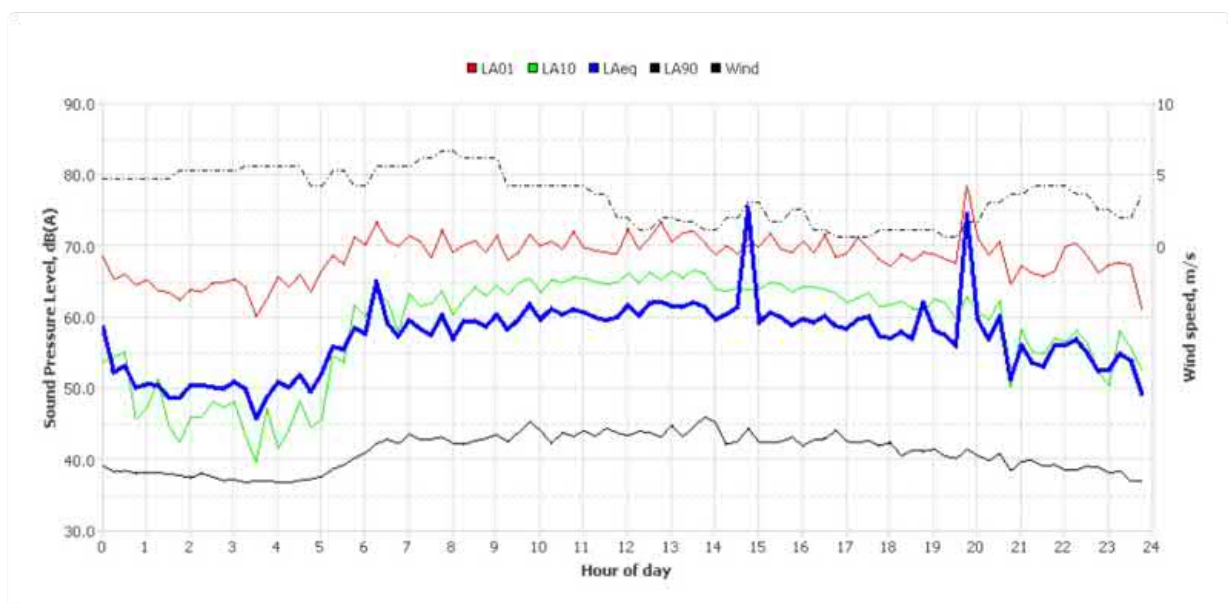
Thursday, 01 Jul 2021

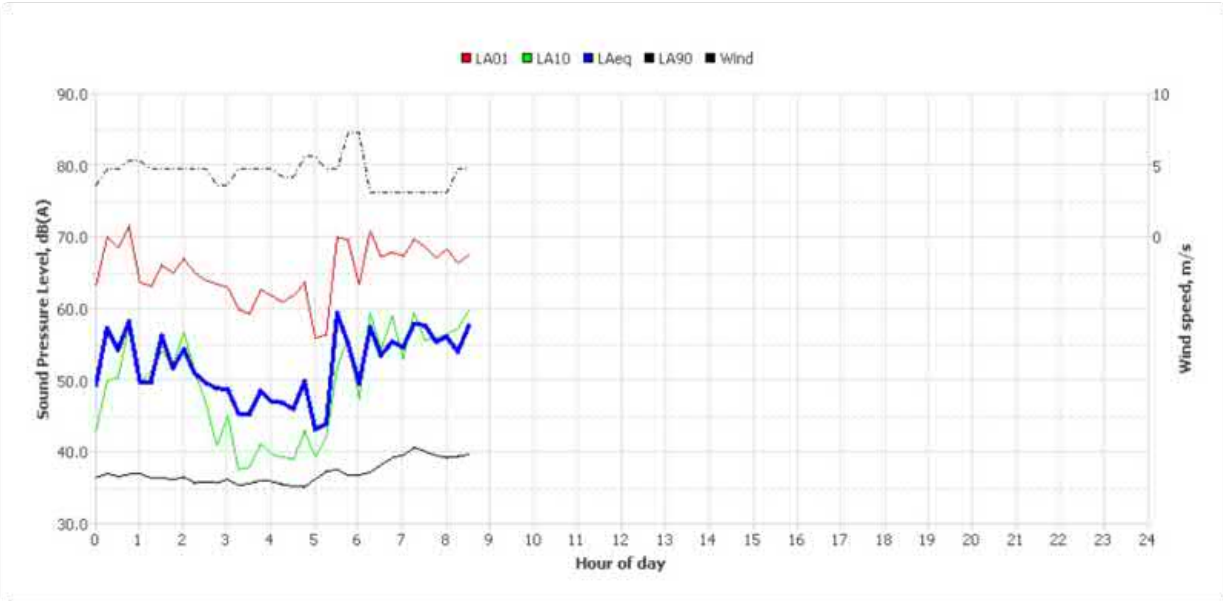


Friday, 02 Jul 2021



Saturday, 03 Jul 2021





# Noise Logger Report

5 Wyndham Street, Alexandria



Item	Information
Logger Type	Rion NL52
Serial number	164395
Address	5 Wyndham Street, Alexandria
Location	Front Yard
Facade / Free Field	Free Field
Environment	Background dominated by Road traffic noise on Wyndham Street 64 to 66 dBA. Bus pass by 69 dBA. Fire truck pass by 84 dBA. Motorbike pass by 70 dBA. Children playing in the park opposite the property audible. Bird calls audible 57 dBA when no traffic.

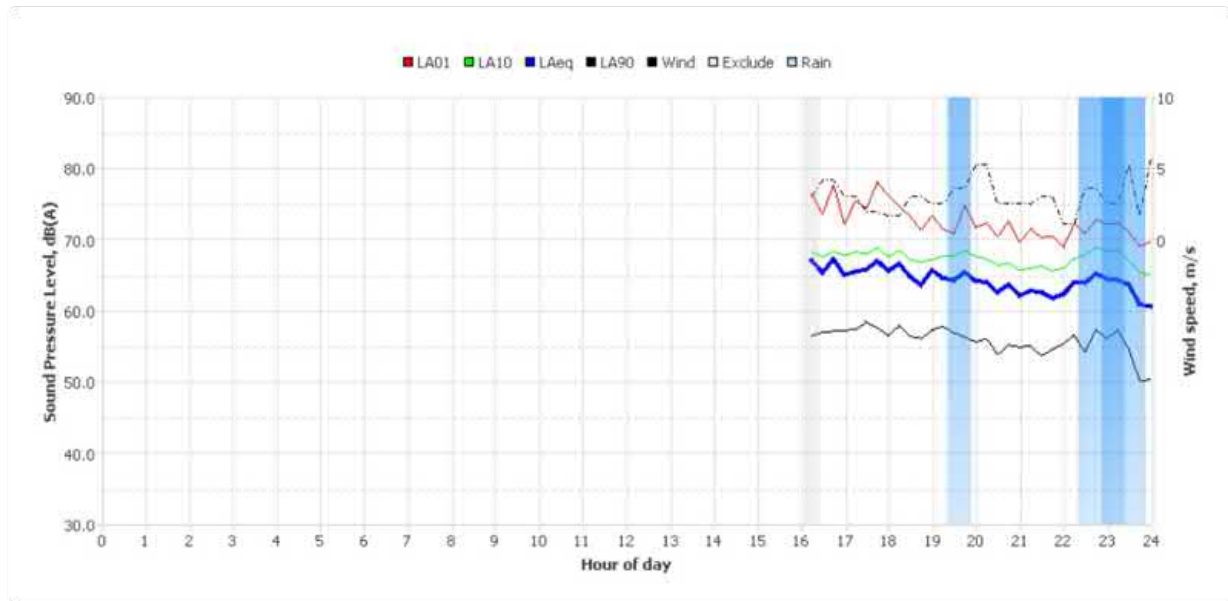
## Measured noise levels

Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq,15hr</sub>	L <sub>Aeq,9hr</sub>
Wed Jun 16 2021	66	64	63	-	-	-	65	63
Thu Jun 17 2021	66	64	63	-	54	-	65	63
Fri Jun 18 2021	67	63	62	-	-	-	66	62
Sat Jun 19 2021	-	-	-	-	-	-	-	-
Sun Jun 20 2021	66	64	61	-	-	-	65	61
Mon Jun 21 2021	67	64	62	-	53	-	66	62
Tue Jun 22 2021	66	64	63	55	54	-	65	63
Wed Jun 23 2021	66	63	61	-	-	48	65	61
Thu Jun 24 2021	65	63	61	-	53	49	65	61
Fri Jun 25 2021	66	63	61	-	52	48	65	61
Sat Jun 26 2021	63	61	61	-	50	48	61	61
Sun Jun 27 2021	63	62	58	51	50	48	63	58
Mon Jun 28 2021	65	62	58	-	50	-	64	58
Tue Jun 29 2021	67	65	62	-	-	-	67	62
Wed Jun 30 2021	66	63	63	55	-	-	65	63
Thu Jul 1 2021	66	63	62	55	-	-	65	62
Fri Jul 2 2021	65	62	62	55	-	48	64	62
Sat Jul 3 2021	64	62	58	-	49	-	63	58
Sun Jul 4 2021	62	62	56	-	49	-	62	56
Mon Jul 5 2021	64	62	61	-	-	-	64	61
Tue Jul 6 2021	65	63	61	-	50	-	65	61
Wed Jul 7 2021	65	-	-	-	-	-	65	-
<b>Summary</b>	<b>65</b>	<b>63</b>	<b>61</b>	<b>55</b>	<b>50</b>	<b>48</b>	<b>65</b>	<b>61</b>

