

**Report VA3292.210517.NIA**

**Cabbagefield Row, Havant**

**Noise Impact Assessment**

**19 May 2021**

**Portsmouth City Council  
Civic Offices  
Guildhall Square  
Portsmouth  
PO1 2AR**

01962 461016  
0203 8650332  
[mail@ventaacoustics.com](mailto:mail@ventaacoustics.com)

registered company no. 10139494

## Contents

|                                                         |          |
|---------------------------------------------------------|----------|
| <b>1. Introduction.....</b>                             | <b>1</b> |
| <b>2. Guidance and Legislation .....</b>                | <b>1</b> |
| 2.1 Havant Pre-Application Response .....               | 1        |
| 2.2 The National Planning Policy Framework (2019) ..... | 1        |
| 2.3 Noise Policy Statement for England (2010).....      | 2        |
| 2.1 ProPG: Planning & Noise (2017).....                 | 3        |
| 2.2 WHO Guidelines for Community Noise (1999).....      | 4        |
| 2.3 BS8233:2014 .....                                   | 4        |
| <b>3. Site Description.....</b>                         | <b>5</b> |
| <b>4. Environmental Noise Survey .....</b>              | <b>5</b> |
| 4.1 Survey Procedure & Equipment .....                  | 5        |
| 4.2 Results .....                                       | 6        |
| <b>5. Effect of Covid Restrictions .....</b>            | <b>6</b> |
| <b>6. ProPG Stage 1 Risk Assessment .....</b>           | <b>7</b> |
| <b>7. Discussion .....</b>                              | <b>7</b> |
| 7.1 Internal Noise Levels .....                         | 7        |
| 7.2 Areas of External Amenity .....                     | 7        |
| 7.3 Impact on Existing Residents .....                  | 8        |
| 7.4 Planning Implications .....                         | 8        |
| <b>8. Conclusion .....</b>                              | <b>8</b> |

## Attachments

|                |                                    |
|----------------|------------------------------------|
| VA3292/SP1     | Indicative Site Plan               |
| VA3292/TH1-TH4 | Environmental Noise Time Histories |
| Appendix A     | Acoustic Terminology               |

# 1. Introduction

It is proposed to develop the green field site at Cabbagefield Row for residential use.

Venta Acoustics has been commissioned by Portsmouth City Council to undertake an assessment of the current environmental noise impact on the site and provide recommendations of acoustic mitigation where required in support of an application for planning permission.

An environmental noise survey has been undertaken to determine the noise levels incident on the site. These levels are then used to undertake an assessment of the likely impact in accordance with the National Planning Policy Framework with reference to relevant standards, guidance and the planning requirements of Havant Council.

Outline mitigation measures are considered and an appraisal of the requirements of external building fabric elements are provided where appropriate.

# 2. Guidance and Legislation

## 2.1 Havant Pre-Application Response

Environmental Health provided the following response to the pre-application consultation:

*“Whilst I have no objection in principle to this development, I would ask that the following condition(s) and informative(s) be added to any positive decision notice, if any future consent were to be granted.*

*Condition 1: The applicant to confirm that the acoustic mitigation measures to be employed with regard to the building envelope, including fenestration and ventilation, for all residential units, will meet BS8223:2014 standards as recommended for indoor ambient noise levels for dwellings, especially in relation to living rooms and bedrooms i.e during the day (07:00 to 23:00) 35 dB  $L_{Aeq,16}$  hour and at night (23:00 to 07:00) 30 dB  $L_{Aeq,8}$  hour for bedrooms. Similarly for traditional external areas that are used for personal amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB  $L_{Aeq}$  with an upper guideline value of 55 dB  $L_{Aeq}$  in noisier environments.*

*Reason: To ensure the residential amenity of the properties is not impacted upon by any external noise levels.”*

## 2.2 The National Planning Policy Framework (2019)

The revised *National Planning Policy Framework* (NPPF), adopted in 2019, sets out the Government’s planning policies for England, superseding all previous planning policy statements and guidance.

