

# Environmental Noise Assessment Report | December 2021

## Tweed Valley Hospital Project, Cudgen NSW

Prepared for: Lendlease Building Pty Ltd

Job Number: A101021.0286.00 NMA28.Rev0 Date: 28/01/2022



**ADE**  
CONSULTING  
GROUP

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# Executive Summary

Environmental noise monitoring was conducted at Tweed Valley Hospital Project, Cudgen NSW commencing on 26 July 2019 as per Lendlease Group requirements. This report will ensure environmental noise produced by the construction works on site comply with:

- Lendlease Building Pty Ltd Tweed Valley Hospital – Management Plan – Noise and Vibration;
- *NSW Work Health and Safety regulation (2017), clause 56 exposure standard for noise* for the duration of the project;
- Conditions C4 – C7, C12 – C14 and B16 of Schedule 3 of the consent; and
- NSW EPA’s Interim Construction Guidelines.

ADE Consulting Group Pty Ltd has been commissioned by Lendlease to provide ongoing construction noise monitoring at three (3) locations within the Tweed Valley Hospital Project’s boundary during construction works pertaining to the development (consent SSD-10353 – Construction of the Tweed Valley Hospital).

This report provides environmental noise monitoring data and analysis for the period of construction during December 2021.

The projects’ noise criteria are met at all times and do not exceed the limitations outlined within the relevant documentation approved within the Development Consent (SSD-10353). The works are compliant against the relevant guidelines, policies, procedures, and standards relating to noise on construction sites.

## Summary of Exceedances for December 2021

No exceedances occurred throughout the month of December 2021.

## Background Environmental Noise Level

Background environmental noise monitoring commenced on 26 July 2019 in three (3) separate locations. These locations are along the southern boundary of the site, near Cudgen Road (refer to *Appendix I – Aerial Photograph*). These monitoring locations were chosen to determine if noise being generated from the construction site complies with the levels stated in the above-mentioned guidelines. It has been determined that if the environmental noise levels at the boundary comply with the relevant guideline values, then the noise levels at the neighbouring properties would not be of great concern.

The time construction noise can be generated is regulated by the inclusion of standard construction hours that are regulated by Conditions C4 – C7 of Schedule 3 of the consent. According to condition C4, the recommended standard hours for construction work are:

Normal Construction – Monday to Friday 6am to 6pm  
Saturday 8am to 1pm  
No work on Sundays or public holidays

The background noise level has been assessed for the project and the EPA’s Interim Guidelines mention that the management level of noise LAeq, 15 min should not be greater than 10 decibels above the background noise level during the normal construction times and no greater than 5 decibels outside of the normal construction times.

The background noise levels and results for monitoring conducted from 26 July to 31 July 2019 are listed in **Table 1** on the following page.

**Table 1.** Background Noise Levels.

	BACKGROUND NOISE LEVELS dB(A)		
	Monitoring Location		
	001 Adjacent to carpark	002 Central location	003 Eastern section
Day: 7am to 6pm	73	73	69
Evening: 6pm to 10pm	63	62	60
Night: 10pm to 7am	57	56	55

# Definitions

<b>Weighting and Loudness:</b>	<p>The overall level of a sound is usually expressed as dBA and not dB. Weighting refers to the human ear’s frequency response to sound. Typically, sound is measured with an A-weighted filter which reduces the significance of lower frequencies and very high frequencies, increasing the importance of mid-frequencies (500 Hz to 4 kHz), and being a good measure of the “loudness” of a sound.</p> <p>A change of 1 to 2 dBA is difficult to detect, whilst a change of 3 to 5 dBA corresponds to a small but noticeable change. A 10 dBA change corresponds to a doubling or halving in apparent loudness.</p>
<b>LAeq:</b>	<p>The time averaged A-weighted sound pressure level for the interval, as defined in AS1005.1. It is generally described as the equivalent continuous A-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.</p>
<b>LAmin/LAmax:</b>	<p>Minimum or Maximum A-weighted noise level detected during the measuring period. It refers to the minimum background noise detected or the maximum Lp measured.</p>
<b>LA90:</b>	<p>A-weighted noise level which is exceeded for 90% of the measuring period. It is usually used as the descriptor for background noise level during the measurement period.</p>
<b>LA1:</b>	<p>Noise level which is exceeded for 1% of the measurement period.</p>
<b>LA10:</b>	<p>Noise level which is exceeded for 10% of the measurement period. The LA10 is often referred to as the average maximum noise level.</p>
<b>Background Noise:</b>	<p>The underlying level of noise present in the ambient noise, excluding the noise source, which is under investigation, when extraneous noise is removed.</p>
<b>Ambient Noise:</b>	<p>Ambient noise of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources.</p>
<b>Daytime</b>	<p>The time period between 07:00 and 18:00, same day, 08:00 to 18:00 Sundays and Public Holidays</p>
<b>Evening-time</b>	<p>The time period between 18:00 and 22:00, same day</p>
<b>Night-time</b>	<p>The time period between 22:00 and 07:00 the next day (08:00 Sunday)</p>
<b>Sound Pressure Level</b>	$L_p = 10 \log_{10} \left( \frac{p^2}{p_{ref}^2} \right) dB$ <p>In the above equation, p is the sound pressure fluctuation relative to atmospheric pressure, and <i>p<sub>ref</sub></i> is 20 microPascals (2 x 10<sup>-5</sup> Pa), the approximate threshold of hearing.</p> <p>Sound or noise is the sensation produced at the ear by small fluctuations in atmospheric pressure. Human ears are sensitive to changes to sound pressure over a wide range, from 20 microPascals to 60 Pascals, in lieu of using a linear scale to represent this range, a logarithmic scale is adopted to better handle.</p>
<b>Sound Power Level</b>	<p>Sound power level cannot be directly measured using a microphone, it does not change with distance and is not influenced by atmospheric conditions. The sound power level refers to the total energy of the sound and is reference to 1 Pico Watt.</p>

# 1 Introduction

## 1.1 Project Background

ADE Consulting Group Pty Ltd (ADE) was commissioned by Lendlease Building Pty Ltd (Lendlease) to assess the levels of construction related noise during the construction of the Tweed Valley Hospital Project, located at 771 Cudgen Road, Cudgen NSW (hereinafter referred to as ‘the Site’).

At the time of the environmental noise monitoring, Lendlease were continuing superstructure works on site. The purpose of environmental noise monitoring is to:

- Assess construction related air borne noise levels against regulatory requirements, development consent conditions, Australian guidelines, and international standards for construction noise management and control on construction sites;
- Mitigate potentially excessive noise generation through site planning and the adoption of appropriate work methods and practices where feasible and reasonable;
- Monitor and assess construction impacts likely to cause annoyance to the amenity on surrounding sensitive receivers, and provide feasible and reasonable recommendations to manage the impacts; and
- Establish and maintain positive relationships with project stakeholders.

The purpose of the Noise Monitoring Assessment (NMA) report is to assess the impacts construction activities from the Tweed Valley Hospital Project have had on noise levels on site and ensure compliance with the Tweed Valley Hospital Management Plan – Noise and Vibration and conditions **C4 – C7**, **C12 – C14** and **B16** from the development consent (refer to **Table 3**).

**Table 2.** Project Specific Information.

Site Details	
<b>Client Name:</b>	Lendlease Building
<b>ADE Project Number:</b>	A101021.0286.00
<b>Site Address:</b>	771 Cudgen Road, Cudgen NSW (Lot 11 DP 1246853)
<b>Date of Report:</b>	28/01/2022
<b>Development Consent</b>	SSD-10353, Health Administration Corporation. Authorized by the Minister for Planning and Public Spaces on 9 March 2020. Consent approved on 12 June 2020.
<b>Objectives:</b>	<ul style="list-style-type: none"> <li>• Comply with relevant guidelines and conditions C4 – C7, C12 – C14 and B16 of the SSD-10353 consent;</li> <li>• Manage potential airborne construction noise impacts from construction activities which have the potential to affect the nearby noise sensitive receivers (Kingscliff TAFE and residential properties); and</li> <li>• Establish and maintain good relationships with the neighbours and wider community.</li> </ul>
<b>Key Legislation:</b>	Protection of the Environment Operations Act 1997 (NSW) (POEO Act). The POEO Act is a key piece of environmental protection legislation and regulates activities via: <ul style="list-style-type: none"> <li>• Environmental protection licensing, as per schedule 1;</li> <li>• Regulation of scheduled and non-scheduled activities;</li> <li>• Environmental protection offences and penalties; and</li> <li>• Establishment of a general duty of care to notify environment harm.</li> </ul>

**Table 3.** Development Consent Conditions.

Conditions of Approval Number		Condition Requirements
Construction Hours	<b>C4</b>	Construction, including the delivery of materials to and from the site, may only be carried out between the following hours: (a) Between 7 am and 6 pm, Mondays to Fridays inclusive; and (b) Between 8 am and 1 pm, Saturdays No work may be carried out on Sundays or public holidays.
	<b>C5</b>	Construction activities may be undertaken outside of the hours in condition <b>C4</b> if required: (a) By the Police or a public authority for the delivery of vehicles, plant or materials; or (b) In an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or (c) Where the works are inaudible at the nearest sensitive receivers; (d) Where a variation is approved in advance in writing by the Planning Secretary or his nominee if appropriate justification is provided for the works; or (e) For the delivery, set-up and removal of construction cranes, where notice of the crane related works is provided to the Planning Secretary and affected residents at least seven days prior to the works.
	<b>C6</b>	Notification of such construction activities as referenced in condition <b>C5</b> must be given to affected residents before undertaking the activities or as soon as is practical afterwards.
	<b>C7</b>	The construction hours must include respite periods and specific times for activities during the day (outside the sensitive times), as required by condition <b>B16</b> of this consent, for the high noise generating construction activities (such as activities that would reach or exceed the Highly Affected Noise Level as defined in the ICNG).
Construction Noise Limits	<b>C12</b>	The development (including roadworks) must be constructed to achieve the project specific construction NMLs detailed in the Noise and Vibration Impact Assessment for SSDA Tweed Valley Hospital Stage 2' by JHA dated 19/09/2019. Additional mitigation measures must be implemented and any activities that are likely to exceed the NMLs or the high affected noise level of 75dB(A) in accordance with the management and mitigation measures in Appendix 3 and the approved CNVMSP required by condition <b>B16</b> .
	<b>C13</b>	Any noise generated during construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed approved noise limits for the site.
	<b>C14</b>	Unattended long-term construction noise monitoring must be undertaken during the duration of the Stage 2 works, consistent with the Stage 1 works in SSD-9575. The location of the loggers and the details of the monitoring methods including the reporting methods should be consistent with the CNVMSP in condition <b>B16</b> and the Stage 1 works in SSD-9575.

## 1.2 Monitoring Locations

The Site is bounded by Tweed Coast Road to the West, Turnock Street to the East and Cudgen Road to the South at Cudgen, NSW (refer to *Appendix I – Aerial Photograph*).

Lendlease requested ADE to set up three (3) Sound Level Meters (SLM) within the Site to assess the levels of noise prior to the sound leaving the site.

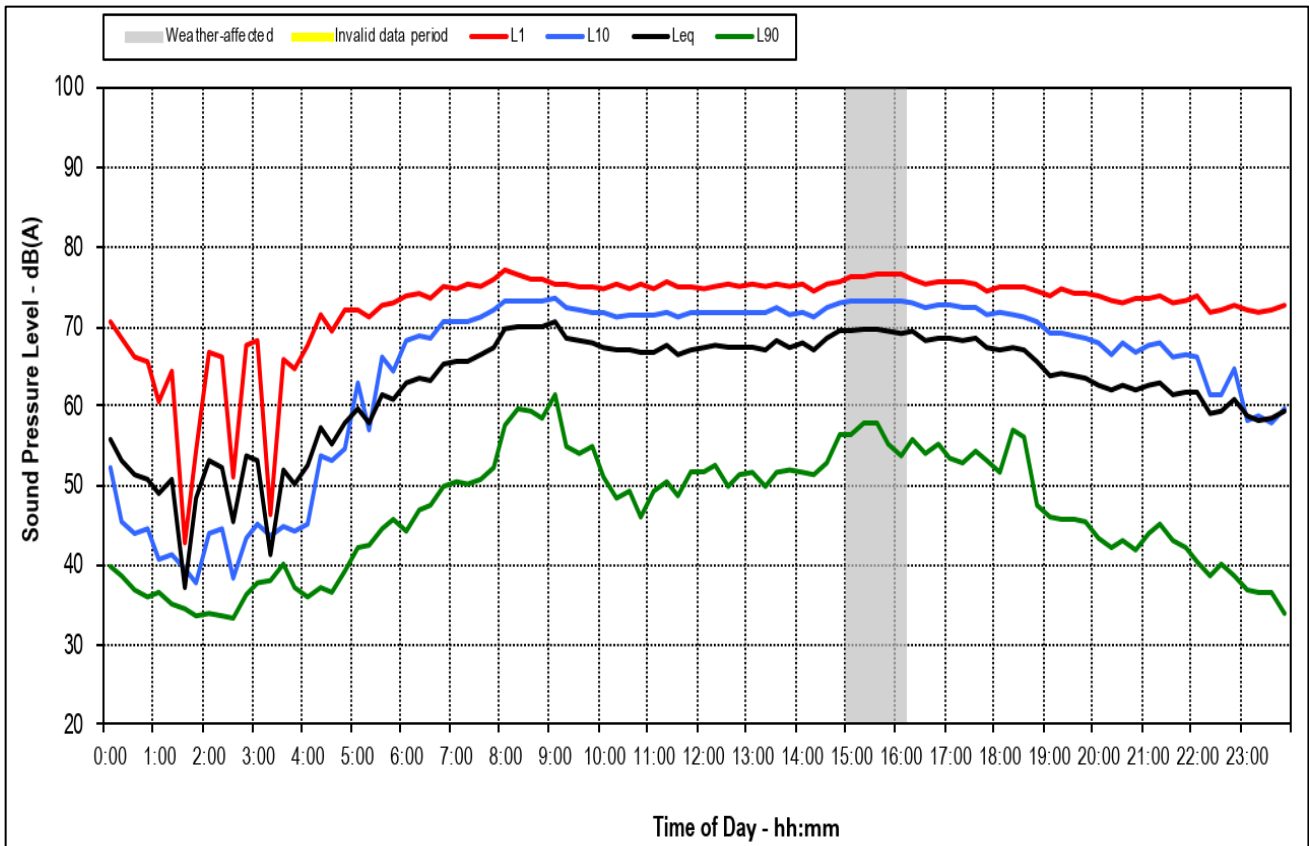


Monitoring to determine the Background Noise Levels commenced on 26 July 2019 and continued until 31 July 2019 before the works started. These background noise levels were determined for the various time periods during the 24-hour day (refer to **Table 4**).

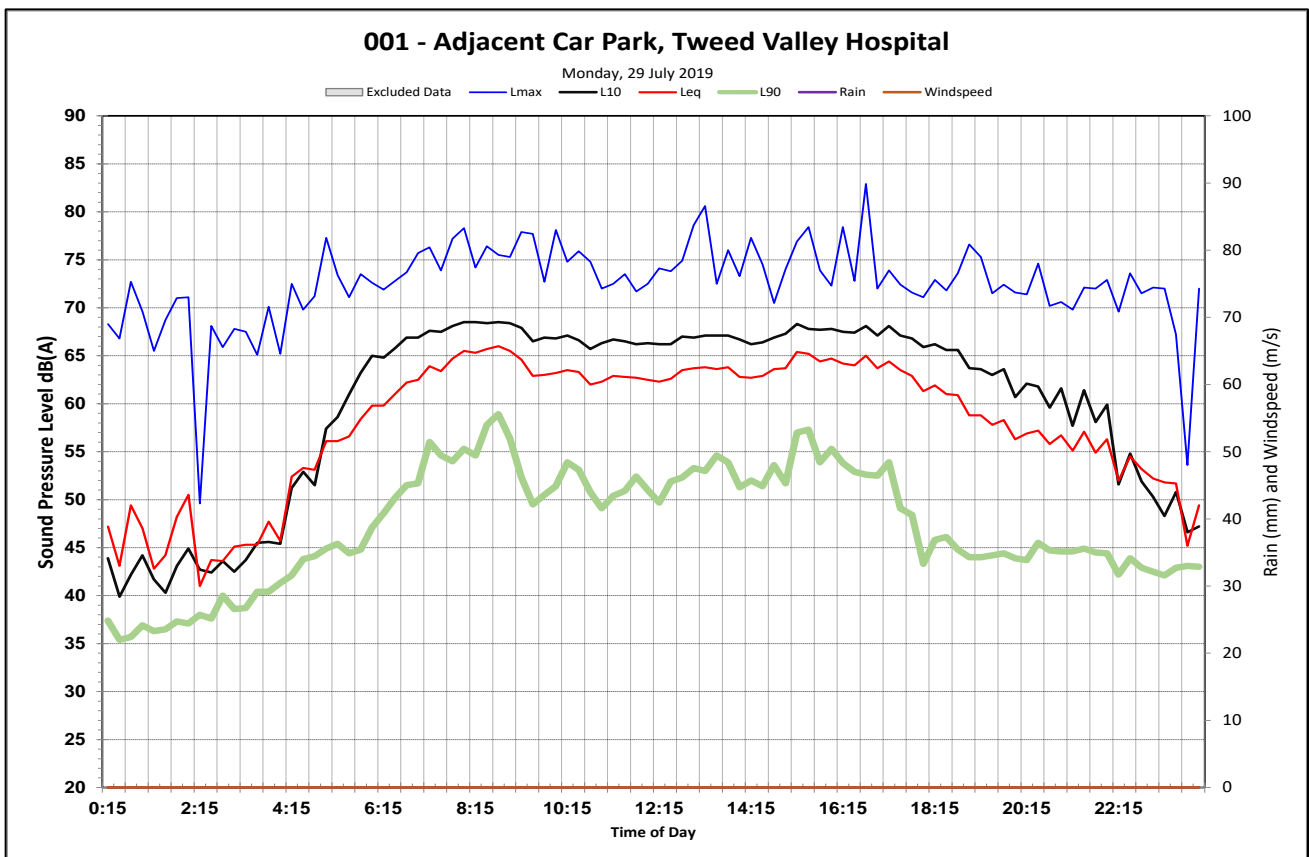
The original baseline noise assessment undertaken in 2018 by Acoustic Studio (in which the NMLs were established) was undertaken at three (3) locations along Cudgen Road. These locations are heavily influenced and dominated by road traffic noise.

The road traffic noise has been considerably consistent over the past three years (since logging data has been available). Based on this observation, the distance correction is reverted to the original limitations, as the background and ambient levels are driven the road traffic noise.

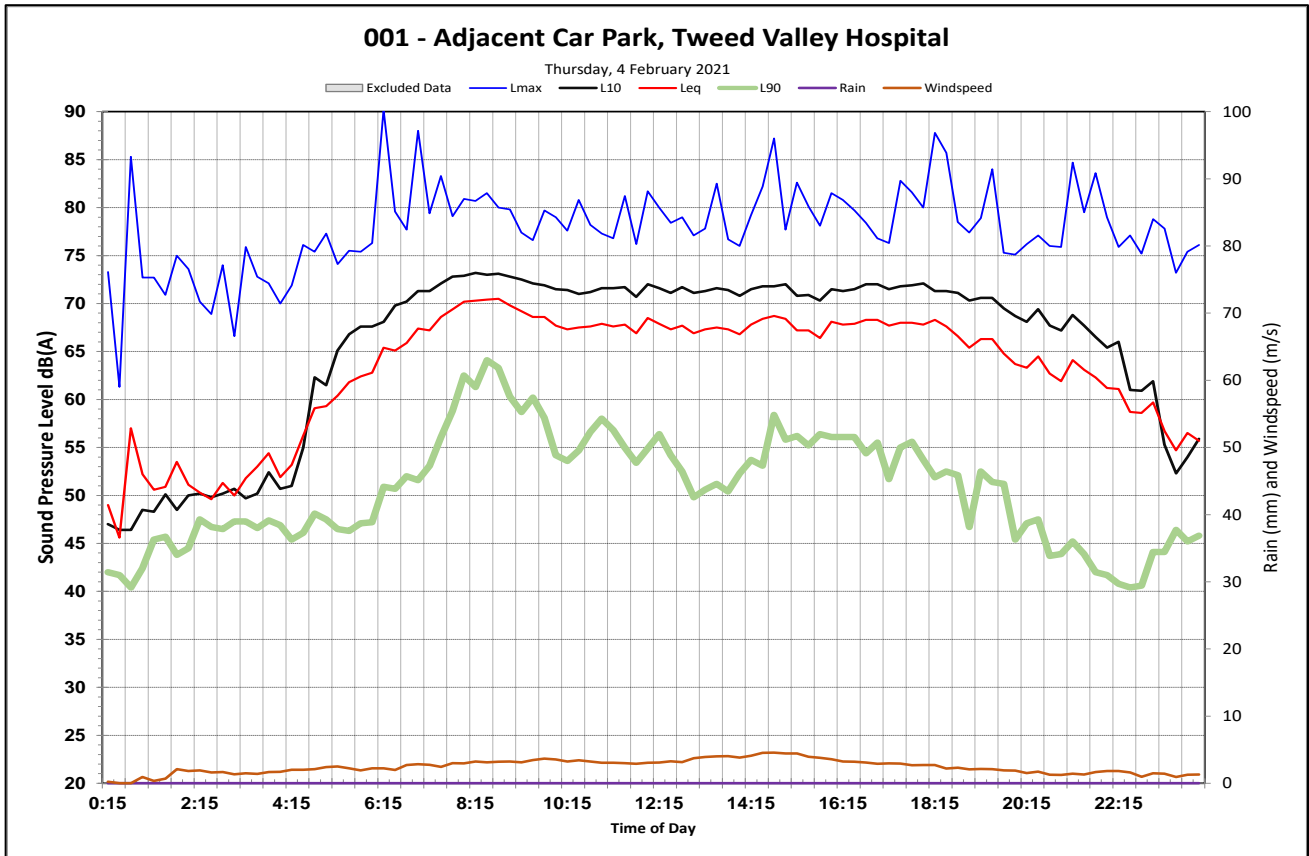
This correlation over time is demonstrated below in **Figure 1**, **Figure 2**, and **Figure 3**.



**Figure 1.** Acoustic Studio baseline noise monitoring, Friday 15 June 2018 – Logger 1 771 Cudgen Road.



**Figure 2.** ADE noise monitoring prior to construction, Monday 28 July 2019.



**Figure 3.** ADE noise monitoring during construction, Thursday 24 February 2021.

These graphs provide a visual context for the ambient environment at the logger’s position along Cudgen Road. The road traffic noise (categorized by a 3 dB correlation between the  $L_{eq}$  and  $L_{10}$ ) are consistent throughout the week period during construction as it is prior to construction (observable 12 months apart between June 2018 and July 2019).

Further, noise levels measured over time have not fluctuated significantly to determine the impact of construction. In some cases, the noise levels have decreased (likely due to COVID-19 and increase in working from home flexibility).

A brief overview of the pre-construction, and during construction noise levels is provided below in **Table 4**.

**Table 4. Noise Levels Over Time | 2018 – 2021.**

Location	Period	L <sub>Aeq</sub>			Rating Background Level			L <sub>Aeq15/9hr</sub>		L <sub>Aeq,1hr</sub>	
		Day	Evening	Night	Day	Evening	Night	Day	Night	Day	Night
001	Acoustic Studios 2018 Pre-construction	68	63	58	49	43	34	66	58	67	57
002		65	61	57	47	39	38	64	57	66	56
003		63	58	54	45	43	38	62	53	64	52
001	ADE Pre-construction July 2019 <sup>A</sup>	64	58	54	46	42	37	63	54	65	57
002		63	58	55	49	41	37	63	55	64	58
003		60	56	53	48	43	39	60	53	61	55
001	ADE February 2021 During Construction	67	63	60	51	40	38	64	57	68	63
002		64	61	57	47	40	36	61	56	62	56
003		58	55	54	46	43	39	56	53	58	52

Note A: Extraneous noise has been removed, weather affected data has not. Results may be lower. Weather data was unavailable during reanalysis of historical data.

### 1.3 Monitoring Frequency

Monitoring is to be carried out for the duration of the project in these locations as per the client request according to the Interim Construction Guideline NSW EPA 2009. Realtime data from the continuous monitoring of the levels of noise is uploaded to cloud storage which is accessed by ADE consultants to monitor the levels of noise. Noise levels downloaded from the cloud will be averaged every 15 minutes (L<sub>Aeq(15 min)</sub>) and compared with the Management Levels.

### 1.4 Noise Management Levels

Noise management levels depend on the noise receivers, the time and the day. For residences, the levels are established depending on the day, the time and the rating background level (RBL). A summary of all relevant noise criteria is provided in the below sections.

#### **NSW Interim Construction Noise Guideline**

The standard construction hours are defined in the *Interim Construction Noise Guideline* (ICNG, DECC 2009) as:

- Monday to Friday 07:00 hrs to 18:00 hrs;
- Saturday 08:00 hrs to 13:00 hrs; and
- No work on Sundays or Public Holidays.

**Table 5** on the following page provides guidance noise management levels for residential premises for airborne construction noise, reproduced from the ICNG.

**Table 5.** Guideline Noise Levels for Residential Premises, Airborne Construction Noise (ICNG).

Time of Day	NML	How to Apply
<p>Standard hours</p> <p>Monday to Friday 7:00 am to 6:00 pm</p> <p>Saturday 8:00 am to 1:00 pm</p> <p>No work on Sundays or Public Holidays</p>	Noise Affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where the predicted (or measured LAeq (15 minute) is greater than the noise affect level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level</li> <li>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</li> </ul>
	Highly Noise Affected >75 dBA	<p>The highly noise affected level represents the point above which there may be a strong community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where noise is above the level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ul style="list-style-type: none"> <li>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>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times</li> </ul> </li> </ul>
Outside recommended standard hours	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> <li>A strong justification would typically be required for works outside the recommended standard hours</li> <li>The proponent should apply all feasible and reasonable work practices to meet the noise affected level</li> <li>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community</li> </ul>

### **Other Sensitive Land Uses and Commercial Receivers**

The Site is surrounded by a number of non-residential land uses. These include:

- Kingscliff TAFE, an educational facility approximately 10 m south/south-east;
- Kingscliff Library, approximately 380 m north-east;
- Tweed Regional Aquatic Centre, approximately 130 m east;
- Kingscliff High School, approximately 500 m south/south-east; and
- Jack Julius Park - passive recreational area, approximately 650 m south-east.

### **Residential Noise Criteria Summary**

The measured background noise levels are used to determine the noise management level (NML) for the project. These NMLs are summarised in **Table 6**.

**Table 6.** Noise Management Level (dB LAeq,15min) for Residential Receivers.

NCA	Logger ID <sup>1</sup>	Standard Hours (RBL+10)	Out of Hours (RBL +5)		
		Day	Day	Evening	Night
NCA-A	2	55	50	48	43
NCA-B	3	57	52	43	41

Note: No works are proposed or are undertaken during OOH time periods

Note 1: Logger ID based off Acoustic Studio Report. Two loggers were used for NCA-B (ID 1 and 3), the lowest logger data is used to establish controlling criteria as per the NPfl and INP (Industrial Noise Policy, 2000)

All calculated distance corrected Management Levels are identified in **Table 7** on the following page.

The SLMs for the project are set up within the construction site, so results from them cannot be directly compared with the Management Levels identified above because they are not measuring the level of noise received by the receptors.

ADE has calculated for each receptor the Management Levels based on:

- The distance in between the receptor and the location of the SLM;
- The distance in between the SLM and the location of the works performed; and
- Knowing that there is a reduction of approximately 6dB(A) for each doubling of distance.

**Table 7.** Calculated Noise Management Levels.

Location	Receptor	Management levels for the nearest receptors based on the distance in between the location of the works and the sound level meter [dB(A)]			
		>86 meters from SLM	86-43 meters from SLM	43-14 meters from SLM	14-6 meters from SLM
001 Adjacent to carpark – NGARA2	Hardy Electrical& Solar (Industrial) 43 meters from the SLM	Day: 75	Day: 81	Day: 87	Day: 93
	764 Cudgen Rd, Kingscliff (Residential) 36 meters from the SLM	>72 meters from SLM	72-36 meters from SLM	36-12 meters from SLM	12-5 meters from SLM
		Day: 73	Day: 79	Day: 85	Day: 91
		Evening: 63	Evening: 69	Evening: 75	Evening: 81
		Night: 57	Night: 63	Night: 69	Night: 75
Highly Noisy: 75	Highly Noisy: 81	Highly Noisy: 87	Highly Noisy: 93		
002 Central location – NGARA1	806 Cudgen Rd, Kingscliff (Residential) 56 meters from the SLM	>112 meters from SLM	112-56 meters from SLM	56-18 meters from SLM	18-8 meters from SLM
		Day: 73	Day: 79	Day: 85	Day: 91
		Evening: 62	Evening: 68	Evening: 74	Evening: 80
		Night: 56	Night: 62	Night: 68	Night: 74
		Highly Noisy: 75	Highly Noisy: 81	Highly Noisy: 87	Highly Noisy: 93
003 Eastern section – NGARA3	64 Cudgen Rd, Kingscliff (Residential) 50 meters from SLM	>94 meters from SLM	94-47 meters from SLM	47-15 meters from SLM	15-7 meters from SLM
		Day: 69	Day: 75	Day: 81	Day: 87
		Evening: 60	Evening: 66	Evening: 72	Evening: 78
		Night: 55	Night: 61	Night: 67	Night: 73
		Highly Noisy: 75	Highly Noisy: 81	Highly Noisy: 87	Highly Noisy: 93
	Tweed Regional Aquatic Centre – Kingscliff (Active recreation area) 105 meters from SLM	>166 meters from SLM	166-83 meters from SLM	83-27 meters from SLM	27-12 meters from SLM
	65 dB(A)	71 dB(A)	77 dB(A)	83 dB(A)	

*Note: Highlighted in yellow are the more restrictive levels.*

## 1.5 Survey Instrumentation and Methodology

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At all locations the SLM was enclosed in a tough case which remained at ground level with an extension pole attached to the case with the microphone mounted on top of the pole. The height of the microphone was approximately 1.5m above the ground level.

A wind shield was placed on each microphone to reduce any wind interference during the measurements. The SLM's microphone is orientated toward the noise sources for all measurements and the area in between the sound level and the noise source was free from any temporary obstacles.

Measurements were carried out since the commencement of the background monitoring on the 26 July 2019 and record in all weather conditions.

The primary measurement parameter was the equivalent continuous A-weighted Sound Pressure Level,  $L_{Aeq}$  15. The  $L_{Aeq}$  15 is the average sound level recorded over 15 minutes. The A-weighting is used as it places emphasis on the middle frequencies of the noise spectrum, while putting less emphasis on the higher and lower frequencies. This emulates the way the human ear responds to sound.

An alarm beacon was set-up with the noise monitors to alert Lendlease and the Site Supervisor in the case of an exceedance in real-time. If the alarm was triggered, Lendlease and the Site Supervisor would receive an email and need to note the date and time, document the activity and consider implementing controls and reviewing work practices before re-commencing works.

Monthly checks of the levels of noise measured by each SLM are being carried out to validate the data with a portable sound level calibrator. If the instrumentation system registers a discrepancy equal to or greater than 1 dB between consecutive checks, any measurement in the interval between the two checks will be considered invalid.

Lendlease has established a daily check list on site to ensure all monitors are operating in the field correctly, have adequate sunlight to power the units and that they are reporting consistently. Lendlease will report any issues immediately to ADE. Furthermore, ADE will conduct daily checks via telemetry to ensure the monitors are operating and recording correctly. ADE are to advise Lendlease of any issues immediately. Monitors will not be removed unless consultation with Lendlease, TSA and HI has occurred and alternative locations are agreed upon.

## 1.6 Existing Noise Environment

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The main noise sources in the area are:

- Construction noise from the Site, including trucks moving to and from the Site;
- Traffic noise (trucks and cars) from the adjacent roads (Cudgen Road);
- Foot traffic noises from workers/people walking around and past the Site; and
- Noises from the workers and mobile plant who use the parking area.



## **1.7 Meteorological Conditions**

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Measurements under raining and windy conditions (greater than 18 Km/h) increase the measured levels of noise and when this happens noise levels measured can become highly variable. Noise levels during raining and windy conditions were not included in the results of this report due to the high variability that these weather conditions may cause.

Meteorological conditions representative of the site have been provided by the Coolangatta weather station from the Bureau of Meteorology from the Australian Government. The Coolangatta weather station is the closest weather station that provides rainfall and wind data in 15-minute intervals that are required to accurately assess the noise levels.

## **1.8 Out of Hours Work**

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Nil for this period.

## **1.9 Missing Data**

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During a routine telemetry check on Monday 6 December 2021, ADE noticed that the Noise/Vibration monitor at monitoring location 001 was not online and had stopped recording on Sunday 5 December 2021. ADE attended site on 6 December 2021 and reset the monitor.

## 2 Results

Results from the A-weighted equivalent continuous noise level over a 15-minute period for each monitoring location are shown in Appendix III. Data recorded during rain or windy periods has been omitted from the results of this report, as these values are highly variable. Please note all data is presented in Australian Eastern Daylight Time (AEDT).

A summary of the results of the monitoring survey are presented below in **Table 8**.

**Table 8.** Unattended Noise Monitoring Results.

Logger ID	Measured Noise Levels, dBA							
	Average Noise Level (L <sub>Aeq</sub> )			Background Noise Levels (RBL)			RNP Defined Noise Level (L <sub>Aeq</sub> ) <sup>1</sup>	
	Day	Evening	Night	Day	Evening	Night	Day, 15 hr	Day, 1 hr
001	68	65	61	54	44	41	69	57
002	66	68	58	52	46	42	68	55
003	61	59	54	49	46	45	60	49

Note: The EPA document Road Noise Policy (RNP, 2011) is used to provide road traffic noise levels for the 15-hour day-time period, and the busiest daytime 1-hour. These levels are for historical correlation purposes.

Legitimate construction noise impacts (such as loud bangs, dropping of heavy machinery, jack hammering/rock breaking, alarms etc) would be impacted at all three (3) loggers with varying noise levels, correlated through graphical analysis.

When an event occurs it is discarded if it cannot be demonstrated that the event occurred on site which could be viewable within the graphs at all three (3) locations. An event which is detected at each three (3) locations can be reasonably assumed to have occurred on site and is then investigated further.

Twenty-Eight (28) noise events were identified during this monitoring period for further investigation. Three (3) events were associated with road traffic noise (i.e., a truck horn or airbrake) occurring along Cudgen Road. Five (5) events did not correlate with any construction activities and are therefore assumed to be an unknown off-site source as they are not consistent with RTN. They are not judged to be noise events occurring on site, or within the boundary of the project. These events were dismissed from the analysis.

Twenty (20) noise events were identified as occurring on-site. All of these events were associated with machinery (crane or forklift) working within close proximity (<5 metres) of the logging equipment. Once these noise events are distance corrected to calculate the noise level experienced at the receiver, they are all below the relevant noise management limits (NMLs).

## 3 Discussion

The measured noise levels presented in **Table 8** and Appendix *III – Noise Graphs* provide context to the ambient noise levels.

Generally, the measured noise levels presented in this report (and by extension past historical reporting) have been dominated and controlled by the ambient road traffic noise levels.

The historical graphs provided in **Section 1.2** illustrates peak-hour traffic in the morning and evening time periods, with consistent traffic throughout the day. The impact from any construction is judged to be at least 10 dB lower than the road traffic noise levels, as the levels have not conclusively changed over time.

Twenty (20) of the other measured noise events occurring throughout the month of December 2021 are judged to be a noise source originating from the construction works, however once distance corrected are below NMLs.

Therefore, no noise exceedances occurred throughout the month of December 2021, thereby indicating adherence to the Lendlease Building Pty Ltd Tweed Valley Hospital – Management Plan – Noise and Vibration.

No further mitigation is required as the project is compliant against the noise management levels, and therefore the development consent conditions in which the project is approved under.

## 4 Conclusion

The projects' noise criteria are met at all times, and do not exceed the limitations outlined within the relevant documentation approved within the Development Consent (SSD-10353). The works are compliant against the relevant guidelines, policies, procedures, and standards relating to vibration on construction sites.

## 5 References

Relevant documents pertaining to the measurement of noise in Australia are provided below.

These documents provide guidance in which the measurement of construction noise, and the management of noise in New South Wales is undertaken.

- AS 1055:2018 Acoustics – Description and measurement of environmental noise.
- AS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors.
- AS 2659.1-1998 Guide to the use of sound measuring equipment – Portable sound level meters.
- Development Consent SSD-10353, Department of Planning, Industry and Environment – Tweed Valley Hospital Stage 2 – 12 July 2020 (approval).
- Interim Construction Noise Guideline (ICNG, DECC 2009).
- Noise Policy for Industry (NPfi, EPA 2017).
- Sydney Metro Construction Noise and Vibration Standard (v4.1, 2020).
- Transport for New South Wales Construction Noise and Vibration Strategy (TfNSW, 2019).
- Tweed Valley Hospital Management Plan – Noise and Vibration, Revision 7.0, Lendlease Building Pty Ltd.
- Tweed Valley Hospital – Noise and Vibration Impact Assessment for State Significant Development (SSD), SVM-2370, Revision: Issue 2, 17 October 2018 – Acoustic Studio.

# Appendix I – Aerial Photograph

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Aerial photograph of the Tweed Valley Hospital Project at Cudgen, NSW (as of 15 November 2021).