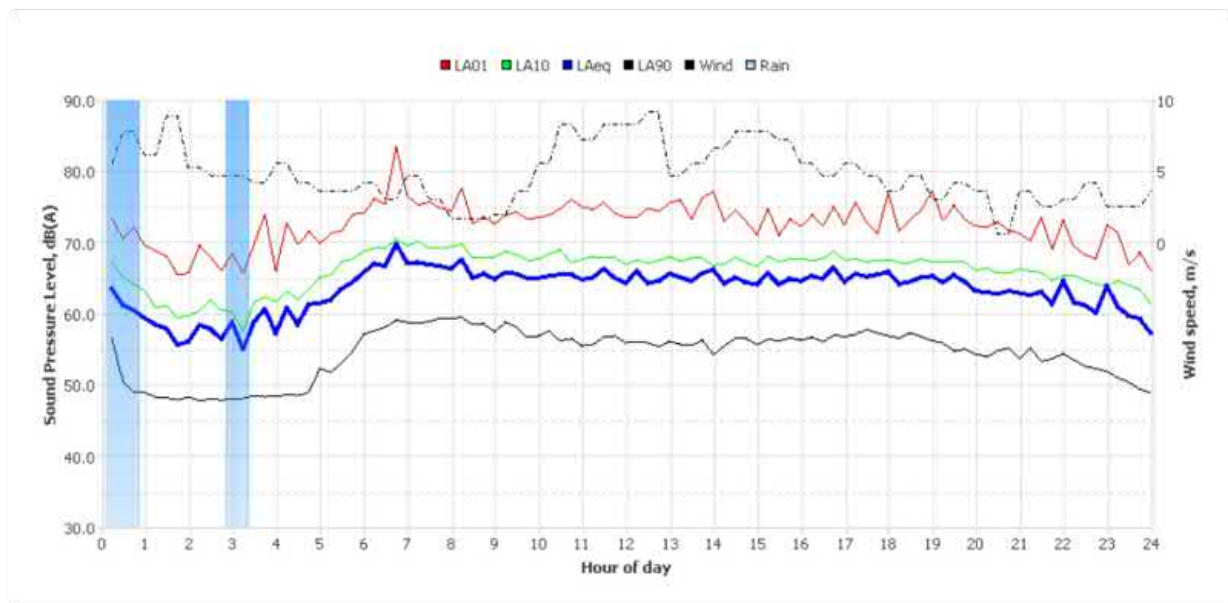
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