In respect of noise, the NPPF states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing developments from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

Hence, Paragraph 180 states that *planning policies and decisions should also ensure new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*

In regards to the term adverse impact, reference is made to the Noise Policy for England:

## 2.3 Noise Policy Statement for England (2010)

The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy: to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

This vision is supported by the following aims:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*

The terms “significant adverse” and “adverse” are related to the following concepts:

- No Observed Effect Level (NOEL) - the level below which no effect on health and quality of life can be detected.
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The guidance acknowledges that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations, but will be different for different noise sources, receptors and times.

In order to enable assessment of impacts in line with these requirements, reference should be made to other currently available guidance.

## 2.1 ProPG: Planning & Noise (2017)

ProPG (Professional Practice Guidance: Planning and Noise) 2017 has been jointly developed by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC) and the Chartered Institute of Environmental Health (CIEH) to guide Local Planning Authorities (LPA's) and Practitioners in assessing the suitability for residential development on sites predominantly exposed to airborne transport noise.

The guidance advocates a proportionate and risk based 2-stage assessment approach.

**Stage 1** is an initial noise risk assessment of the site, based on measurements or predictions, in the absence of mitigation or consideration of the proposed layout. A risk category is assigned to the site as follows:

| Risk Category   | Indicative Daytime Noise Levels $L_{Aeq,16hr}$ | Indicative Night Time Noise Levels $L_{Aeq,8hr}$ | Pre-Planning Application Advice                                                                                                                                                                                     |
|-----------------|------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Negligible Risk | < 50 dB                                        | < 40 dB                                          | Indication that the development site is likely to be acceptable from a noise perspective and application need not normally be delayed on noise grounds.                                                             |
| Low Risk        | 50 - 60 dB                                     | 40 - 50 dB                                       | Indication that the development site is likely to be acceptable provided a good acoustic design process is followed and is confirmed in a detailed Acoustic Design Statement confirming how noise will be mitigated |
| Medium Risk     | 60 - 70 dB                                     | 50 - 60 dB                                       |                                                                                                                                                                                                                     |
| High Risk       | > 70dB                                         | > 60dB                                           | Indication that the development site may be refused on noise grounds unless a good acoustic design process and detailed Acoustic Design statement can demonstrate the significant noise risk can be mitigated.      |

### Notes

- Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.
- Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".
- $L_{Aeq,16hr}$  is for daytime 0700 – 2300,  $L_{Aeq,8hr}$  is for night-time 2300 – 0700.
- An indication that there may be more than 10 noise events at night (2300 – 0700) with  $L_{Amax,F} > 60$  dB means the site should not be regarded as negligible risk.

The table suggests hard boundaries between risk categories based on values. The intent is a more considered and progressive increase in risk level as noise levels increase.

**Table 2.1 – ProPG Stage 1 Site Noise Risk Assessment**

**Stage 2** is a detailed assessment of the proposals with consideration of four key elements:

- Element 1 – demonstrating a "Good Acoustic Design Process"
- Element 2 – observing internal "Noise Level Guidelines"

- Element 3 – undertaking an “External Amenity Area Noise Assessment”
- Element 4 – consideration of “Other Relevant Issues”

## 2.2 WHO Guidelines for Community Noise (1999)

The guidance in this document details suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this document are shown in Table 2.2.

| Criterion                                                                         | Environment | Design range $L_{Aeq,T}$ dB |
|-----------------------------------------------------------------------------------|-------------|-----------------------------|
| Maintain speech intelligibility and avoid moderate annoyance, daytime and evening | Living Room | 35 dB                       |
| Prevent sleep disturbance, night time                                             | Bedrooms    | 30 dB                       |

Table 2.2 – Excerpt from WHO

[dB ref. 20µPa]

This guidance also states:

*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB  $L_{Amax}$  more than 10-15 times a night (Vallet & Vernet 1991).*

For outdoor living areas, it is stated that:

*To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB  $L_{Aeq}$  on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB  $L_{Aeq}$ . Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development.*

For sleep disturbance, i.e. in bedrooms at night, the NOEL can, therefore, be taken as anything below 30dB(A), whilst the onset of the LOAEL occurs at 30dB(A) and above. The SOAEL cannot be inferred from this information.

During daytime periods, for avoidance of annoyance, the NOEL relates to anything up to 50dB(A) (typically applied to external areas, such as gardens), whilst the onset of the LOAEL occurs at 50dB(A) and above.