## Appendix II – Monitoring Locations

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Photograph 1 Representative photograph of monitoring location 001 – Adjacent Carpark location, as observed 08/12/2021





Photograph 2 Representative photograph of monitoring location 002 – Central location, as observed 08/12/2021



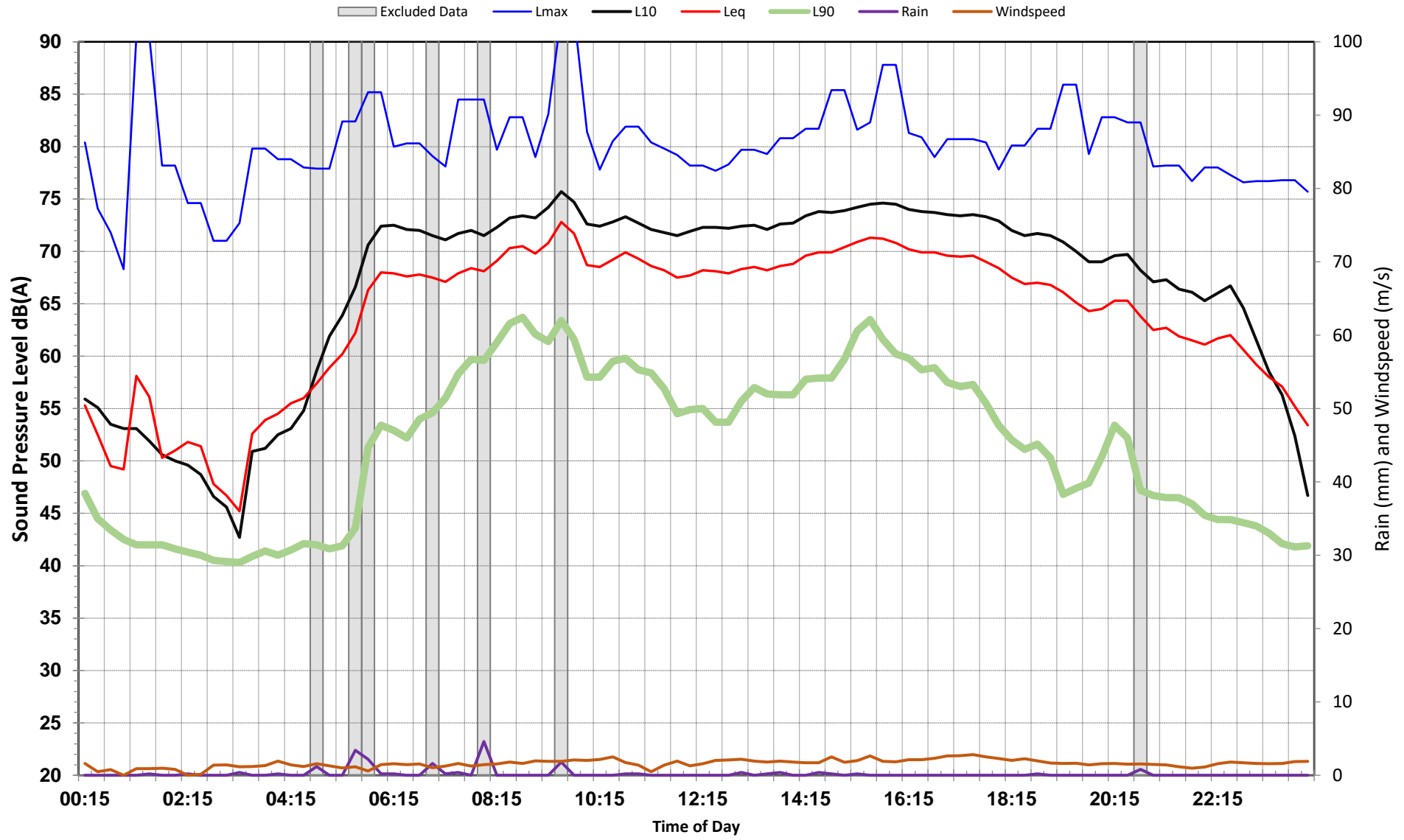
Photograph 3 Representative photograph of monitoring location 003 – Eastern Section of Site, as observed 08/12/2021

## Appendix III – Noise Graphs

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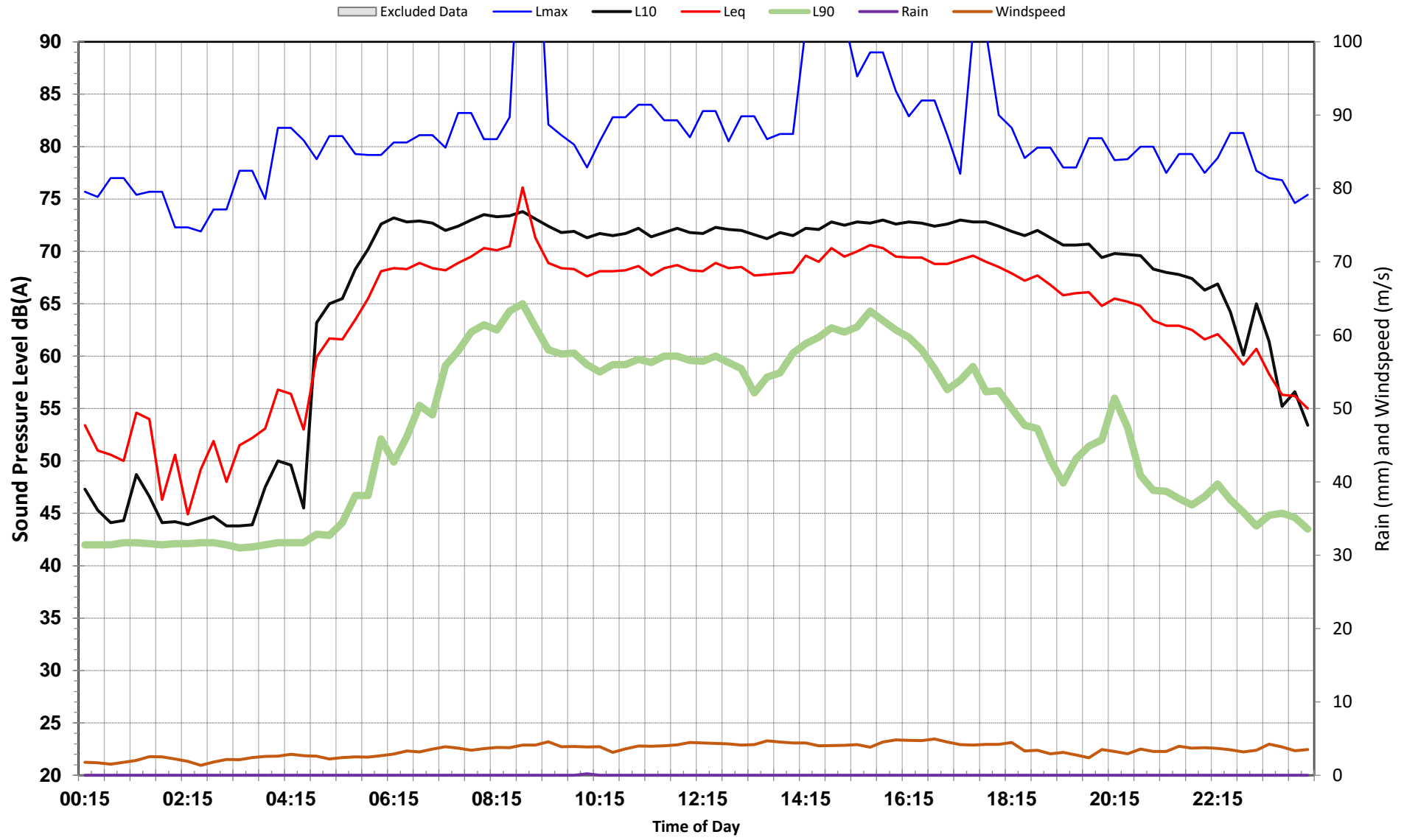
# 001 - Adjacent Car Park | Tweed Valley Hospital

Wednesday, 1 December



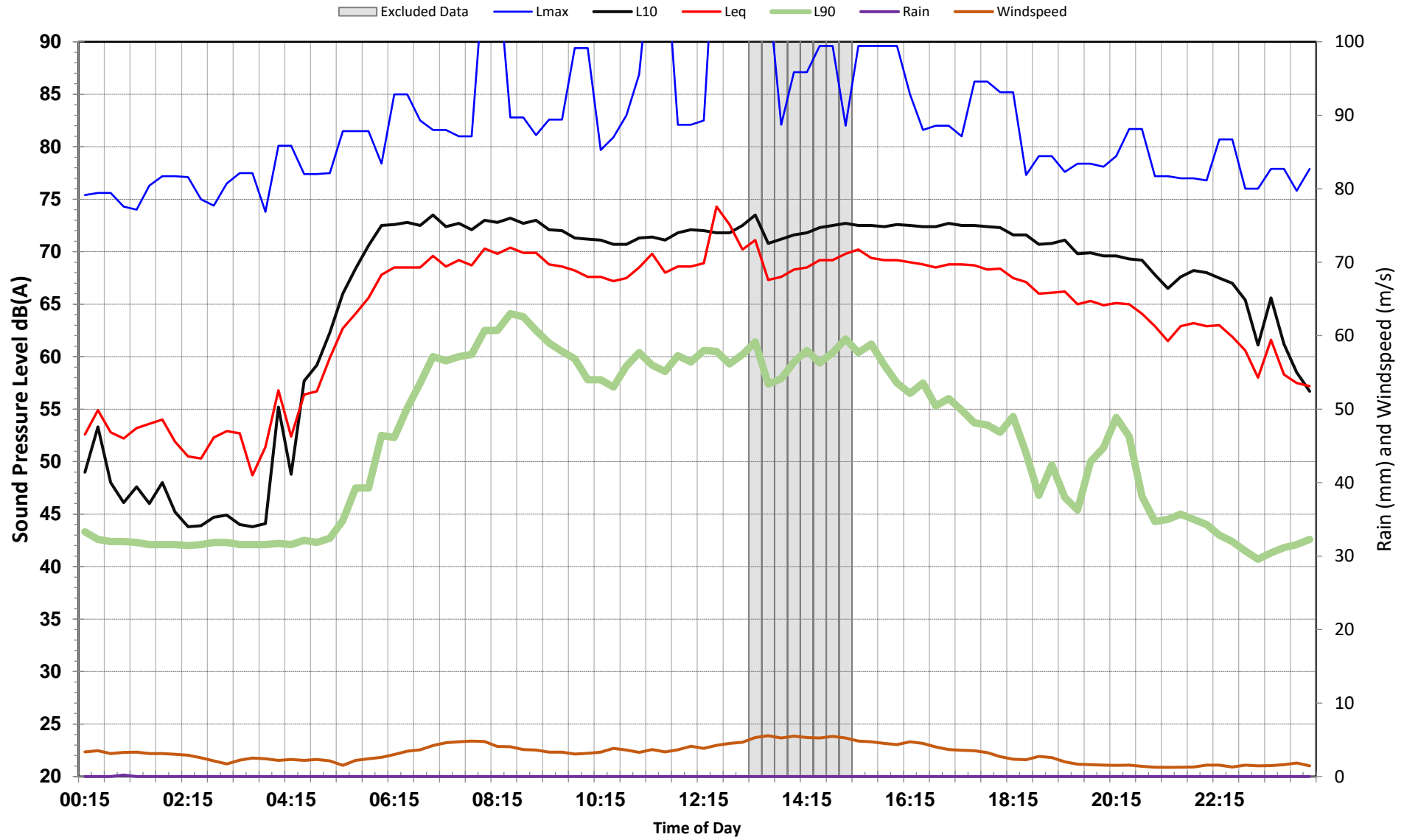
# 001 - Adjacent Car Park | Tweed Valley Hospital

Thursday, 2 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

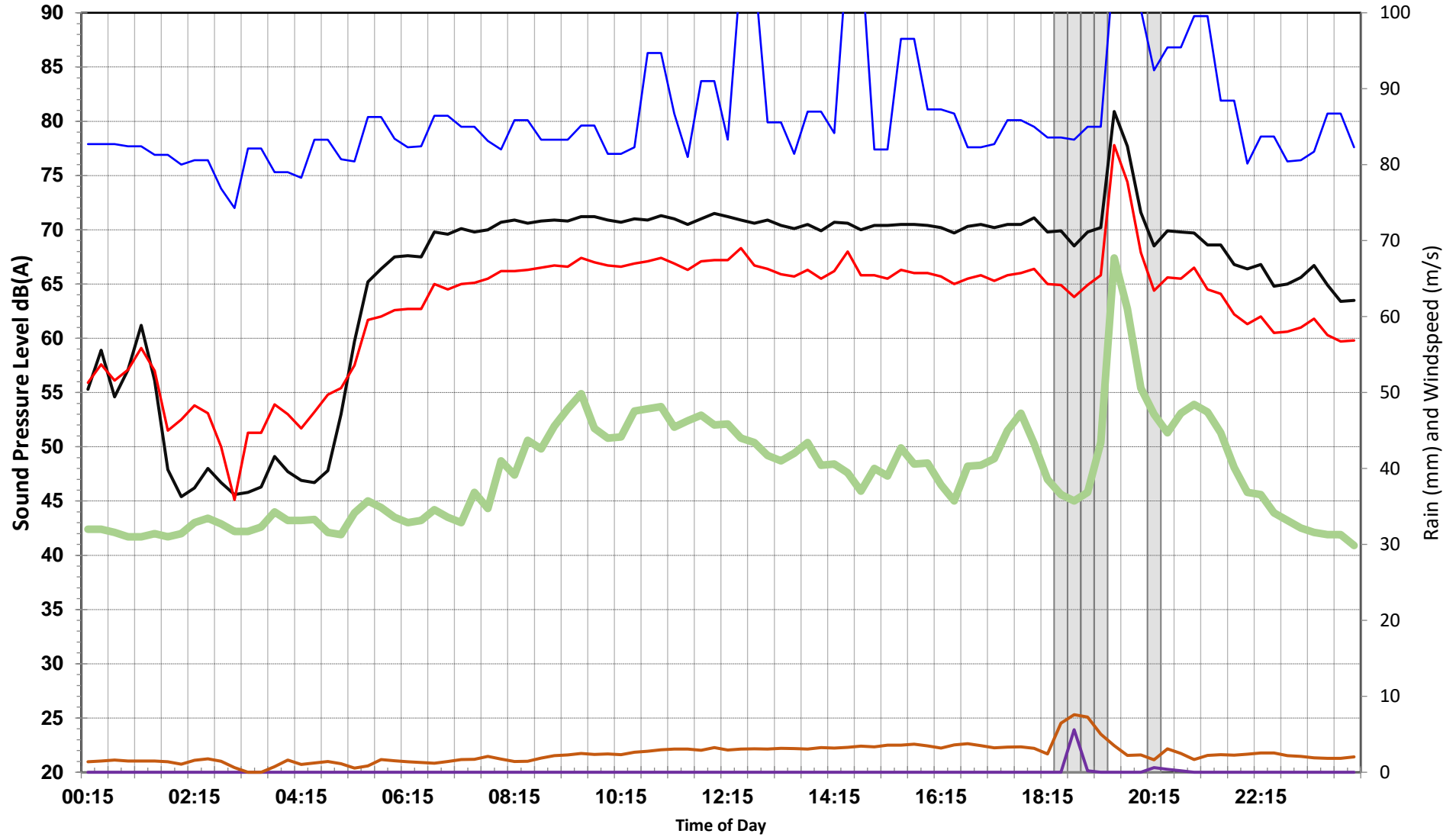
Friday, 3 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

Saturday, 4 December 2021

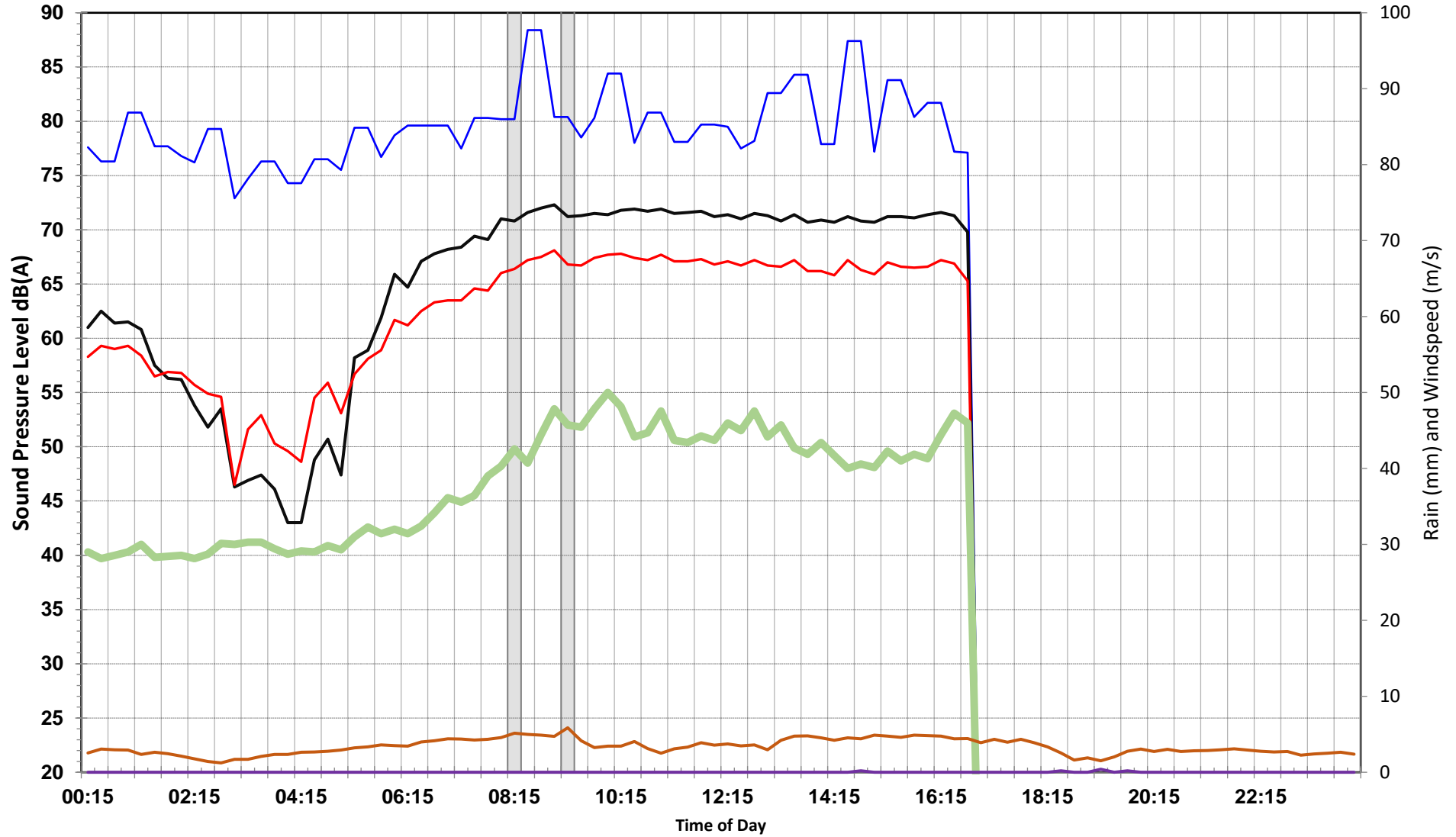
Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 001 - Adjacent Car Park | Tweed Valley Hospital

Sunday, 5 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed

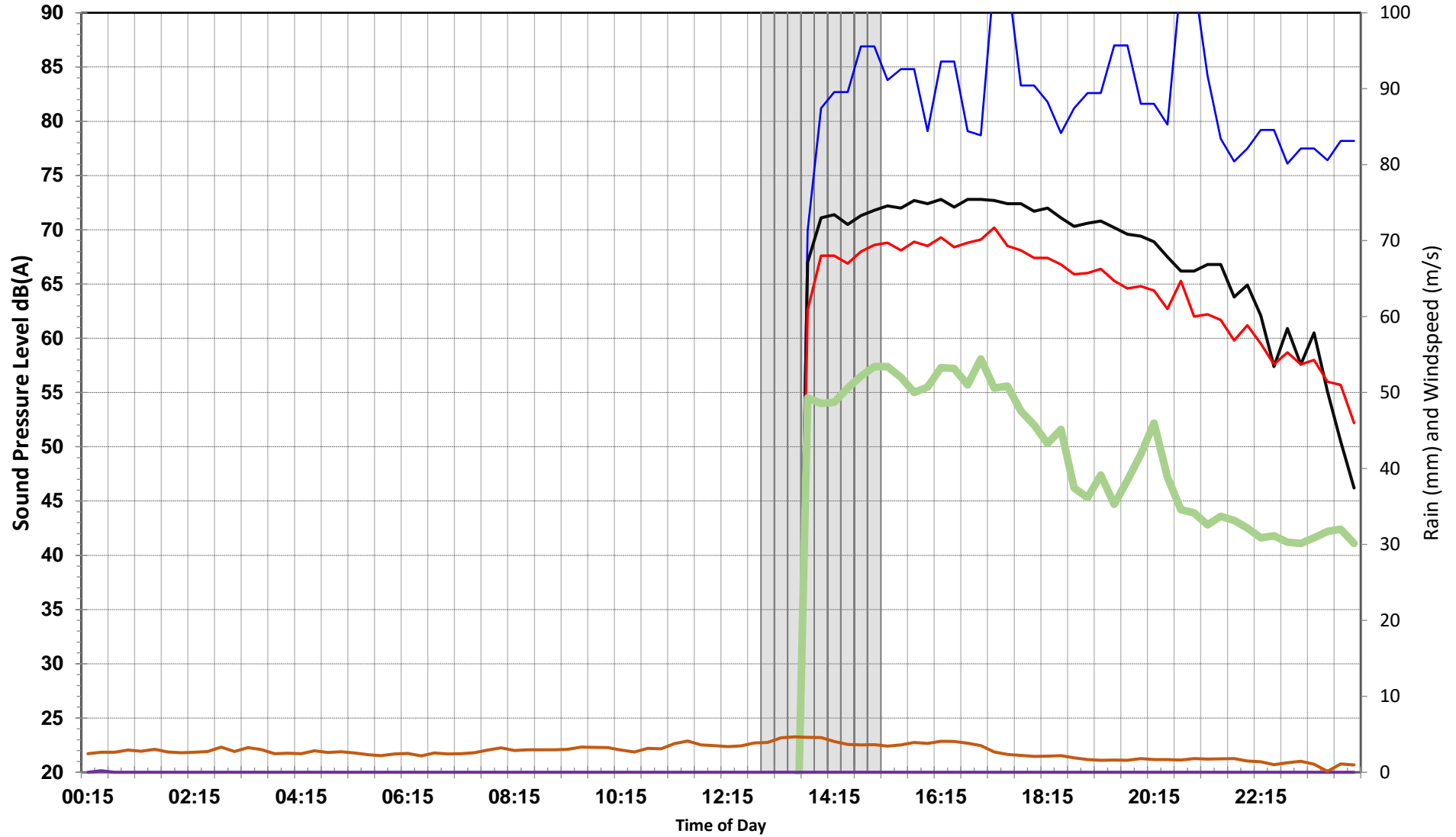




# 001 - Adjacent Car Park | Tweed Valley Hospital

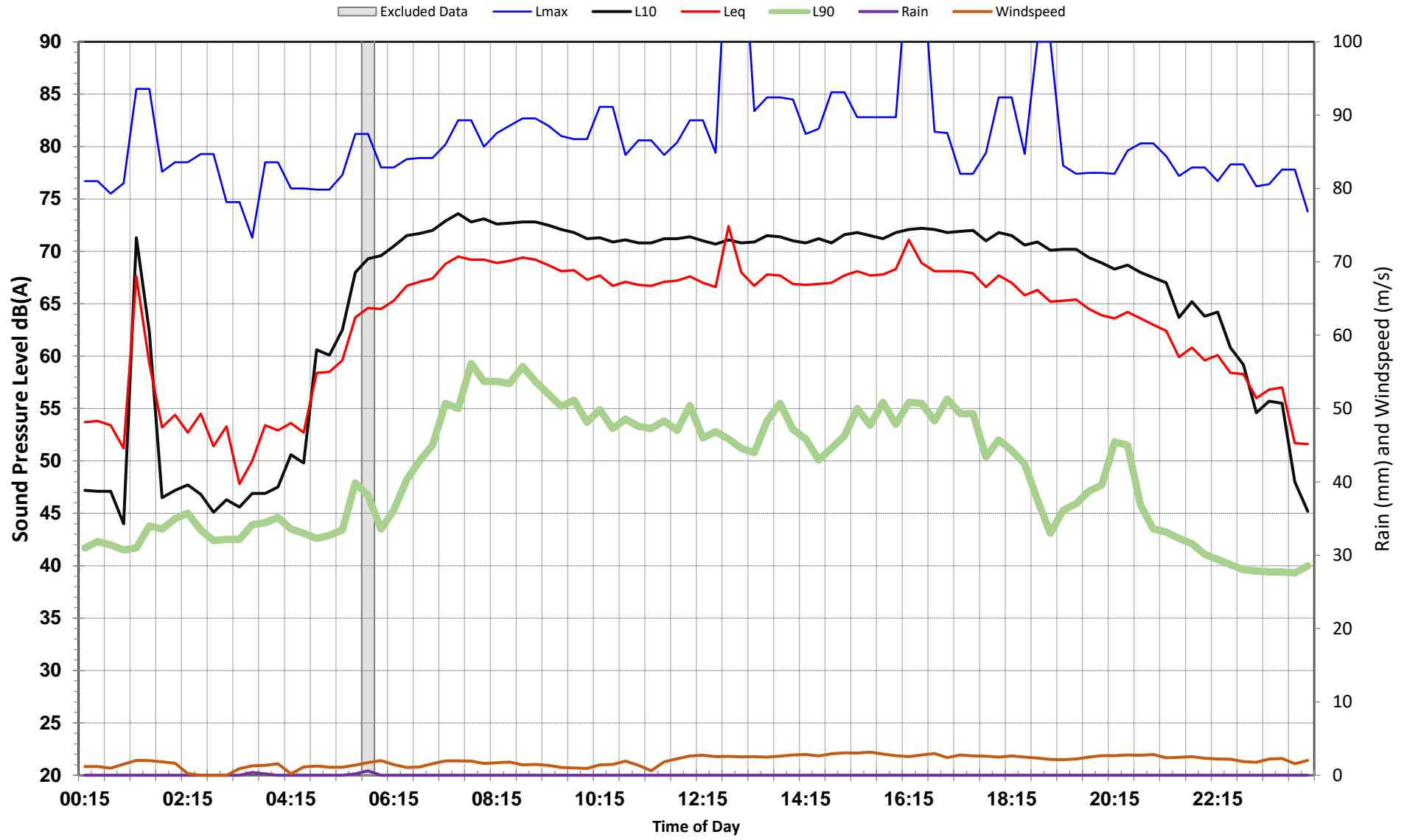
Monday, 6 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed



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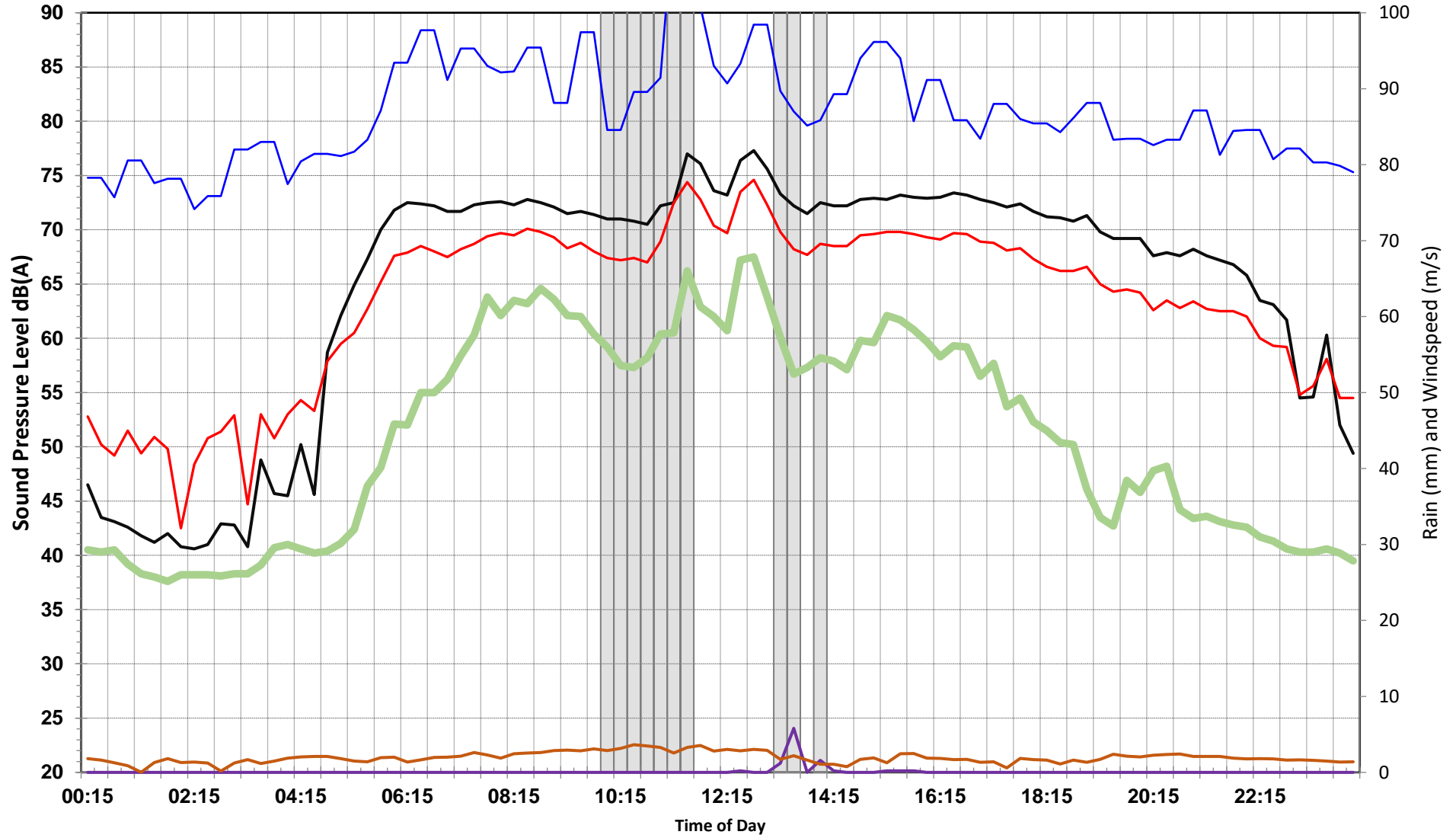
Tuesday, 7 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

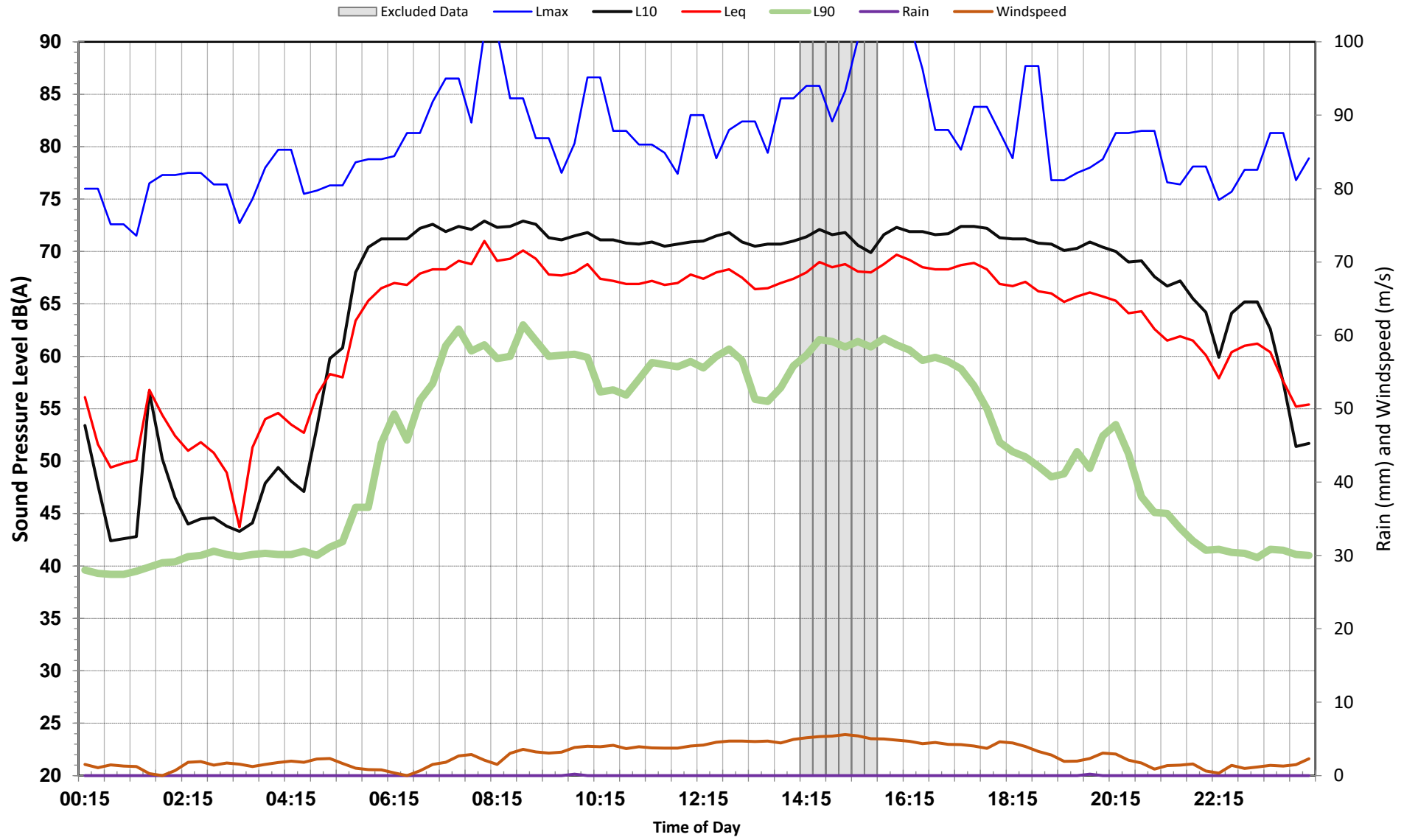
Wednesday, 8 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 001 - Adjacent Car Park | Tweed Valley Hospital

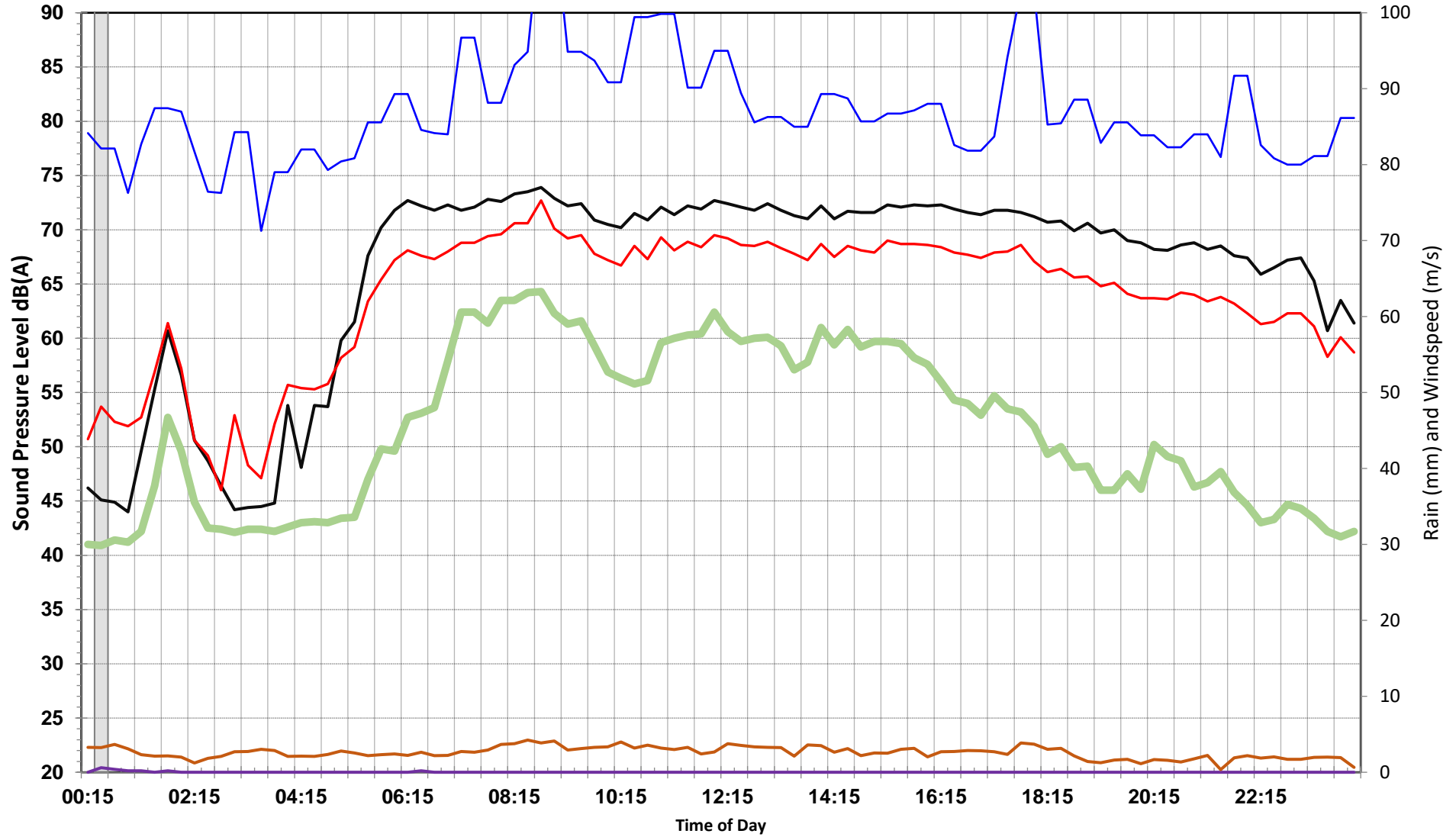
Thursday, 9 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