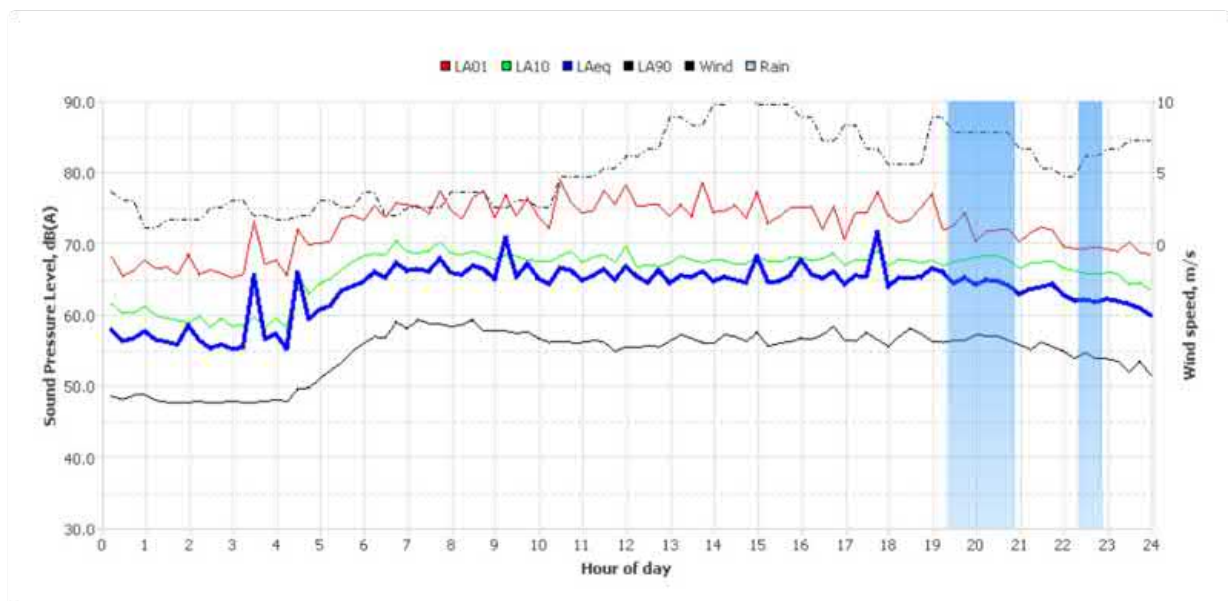
Wednesday, 16 Jun 2021



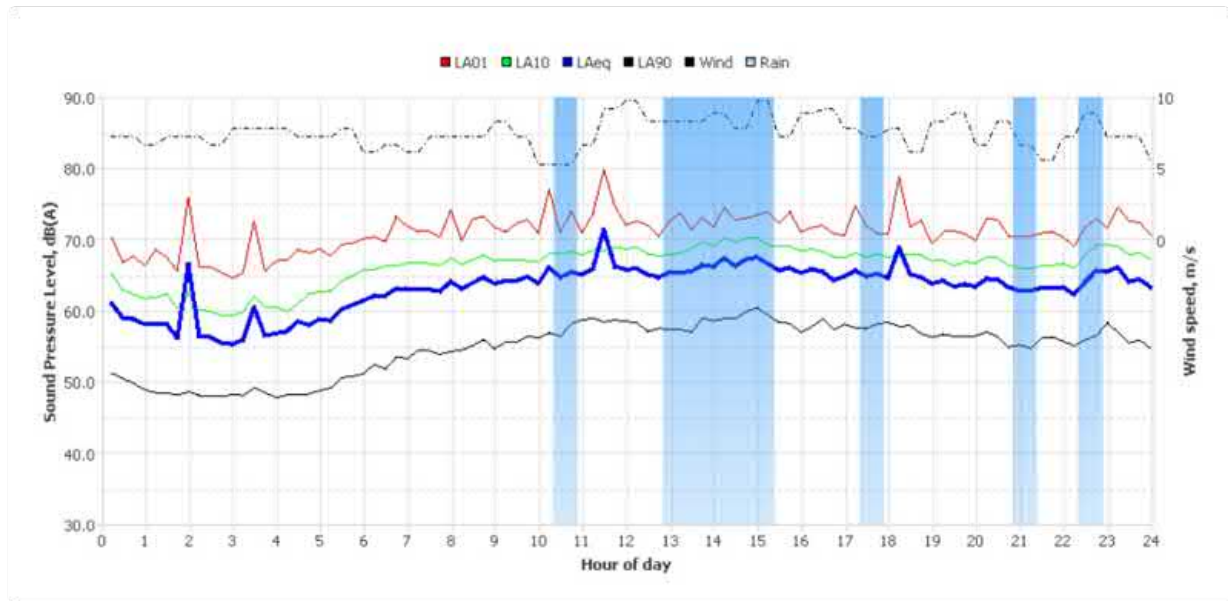
Thursday, 17 Jun 2021



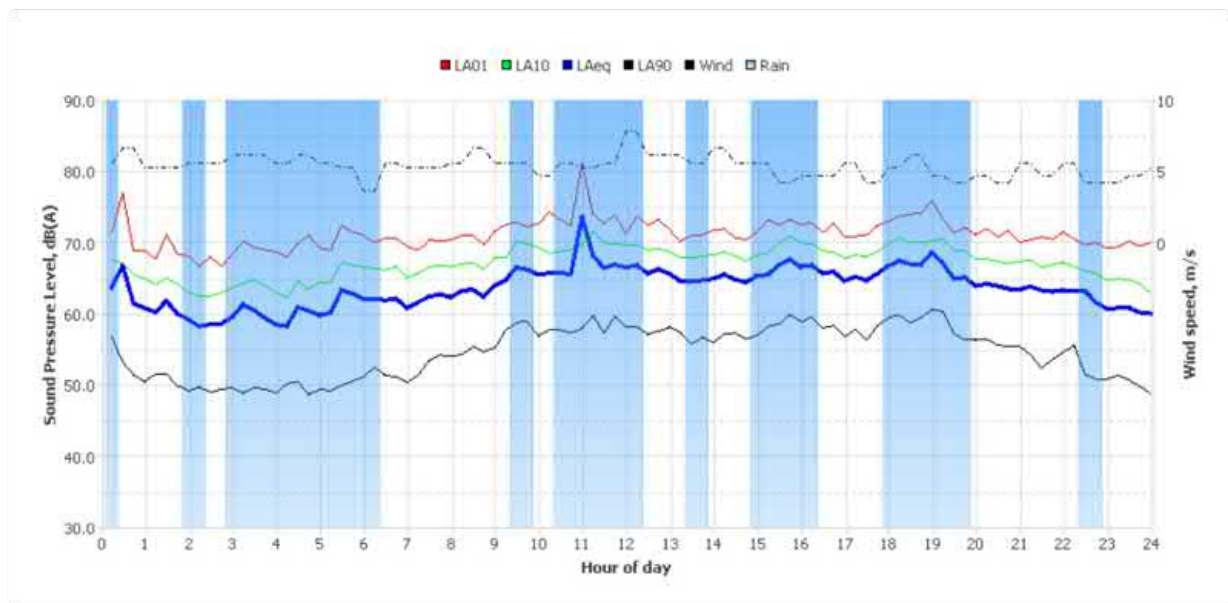
Friday, 18 Jun 2021



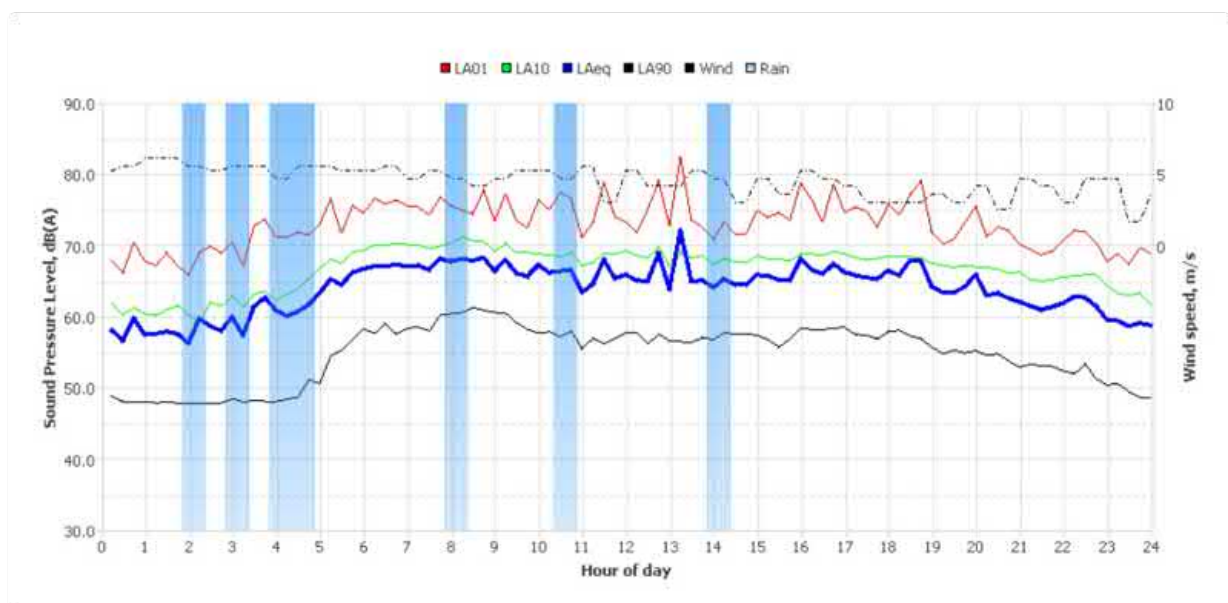
Saturday, 19 Jun 2021



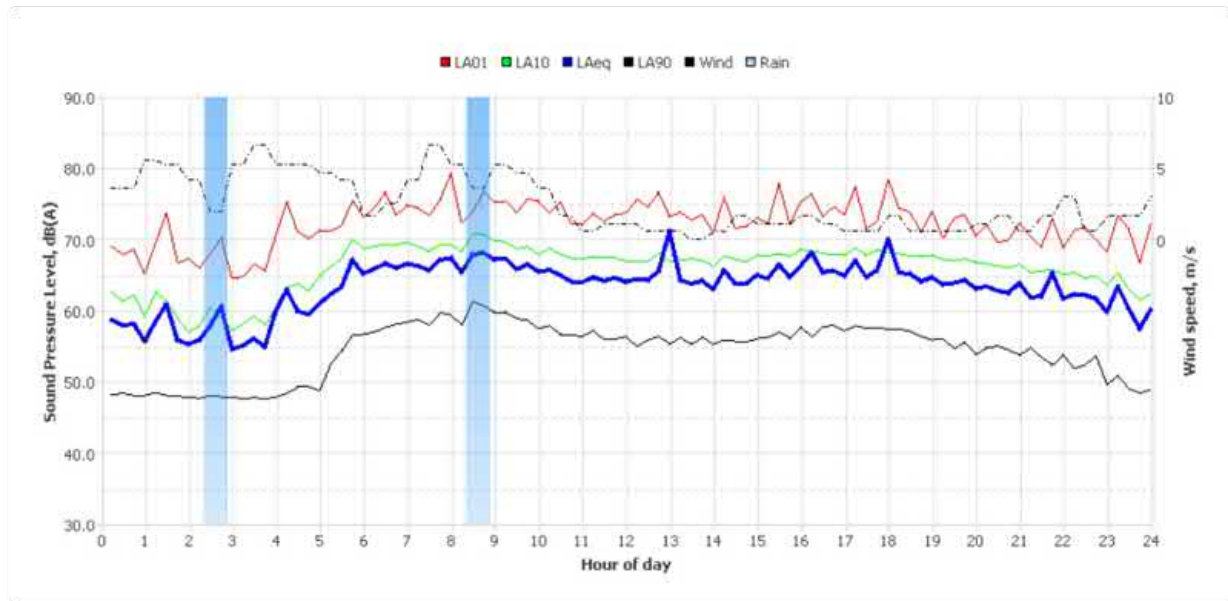
Sunday, 20 Jun 2021