## 2.3 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to desirable internal ambient noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.3.

| Activity                   | Location    | 07:00 to 23:00      | 23:00 to 07:00     |
|----------------------------|-------------|---------------------|--------------------|
| Resting                    | Living Room | 35 dB LAeq, 16 hour | -                  |
| Dining                     | Dining Room | 40 dB LAeq, 16 hour | -                  |
| Sleeping (daytime resting) | Bedroom     | 35 dB LAeq, 16 hour | 30 dB LAeq, 8 hour |

Table 2.3 – Excerpt from BS8233:2014 - Indoor ambient noise levels for dwellings

[dB ref. 20μPa]

For external areas the standard states the following:

*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments.*

*However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*

### 3. Site Description

As illustrated on attached site plan VA3292/SP1, the green field site is to the north of Swanmore Road in the Warren Park area of Leigh Park. Warren Park is an existing housing estate.

The site is otherwise surrounded by open land, although it is understood that the land to the east is the site of a proposed reservoir.

The main source of noise affecting the area is the A3, some 600m to the west. The nearest identified commercial use is the Dunsbury Business Park some 700m to the south west. No commercial or industrial noise was noted on site during visits and it is not expected that commercial noise would be significant given the existing dwellings in closer proximity.

The proposal is to develop a total of 150 dwelling, with both houses and apartments, on the site.

### 4. Environmental Noise Survey

#### 4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Tuesday 27<sup>th</sup> and Friday 30<sup>th</sup> April 2021 at the location shown in site plan VA3292/SP1. This location was chosen to be representative of the noise level across the site.

Continuous 5-minute samples of the LAeq, LAmaz, LA10 and LA90 sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

| Manufacturer                | Model Type | Serial No    | Calibration     |         |
|-----------------------------|------------|--------------|-----------------|---------|
|                             |            |              | Certificate No. | Date    |
| NTi Class 1 Integrating SLM | XL2        | A2A-11461-E0 | UCRT20/1699     | 27/7/20 |
| Larson Davis calibrator     | CAL200     | 13049        | UCRT21/1385     | 22/3/21 |

**Table 4.1 – Equipment used for the survey**

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

## 4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA3292/TH1-4.

The site is primarily affected by traffic noise from the A3. Subjectively, during the site visits the sound of road traffic was faintly audible with the ambient noise being dominated by birdsong.

The average noise levels for the Daytime and Night-time periods, as measured at the automated monitoring position were:

| Monitoring Period   | $L_{Aeq,T}$ |
|---------------------|-------------|
| 07:00 – 23:00 hours | 49 dB       |
| 23:00 – 07:00 hours | 45 dB       |

**Table 4.2 – Average ambient noise levels at measurement locations**

[dB ref. 20µPa]

The typical night time  $L_{Amax}$  events were recorded to be in the order of 63dB  $L_{Amax,fast}$ .

## 5. Effect of Covid Restrictions

At the time of the survey Covid travel restrictions were largely lifted although advice to minimise travel was in place. Schools were open and subjectively the A3 was noted as being busy.

To support the survey data other sources of data was reviewed.

The English Noise Map (viewable at <http://www.extrium.co.uk/noiseviewer.html>) indicates that noise from the A3 also were in general support of the measured levels, with the site outside of the  $L_{Aeq,16hr}$  55dB contour shown for daytime levels. At night the model shows the site being within the  $L_{Aeq,8hr}$  50-55dB contour. This may be due to reduced night time traffic volumes during the survey or

the difference in measurement height (measurements were taken at approximately 2m high, English Noise Map is calculated at 4m high).

## 6. ProPG Stage 1 Risk Assessment

The noise levels shown in Table 4.2 show that the site lies in the 'Negligible Risk' to 'Low Risk' category range.

This is an indication that the development site is likely to be acceptable from a noise perspective and application need not normally be delayed on noise grounds.

## 7. Discussion

The measured noise levels are considered representative of levels across the site.

On development, the buildings to the west would provide additional screening to the remaining buildings, with most facades expected to have slightly lower levels than measured.

### 7.1 Internal Noise Levels

BS8233 suggests that a loss of around 15dB can be expected from a partially open window. The document also includes a note that states '*...the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*'. It is considered that where occupants have a choice, the desirable aspect of an open window offsets the slight increase in internal noise levels and the 5dB relaxation is generally acceptable. This is supported by the ProPG document in Note 7 of figure 2 and in section 2.30.