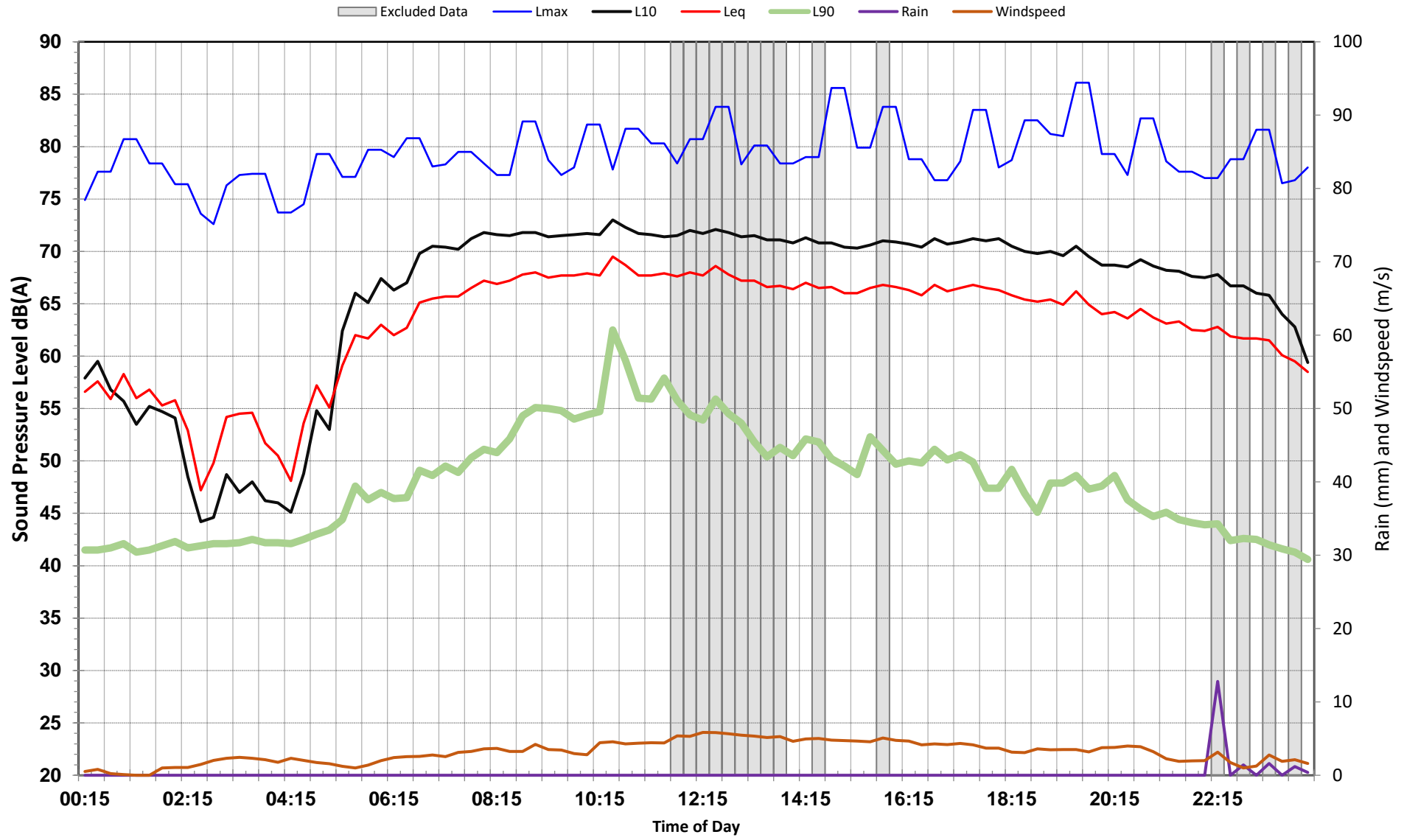
Friday, 10 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 001 - Adjacent Car Park | Tweed Valley Hospital

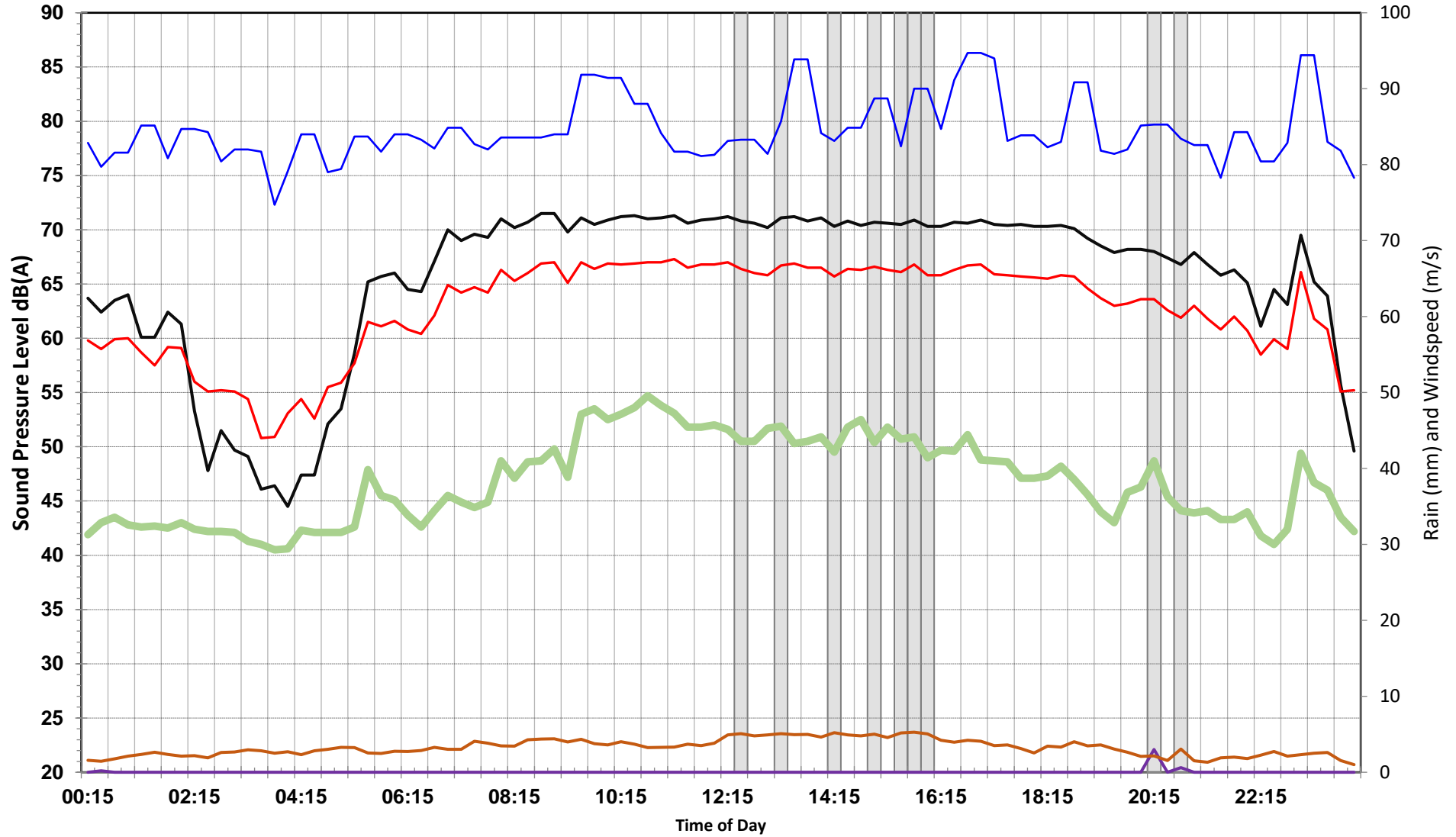
Saturday, 11 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

Sunday, 12 December 2021

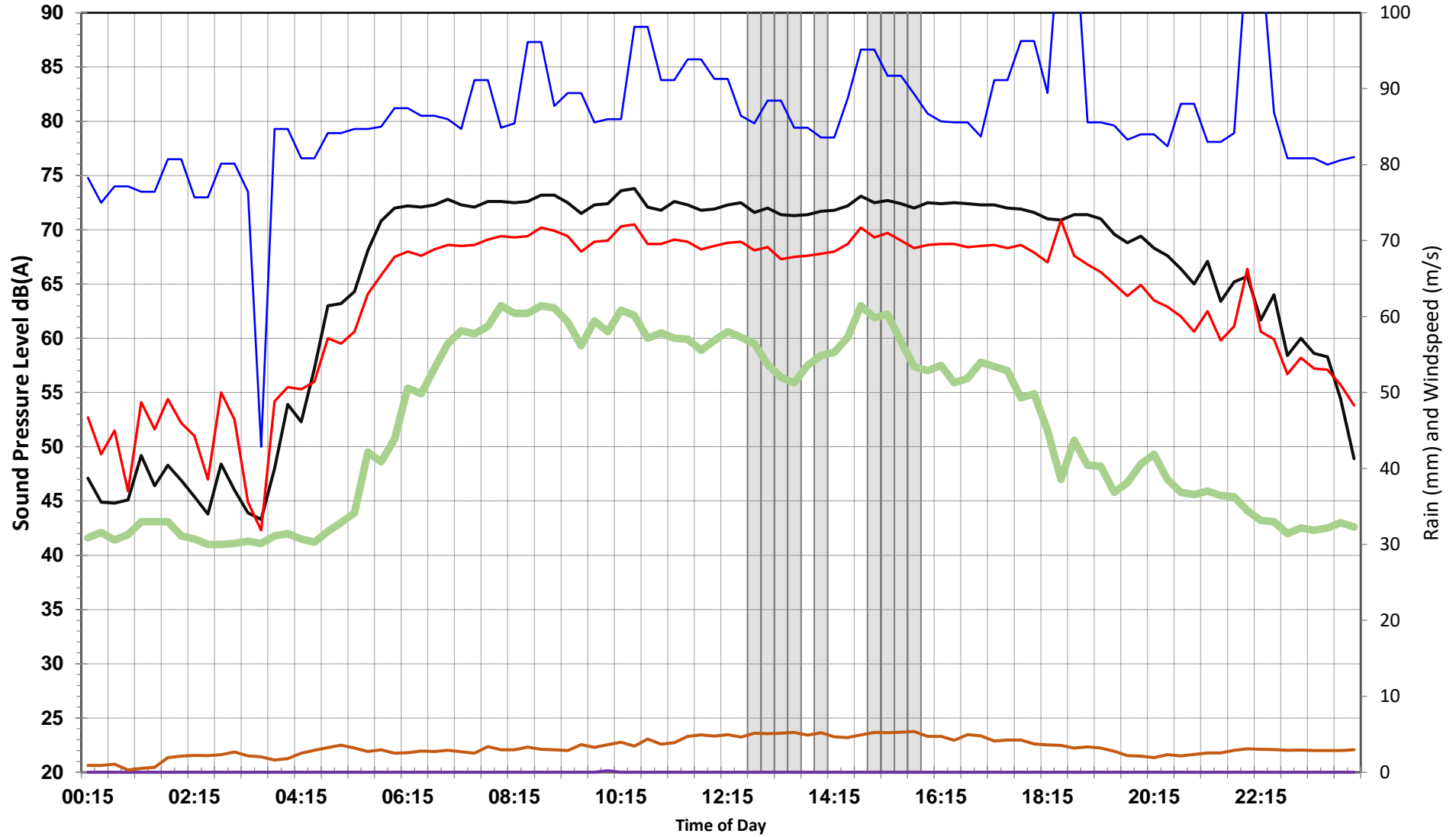
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# 001 - Adjacent Car Park | Tweed Valley Hospital

Monday, 13 December 2021

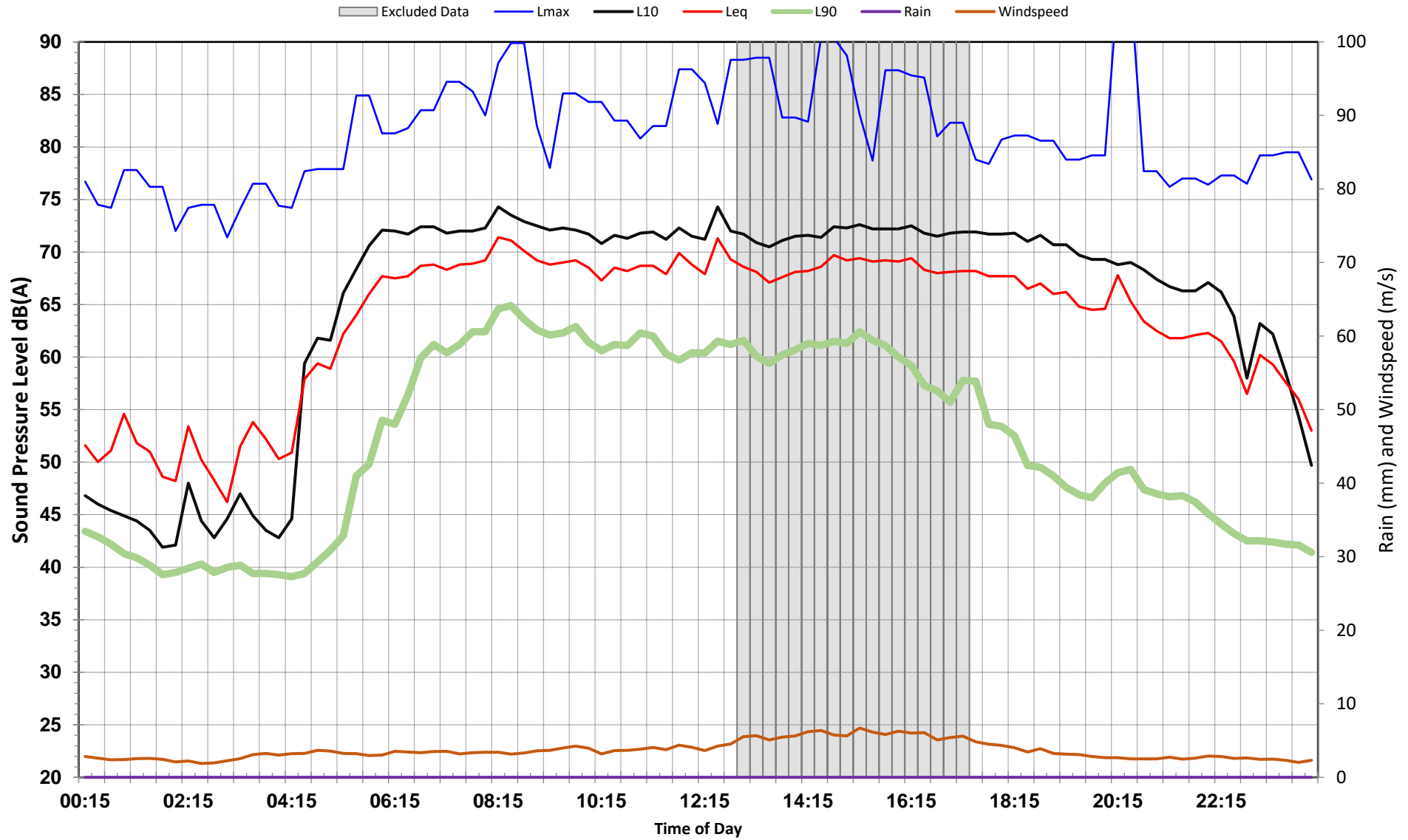
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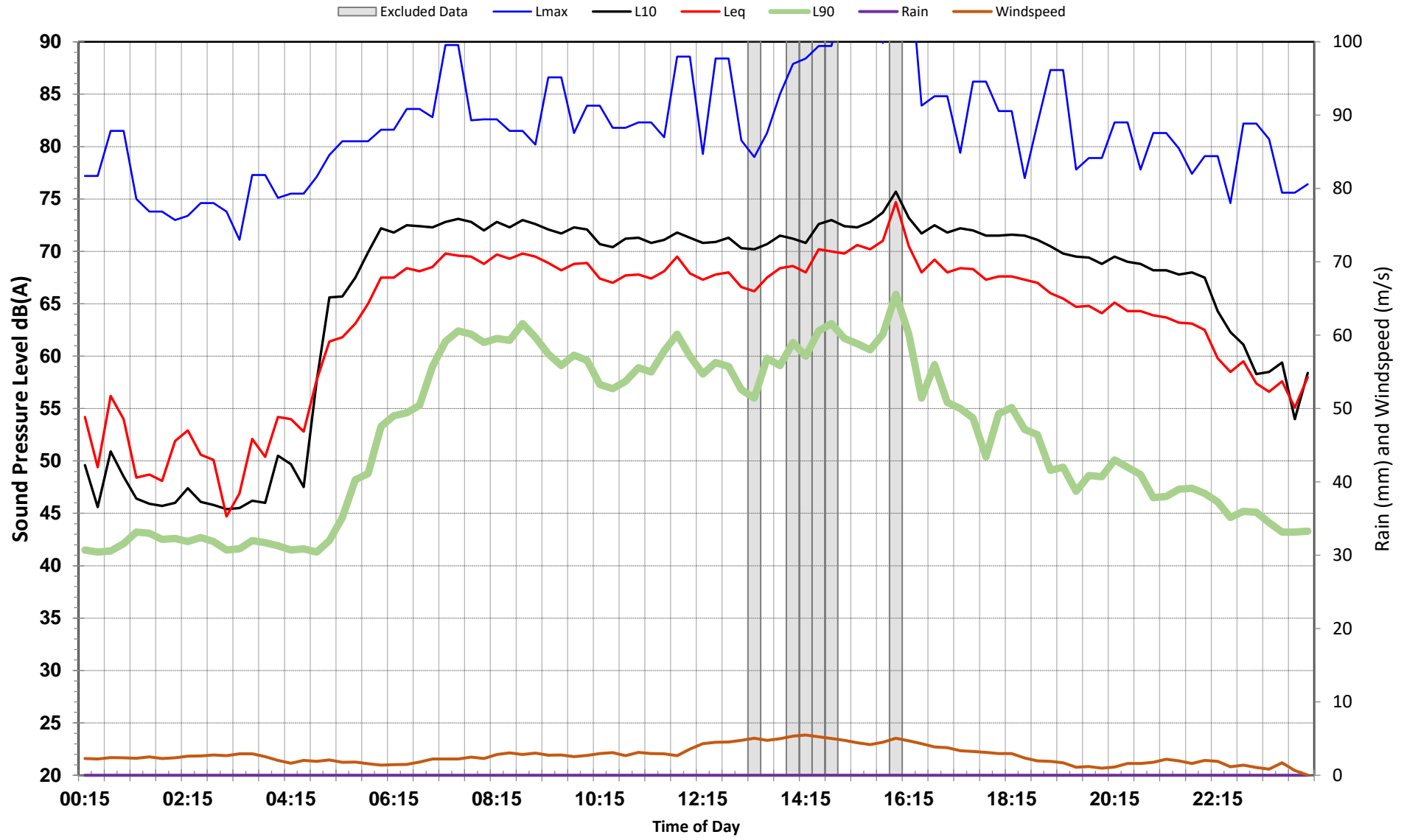
# 001 - Adjacent Car Park | Tweed Valley Hospital

Tuesday, 14 December 2021



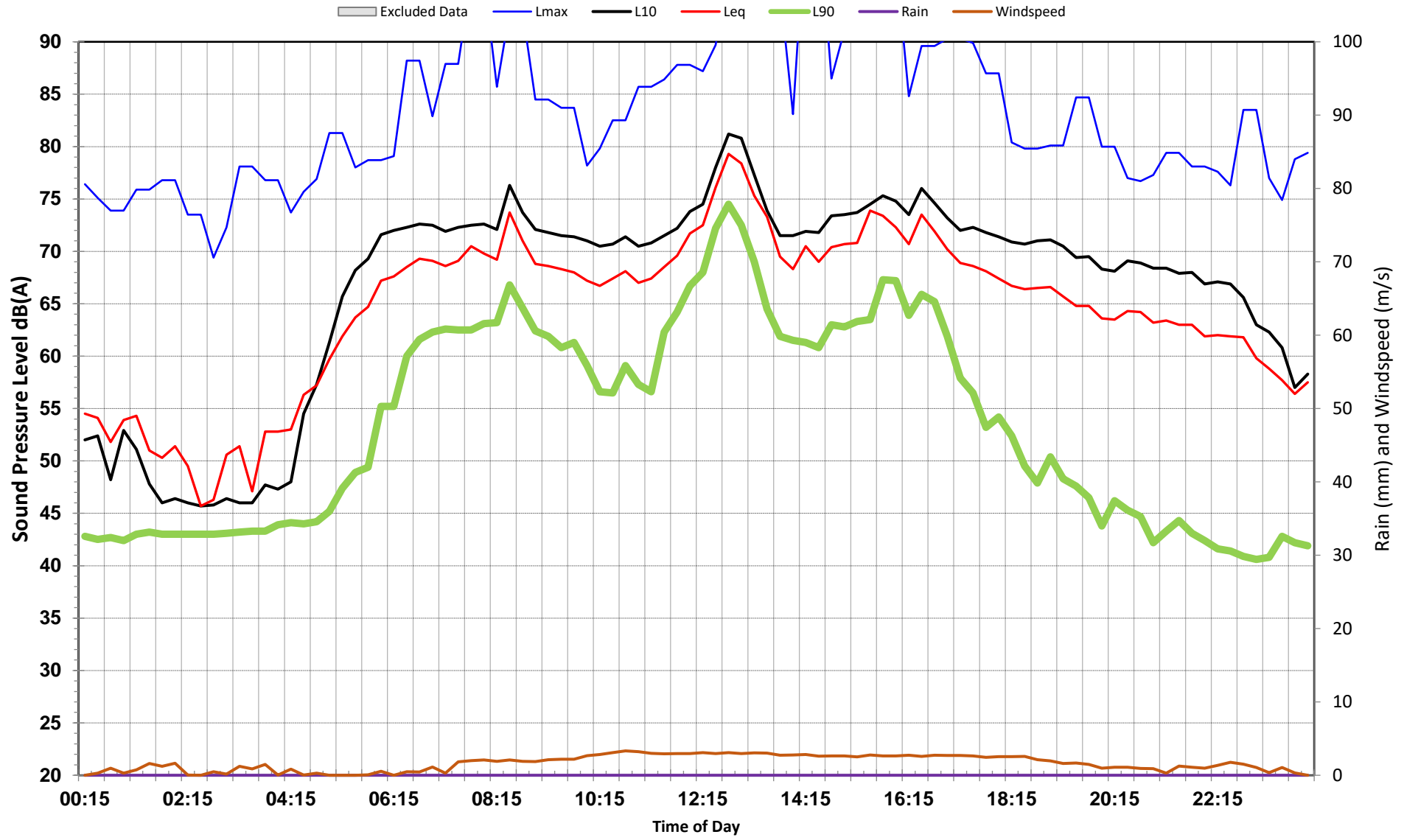
# 001 - Adjacent Car Park | Tweed Valley Hospital

Wednesday, 15 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

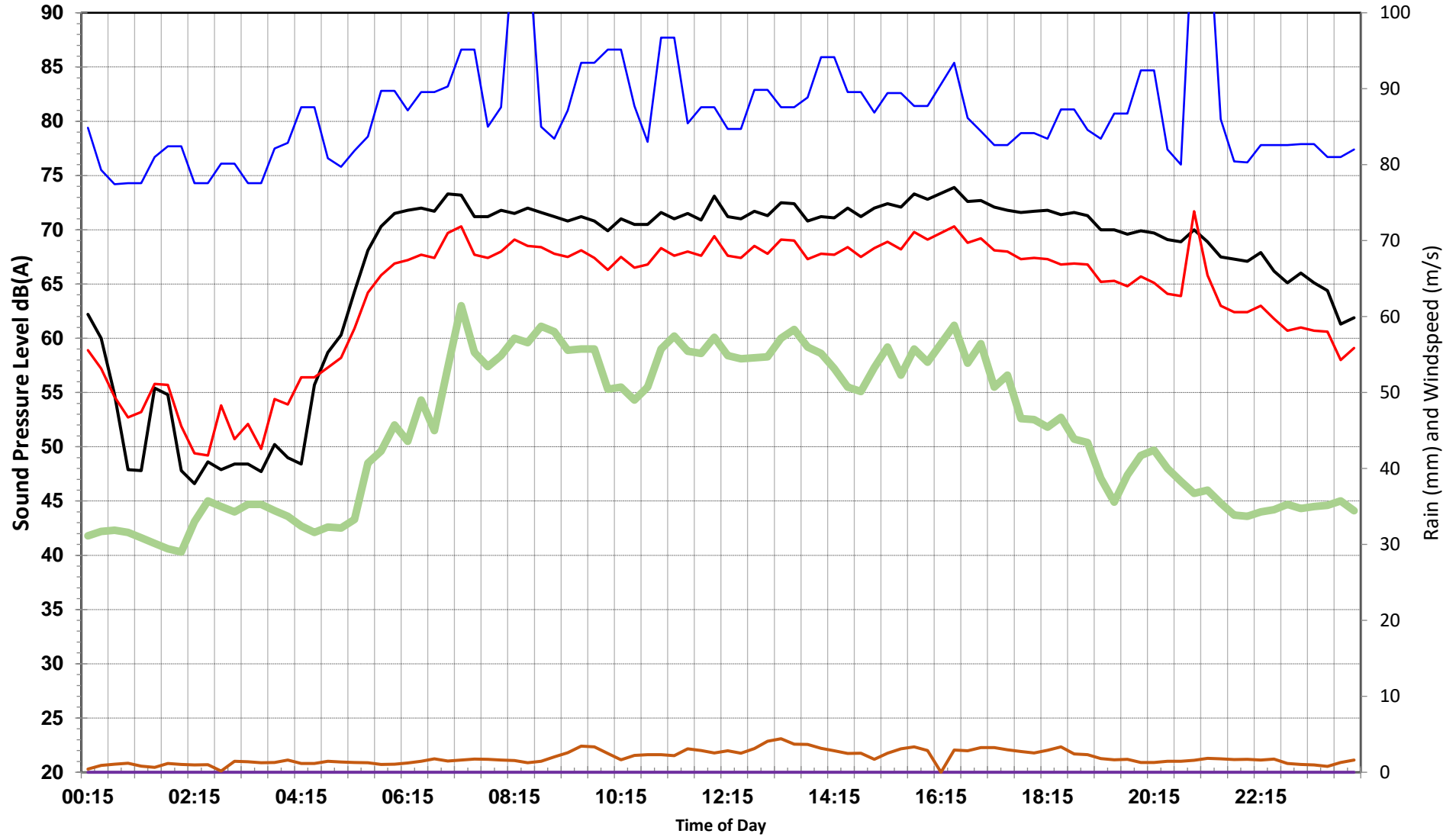
Thursday, 16 December 2021



# 001 - Adjacent Car Park | Tweed Valley Hospital

Friday, 17 December 2021

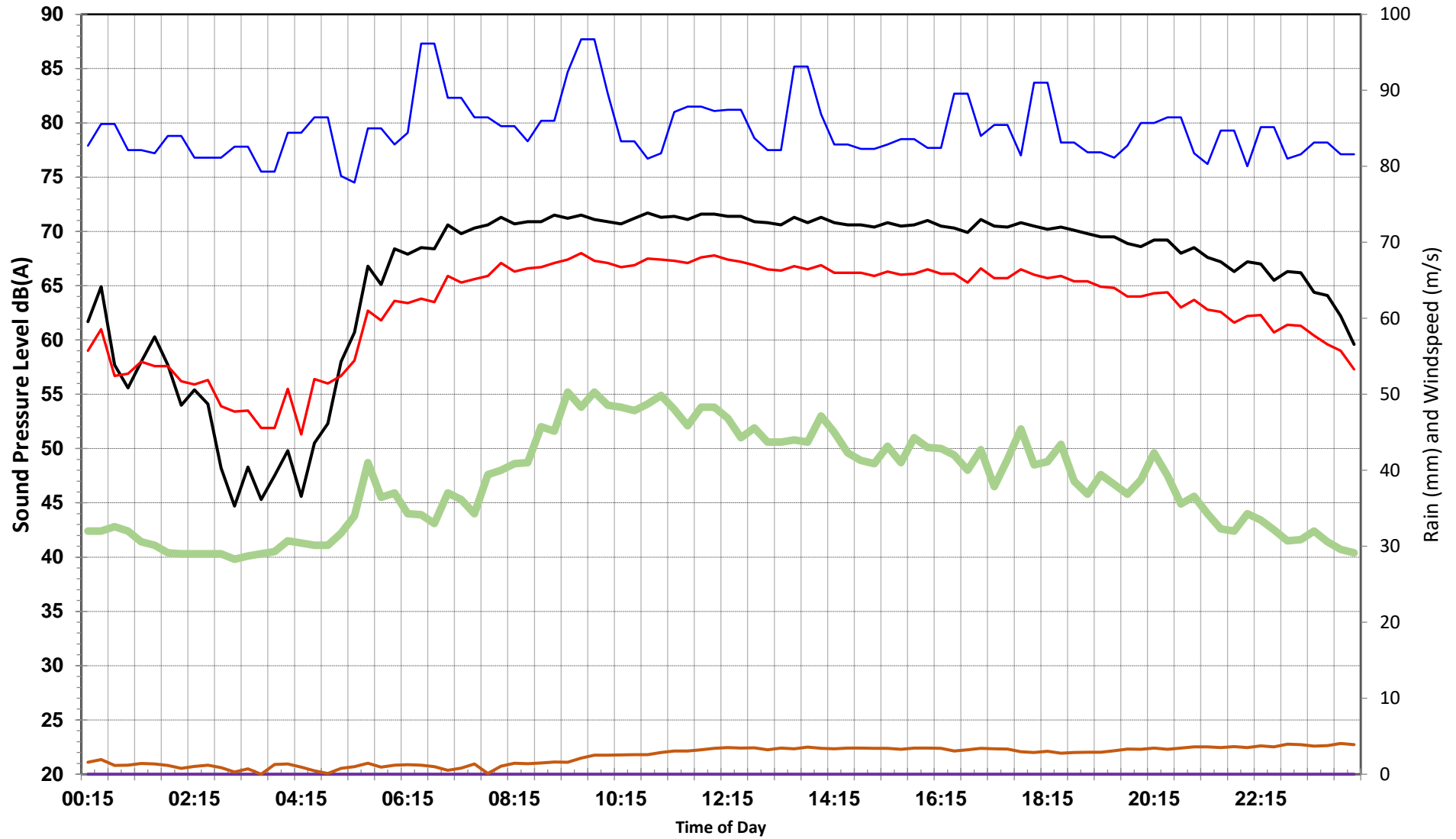
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# 001 - Adjacent Car Park | Tweed Valley Hospital

Saturday, 18 December 2021

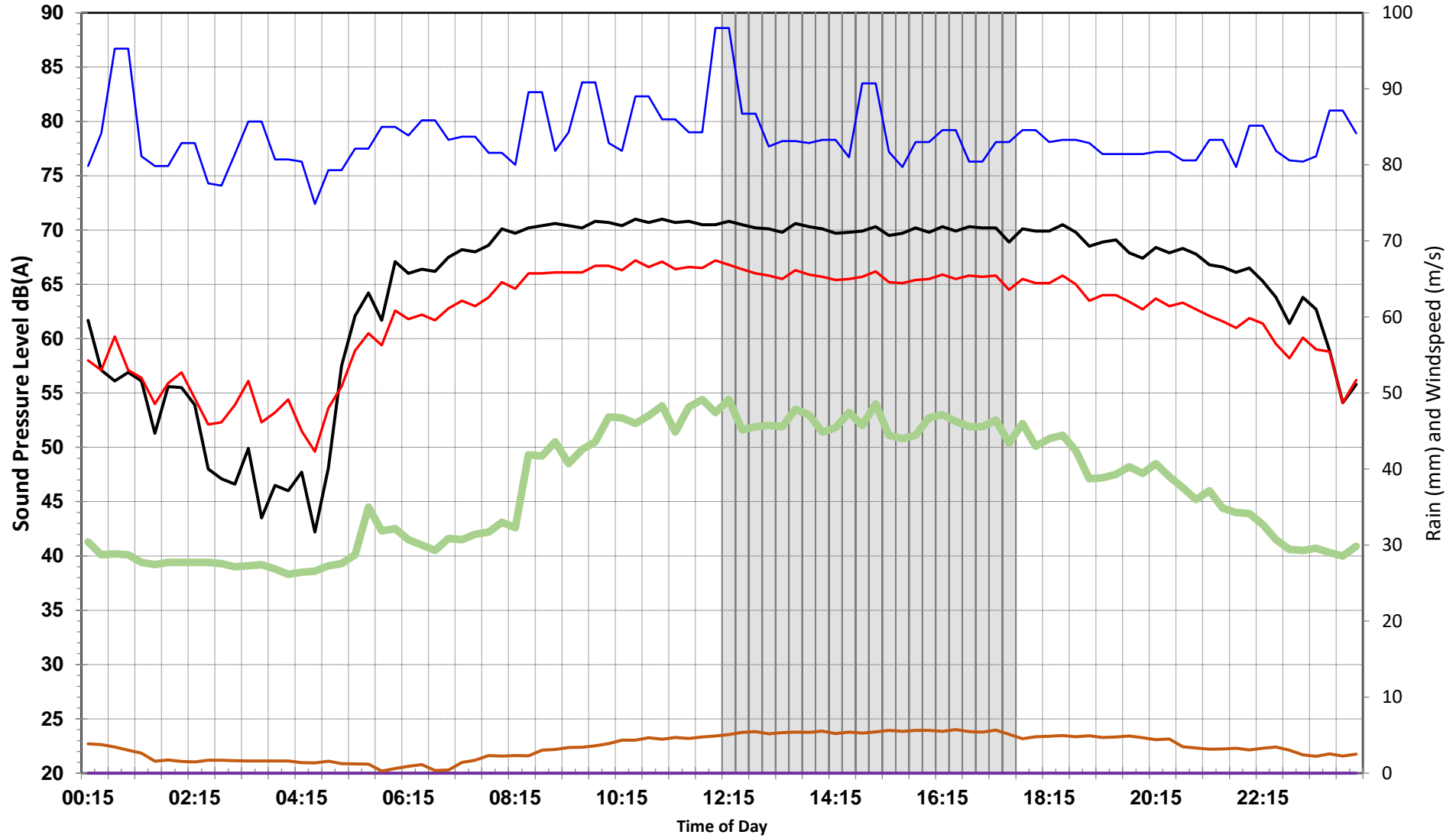
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# 001 - Adjacent Car Park | Tweed Valley Hospital