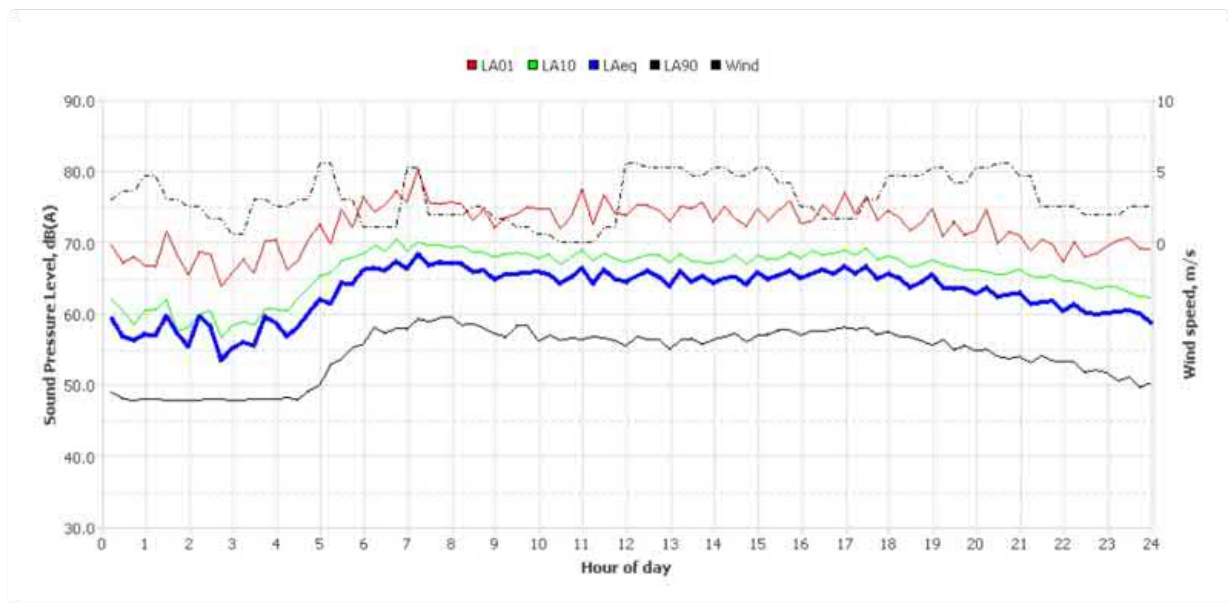
Monday, 21 Jun 2021



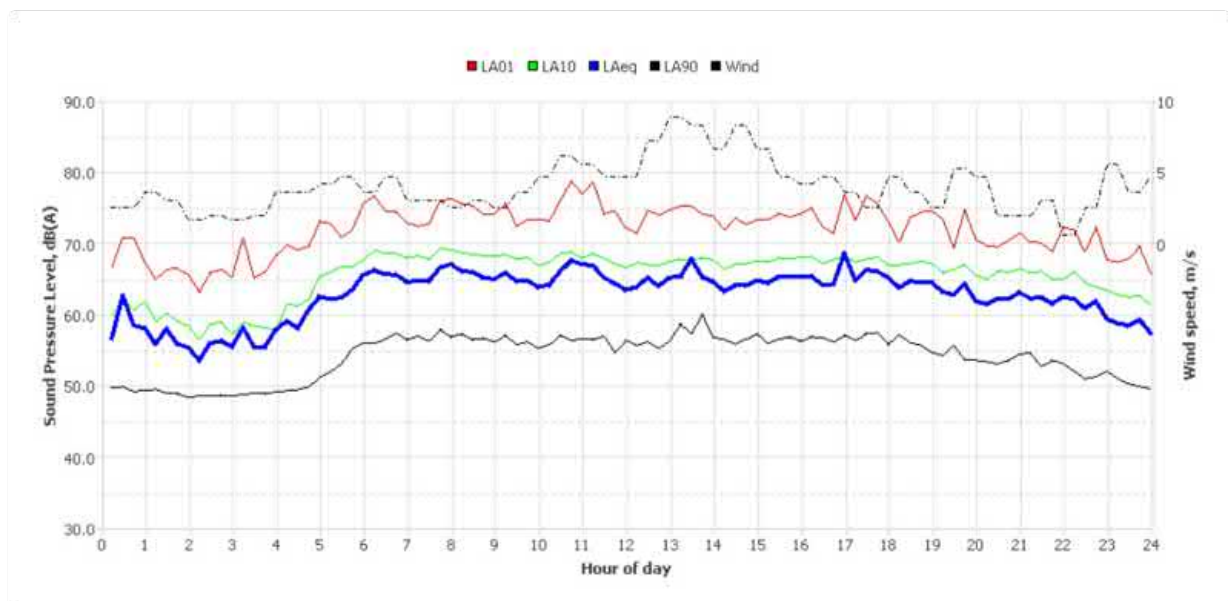
Tuesday, 22 Jun 2021



Wednesday, 23 Jun 2021

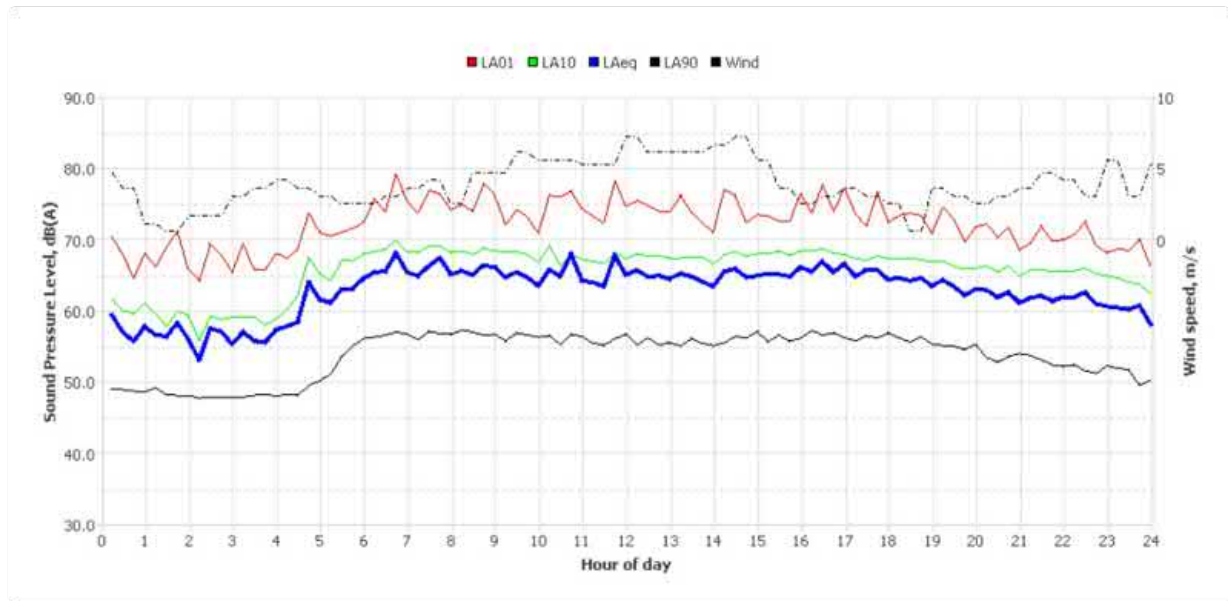


Thursday, 24 Jun 2021

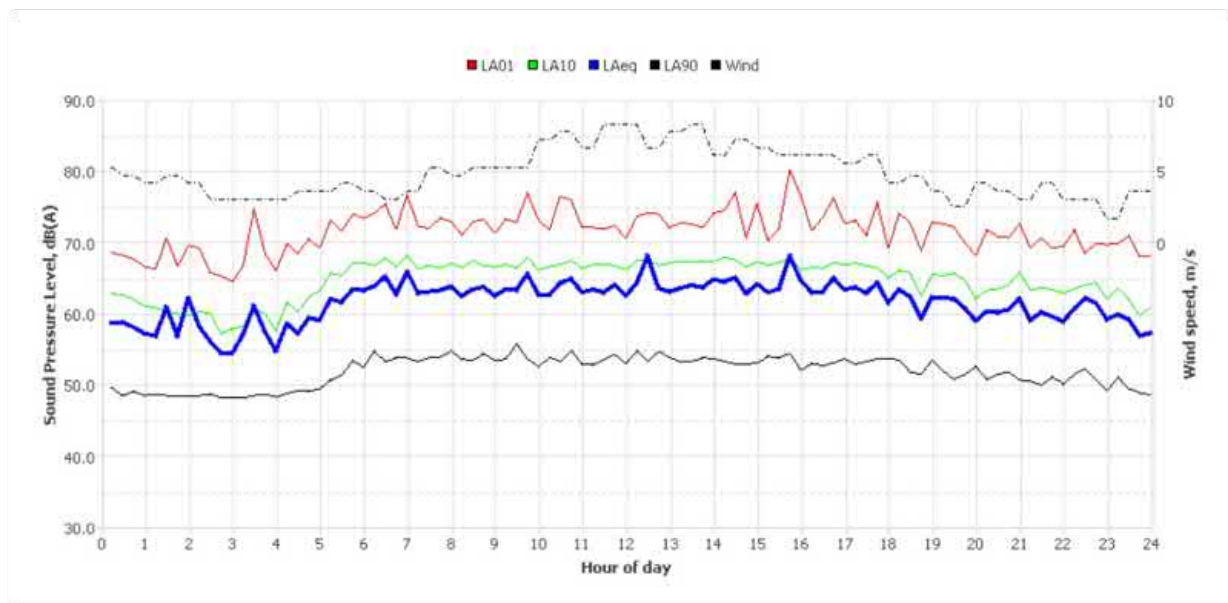




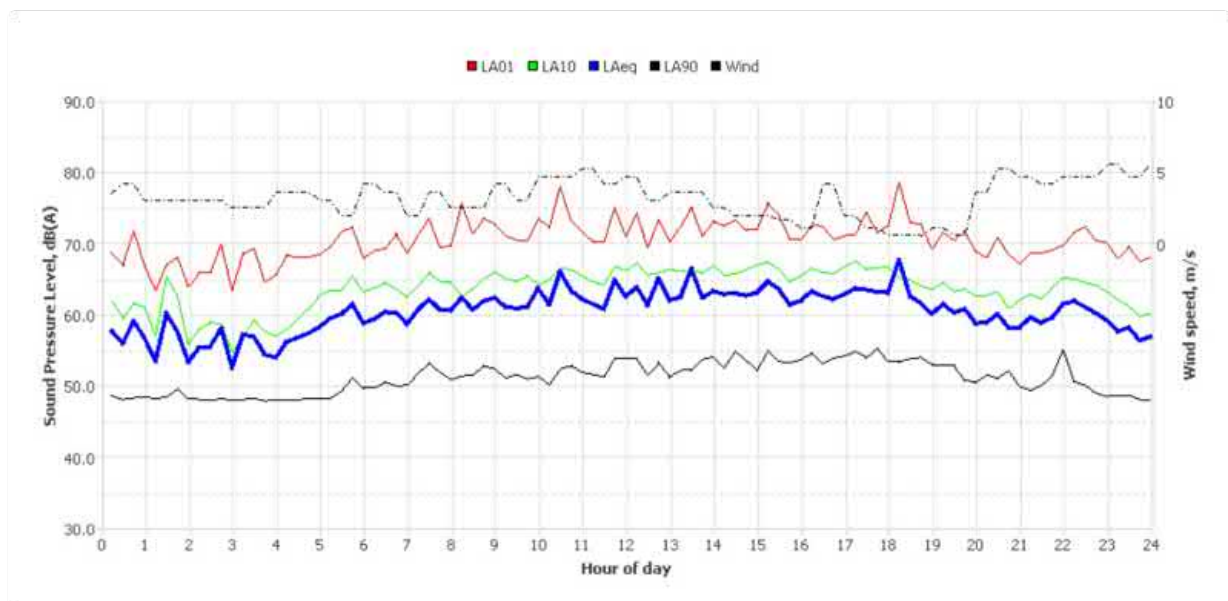
Friday, 25 Jun 2021