With the measured levels, appropriate internal noise levels are generally expected with windows partially open.

Using the night time noise levels from the English Noise Map, a slight exceedance of the BS8233 and WHO recommendations is indicated on only the most affected facades, although this would be expected to be within the 5dB relaxation level discussed above.

Using standard building constructions and thermal double glazing, the internal noise levels are expected to comfortably achieve the recommended internal noise levels.

Therefore, there is not considered to be a requirement for specific glazing or ventilation schemes.

### 7.2 Areas of External Amenity

External noise levels comply with the World Health Organisation guideline value for external amenity of  $L_{Aeq,16hour}$  55dB. No mitigation measures are deemed necessary in relation to external noise levels.

The outdoor noise levels across the site can therefore be considered to fall between the LOAEL and SOAEL levels, generally being below the level that is expected to cause significant annoyance.

### 7.3 Impact on Existing Residents

The development is proposed to have 300 parking spaces. Peak traffic generation is expected to be moderate which would not be expected to generate a significant impact on the existing dwellings.

The current proposals show a substation and pump station in the south west corner of the site. This is some 40m from the nearest existing dwelling and 30m from the nearest proposed dwellings. Details of the equipment to be installed are not currently available. However, based on experience of substations and underground pump stations from similar developments elsewhere, no significant impact is expected at these distances.

| Source                                                                                                                                                                            | Source Noise Level (@1m) | Correction to 30m<br>$20\log(30)$ | Resultant Level at Dwelling |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------|-----------------------------|
| Pumping Station                                                                                                                                                                   | $L_{Aeq}$ 44dB           | -30dB                             | $L_{Aeq}$ 14dB              |
| Substation                                                                                                                                                                        | $L_{Aeq}$ 39dB           | -30dB                             | $L_{Aeq}$ 9dB               |
| Night time background noise levels were measured to be around $L_{A90}$ 31dB. The predicted noise levels are well below the background noise levels and a low impact is expected. |                          |                                   |                             |

**Table 7.1 – Indicative calculation of pump and substation noise level at nearest dwelling**

The heating scheme for the development has not been finalised. If air source heat pumps (ASHP) are used the impact would be assessed at the nearest dwellings following the guidance of BS4142: 2014 *Methods for rating and assessing industrial and commercial sound* and designed to achieve a low impact.

### 7.4 Planning Implications

The scheme is not expected to be exposed to or generate an adverse noise impacts. As such the scheme is considered to comply with the intents of the local and national planning requirements.

## 8. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the prevailing noise climate in the locality of Cabbagefield Row, Havant in support of a planning application for the proposed development of new residential dwellings.

The measured levels have been assessed against the National Planning Policy Framework and currently available standards and guidance documents including World Health Organisation *Guidelines for Community Noise* (1999) and BS8233:2014 *Guidance on sound Insulation and noise*.

Appropriate external and internal noise criteria have been considered to minimise adverse impacts on health and quality of life as a result of the new development.

Noise levels on site are considered to be low and no further mitigation is considered necessary.

The proposed scheme is not expected to experience a significant adverse noise impact and the site is considered acceptable for the proposed residential use.