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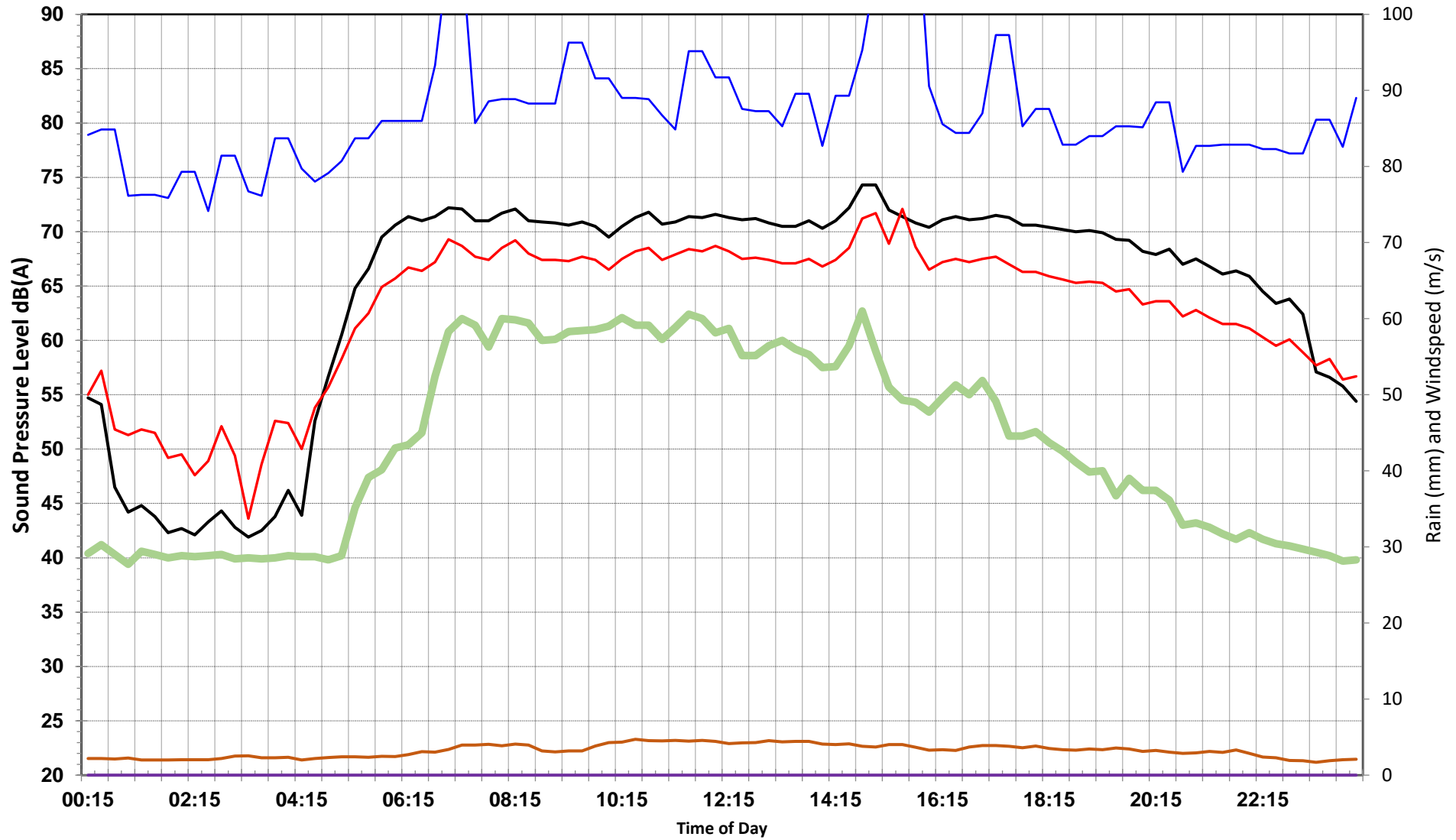
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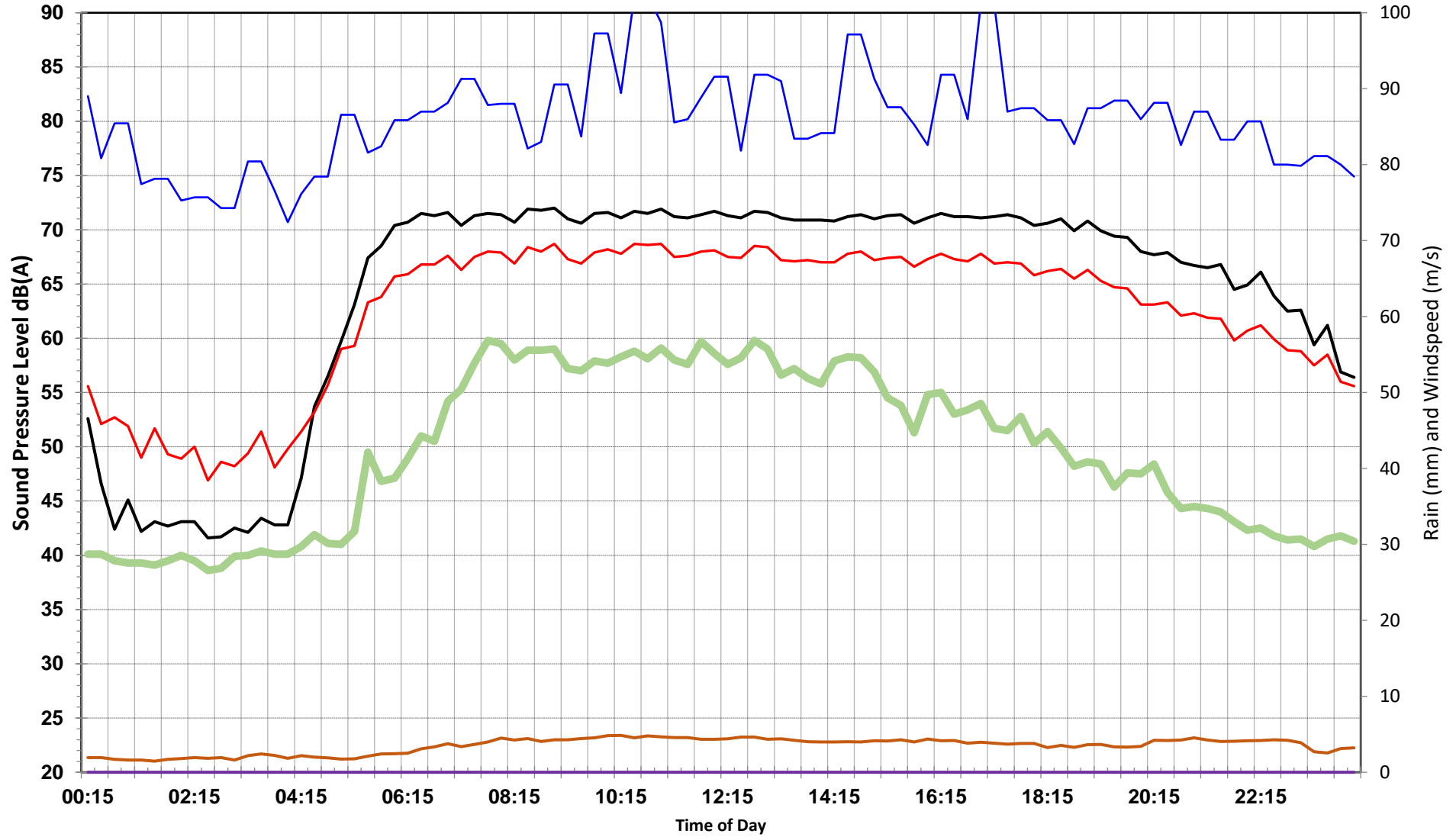
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# 001 - Adjacent Car Park | Tweed Valley Hospital

Tuesday, 21 December 2021

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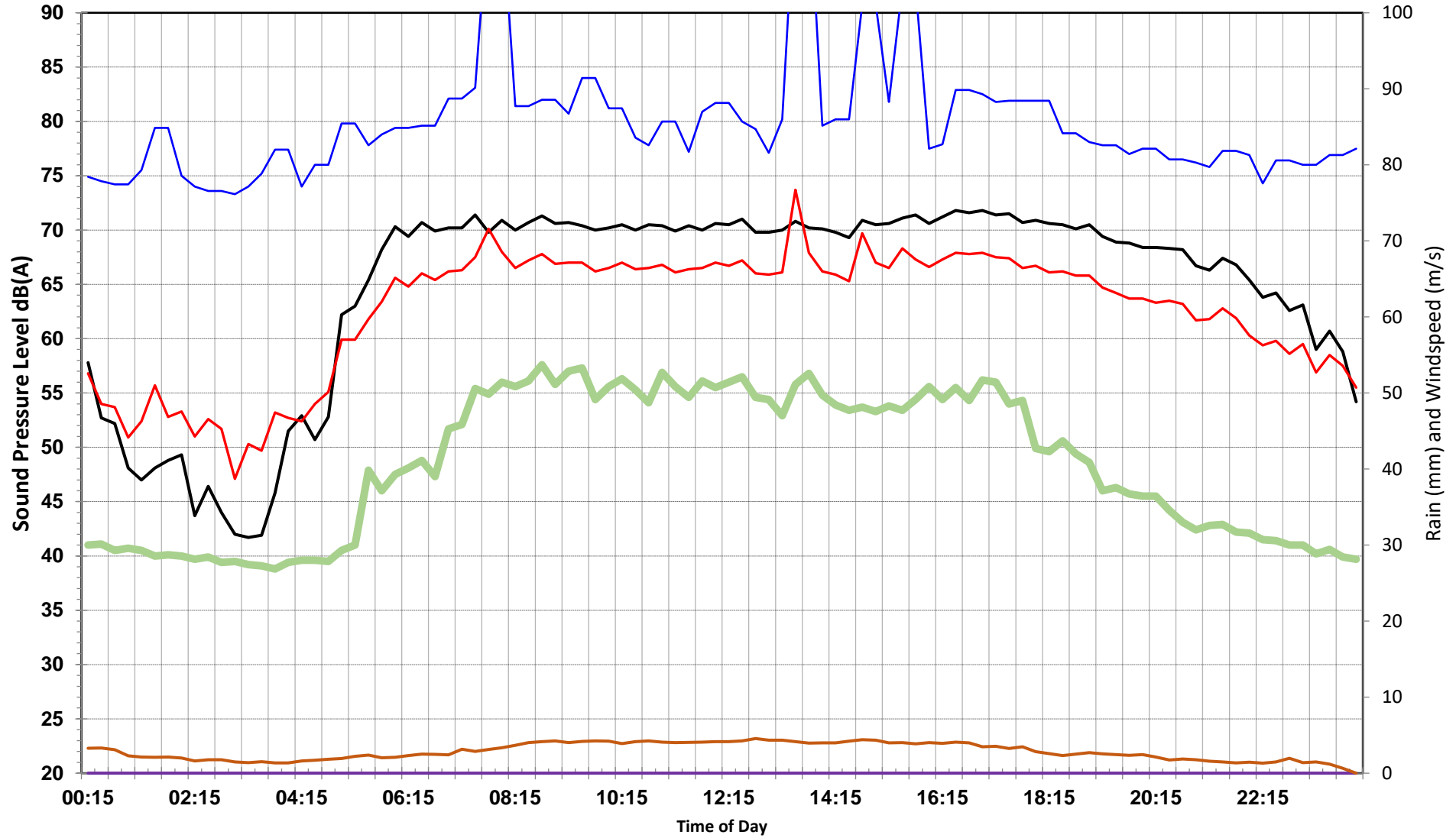




# 001 - Adjacent Car Park | Tweed Valley Hospital

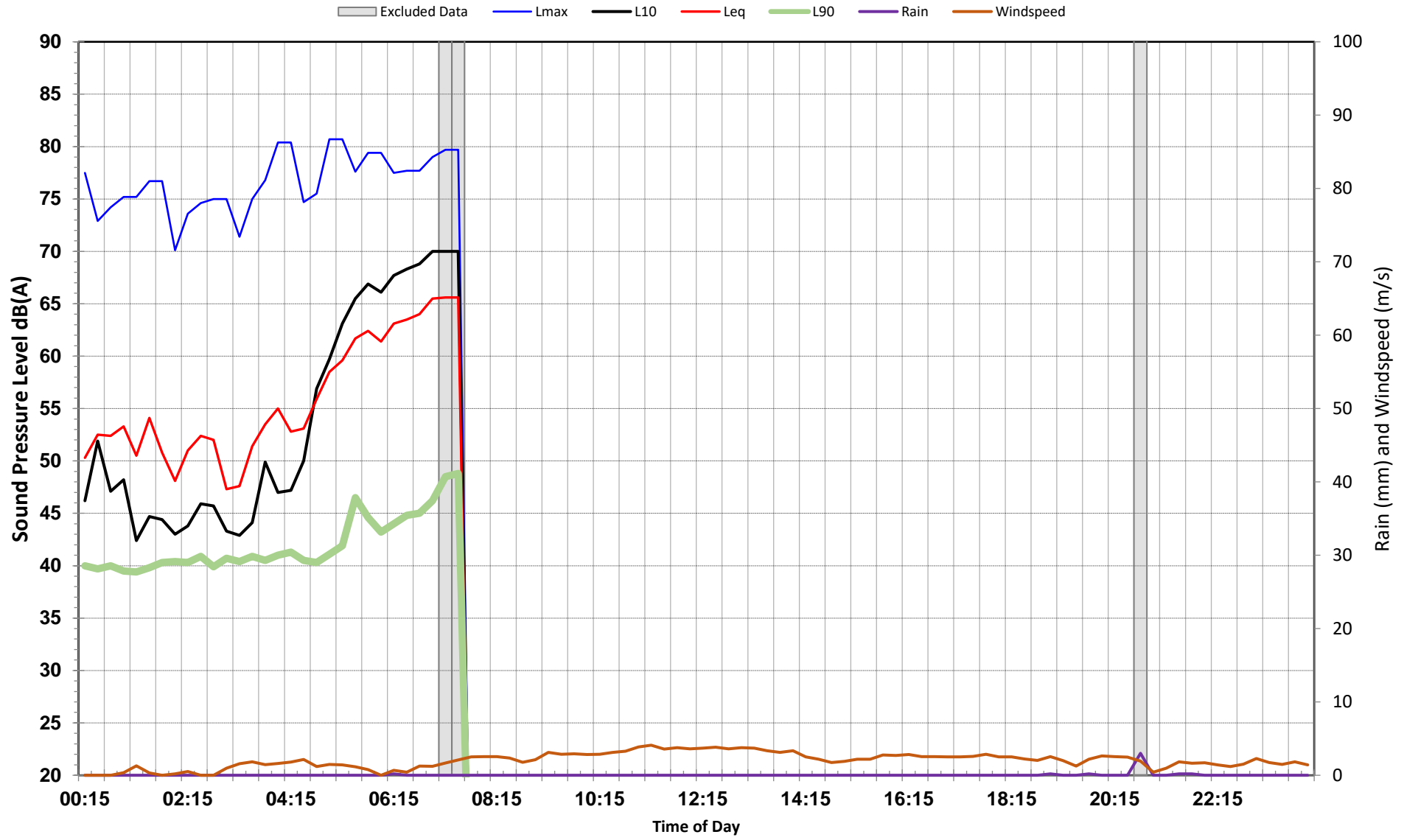
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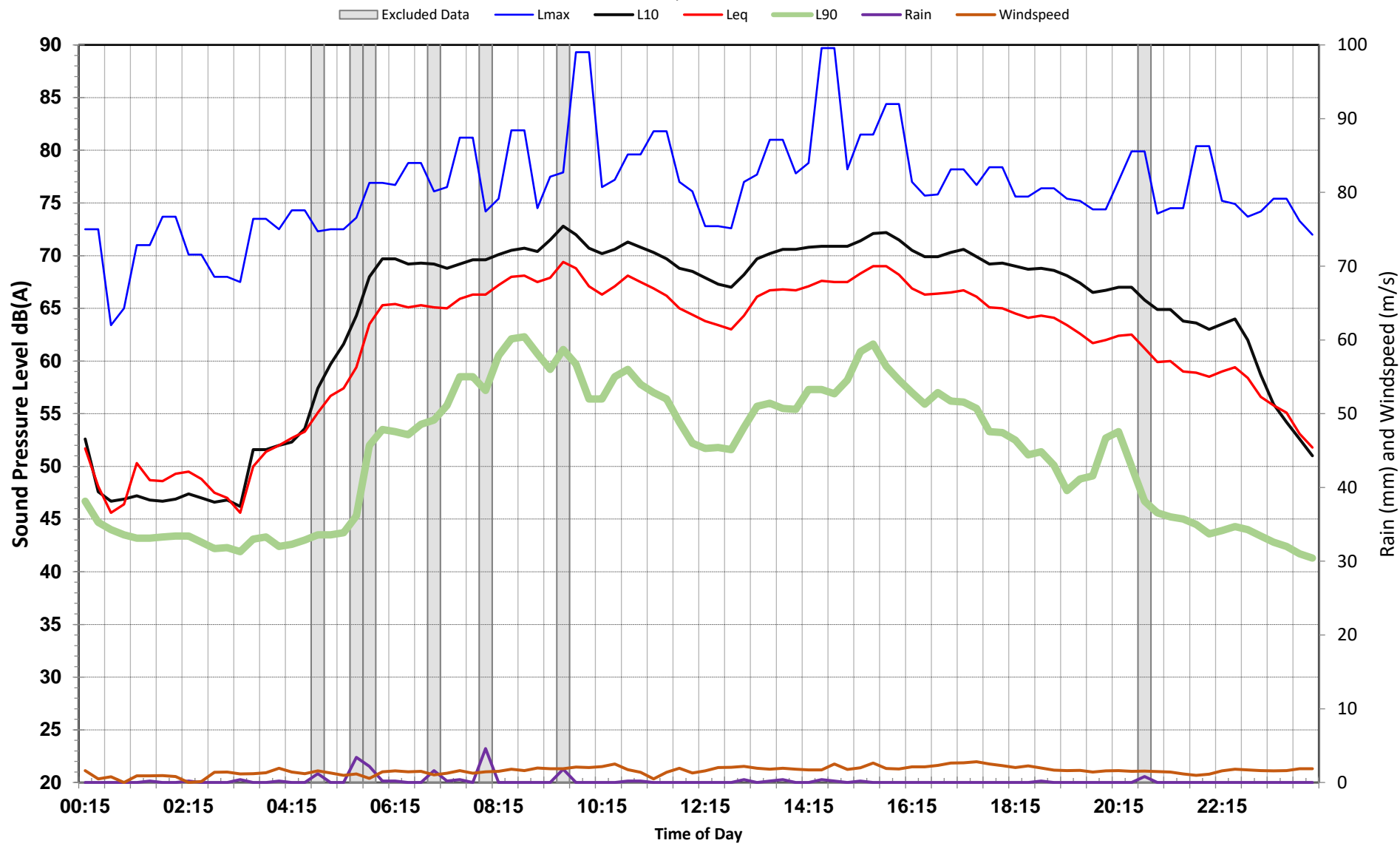
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Thursday, 23 December 2021



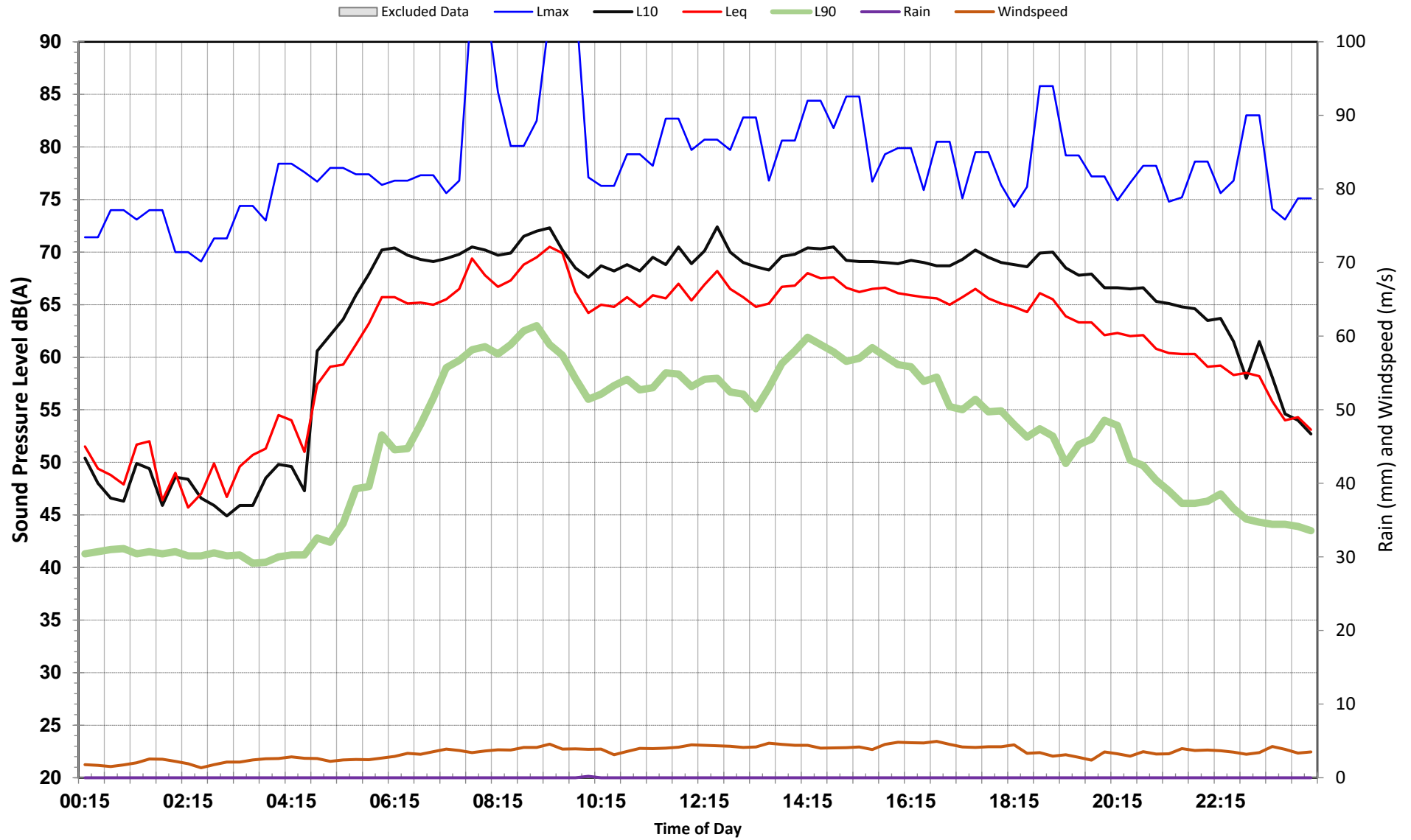
# 002 - Central Car Park | Tweed Valley Hospital

Wednesday, 1 December



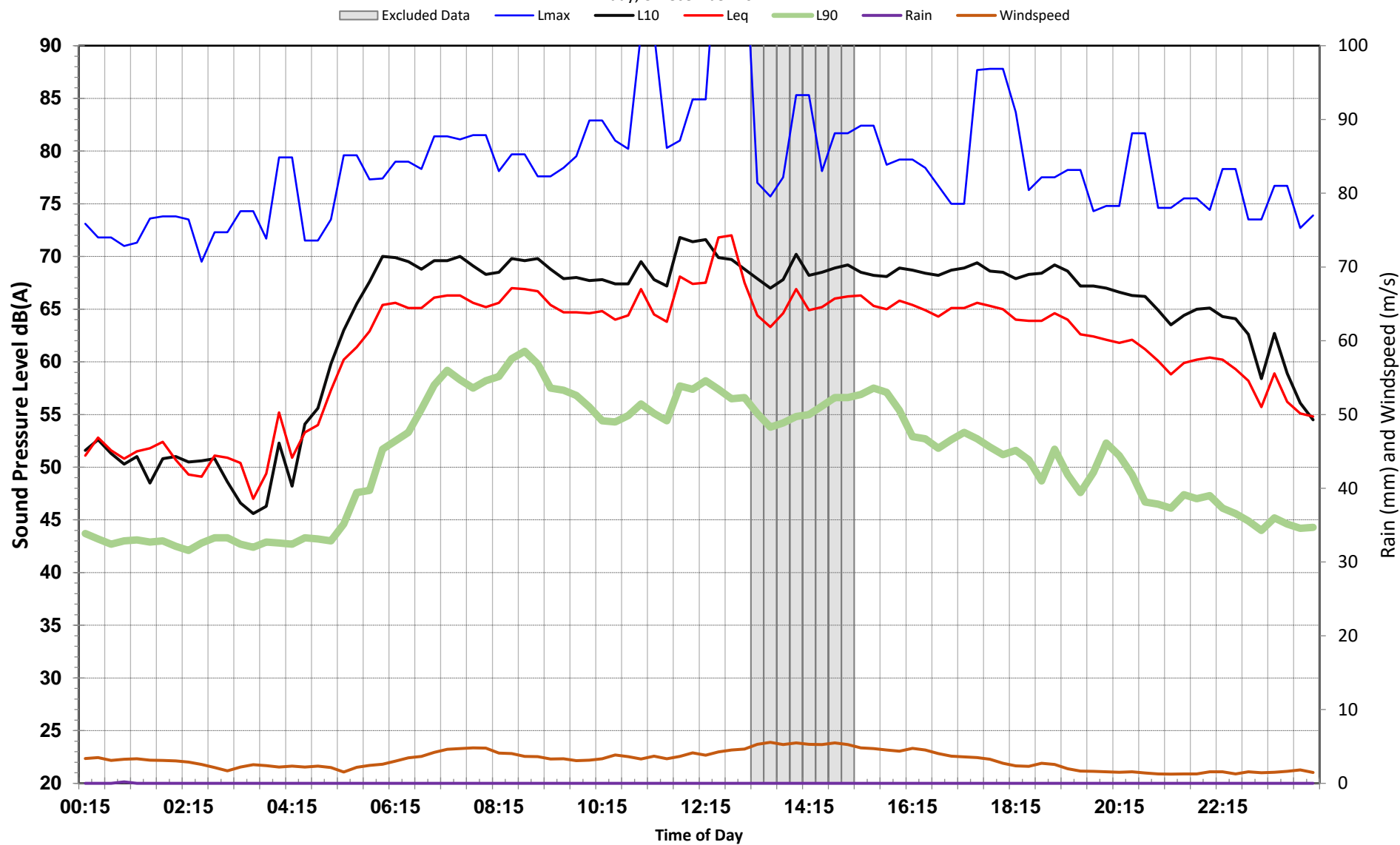
# 002 - Central Car Park | Tweed Valley Hospital

Thursday, 2 December 2021



# 002 - Central Car Park | Tweed Valley Hospital

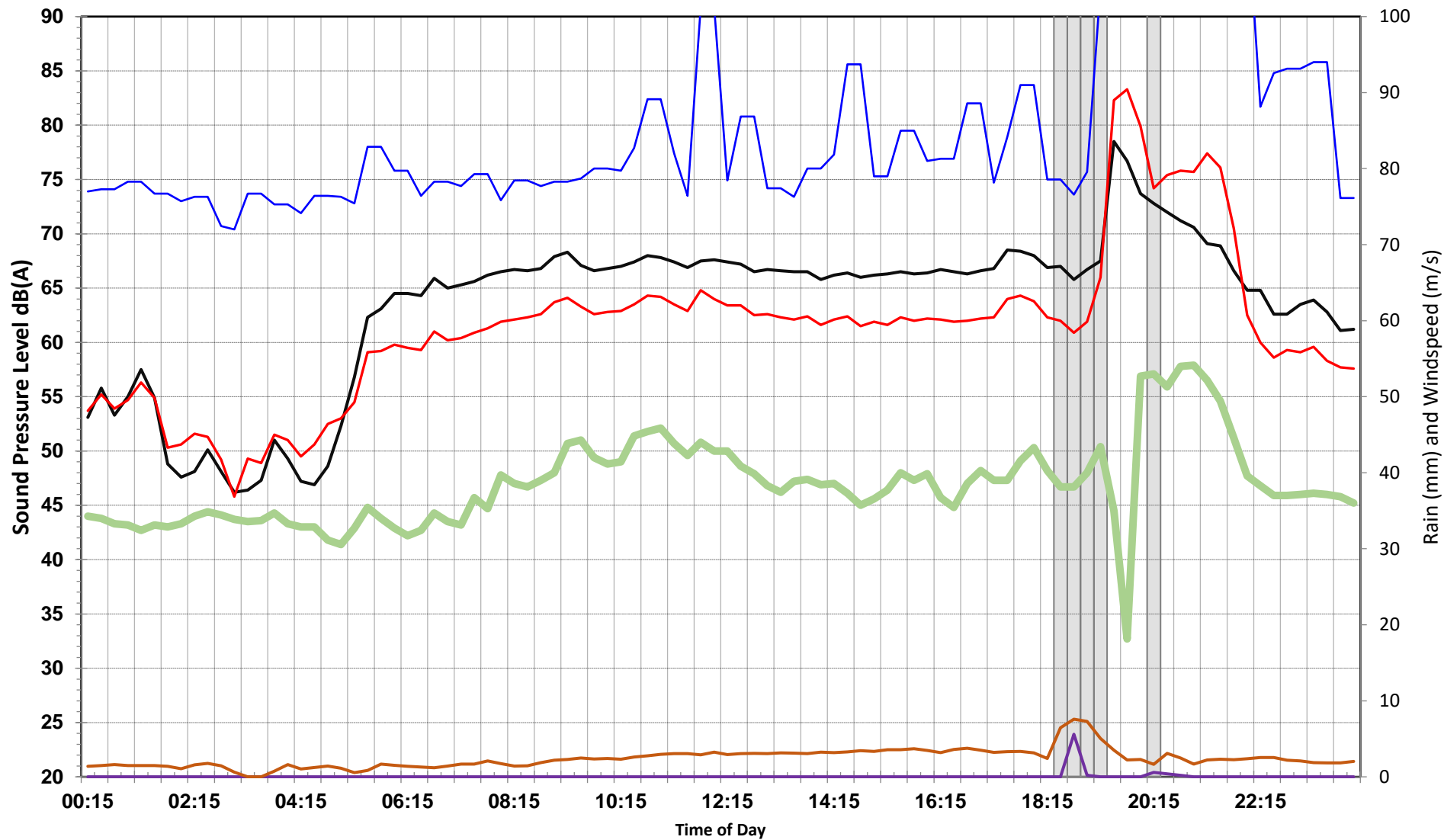
Friday, 3 December 2021



# 002 - Central Car Park | Tweed Valley Hospital

Saturday, 4 December 2021

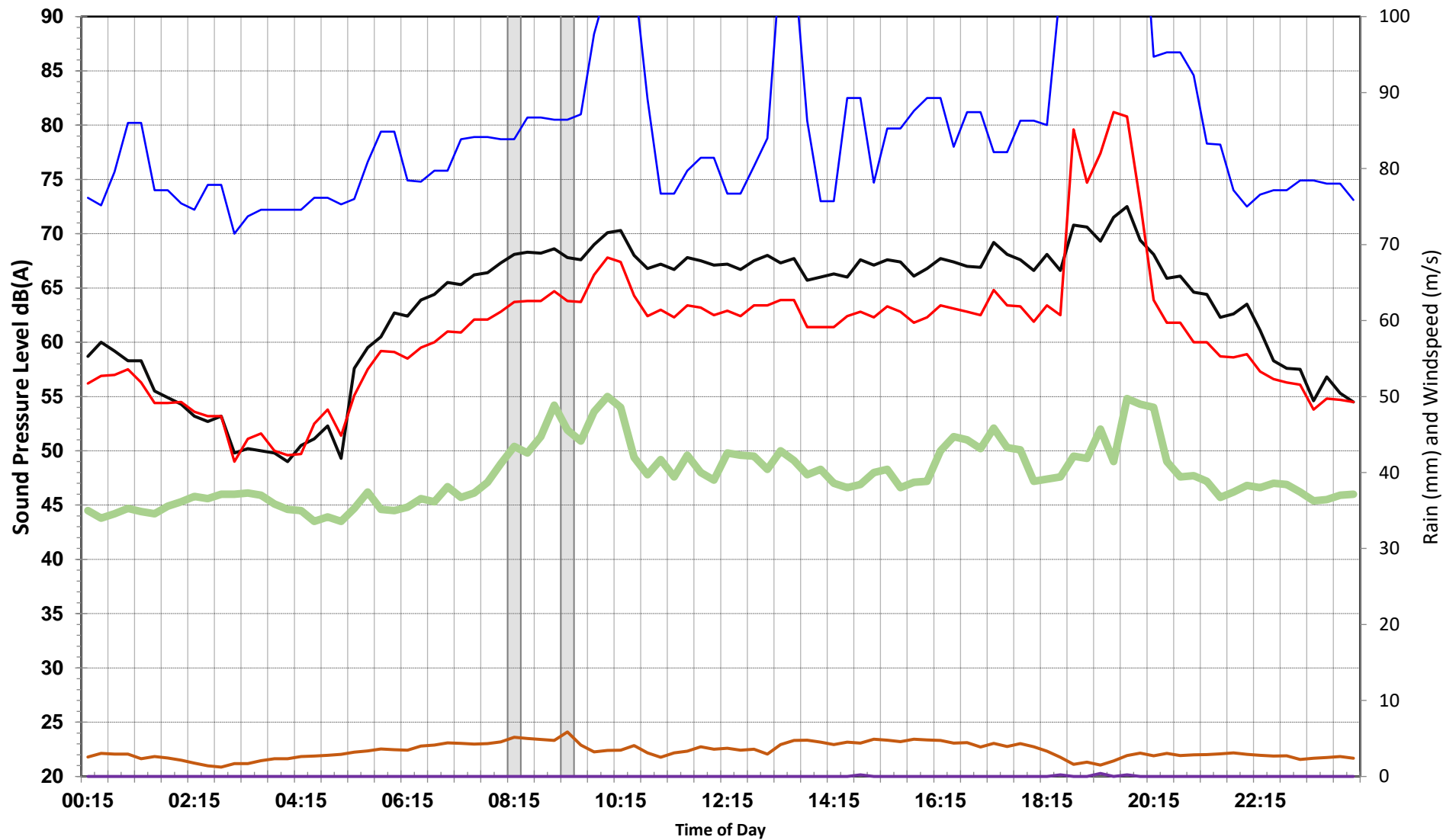
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# 002 - Central Car Park | Tweed Valley Hospital

Sunday, 5 December 2021

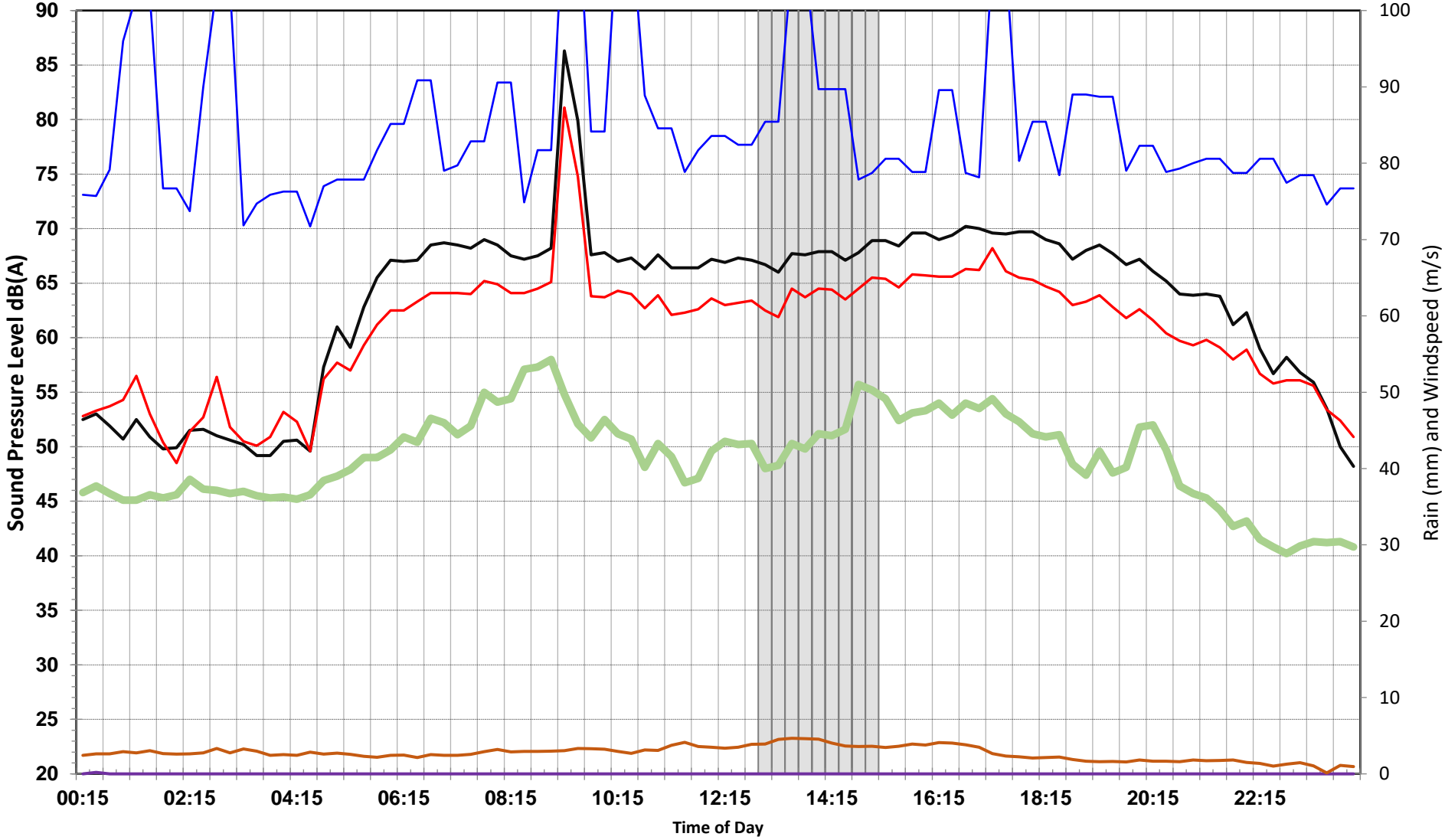
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# 002 - Central Car Park | Tweed Valley Hospital

Monday, 6 December 2021

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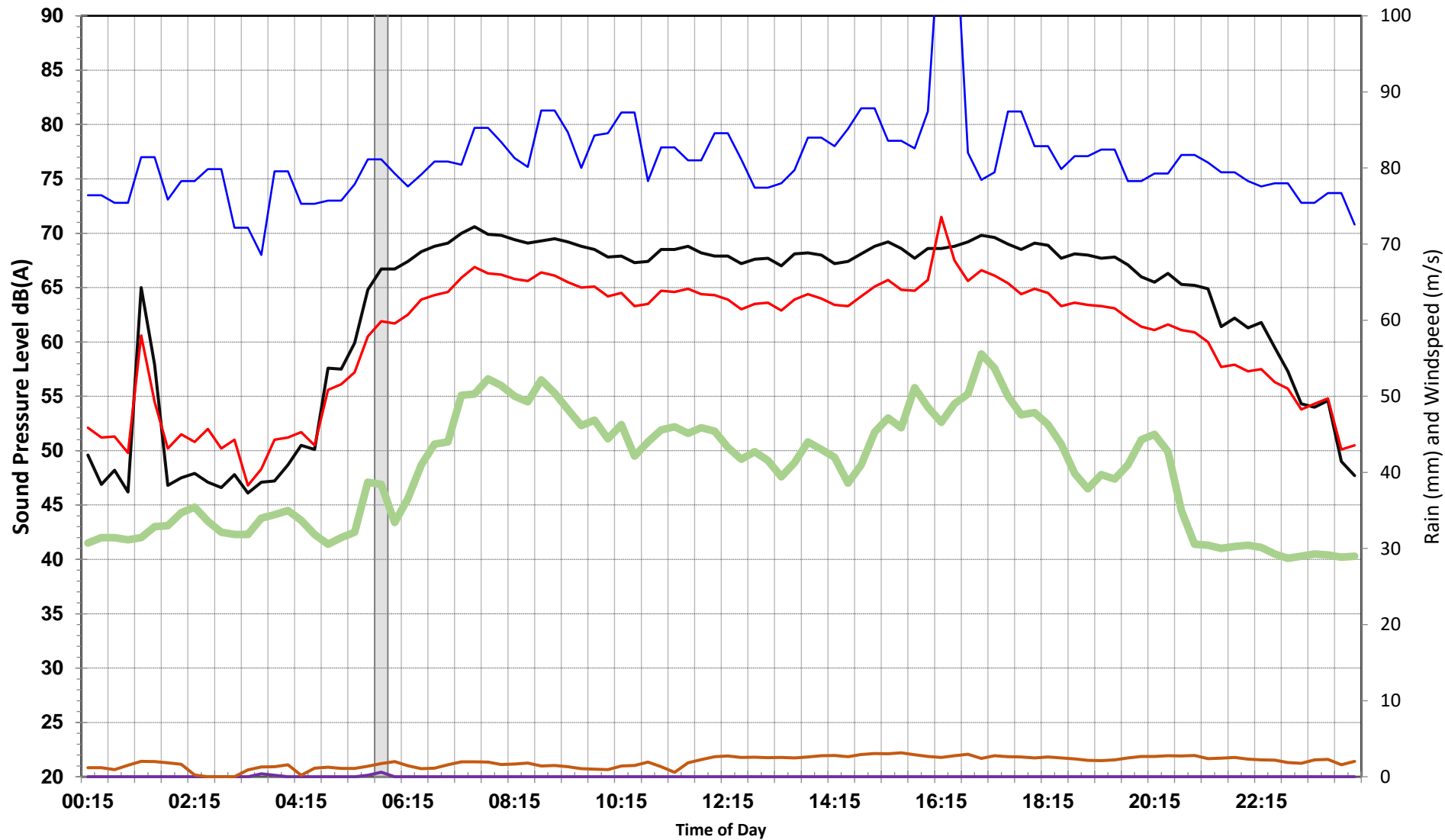