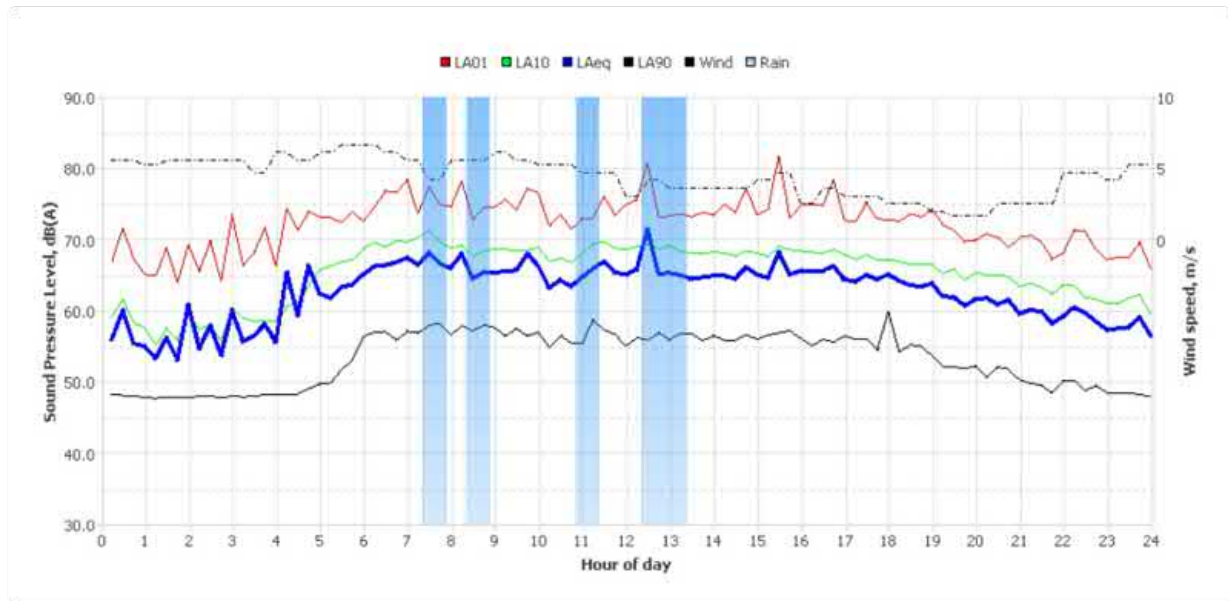
Saturday, 26 Jun 2021



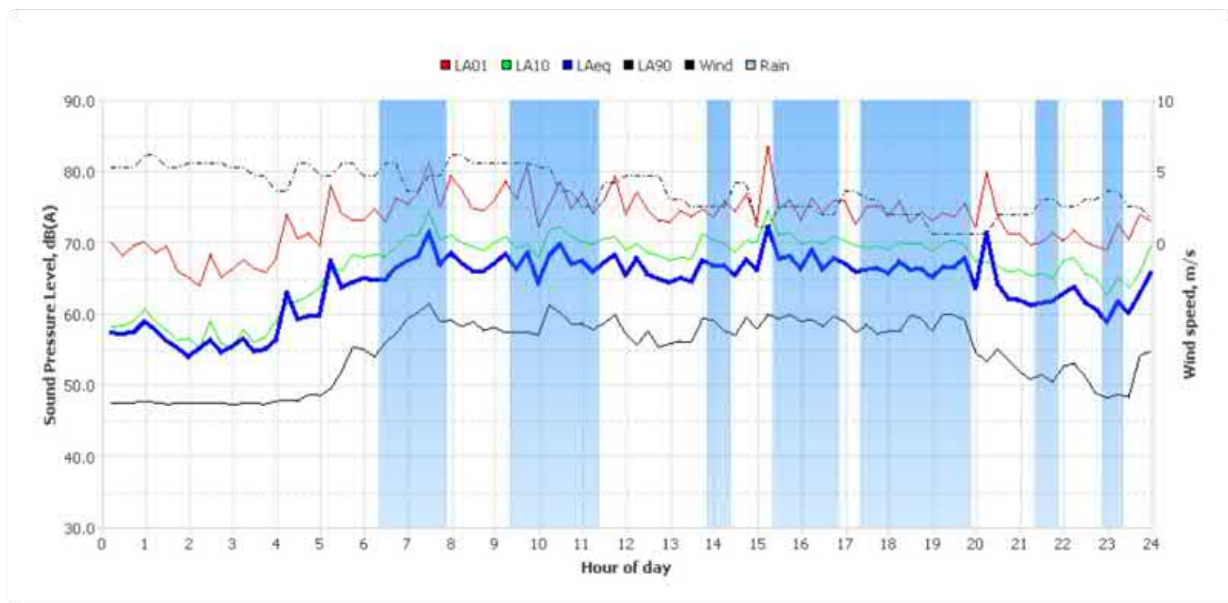
Sunday, 27 Jun 2021



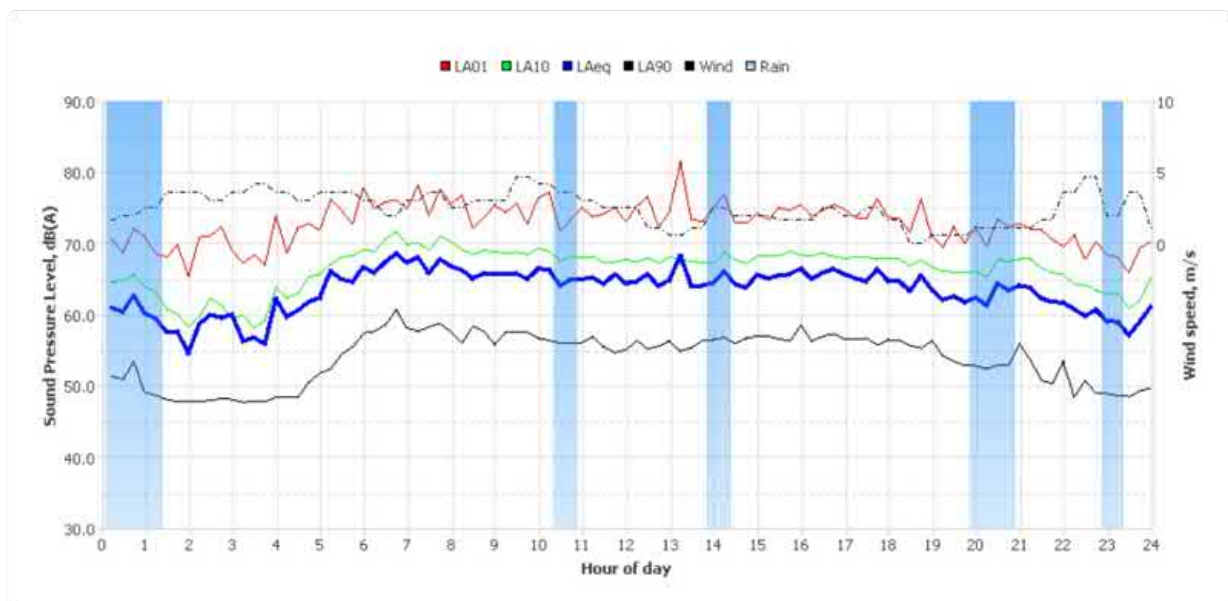
Monday, 28 Jun 2021



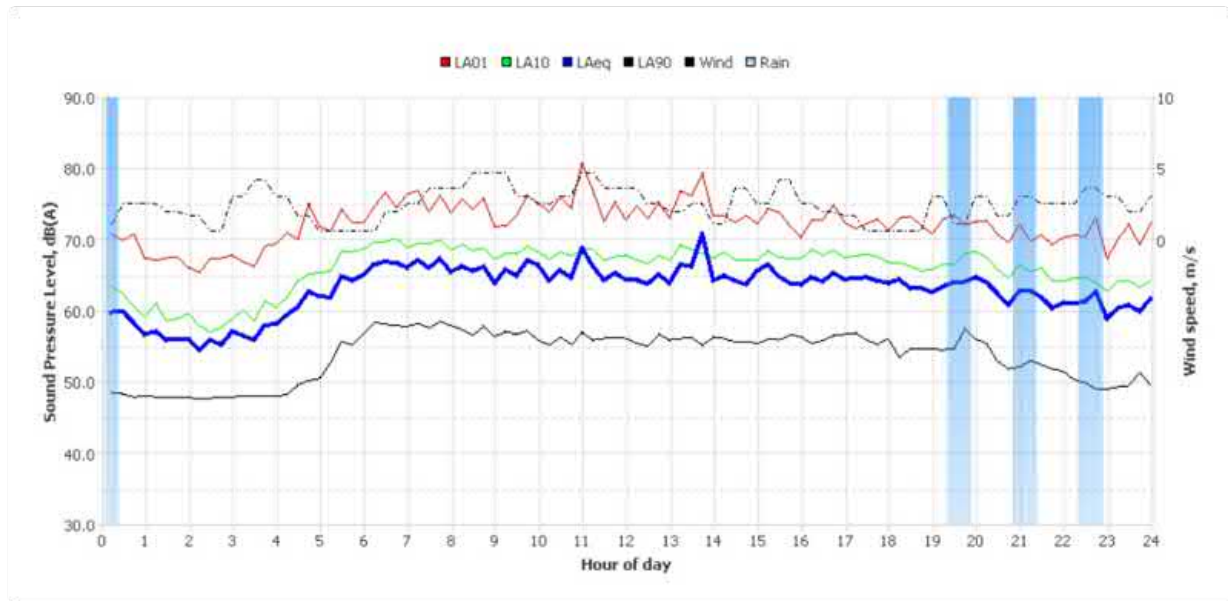
Tuesday, 29 Jun 2021



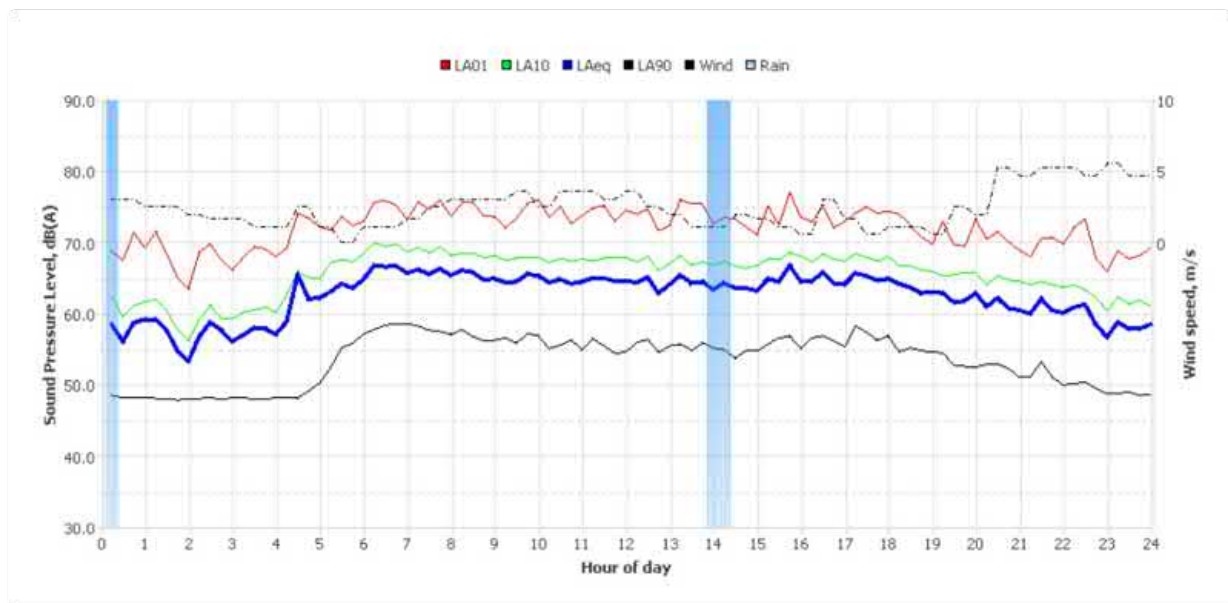
Wednesday, 30 Jun 2021