**Steven Liddell MIOA**



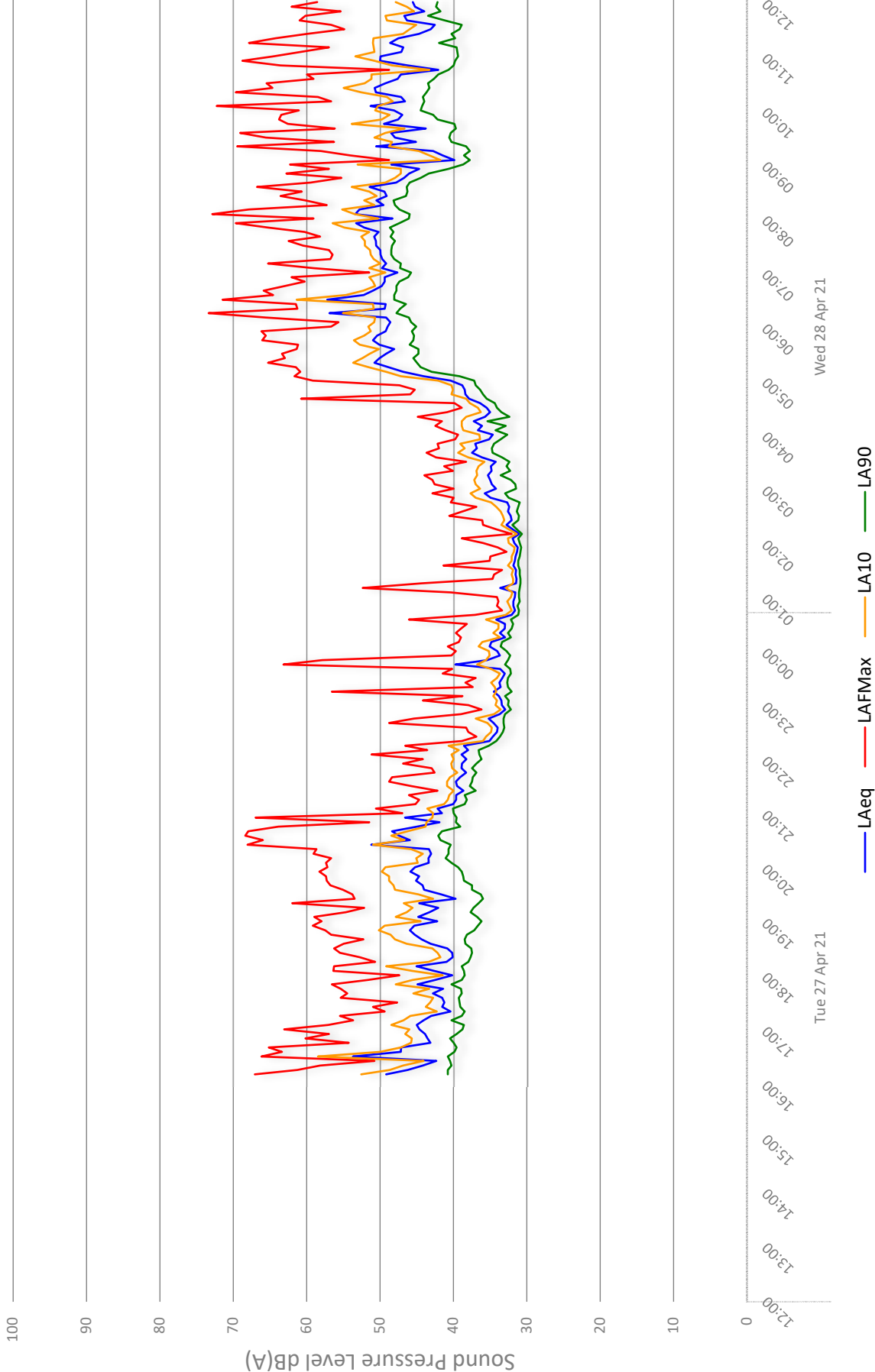