# 002 - Central Car Park | Tweed Valley Hospital

Tuesday, 7 December 2021

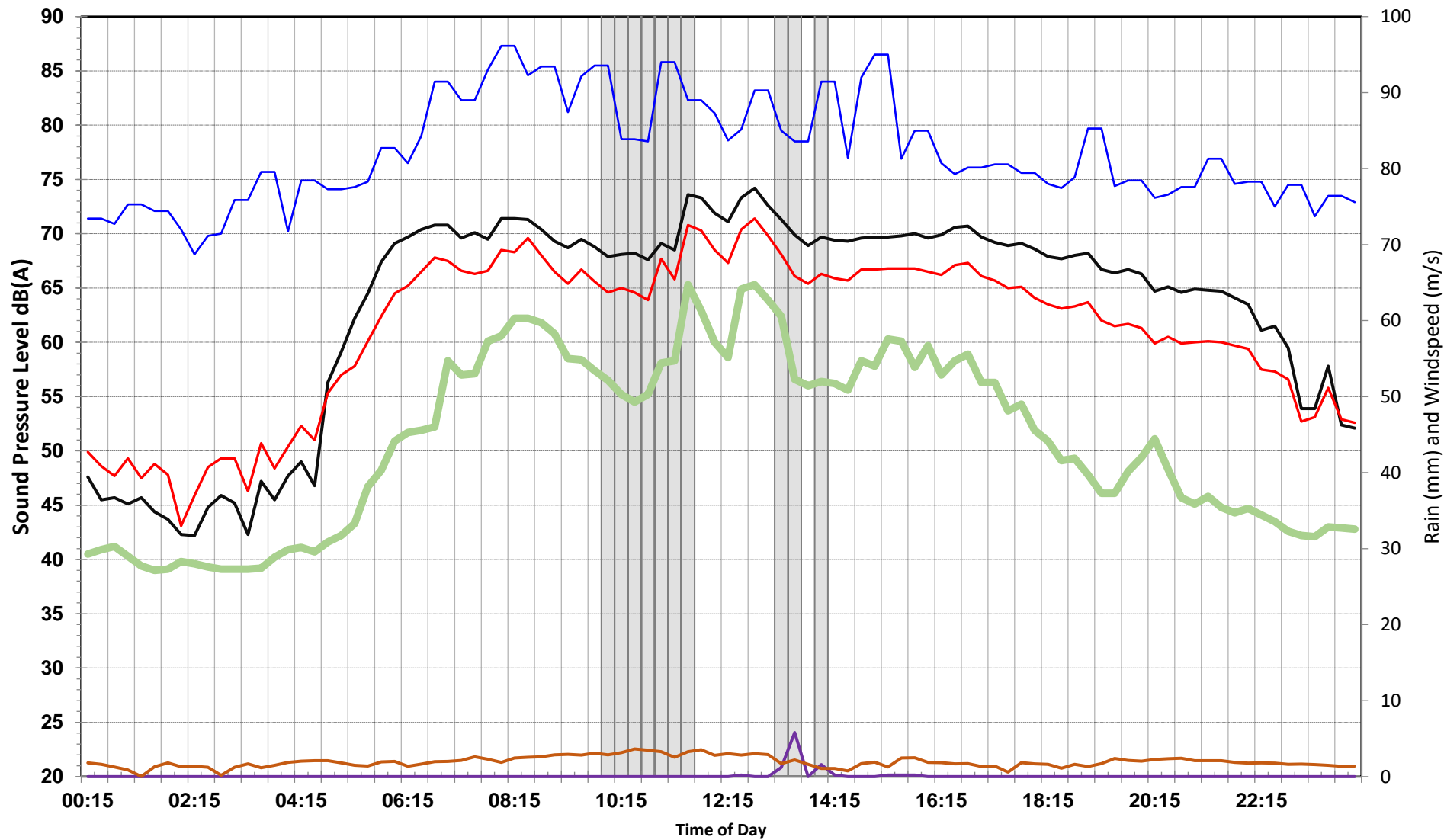
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# 002 - Central Car Park | Tweed Valley Hospital

Wednesday, 8 December 2021

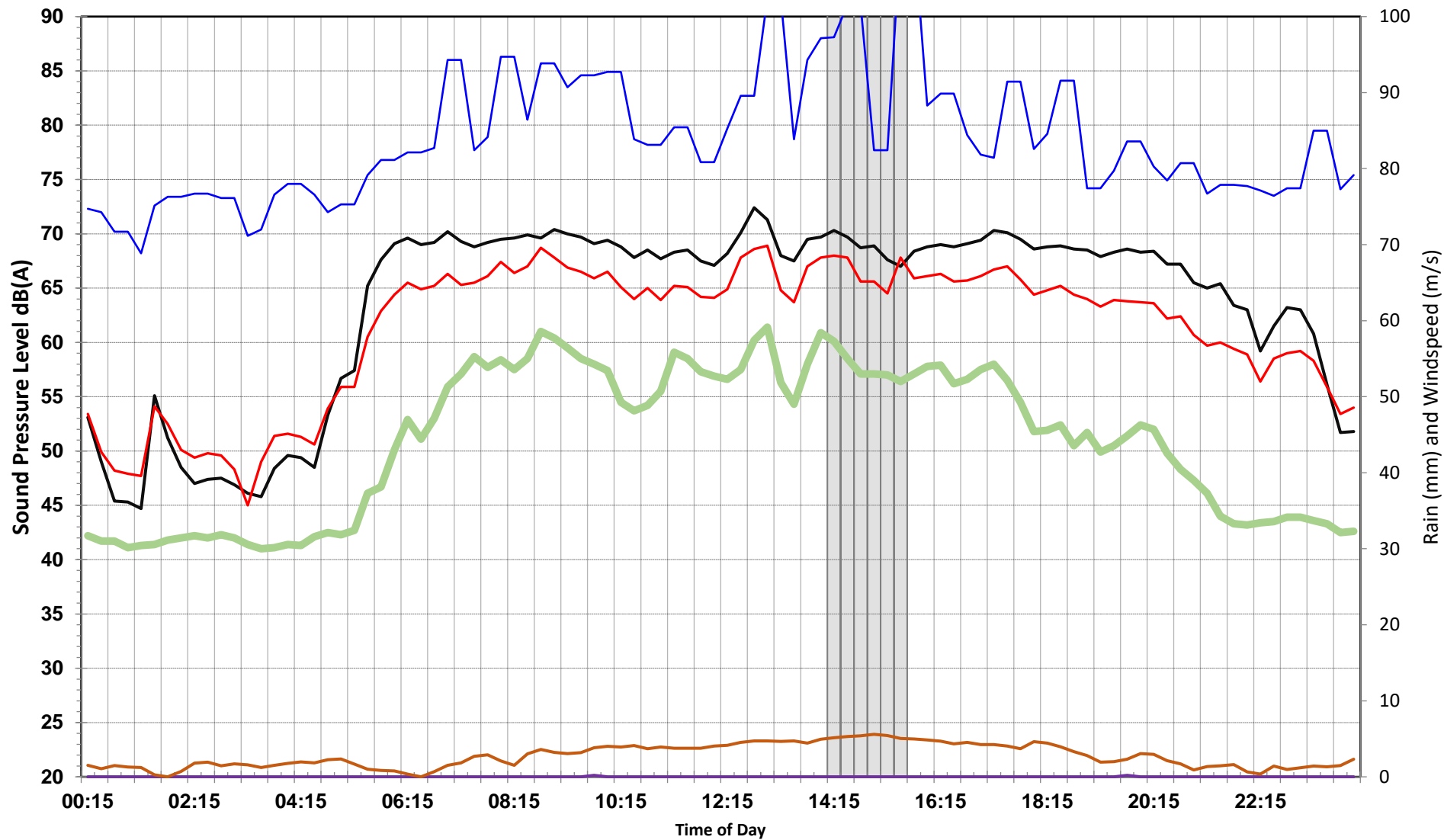
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# 002 - Central Car Park | Tweed Valley Hospital

Thursday, 9 December 2021

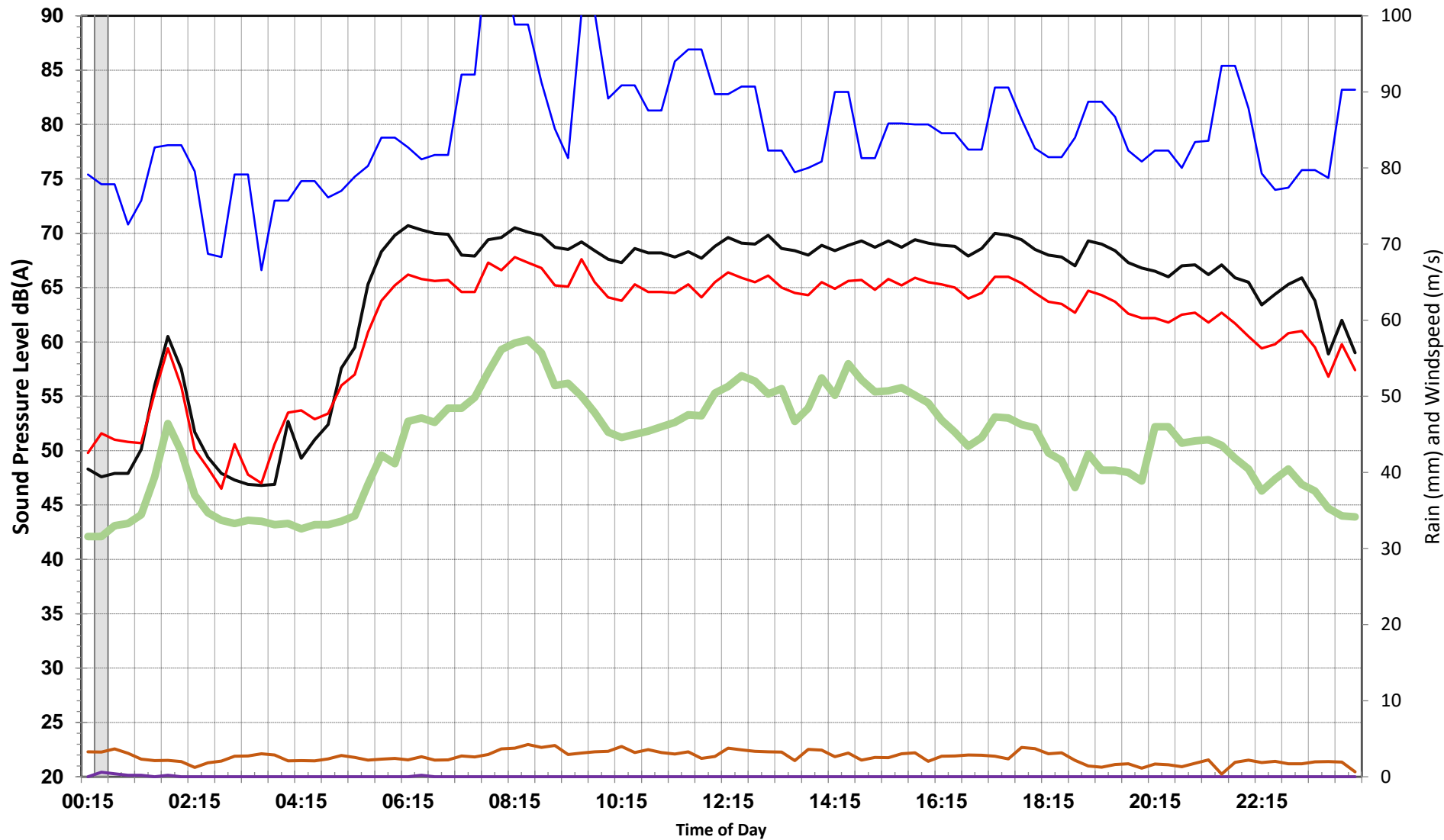
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# 002 - Central Car Park | Tweed Valley Hospital

Friday, 10 December 2021

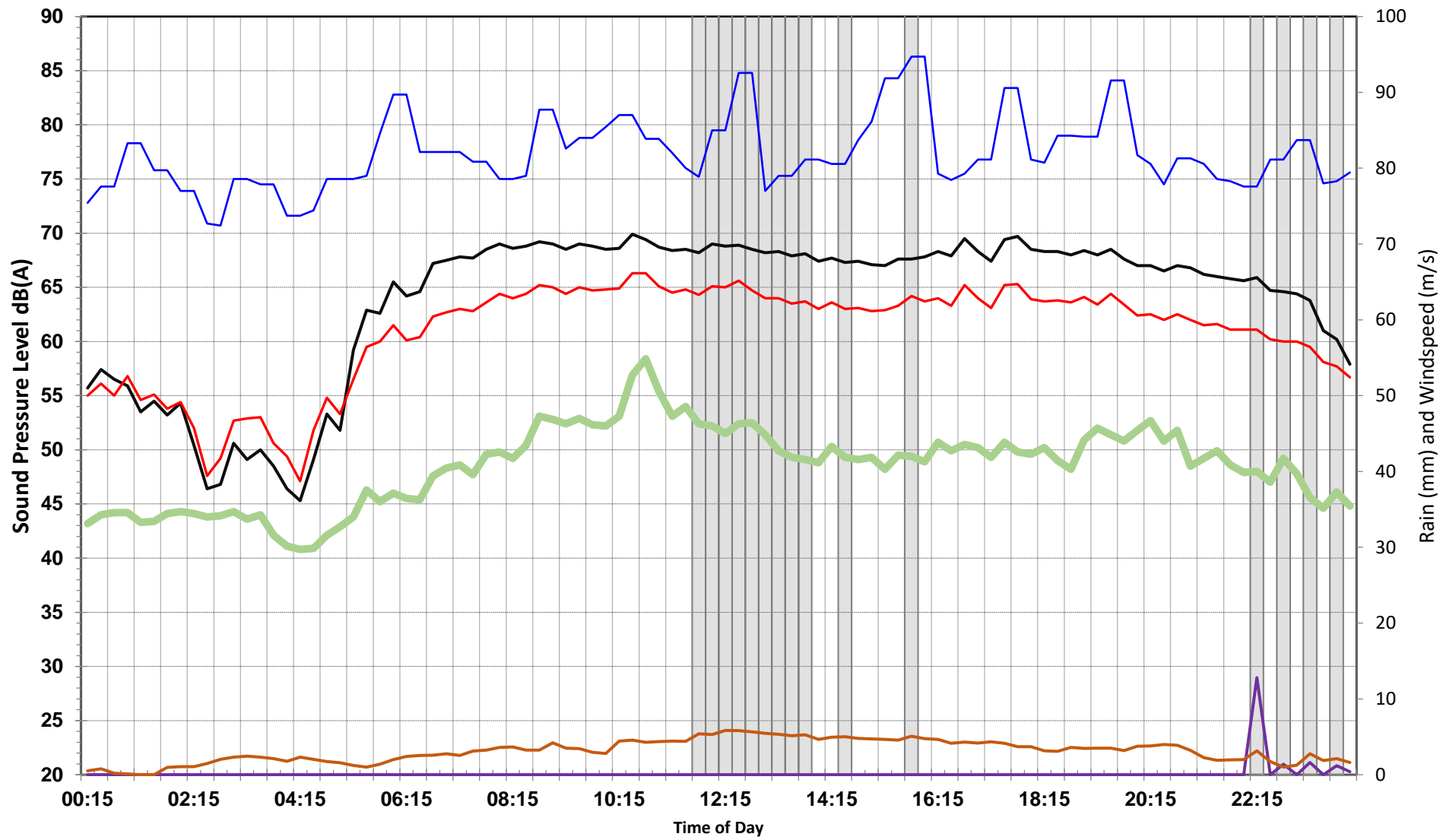
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# 002 - Central Car Park | Tweed Valley Hospital

Saturday, 11 December 2021

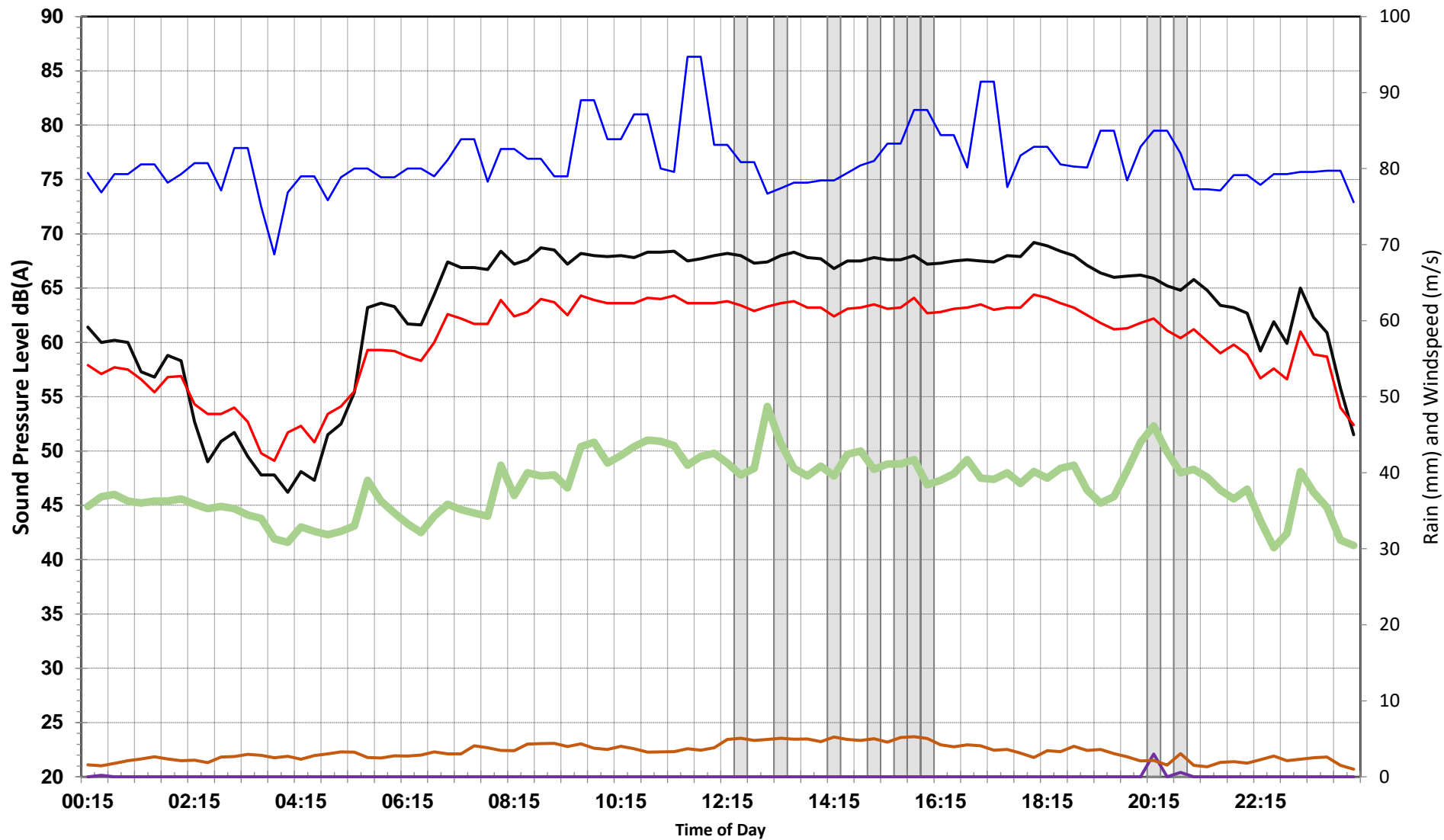
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# 002 - Central Car Park | Tweed Valley Hospital

Sunday, 12 December 2021

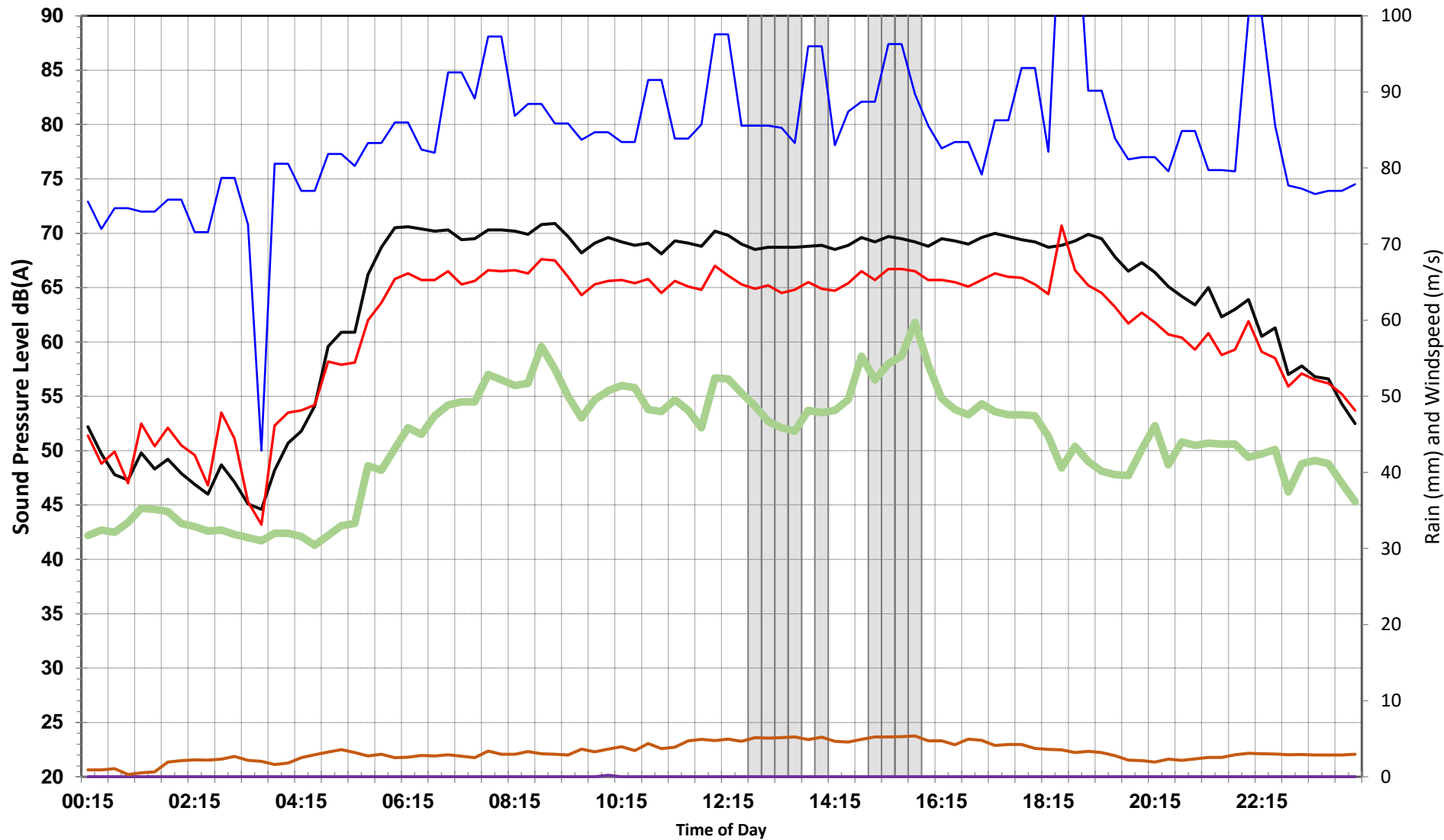
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# 002 - Central Car Park | Tweed Valley Hospital

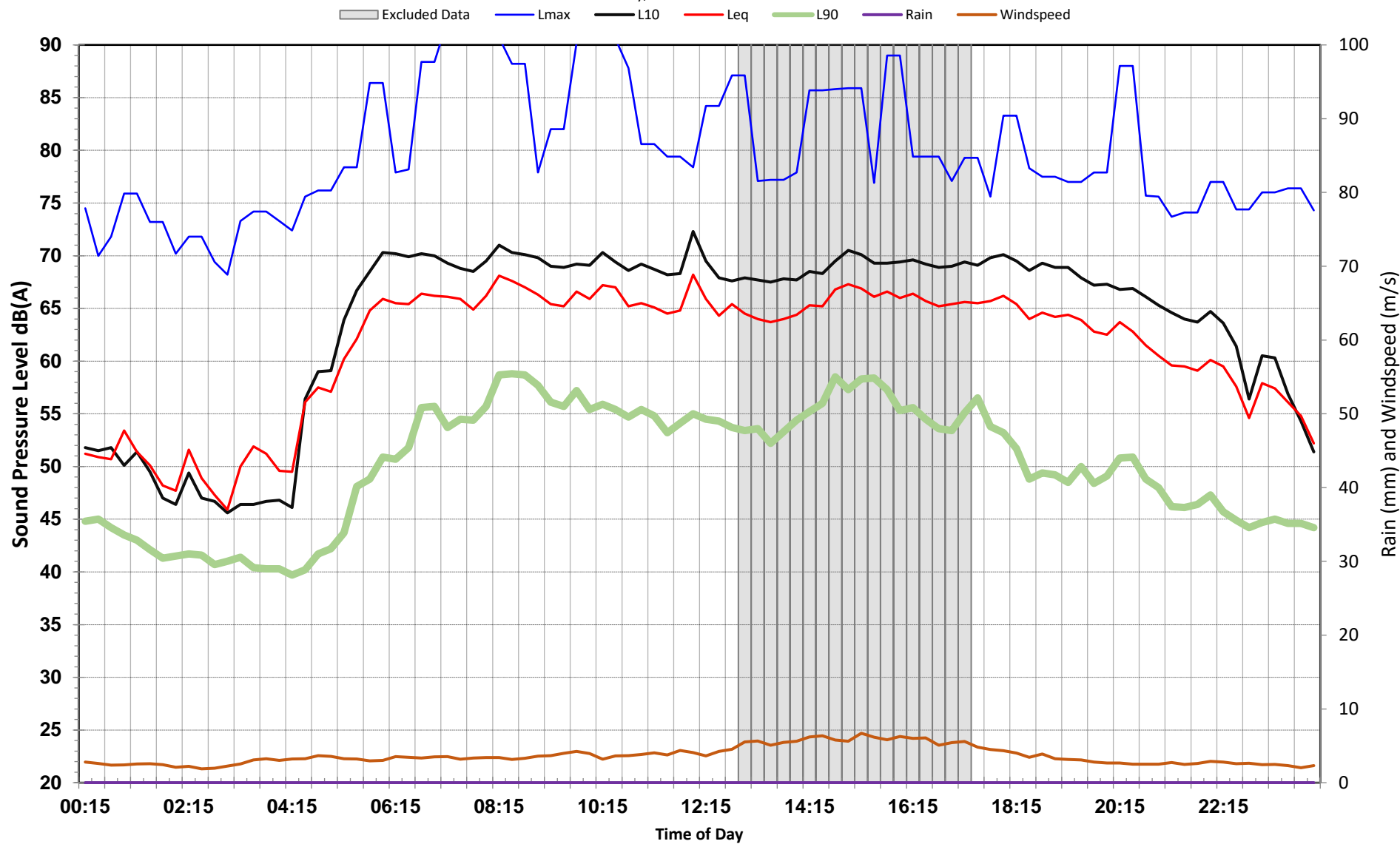
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# 002 - Central Car Park | Tweed Valley Hospital

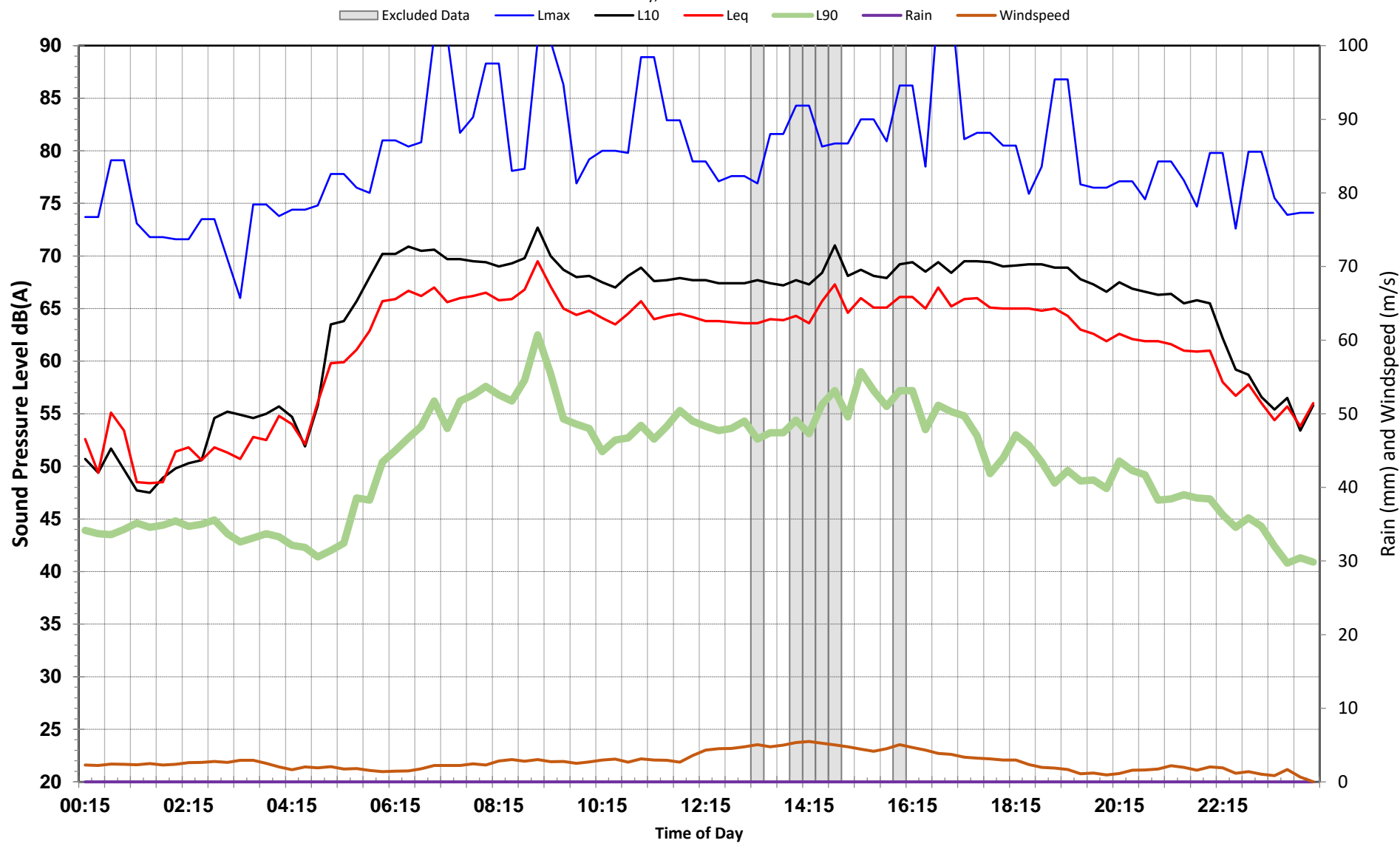
Tuesday, 14 December 2021





# 002 - Central Car Park | Tweed Valley Hospital

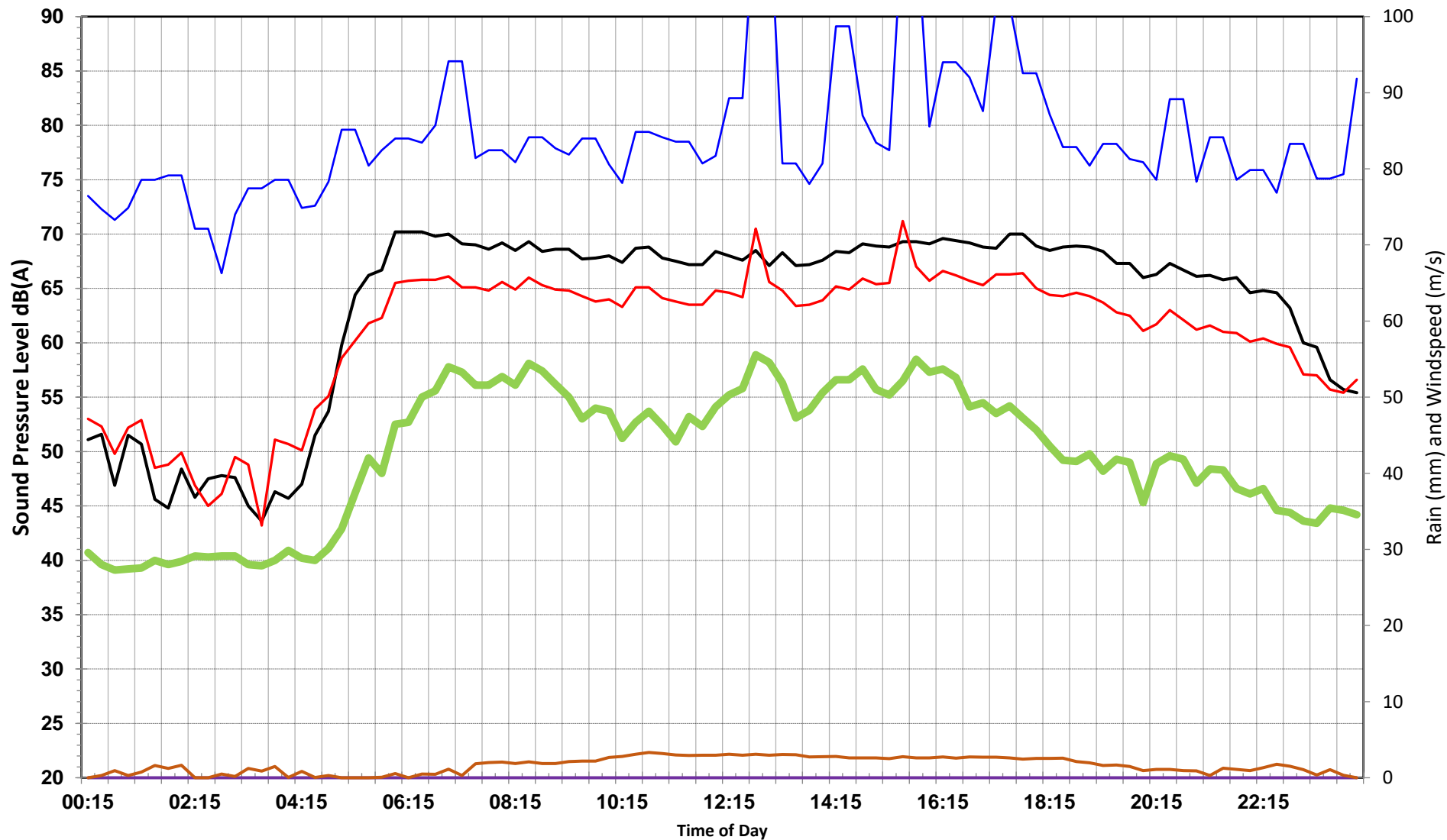
Wednesday, 15 December 2021



# 002 - Central Car Park | Tweed Valley Hospital

Thursday, 16 December 2021

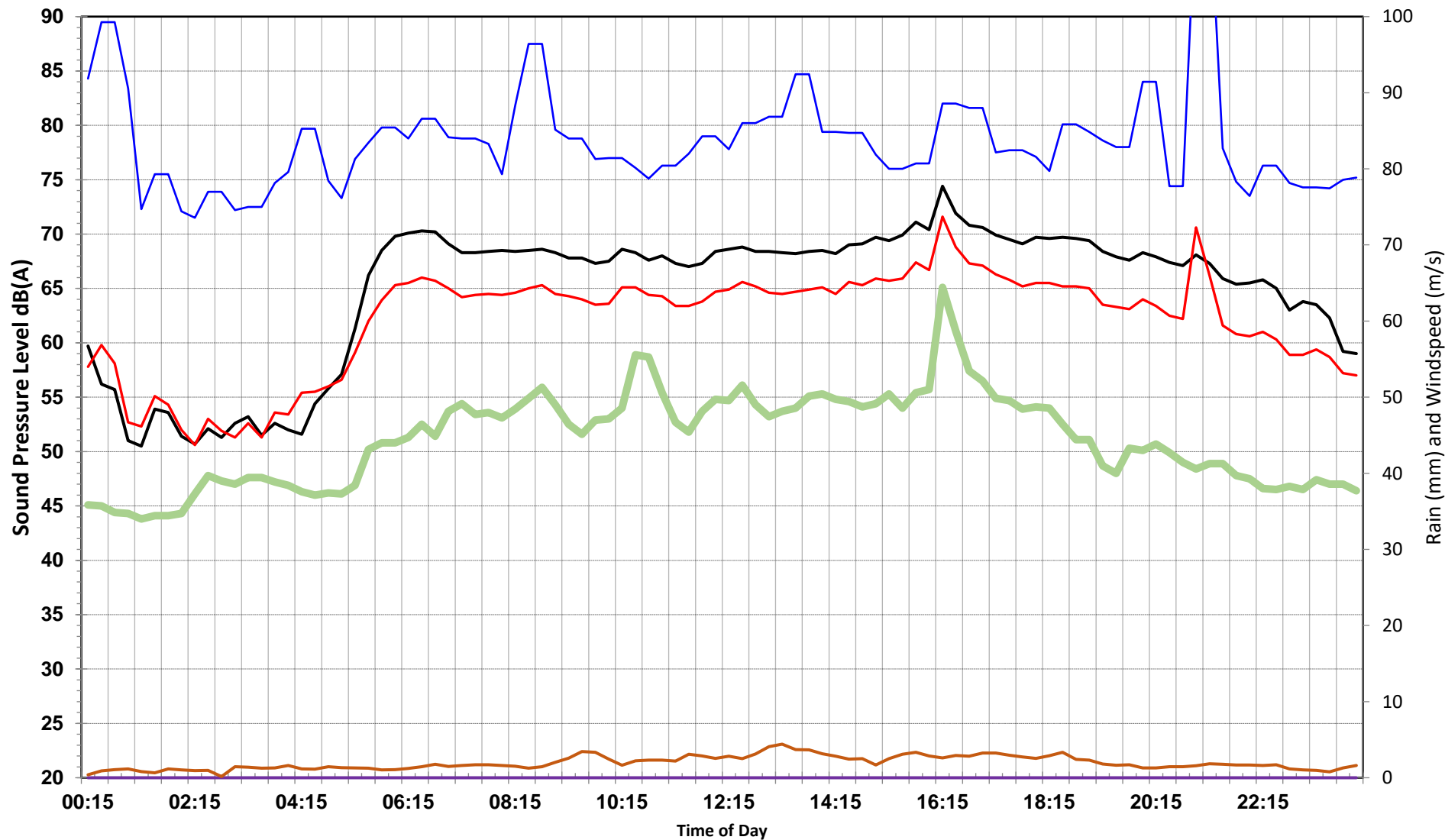
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# 002 - Central Car Park | Tweed Valley Hospital