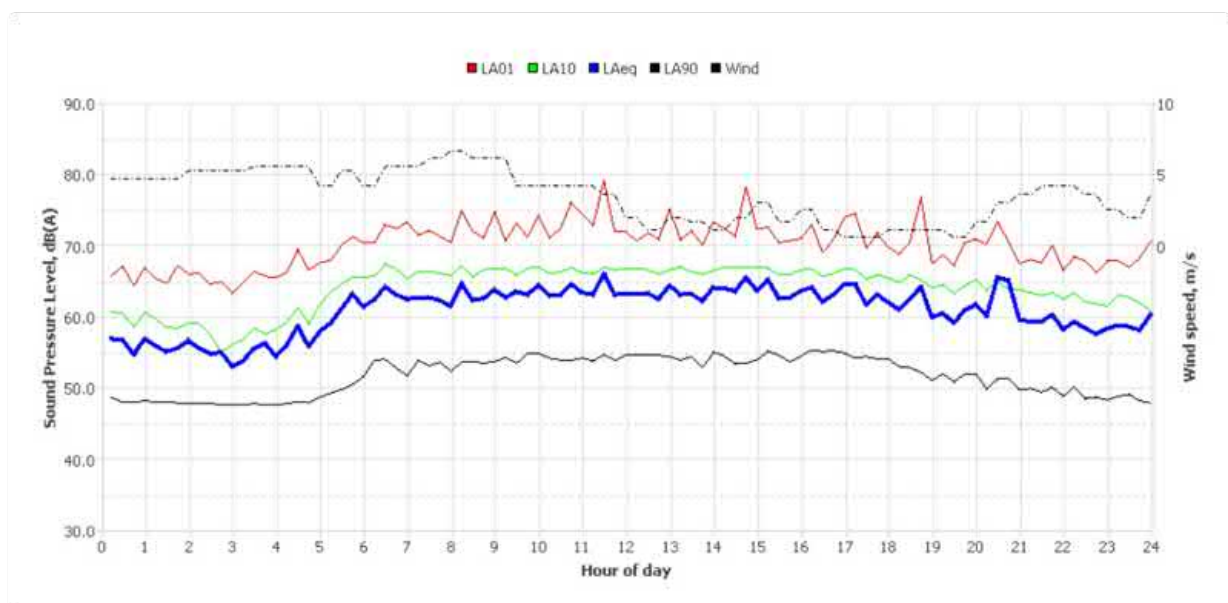
Thursday, 01 Jul 2021



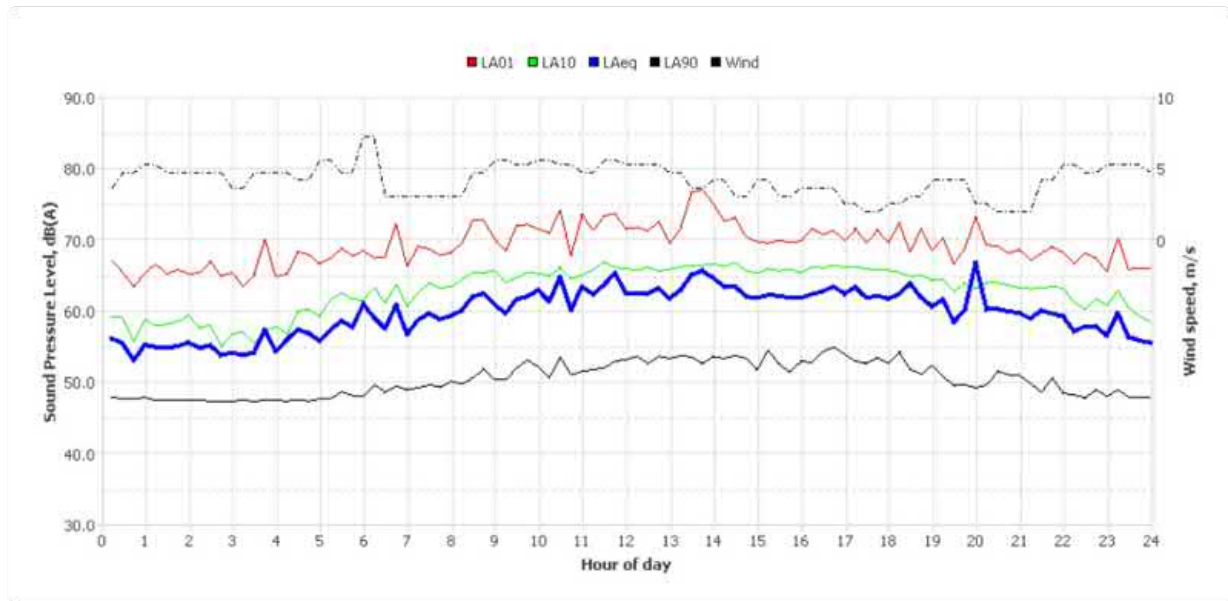
Friday, 02 Jul 2021



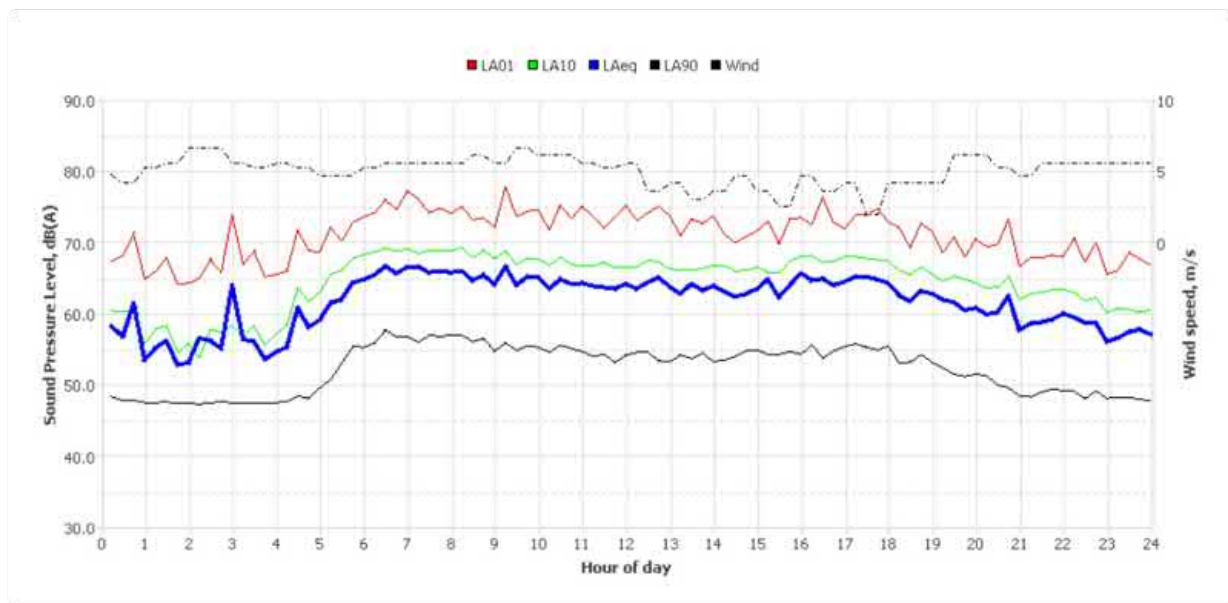
Saturday, 03 Jul 2021



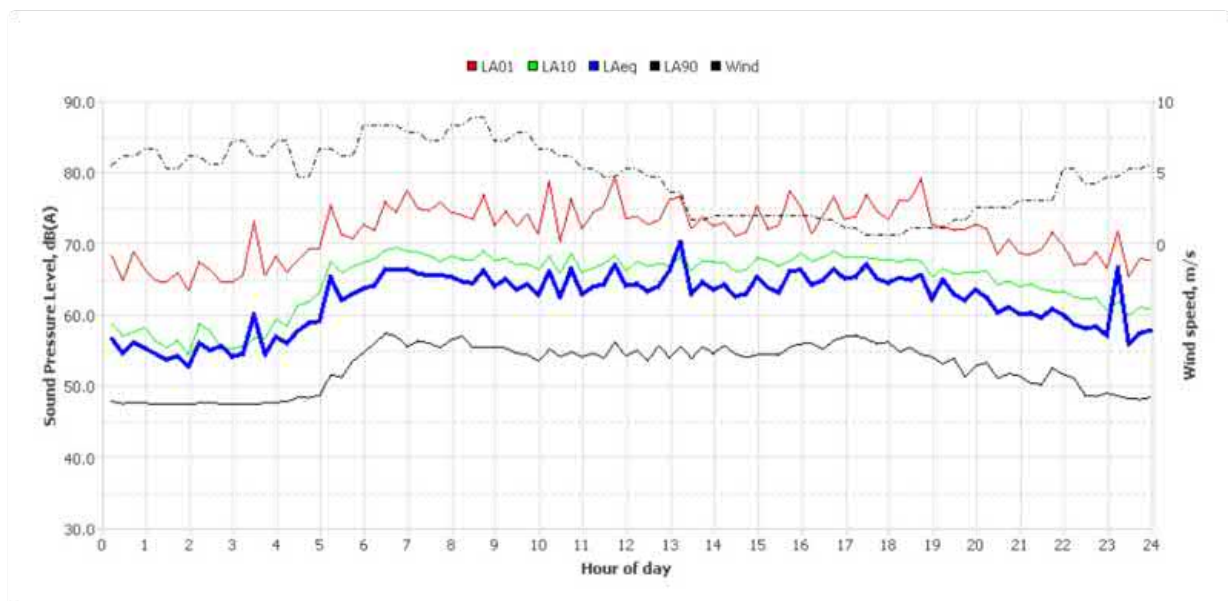
Sunday, 04 Jul 2021

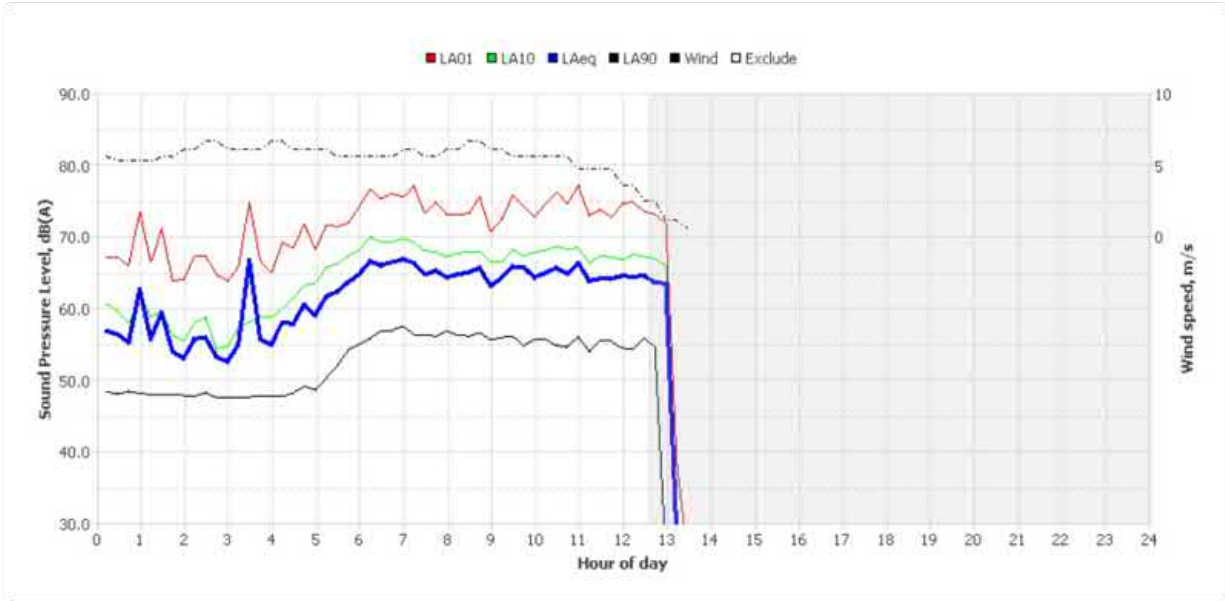


Monday, 05 Jul 2021



Tuesday, 06 Jul 2021





# Appendix C

## Noise Contour Maps





Rail Noise Level in dB(A)

<= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

Scale 1:1000  
0 5 10 20 30 40 m







Rail Noise Level in dB(A)

<= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

Scale 1:1000

0 5 10 20 30 40 m





Rail Noise Level in dB(A)

<= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 <

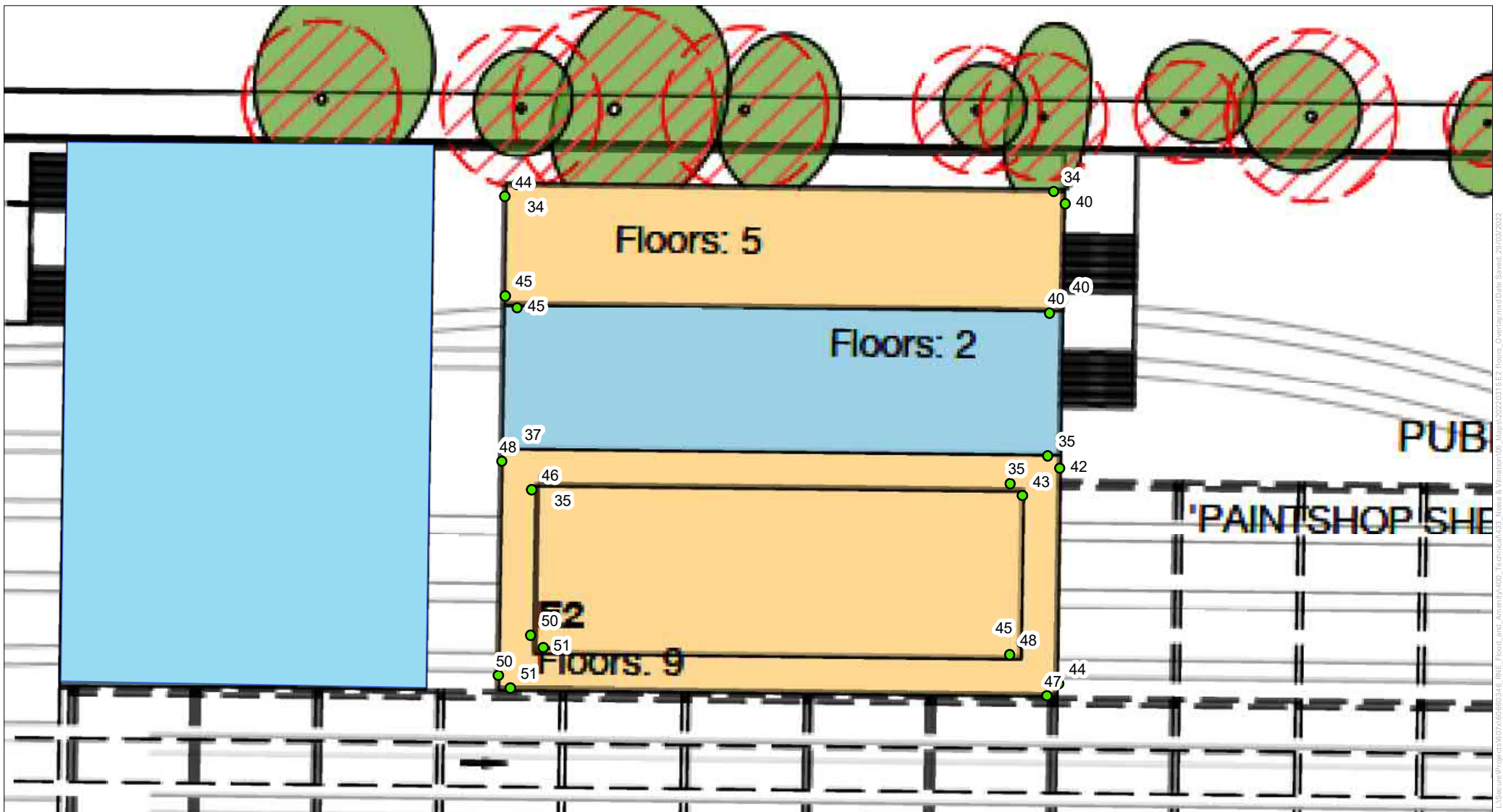
Scale 1:1000  
0 5 10 20 30 40 m





# Appendix D

## Predicted rail noise levels



Redevelopment of Redfern North-Eveleigh - Paint Shop Sub-Precinct

E2 - Top level - Predicted night-time external noise levels

Legend

$L_{Aeq,9hour}$ , dB(A)

- ≤55 dB(A)
- >55 dB(A)



**AECOM**

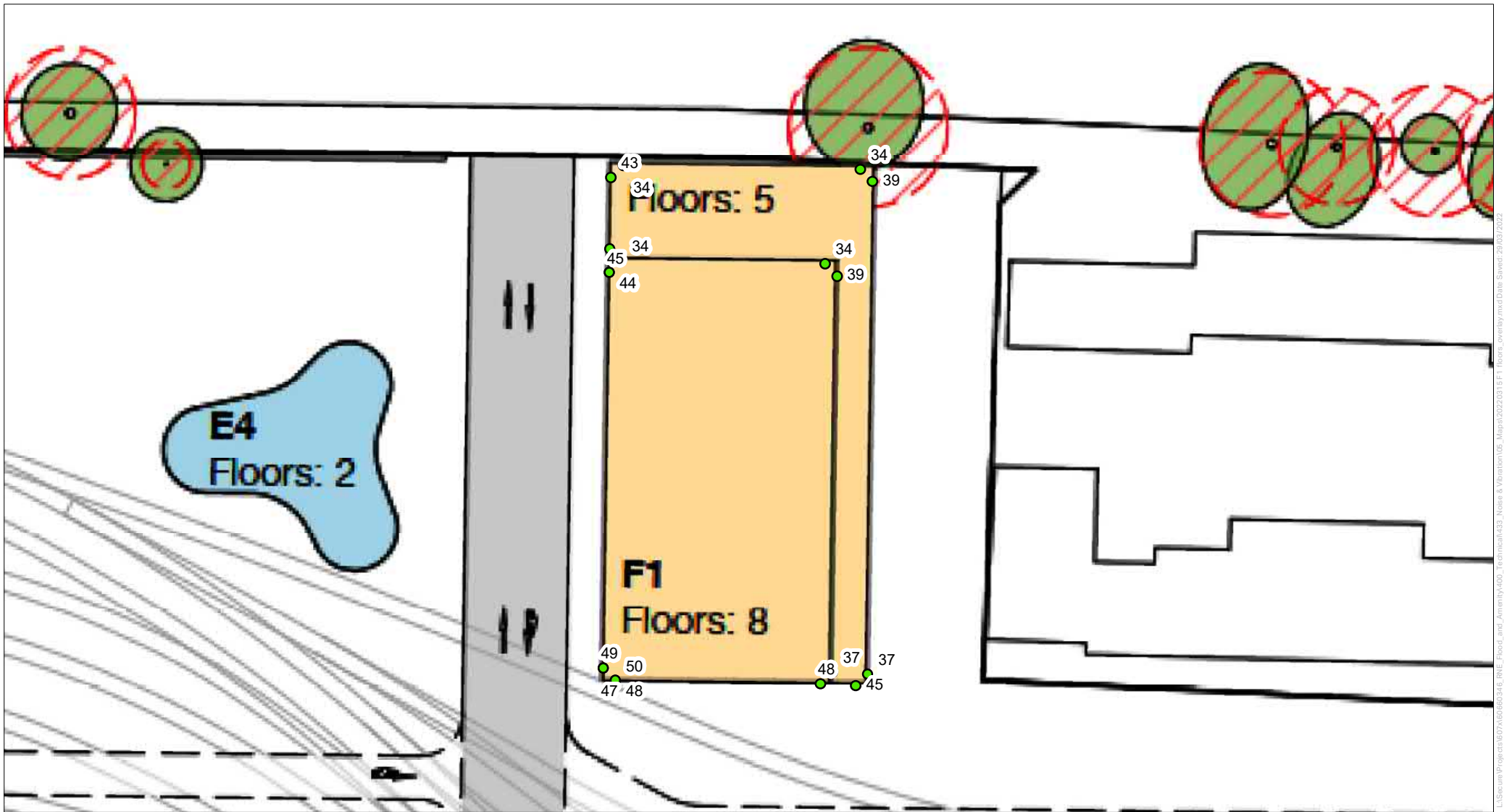
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Source:

L:\Security\Projects\9074\9074-00000000-0000-0000-0000-000000000000 - RNE - Flood and - Aemity\402 - Topographic - Jobs\2022\0315 E2 - Floors - Overlay.rvt Date Saved: 29/03/2022



Redevelopment of Redfern North-Eveleigh - Paint Shop Sub-Precinct

F1 - Top level - Predicted night-time external noise levels



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Source:

I:\Secure\Projects\907\Aveleigh\907-146\_RNE\_Plan\_01\_Amenity\402\_Technical\403\_Noise & Vibration\06\_Map\90720231515.F1\_Floors\_08\_top\_level\_Predicted\_Night\_Time\_External\_Noise\_Level\_2023072023







# Appendix E

## Attended Rail noise measurements

## Appendix E Rail traffic noise monitoring results

The results of the attended rail noise measurements detailed in Section 3.4 are presented below in Table D.

**Table E Measured Train Pass-by Noise Levels**

Track	Time	Measurement duration, sec	Measured sound pressure level at 15 m, L <sub>AE</sub> dB(A)
Down	12:07	19	79
Up	12:08	17	80
Down	12:09	25	79
Down	12:10	14	76
Up	12:11	15	78
Down	12:13	19	79
Down	12:15	17	78
Down	12:18	21	89
Up	12:18	21	74
Up	12:19	15	79
Up	12:21	13	70
Down	12:21	12	83
Up	12:22	15	76
Up	12:23	9	78
Down	12:27	19	68
Down	12:28	18	80
Down	12:30	19	69
Up	12:31	20	74
Up	12:32	88	89
Up	12:35	10	80
Up	12:36	14	75
Down	12:37	13	77
Up	12:38	17	80
Down	12:39	18	80
Up	12:40	26	75
Down	12:44	16	80
Up	12:45	11	81
Up	12:45	15	74
Down	12:48	9	77
Down	12:49	15	80
Up	12:51	16	75
Up	12:53	18	82
Down	12:54	15	81

Track	Time	Measurement duration, sec	Measured sound pressure level at 15 m, $L_{AE}$ dB(A)
Up	12:57	17	78
Down	12:58	14	79
Up	13:02	13	80
Up	13:03	18	72
Up	13:06	16	75
Down	13:07	11	80
Down	13:09	21	78