Figure VA3292/TH2

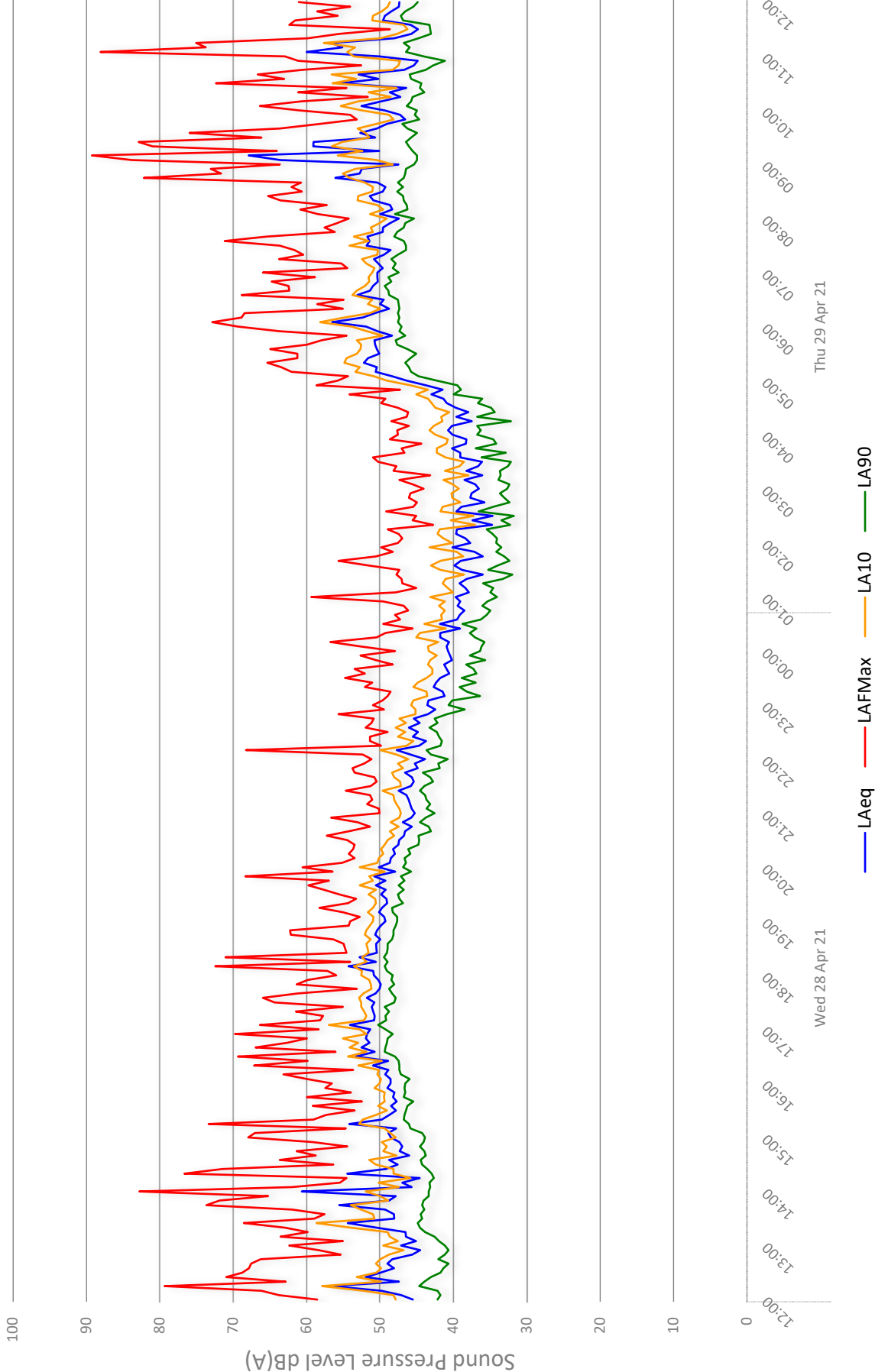