Friday, 17 December 2021

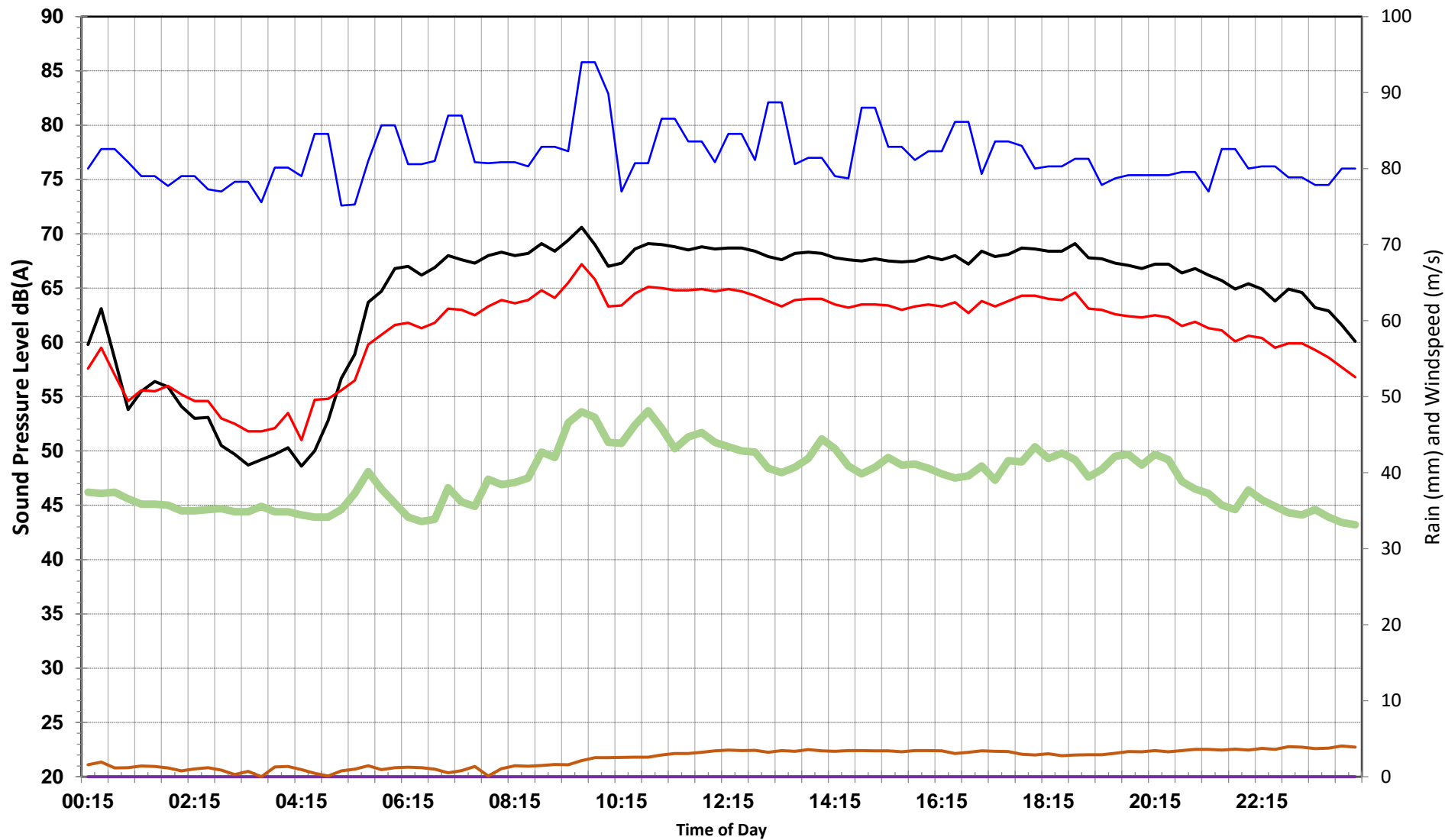
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# 002 - Central Car Park | Tweed Valley Hospital

Saturday, 18 December 2021

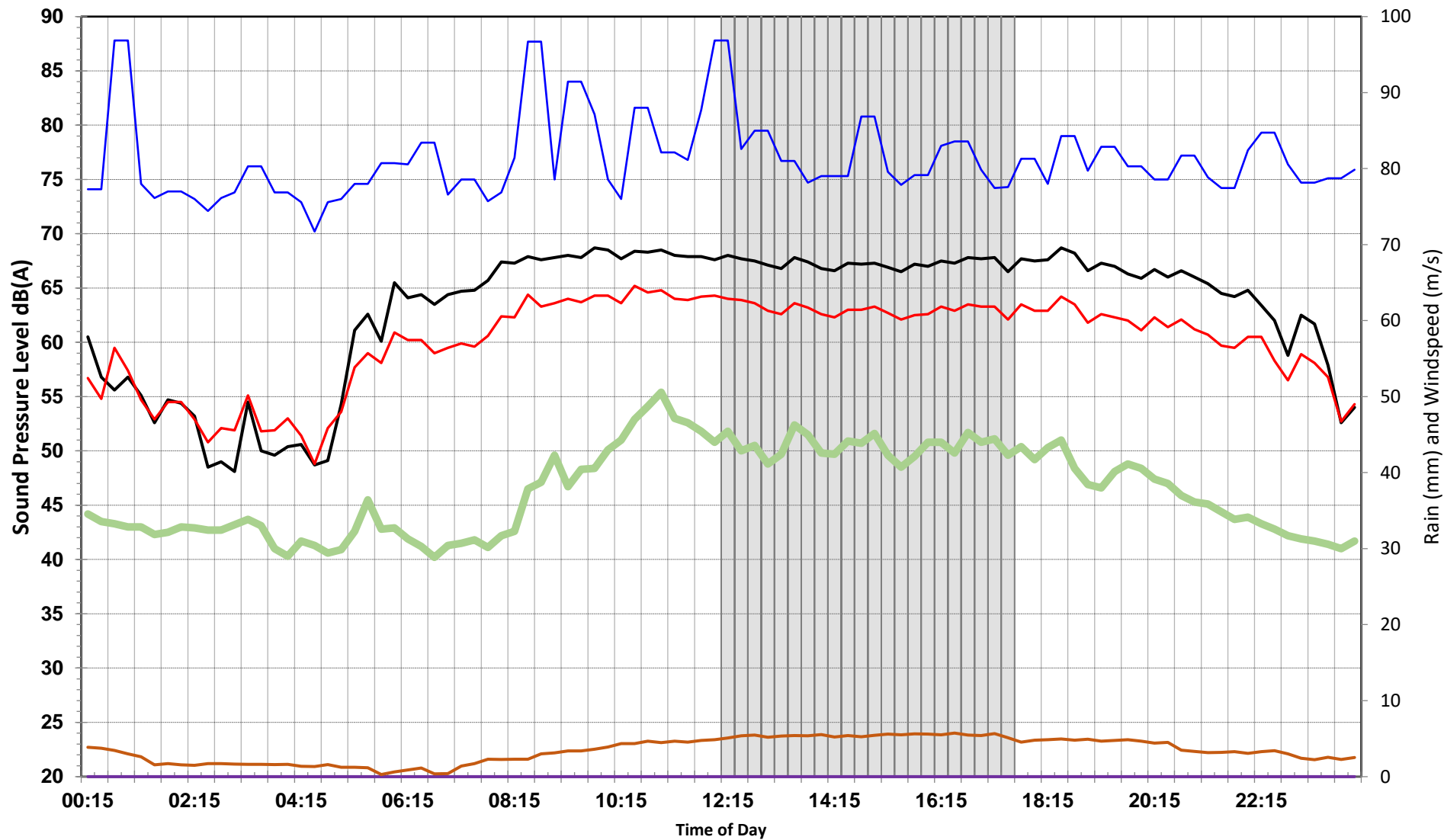
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# 002 - Central Car Park | Tweed Valley Hospital

Sunday, 19 December 2021

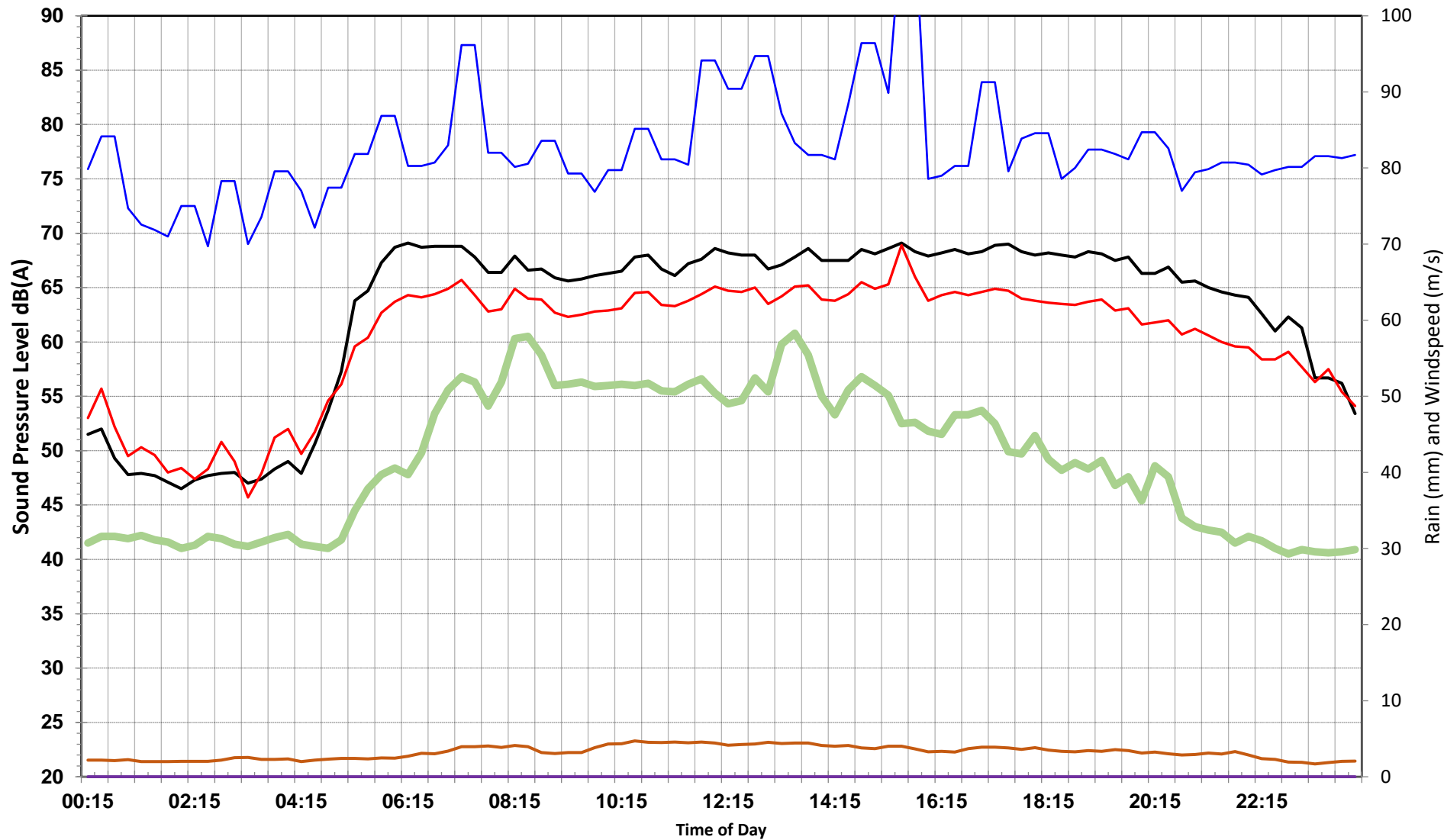
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# 002 - Central Car Park | Tweed Valley Hospital

Monday, 20 December 2021

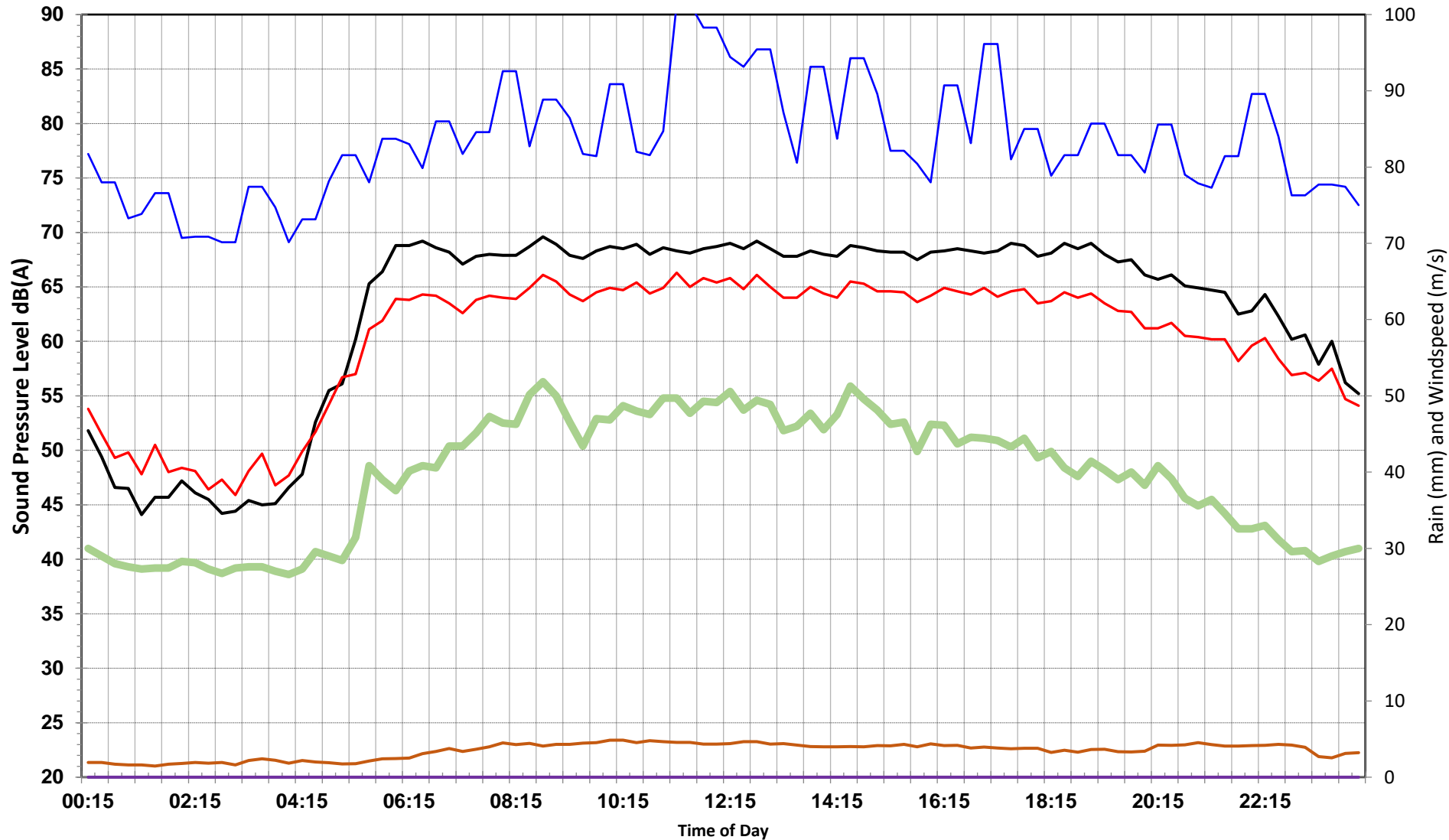
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# 002 - Central Car Park | Tweed Valley Hospital

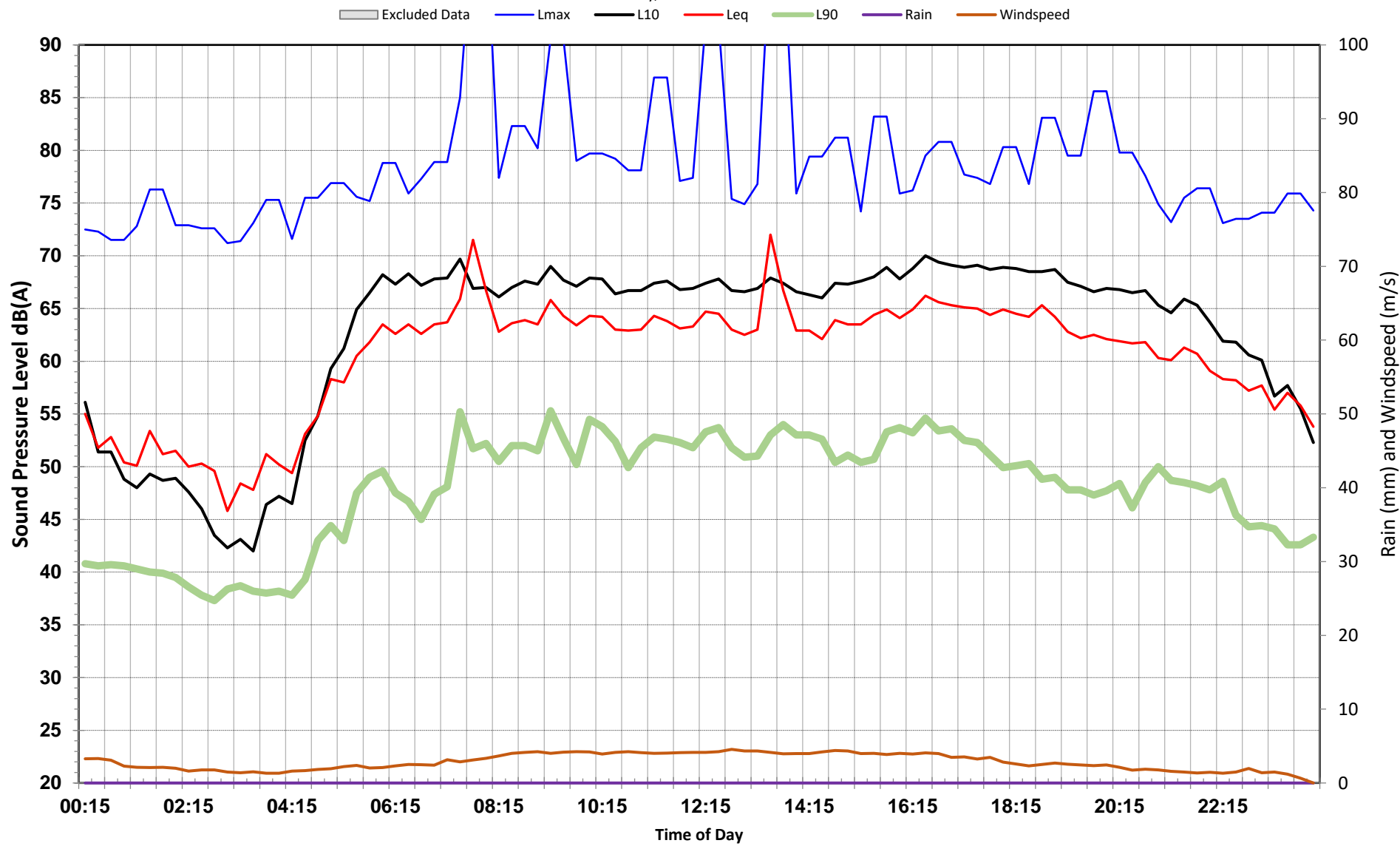
Tuesday, 21 December 2021

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# 002 - Central Car Park | Tweed Valley Hospital

Wednesday, 22 December 2021

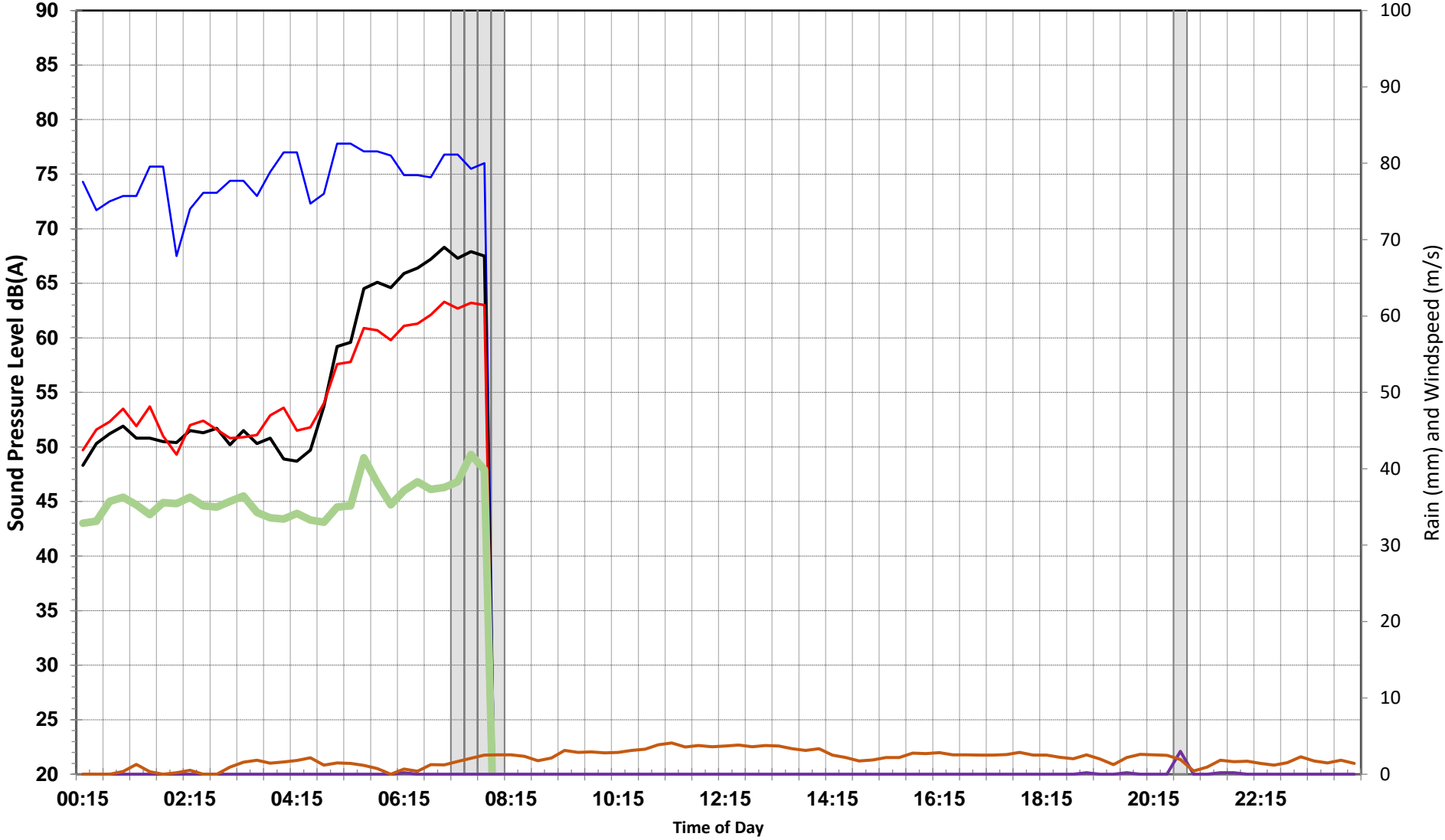




# 002 - Central Car Park | Tweed Valley Hospital

Thursday, 23 December 2021

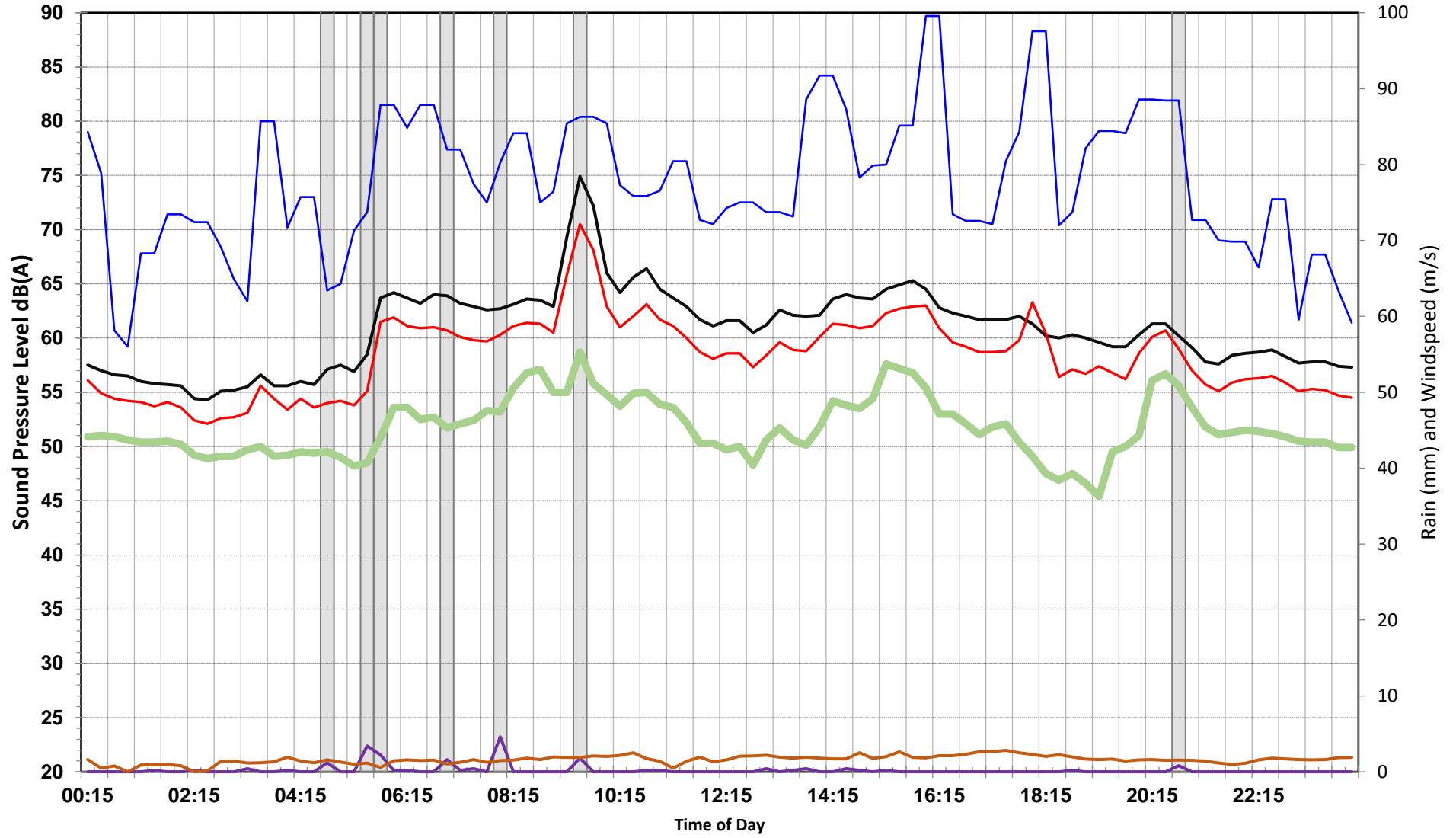
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# 003 - Eastern Section | Tweed Valley Hospital

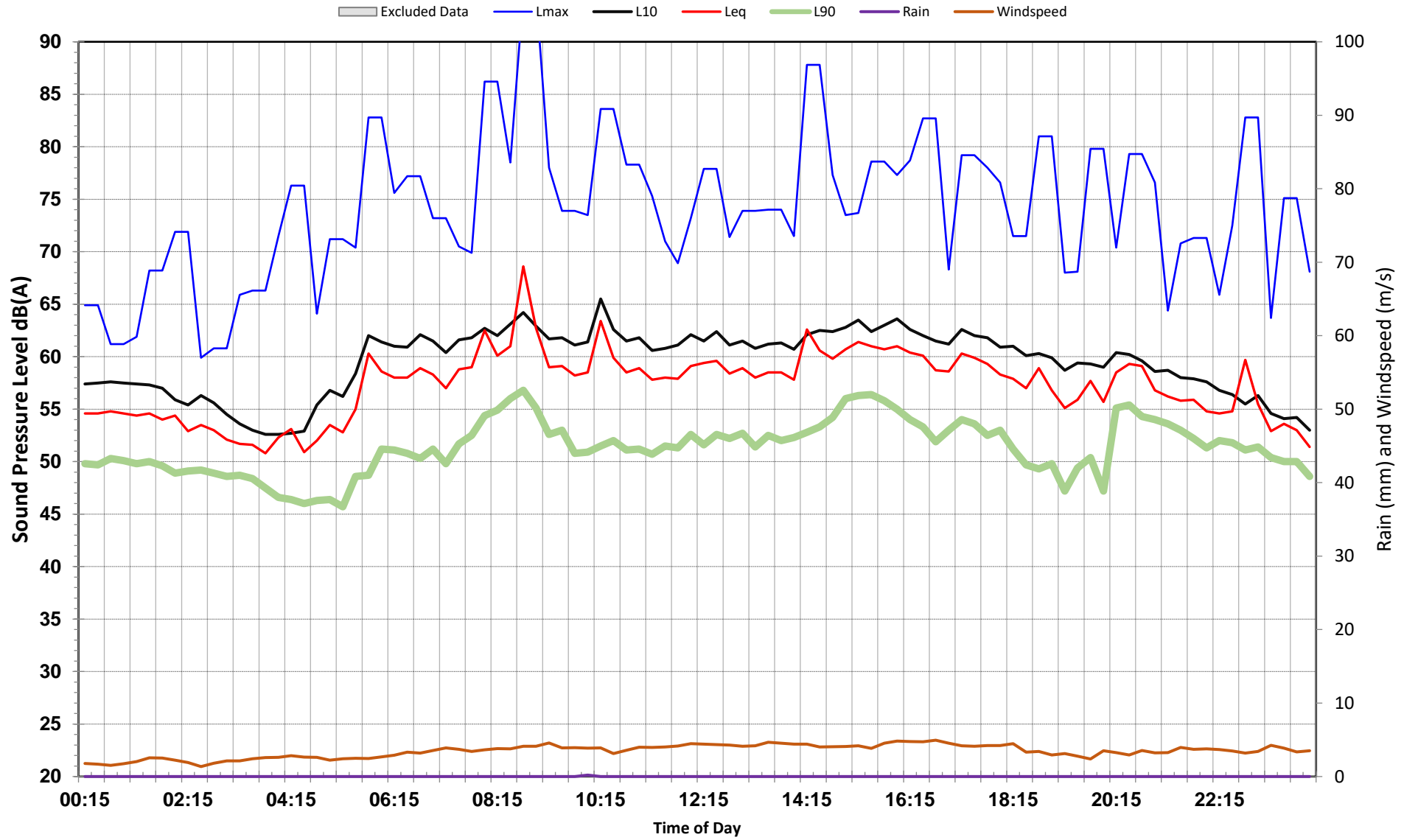
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# 003 - Eastern Section | Tweed Valley Hospital

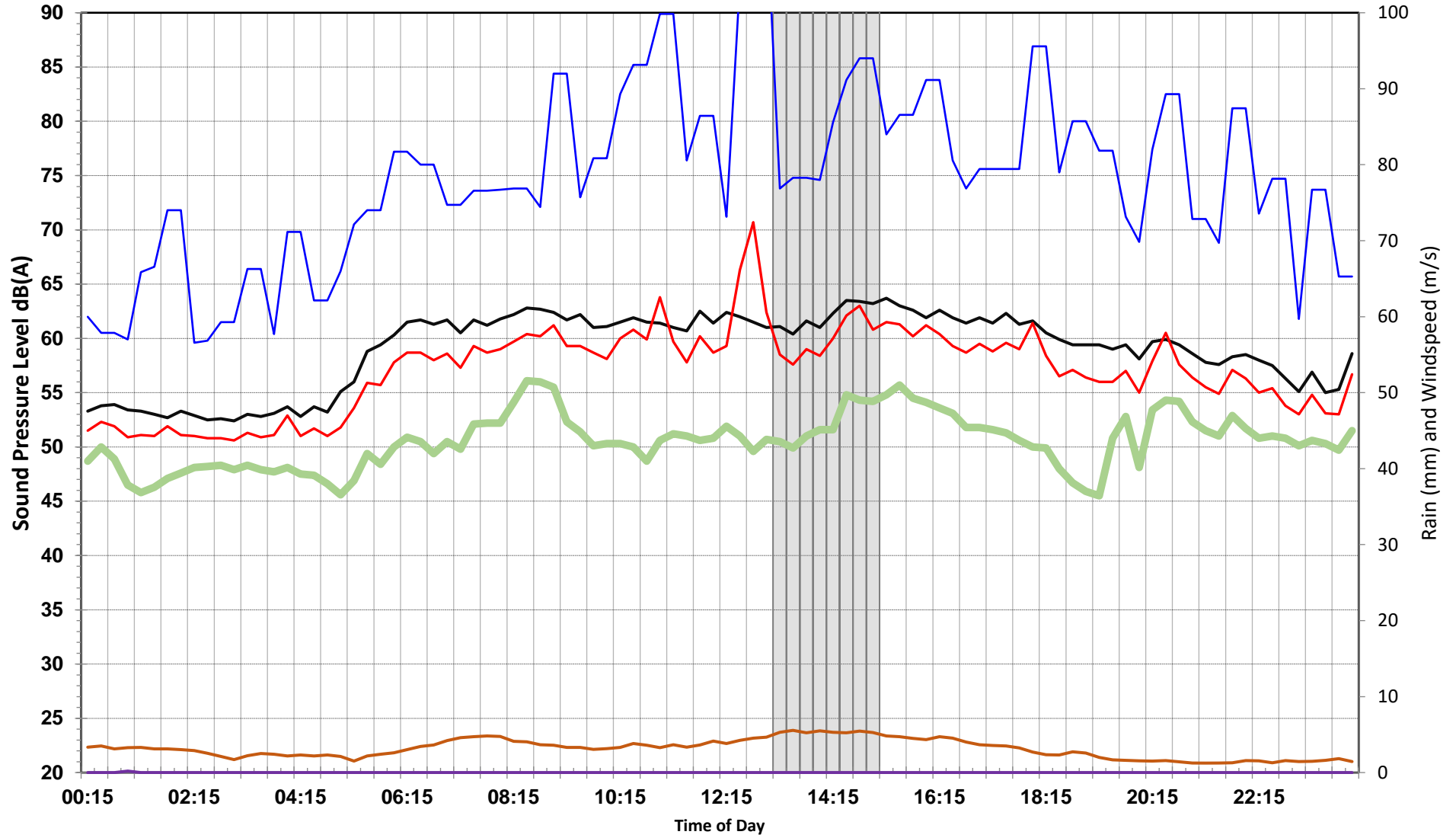
Thursday, 2 December 2021



# 003 - Eastern Section | Tweed Valley Hospital

Friday, 3 December 2021

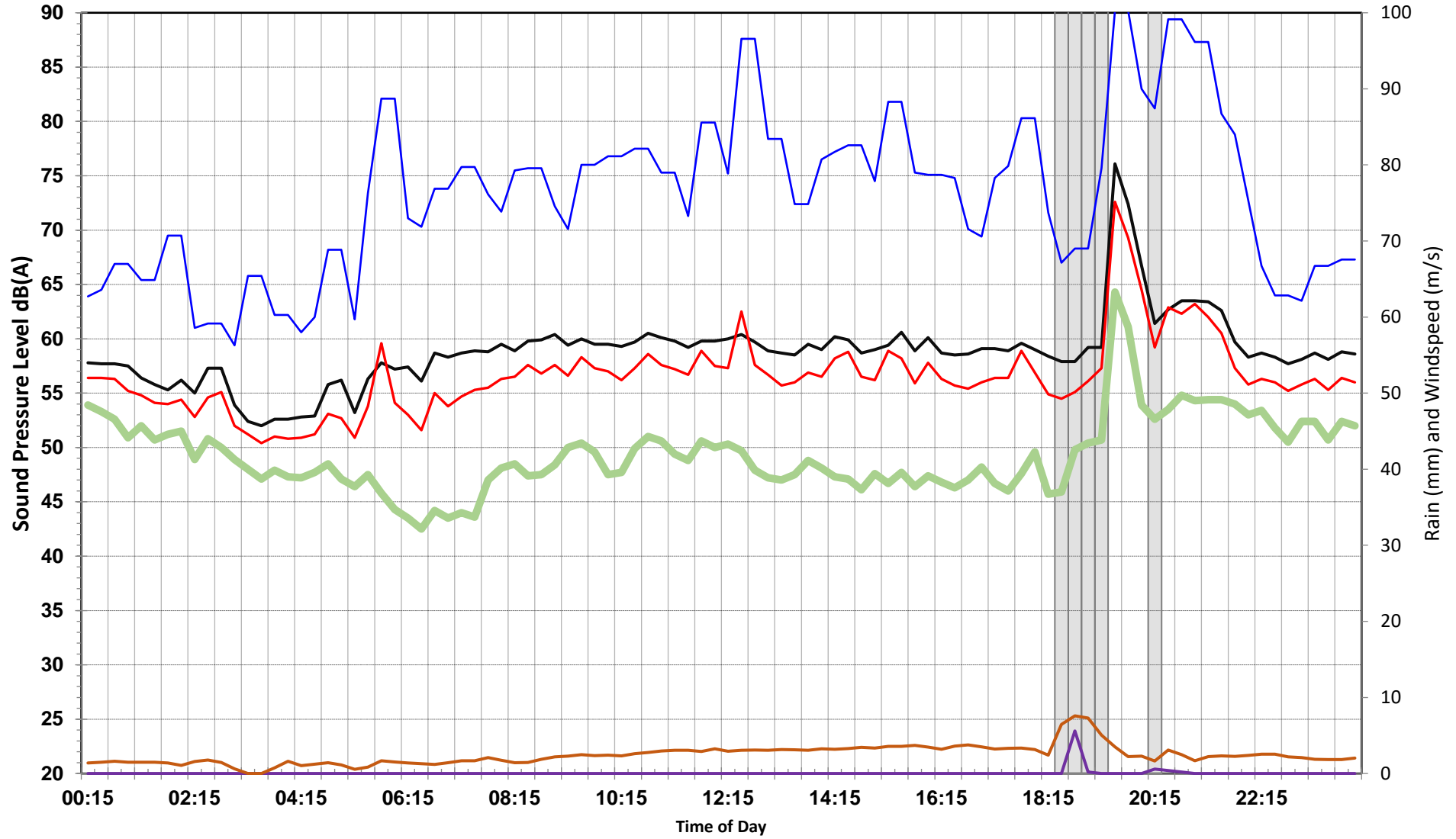
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# 003 - Eastern Section | Tweed Valley Hospital

Saturday, 4 December 2021

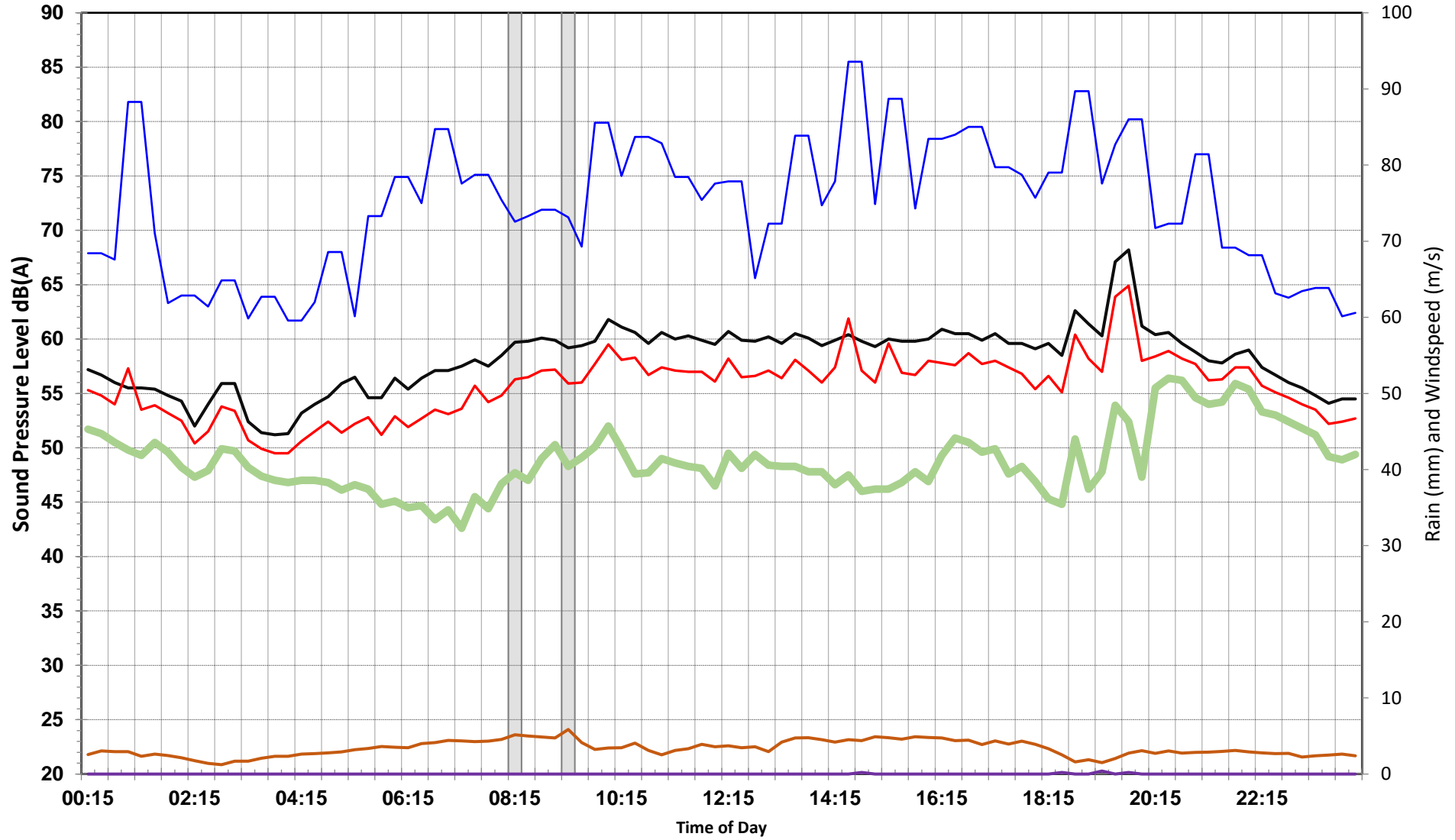
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# 003 - Eastern Section | Tweed Valley Hospital

Sunday, 5 December 2021

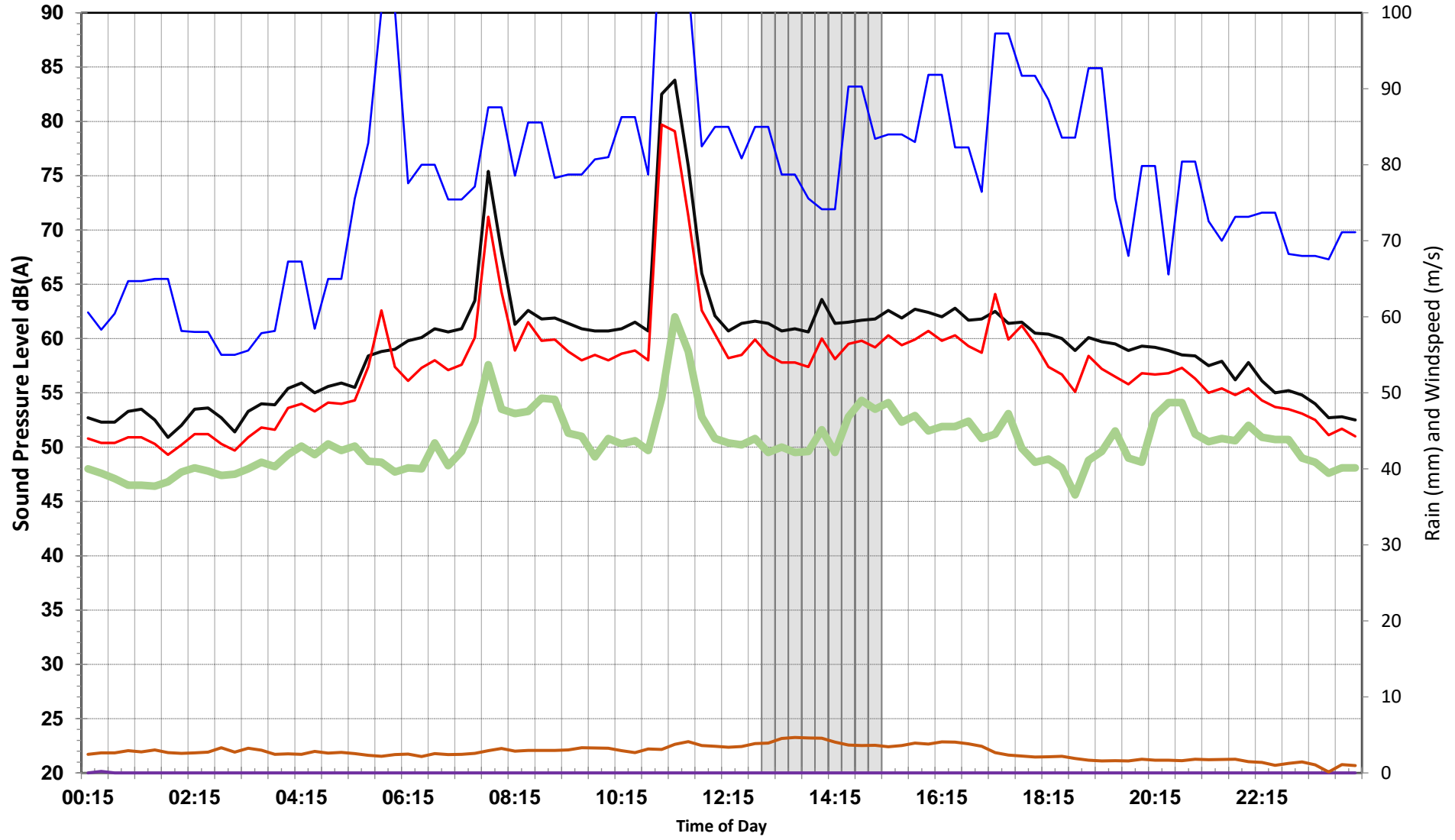
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# 003 - Eastern Section | Tweed Valley Hospital

Monday, 6 December 2021

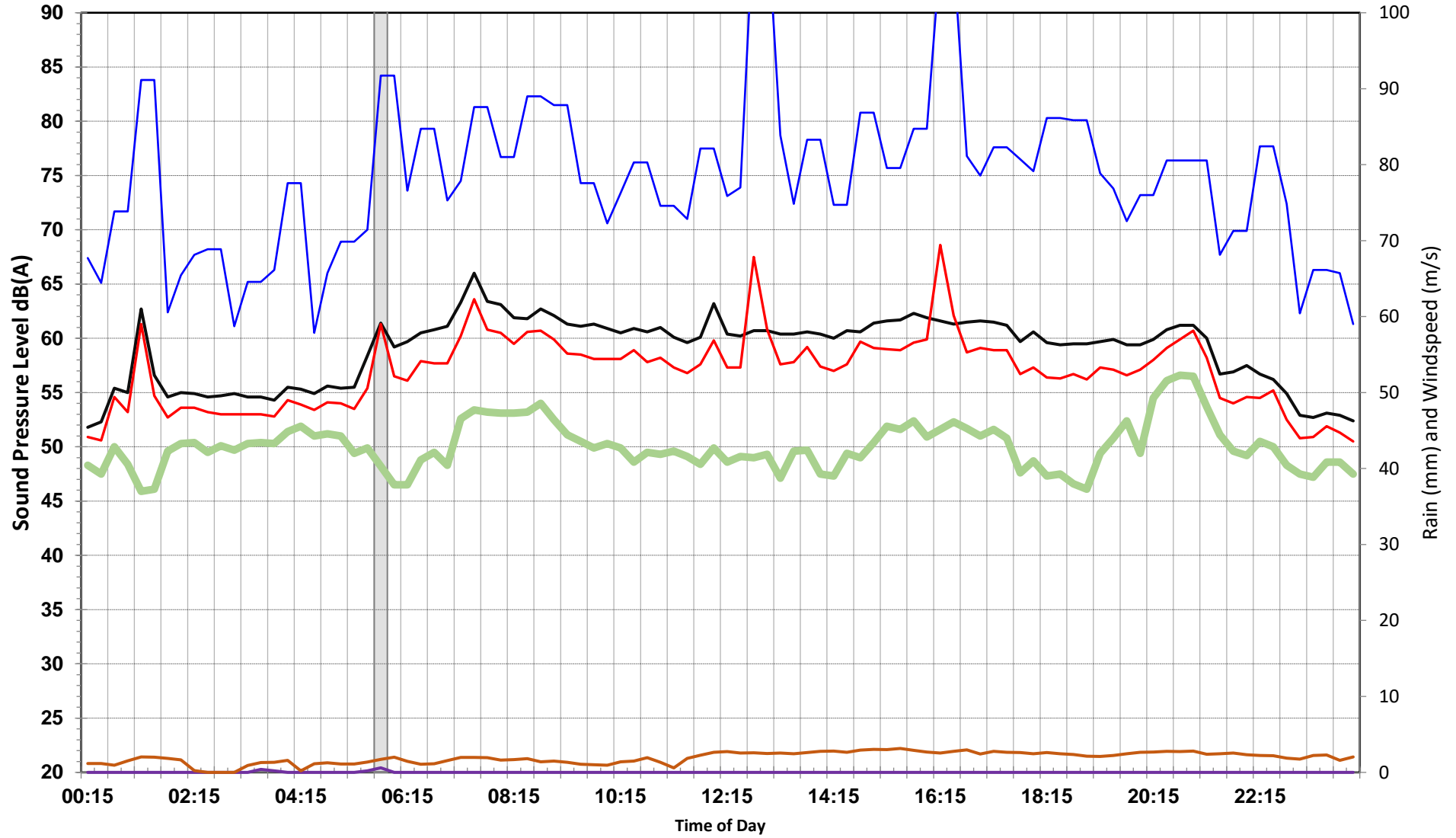
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# 003 - Eastern Section | Tweed Valley Hospital

Tuesday, 7 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed

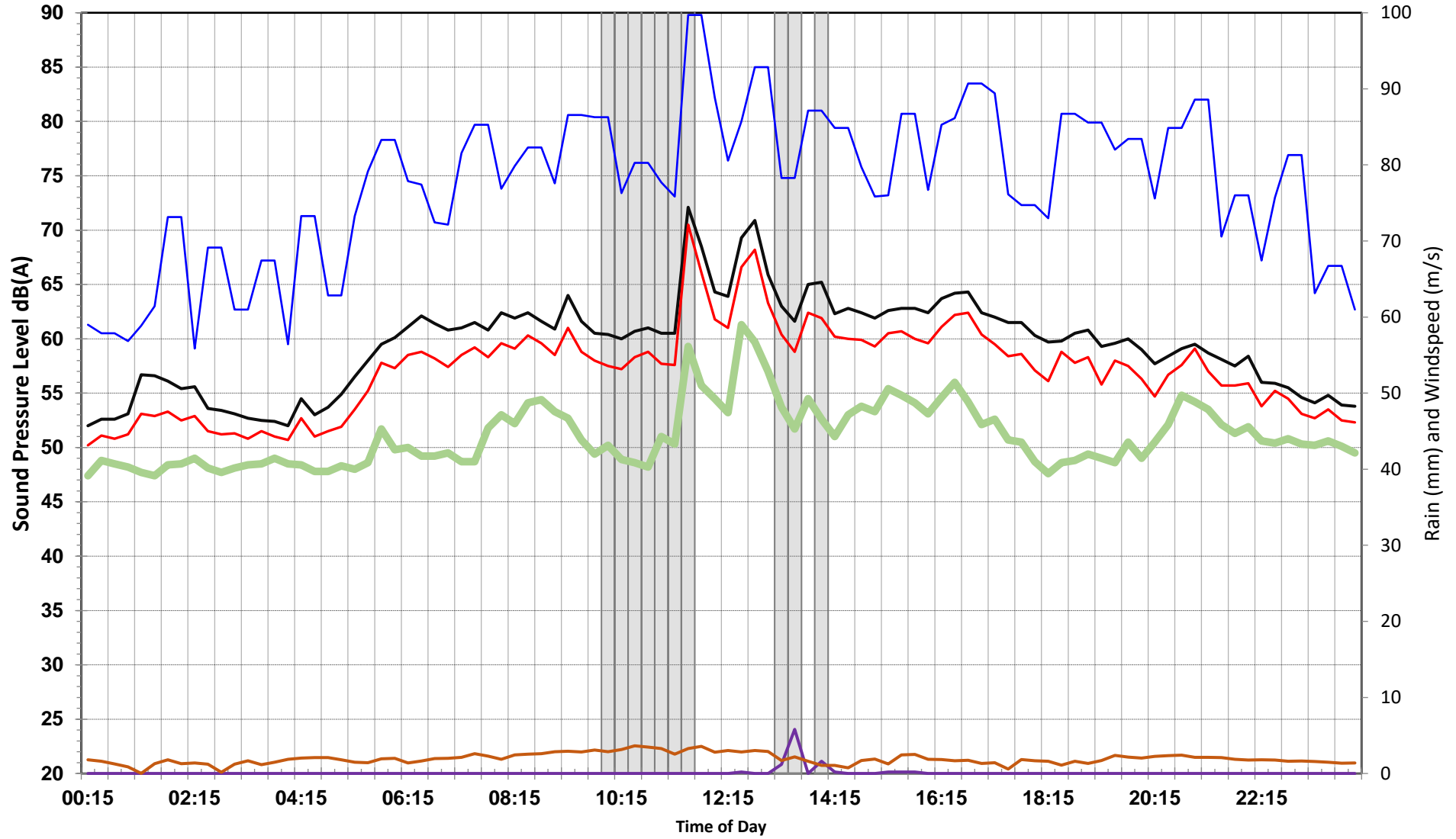




# 003 - Eastern Section | Tweed Valley Hospital

Wednesday, 8 December 2021

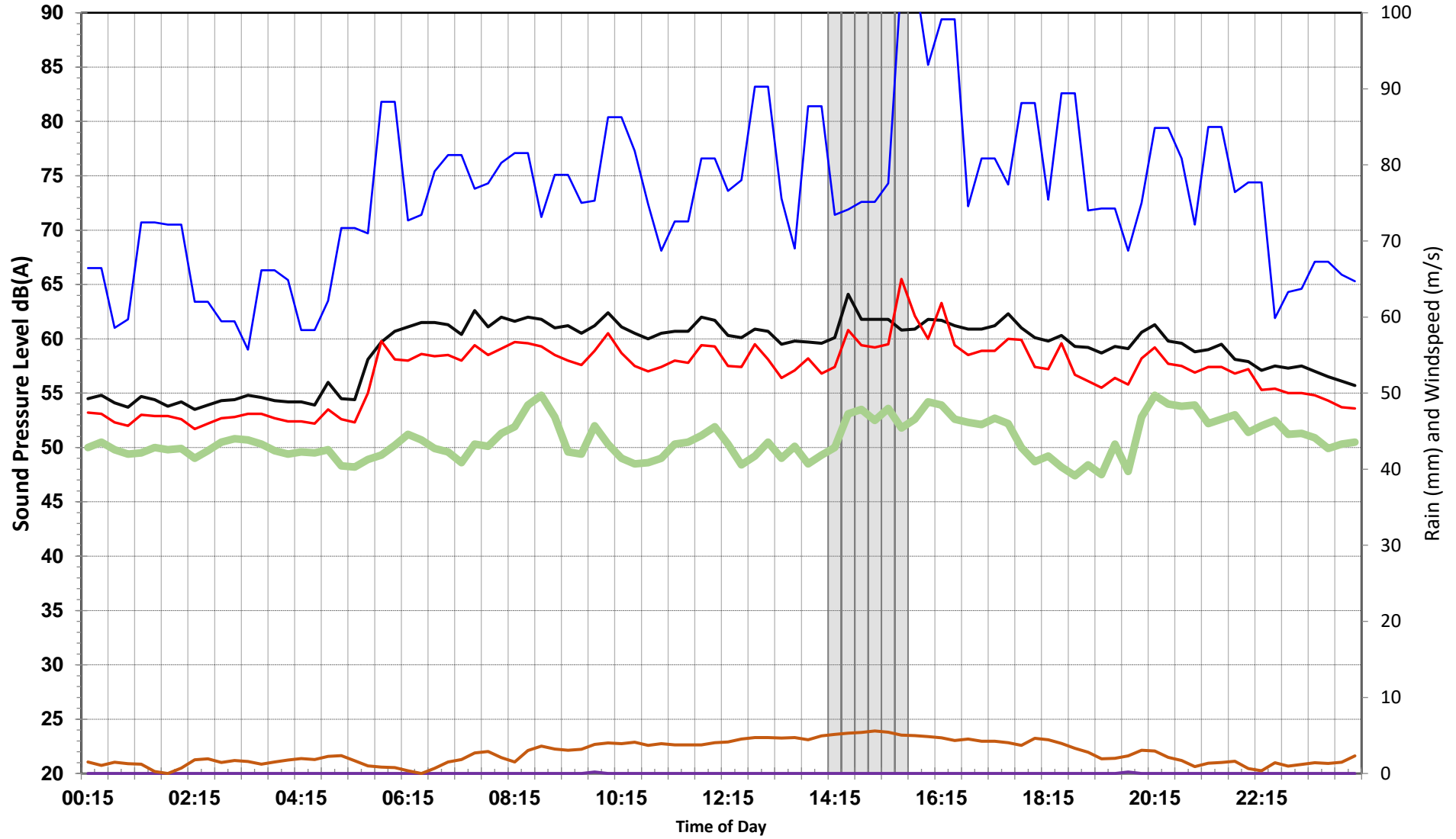
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# 003 - Eastern Section | Tweed Valley Hospital

Thursday, 9 December 2021

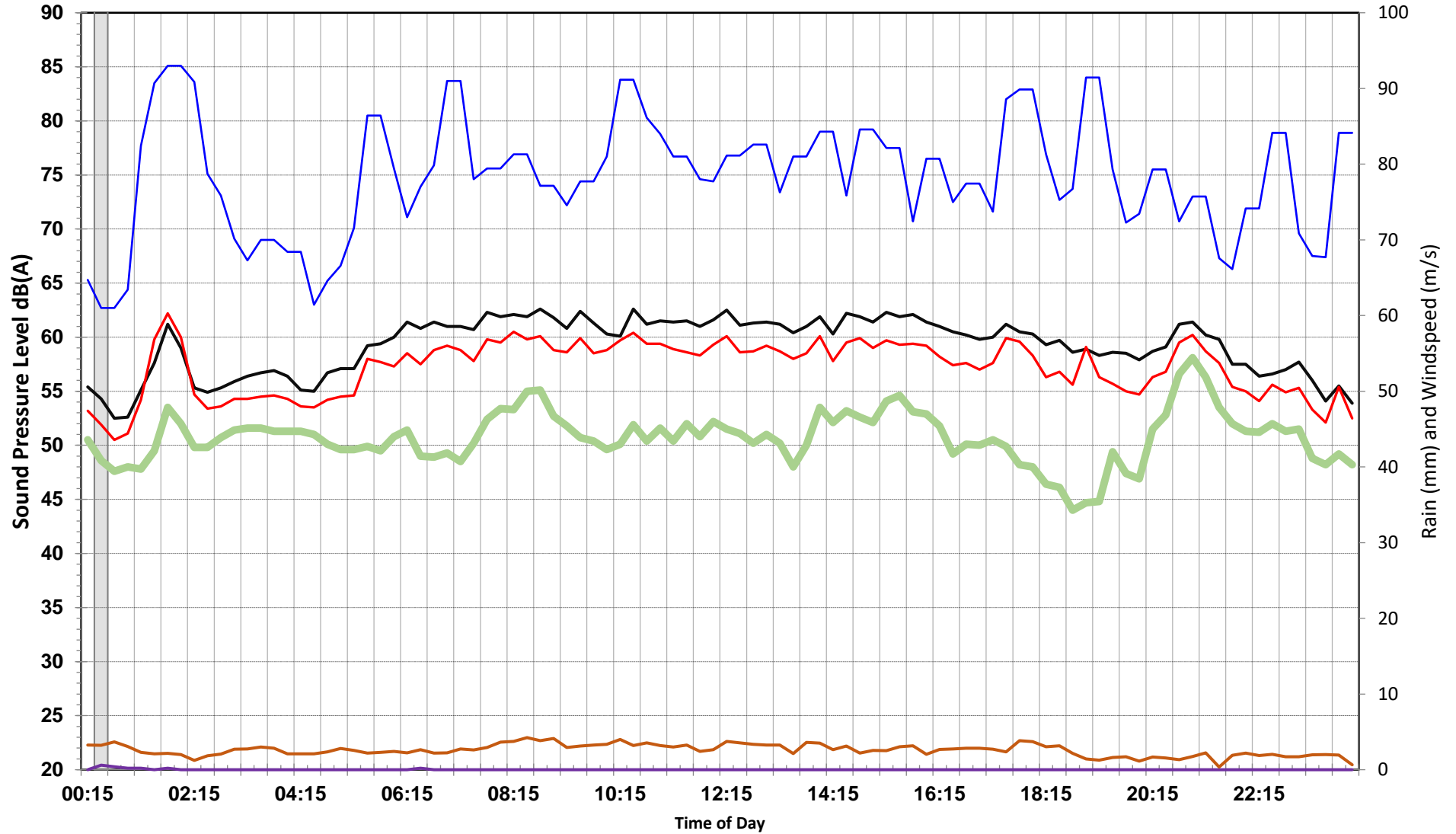
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# 003 - Eastern Section | Tweed Valley Hospital

Friday, 10 December 2021

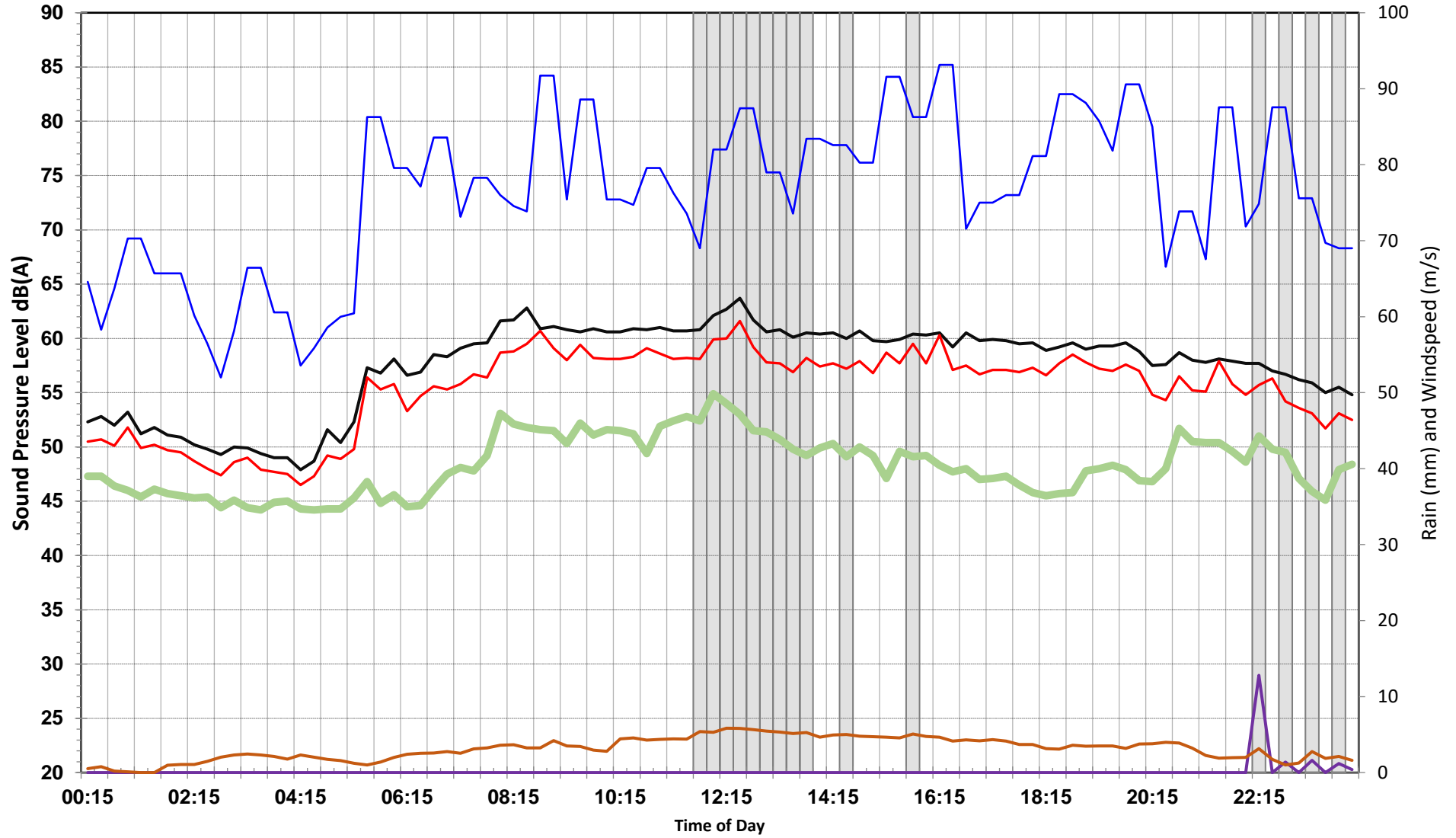
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# 003 - Eastern Section | Tweed Valley Hospital

Saturday, 11 December 2021

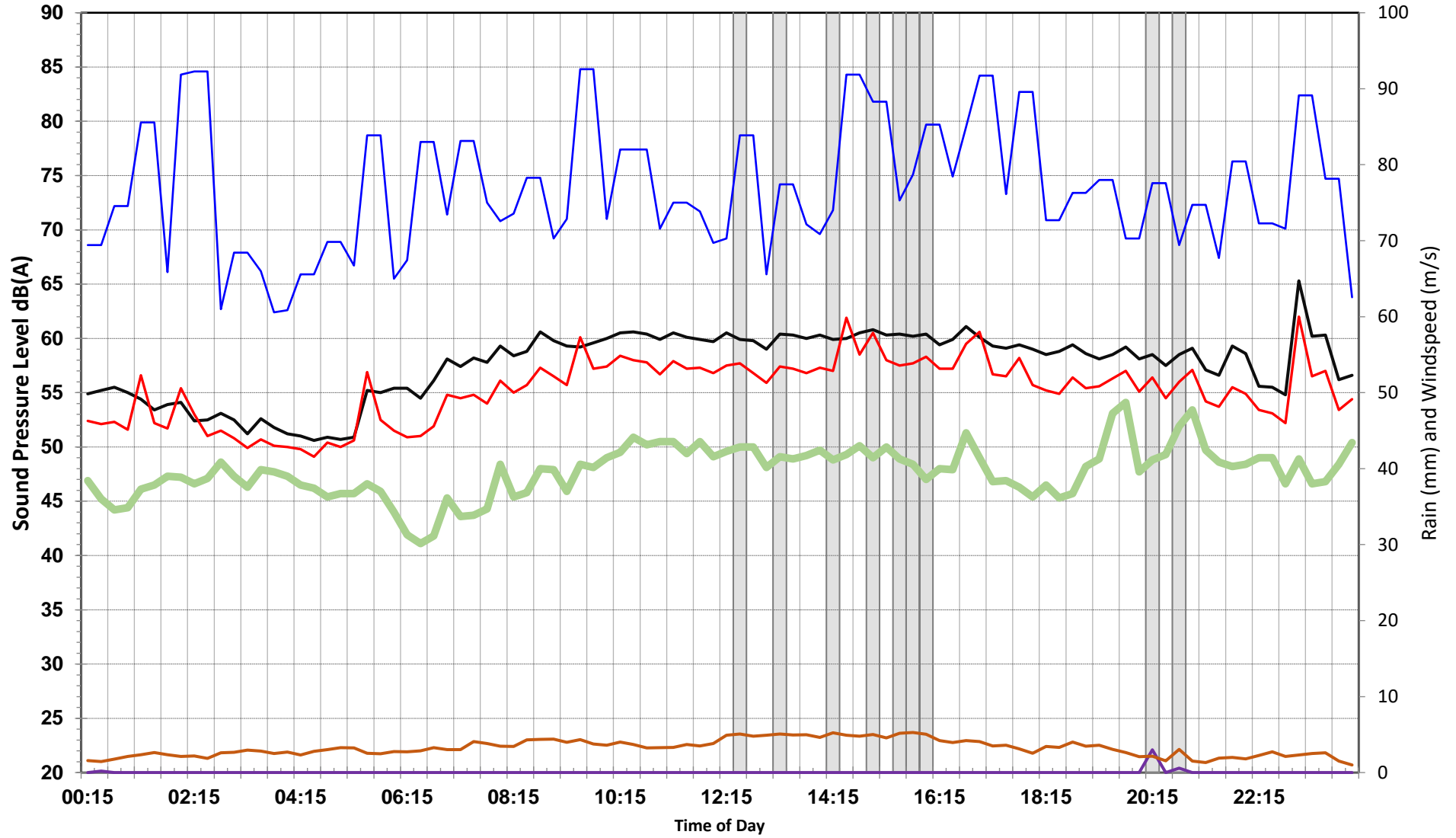
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# 003 - Eastern Section | Tweed Valley Hospital

Sunday, 12 December 2021

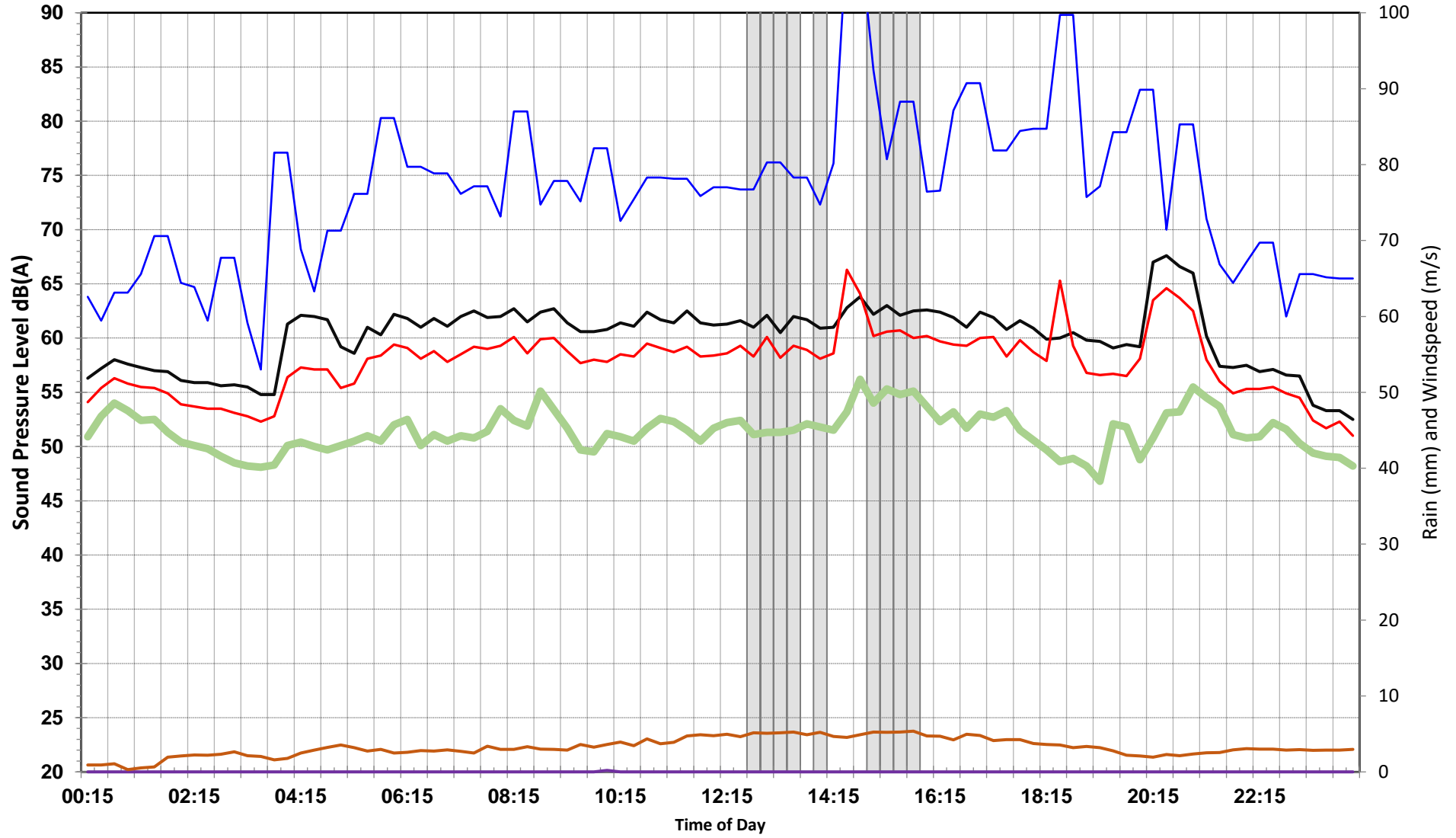
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# 003 - Eastern Section | Tweed Valley Hospital