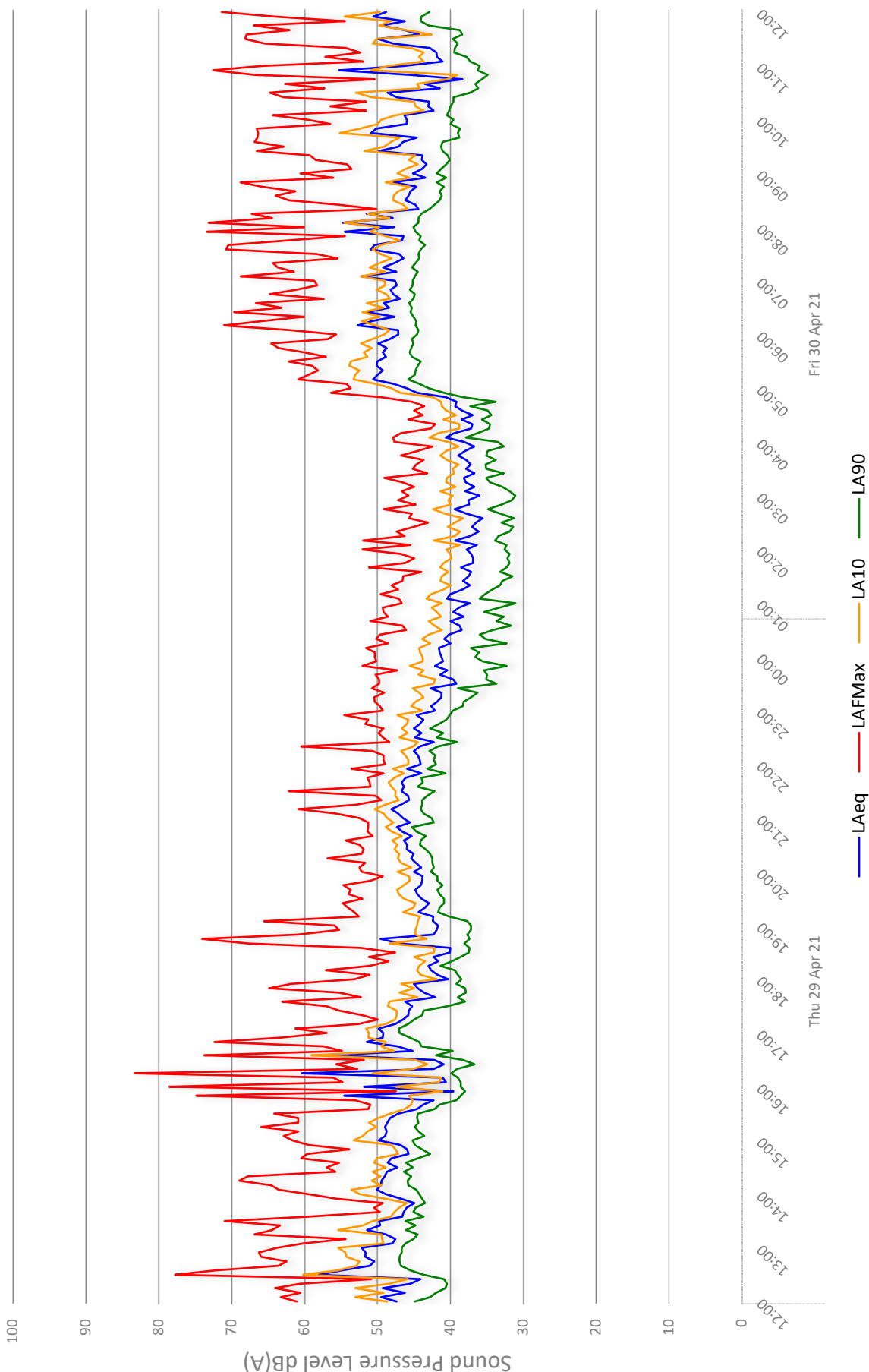
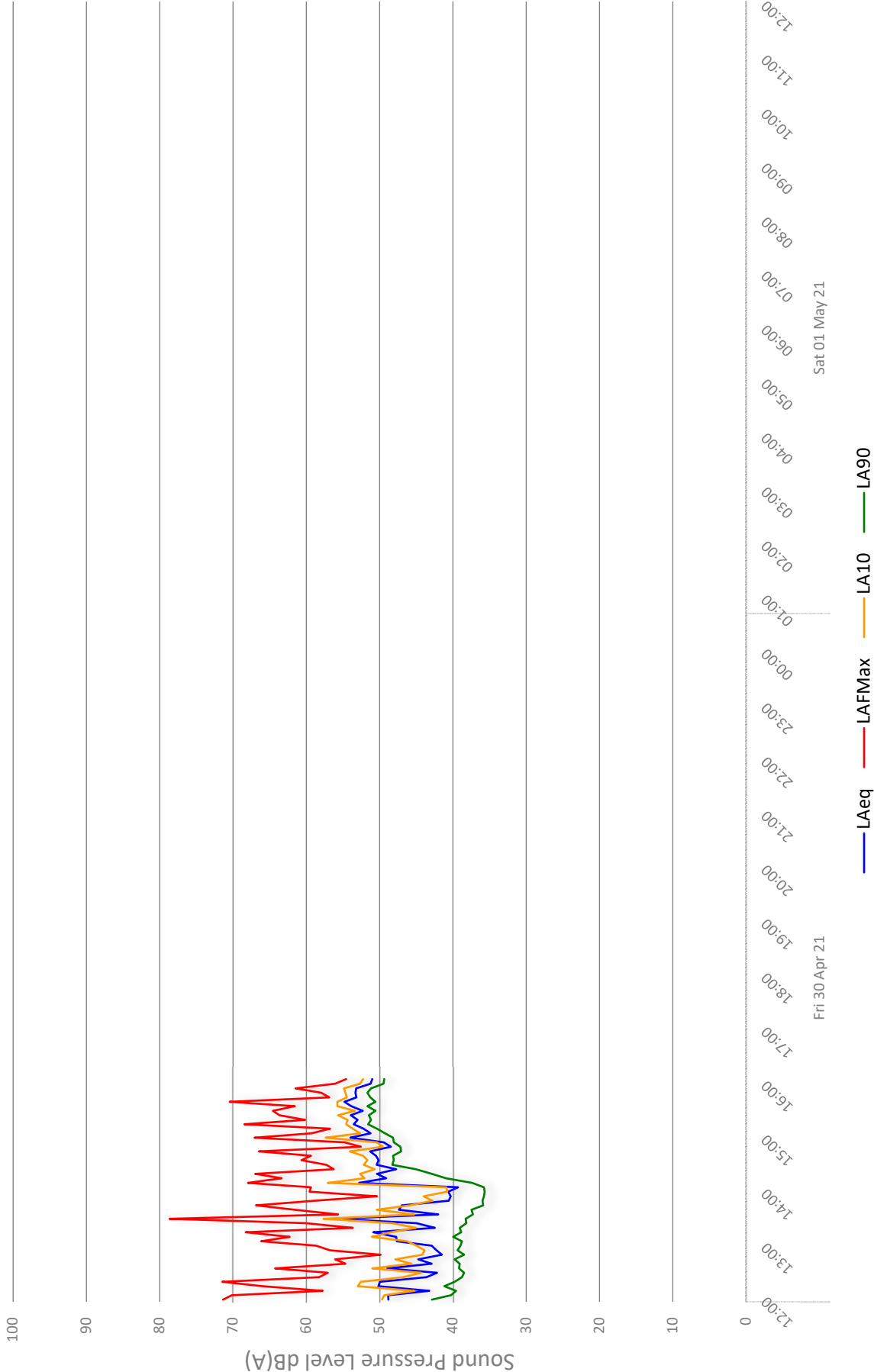