Monday, 13 December 2021

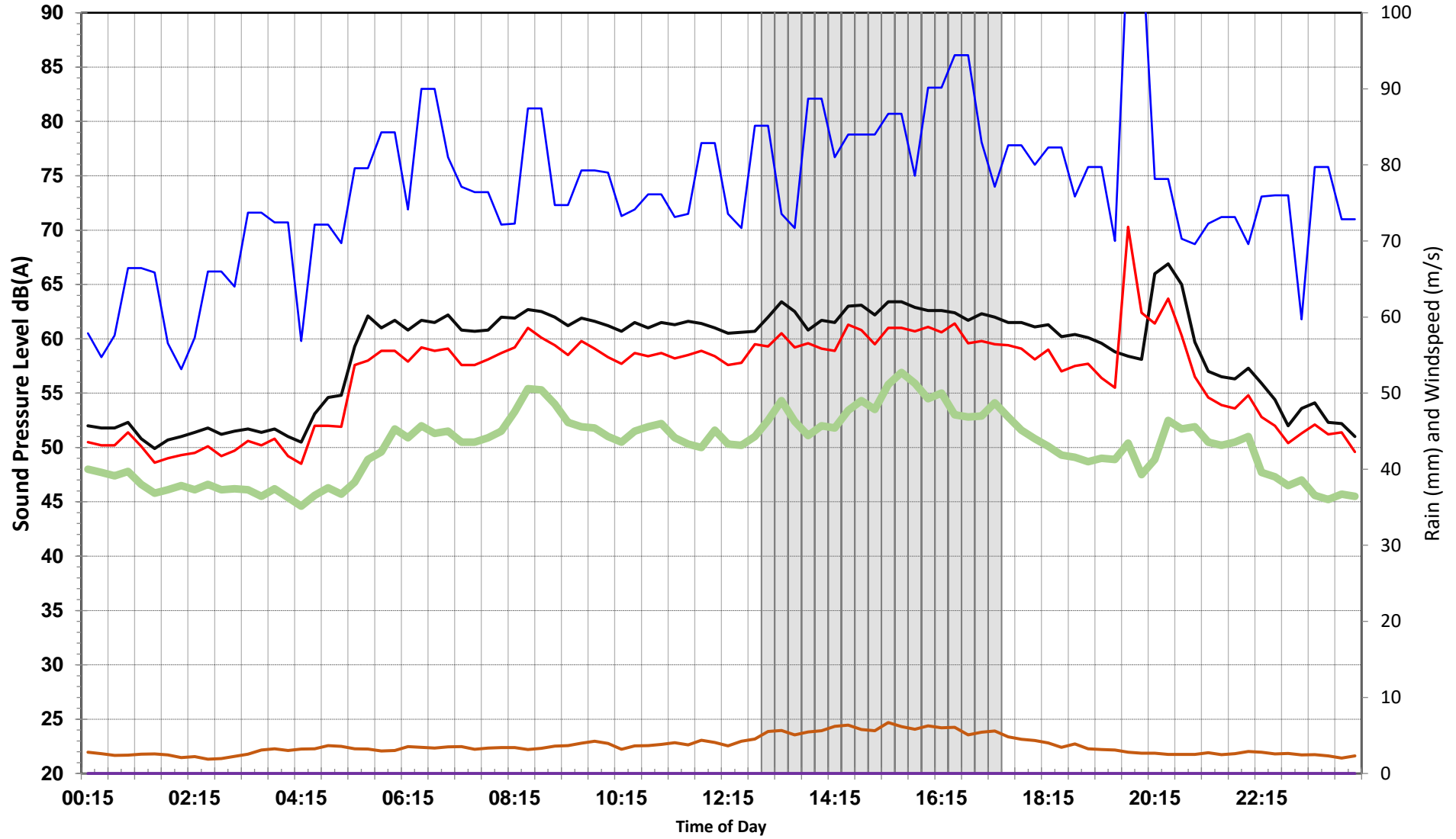
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# 003 - Eastern Section | Tweed Valley Hospital

Tuesday, 14 December 2021

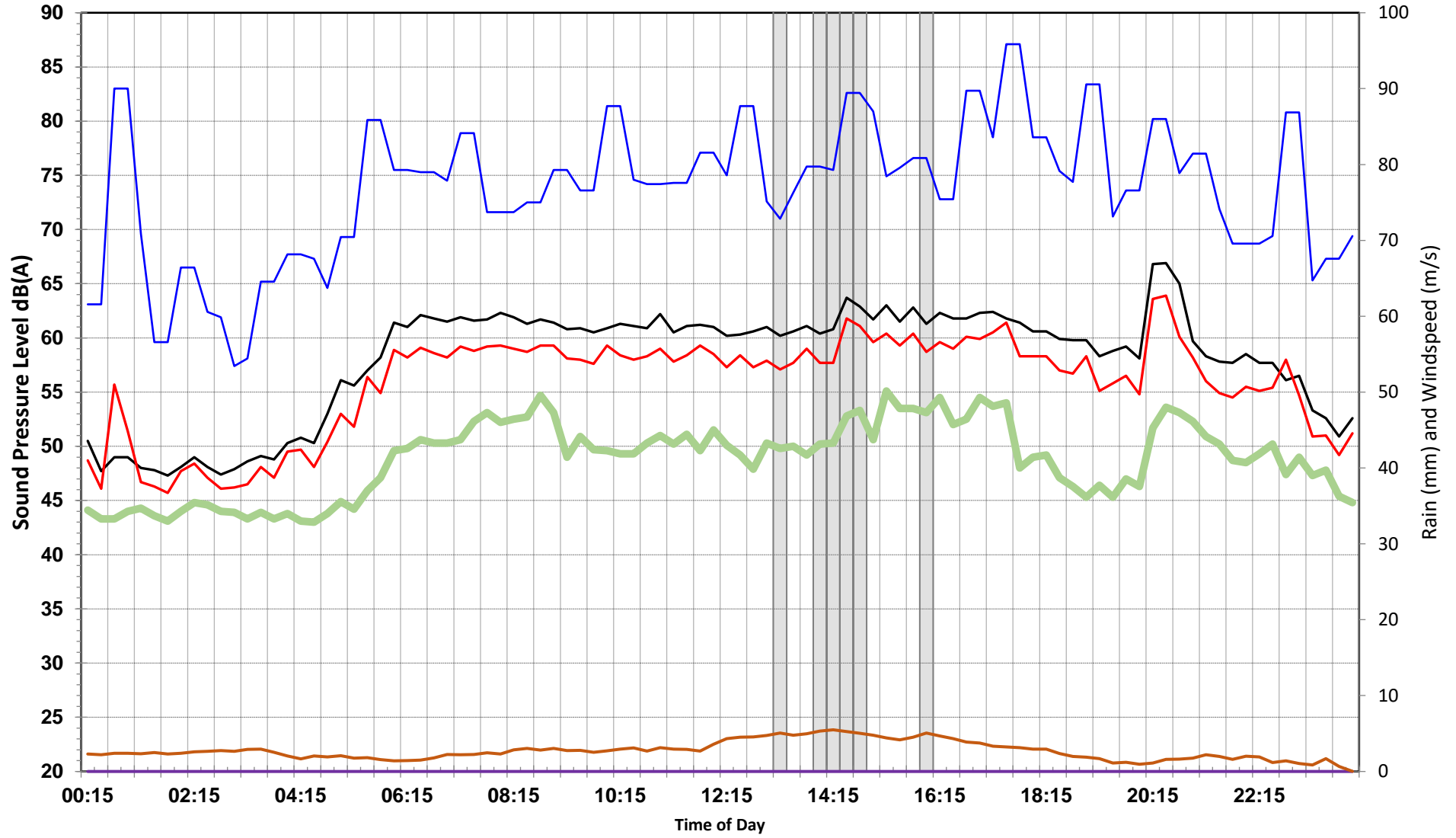
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# 003 - Eastern Section | Tweed Valley Hospital

Wednesday, 15 December 2021

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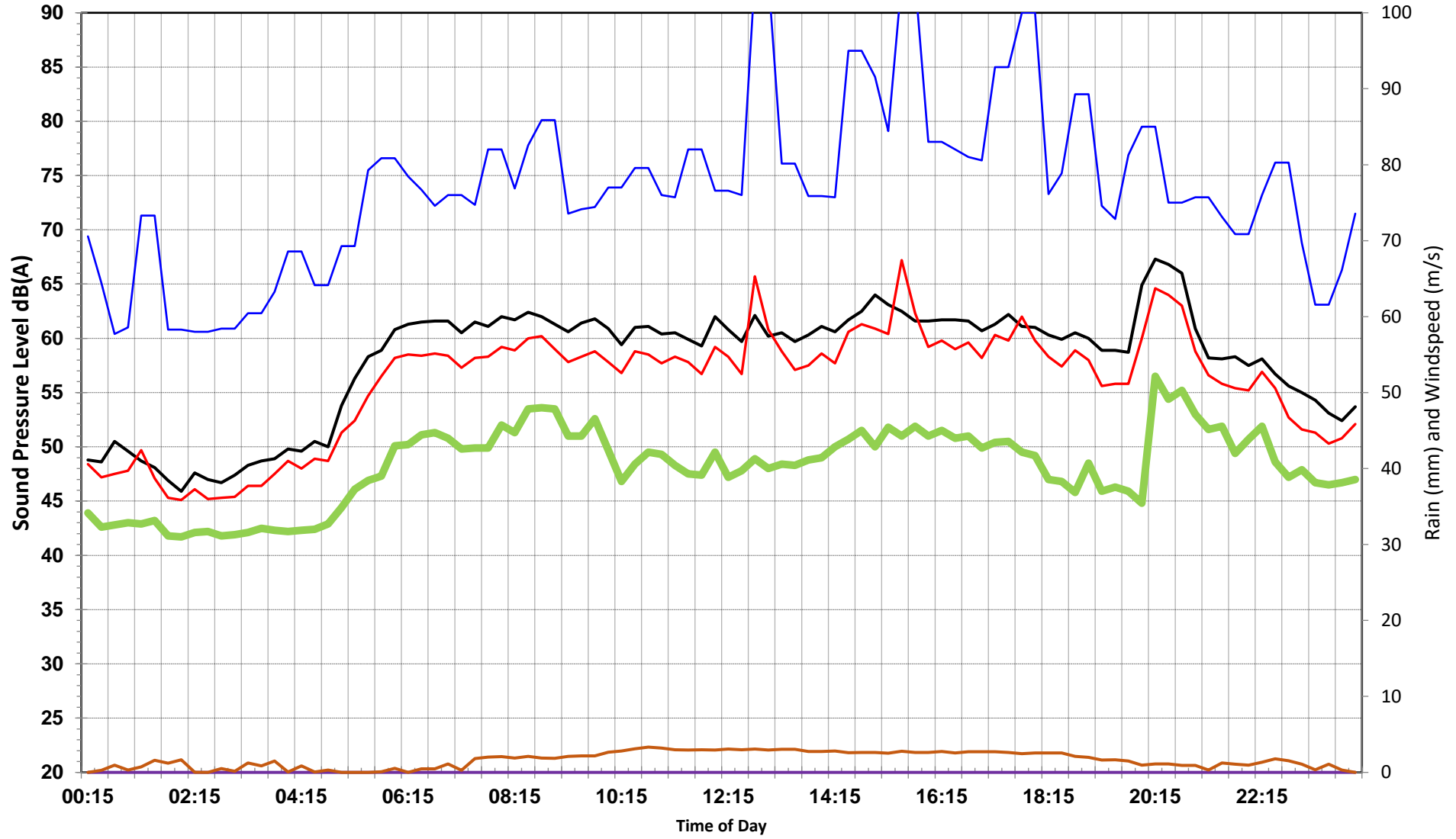




# 003 - Eastern Section | Tweed Valley Hospital

Thursday, 16 December 2021

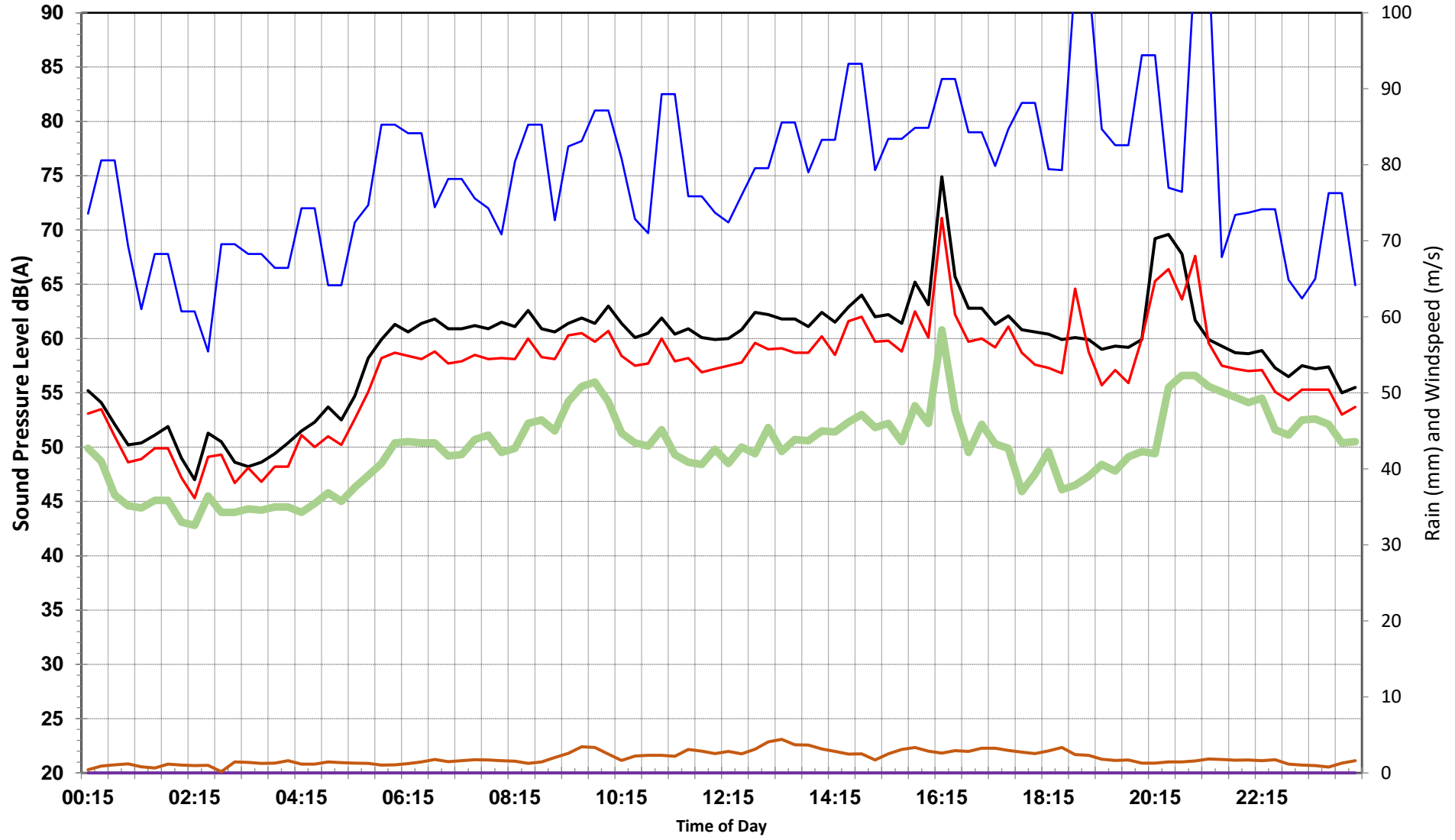
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# 003 - Eastern Section | Tweed Valley Hospital

Friday, 17 December 2021

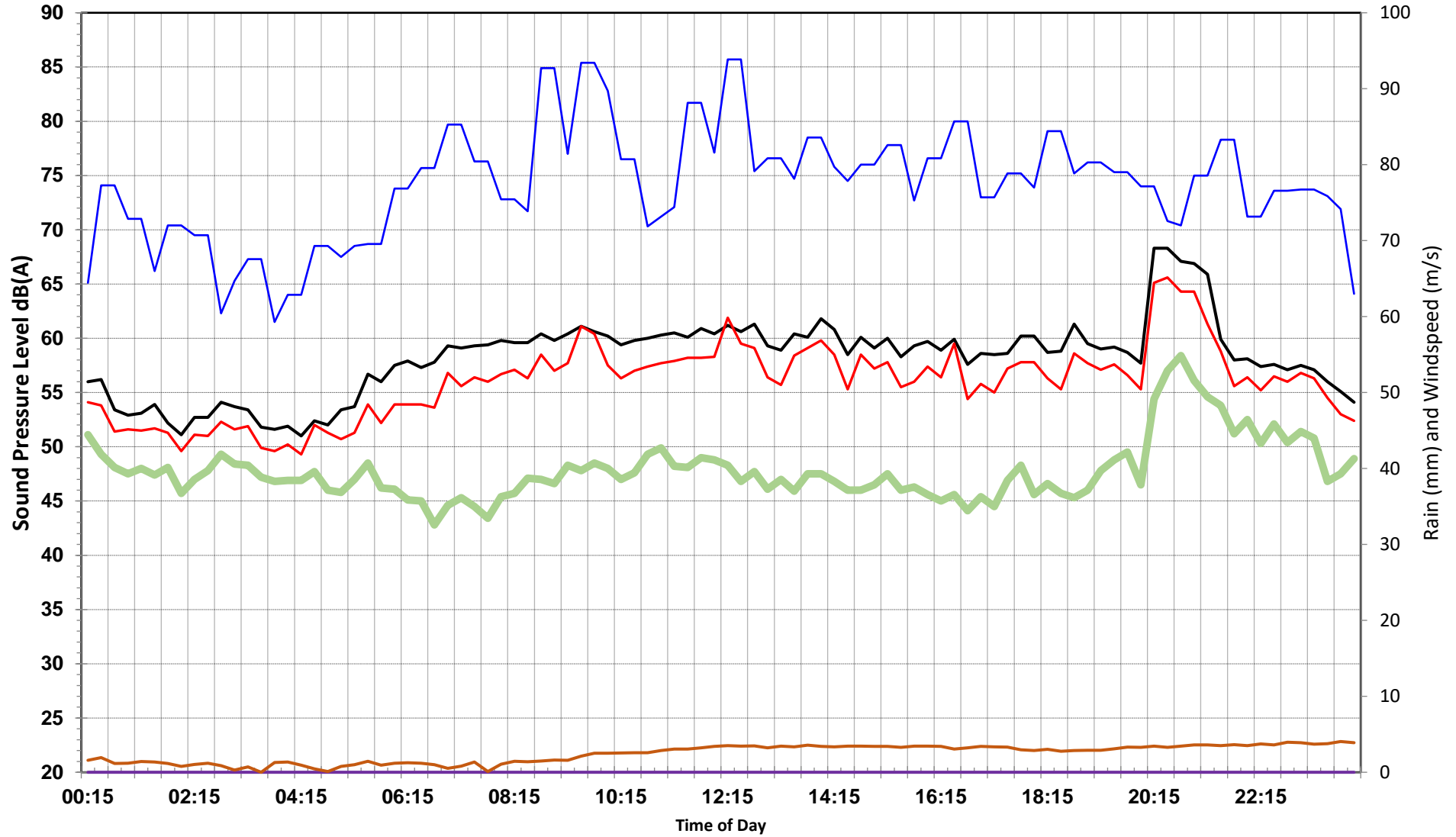
Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 003 - Eastern Section | Tweed Valley Hospital

Saturday, 18 December 2021

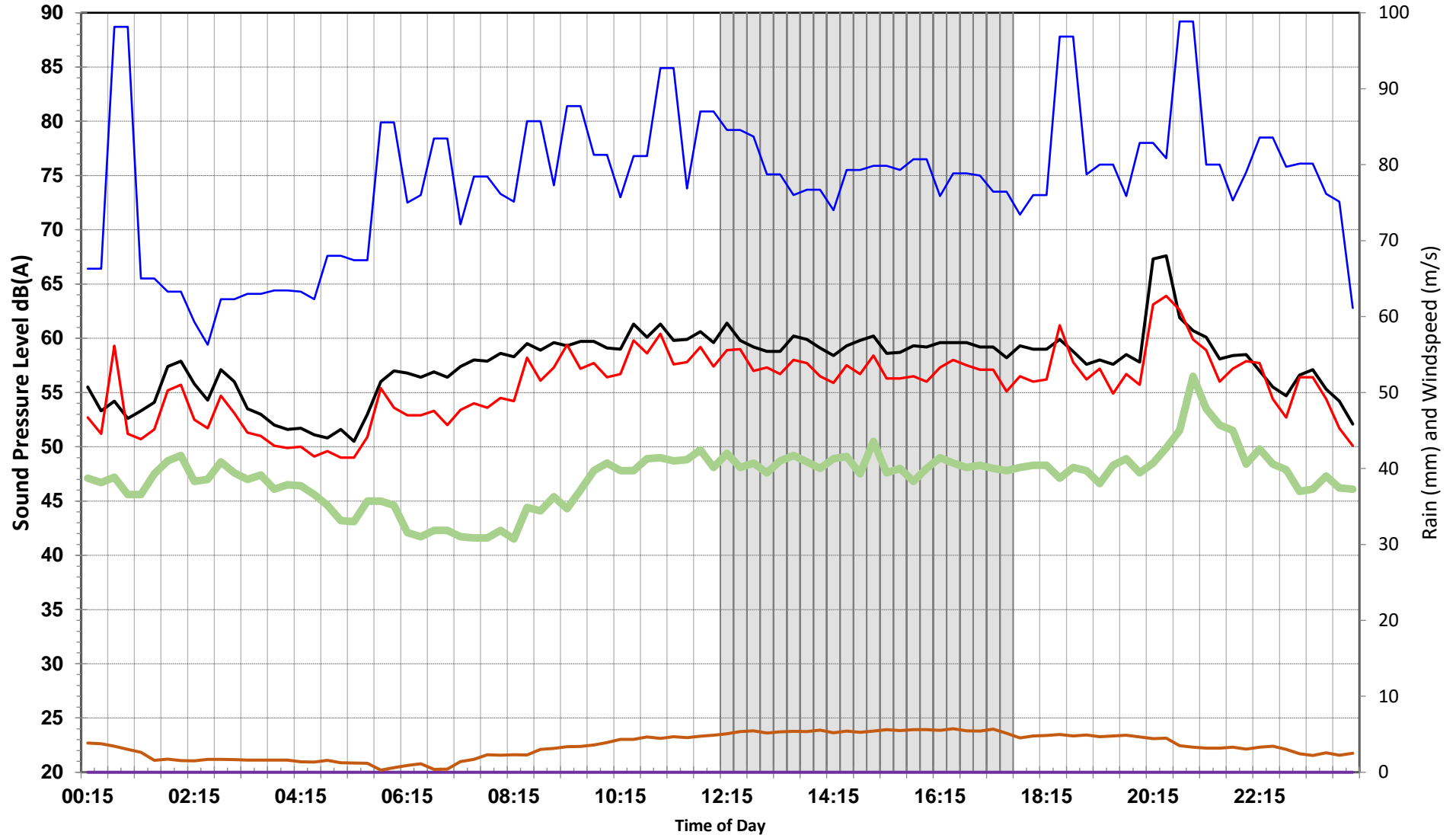
Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 003 - Eastern Section | Tweed Valley Hospital

Sunday, 19 December 2021

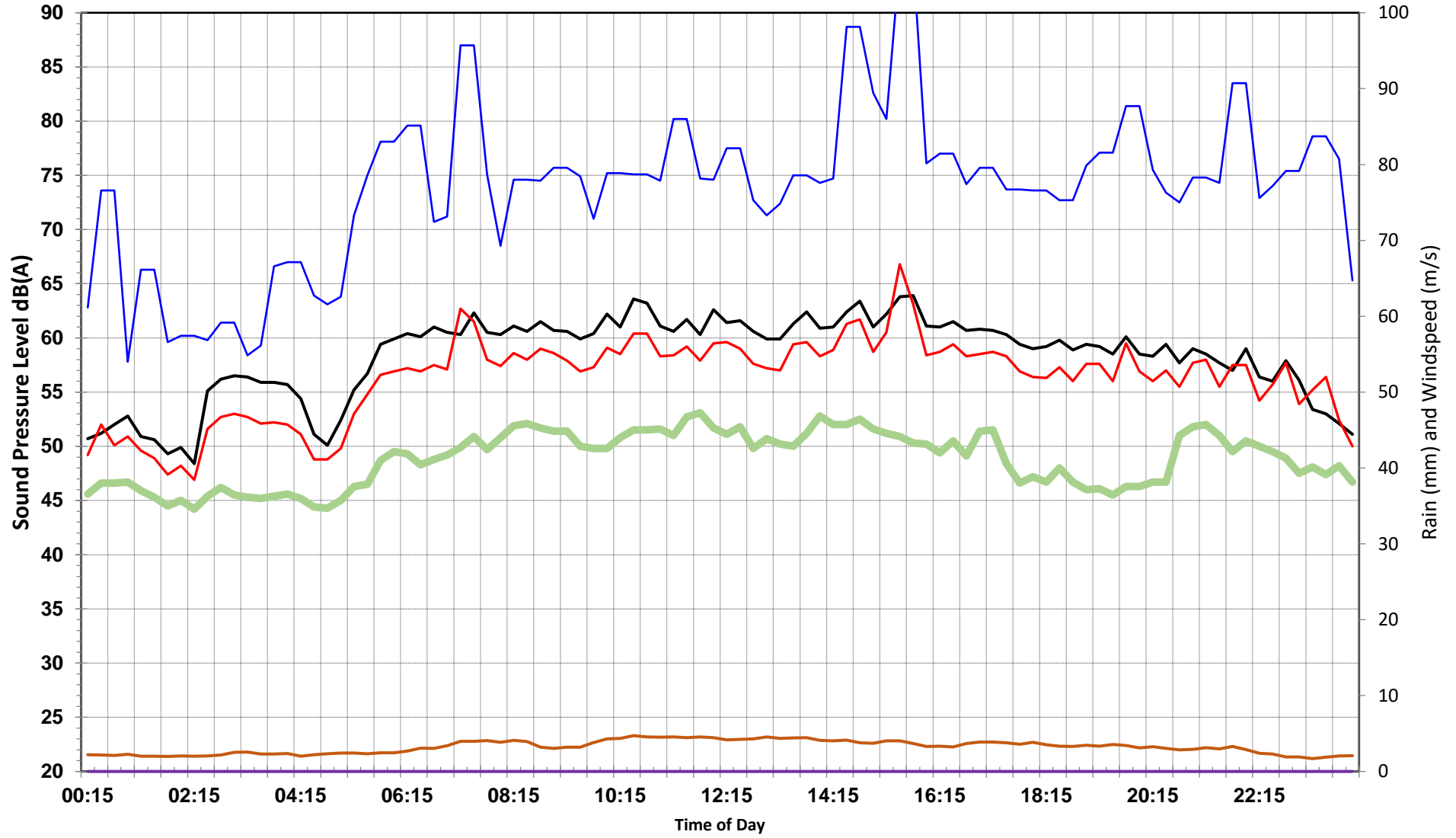
Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 003 - Eastern Section | Tweed Valley Hospital

Monday, 20 December 2021

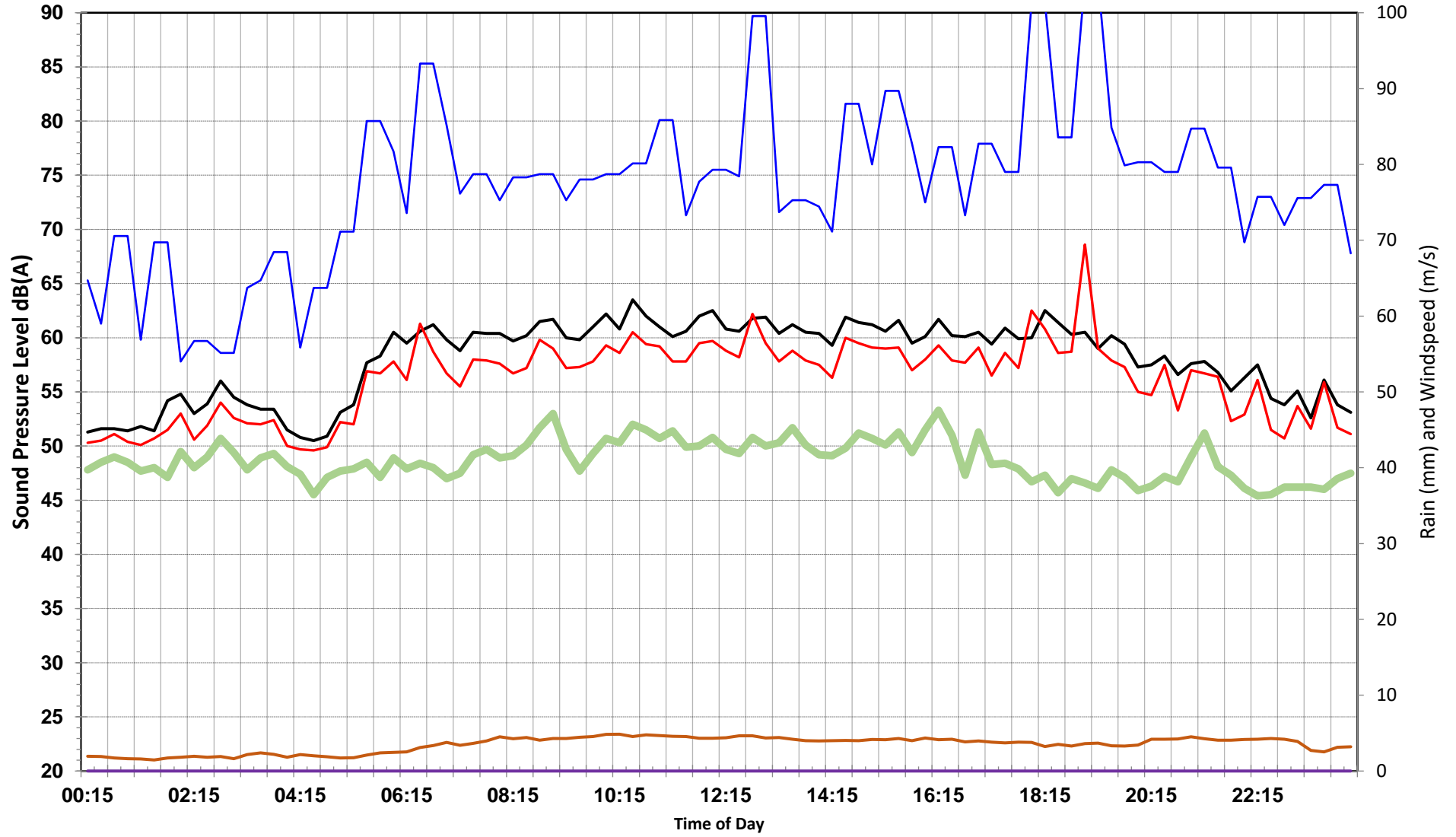
Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 003 - Eastern Section | Tweed Valley Hospital

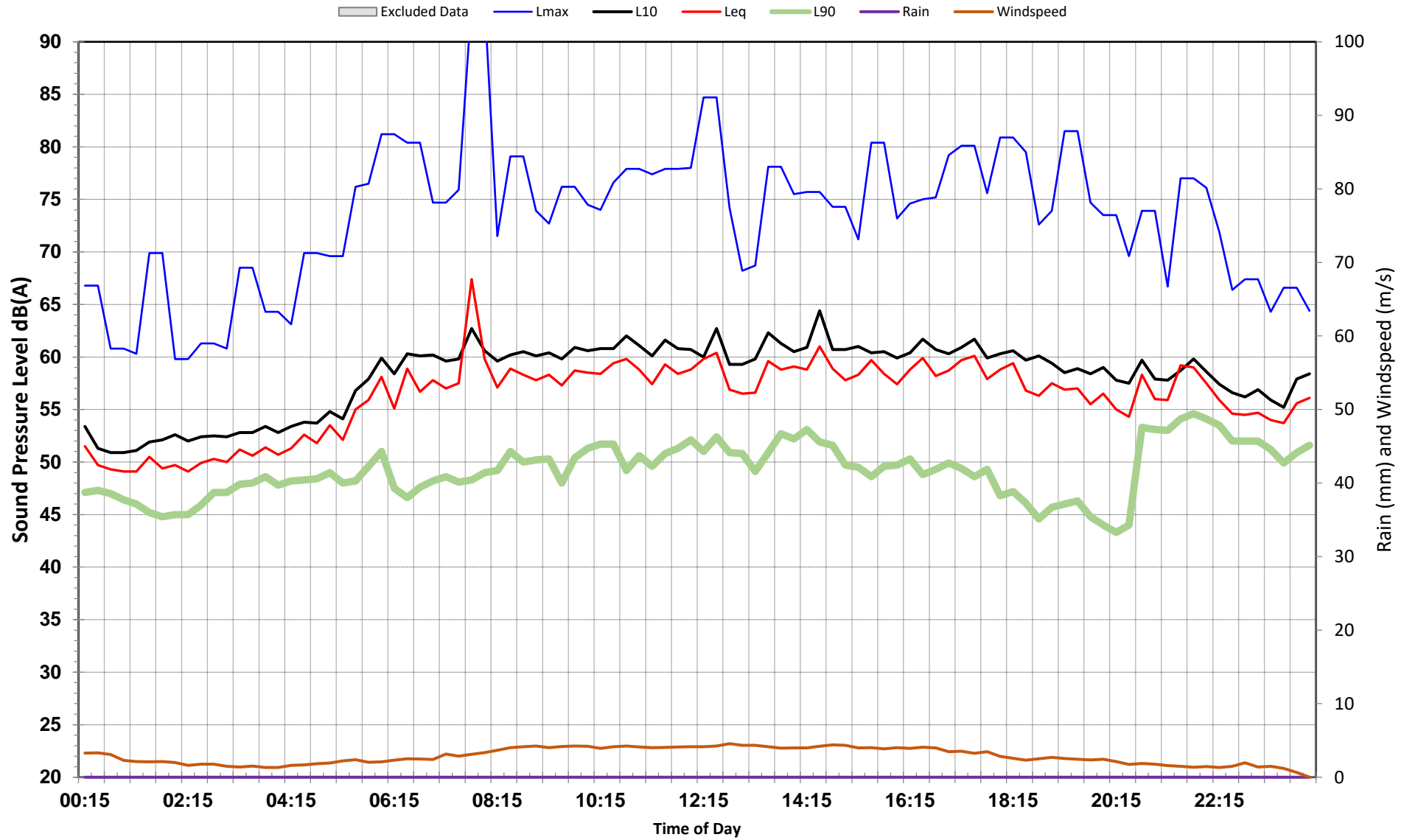
Tuesday, 21 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed



# 003 - Eastern Section | Tweed Valley Hospital

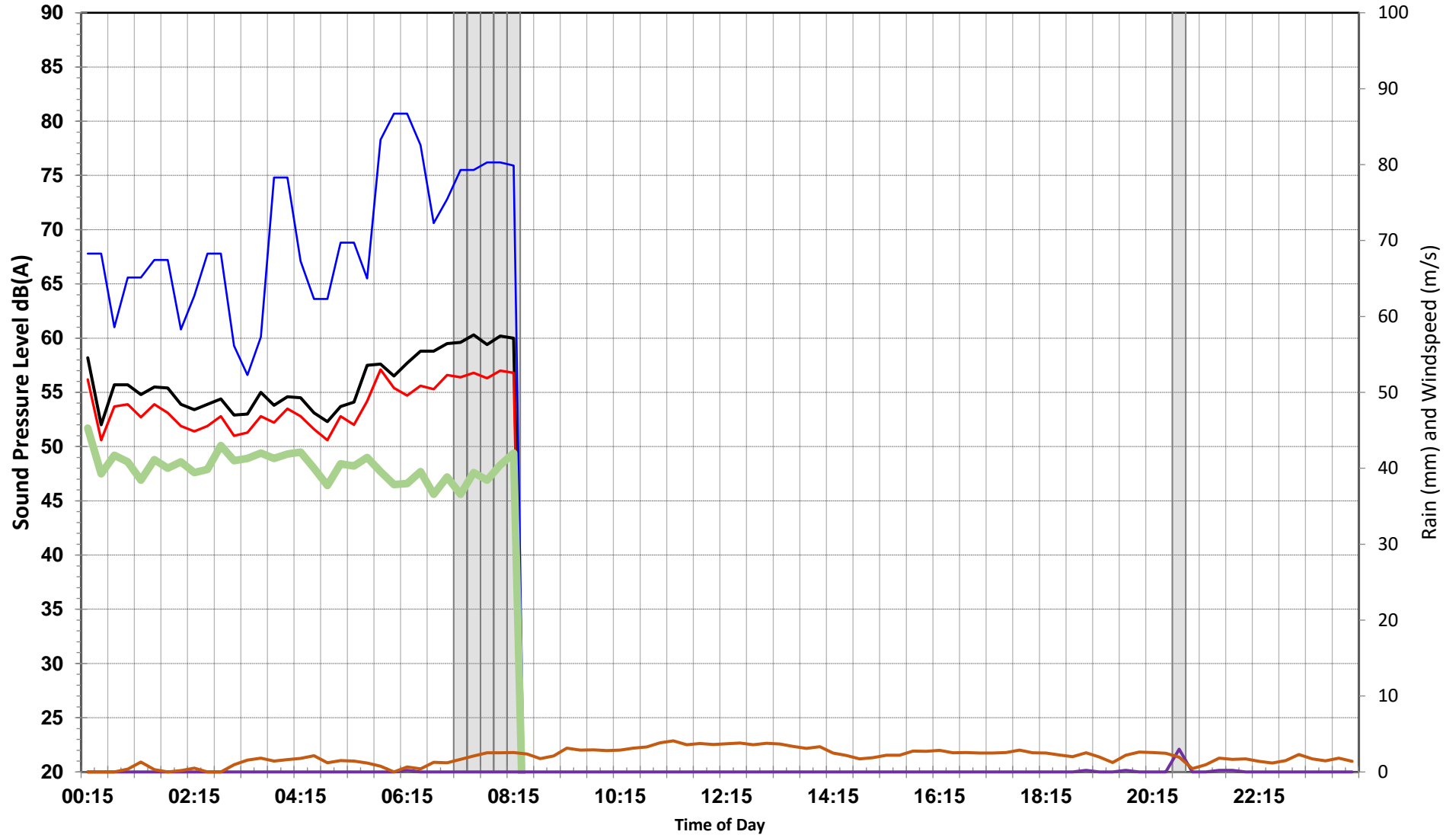
Wednesday, 22 December 2021



# 003 - Eastern Section | Tweed Valley Hospital

Thursday, 23 December 2021

Excluded Data Lmax L10 Leq L90 Rain Windspeed







*Further details regarding ADE's Services are available via*

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