Figure VA3292/TH3





## Acoustic Terminology & Human Response to Broadband Sound

### 1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sound</b>                                           | Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Noise</b>                                           | Sound that is unwanted by or disturbing to the perceiver.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Frequency</b>                                       | The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.                                                                                                                                                                                                                                               |
| <b>dB(A):</b>                                          | Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or $L_A$ .<br><br>A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc).        |
| <b><math>L_{eq}</math> :</b>                           | The concept of $L_{eq}$ (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because $L_{eq}$ is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.                                                                                             |
| <b><math>L_{10}</math> &amp; <math>L_{90}</math> :</b> | Statistical $L_n$ indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, $L_{10}$ is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, $L_{90}$ is the typical minimum level and is often used to describe background noise.<br><br>It is common practice to use the $L_{10}$ index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow. |
| <b><math>L_{max}</math> :</b>                          | The maximum sound pressure level recorded over a given period. $L_{max}$ is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged $L_{eq}$ value.                                                                                                                                                                                                                                                                                                                                                                    |

### 1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

|                                 |    |     |     |     |      |      |      |      |
|---------------------------------|----|-----|-----|-----|------|------|------|------|
| Octave Band Centre Frequency Hz | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---------------------------------|----|-----|-----|-----|------|------|------|------|

### 1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

| Change in Sound Level<br>dB | Subjective Impression                             | Human Response   |
|-----------------------------|---------------------------------------------------|------------------|
| 0 to 2                      | Imperceptible change in loudness                  | Marginal         |
| 3 to 5                      | Perceptible change in loudness                    | Noticeable       |
| 6 to 10                     | Up to a doubling or halving of loudness           | Significant      |
| 11 to 15                    | More than a doubling or halving of loudness       | Substantial      |
| 16 to 20                    | Up to a quadrupling or quartering of loudness     | Substantial      |
| 21 or more                  | More than a quadrupling or quartering of loudness | Very Substantial |

### 1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.