

# BMA



BHP Mitsubishi Alliance

# Appendix D

## Noise and Vibration Assessment

# CAVAL RIDGE MINE - HORSE PIT EXTENSION PROJECT

## Noise and Vibration Impact Assessment

Prepared for:

BM Alliance Coal Operations Pty Ltd  
480 Queen Street  
Brisbane QLD 4000

SLR Ref: 620.13593-R01  
Version No: -v1.0  
July 2021



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## BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with BM Alliance Coal Operations Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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## DOCUMENT CONTROL

| Reference          | Date         | Prepared    | Checked     | Authorised  |
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| 620.13593-R01-v1.0 | 29 July 2021 | Steve Henry | Shane Elkin | Shane Elkin |
|                    |              |             |             |             |
|                    |              |             |             |             |

## EXECUTIVE SUMMARY

### Introduction

The Caval Ridge Mine (CVM) is owned and operated by BM Alliance Coal Operations Pty Ltd (BMA), on behalf of the Central Queensland Coal Associates Joint Venture (CQCA JV) and is located approximately 6 km south of Moranbah in Central Queensland. Open cut mining operations take place in two pits: Horse Pit (north of Peak Downs Highway) and Heyford Pit (north of Harrow Creek) that produce hard coking coal product for the export market. Operations at CVM are undertaken under the conditions of Environmental Authority (EA) EPML00562013 (in effect as of 10 August 2020), EPBC Act approval 2008/4417 and the Coordinator-General's imposed conditions.

Due to changes in mine sequencing, improvements in mining efficiency and further resource definition, an extension to the approved mining footprint of Horse Pit is required to continue mining. The Horse Pit Extension Project (the Project) is located in portions of Mining Lease (ML) 1775, ML 70403 and ML 70462, north of the Peak Downs Highway.

BMA is seeking an amendment to their existing EA EPML00562013 (over ML 1775, ML 70403 and ML 70462) for the purpose of extending the approved mining footprint of Horse Pit. To support the amendment application, this assessment has considered noise and vibration impacts from the proposed operations of the Project, and where relevant combined CVM operations, upon the surrounding noise and vibration sensitive receptors.

### Existing Environment

To assist with defining the existing (pre-Project) acoustic environment, unattended and operator attended noise monitoring was completed at four (4) receptor locations surrounding CVM during April and May 2020 (refer to summary table below).

CVM noise was observed by SLR to be audible (to varying degrees) at monitoring locations R2 (881 Long Pocket Road), R7 (Skyville/Bufel Park boundary) and R12 (Bufel Park Village). Consequently, Rating background levels (RBL) have only been reported for monitoring location R6 (Winchester Downs).

| Monitoring Location                      | Ambient LAeq Noise Levels, dBA |         |            | Rating Background Level LA90, dBA |         |            |
|--|--------------------------------|---------|------------|-----------------------------------|---------|------------|
|  | Daytime                        | Evening | Night-time | Daytime                           | Evening | Night-time |
| R2. 881 Long Pocket Rd                   | 51                             | 51      | 45         | -                                 | -       | -          |
| R7. Skyville/Bufel Park Village boundary | 41                             | 34      | 34         | -                                 | -       | -          |
| R12 Bufel Park Village                   | 50                             | 45      | 43         | -                                 | -       | -          |
| R6. Winchester Downs                     | 41                             | 59      | 49         | 26                                | 24      | 24         |

Based on the definition of a "Sensitive place" within the existing CVM EA, a total of four (4) isolated noise sensitive receptors (i.e. R1, R2, R6 and R7) at distances ranging from 2.2 km to 5.7 km to CVM have been identified and considered in this assessment. The township of Moranbah, located approximately 5.5 km north of CVM, was also included in the assessment (i.e.R3-R5).

## EXECUTIVE SUMMARY

### Noise and Vibration Assessment Criteria

Potential noise and vibration (blasting) impacts from the Project have been assessed against the noise and vibration limits prescribed in the existing CVM EA as well as the requirements of the EP Act and EPP(Noise). The table below outlines the operational mining noise criteria referenced in this assessment.

| Reference                 | Noise Criteria dBA, Assessable at a Residential Noise Sensitive Receptor |                 |                 |
|---------------------------|--|-----------------|-----------------|
|                           | Daytime  | Evening         | Night-time      |
| CVM EA - LAeq, adj, 15min | 30   | 30              | 30              |
| CVM EA - LA1, adj, 15min  | 52 <sup>A</sup>  | 52 <sup>A</sup> | 52 <sup>A</sup> |
| EPP(Noise) – LAeq,15min   | 42 <sup>B</sup>  | 42 <sup>B</sup> | 37 <sup>B</sup> |
| EPP(Noise) – LA1,15min    | 52 <sup>B</sup>  | 52 <sup>B</sup> | 47 <sup>B</sup> |

<sup>A</sup> Internal criterion from CVM EA with a conservative 7 dB façade reduction to derive an externally assessable criterion.

<sup>B</sup> Internal criteria adopted from EPP(Noise) with a conservative 7 dB façade reduction to derive an externally assessable criterion. The derived daytime and evening criteria are lower than the reported 'outdoor' noise criteria for a residential receptor (by 10 dBA).

Based on SLR's experience with projects of a similar nature, as administered under the EP Act, compliance to the Acoustic Quality Objectives within the EPP(Noise) is recommended for the Project.

For assessment of potential blasting impacts (i.e. airblast overpressure and ground vibration), the current CVM EA blasting limits (summarised in the table below) are aligned with the EP Act and therefore have been applied in the assessment of the Project.

| Parameter                               | Sensitive or Commercial Place Blasting Limits  |
|---|--|
| Ground vibration peak particle velocity | Vibrations of more than 35 Hz, no more than 25 mm/s peak particle velocity at any time.  |
|   | Vibrations of no more than 35 Hz, no more than 10 mm/s peak particle velocity at any time.   |
| Airblast overpressure level             | 115 dB (Linear peak) for four (4) out of five (5) consecutive blasts regardless of the interval between blasts, and not greater than 120 dB (Linear peak) at any time. |

### Mine Operations

The assessment has modelled Project and total CVM mine noise emission levels from three (3) representative operational mining scenarios coinciding with FY2030, FY2040 and FY2050 (summarised in the below table). Through a review of BMA supplied information as part of this assessment, these three (3) modelled scenarios approximately span the life of the Project as well as targeting the 'worst-case' year(s) for the Project based on Run of Mine (ROM) and product coal output as well as proximity of mining operations to adjacent noise sensitive receptors.

## EXECUTIVE SUMMARY

| ID | Noise Sensitive Receptor | Predicted Noise Level (L <sub>Aeq</sub> dBA) |                 |                 |                 |                 |                 |
|----|--------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|
|    |                          | FY2030                                       |                 | FY2040          |                 | FY2050          |                 |
|    |                          | Neutral Weather                              | Adverse Weather | Neutral Weather | Adverse Weather | Neutral Weather | Adverse Weather |
| R1 | 541 Railway Station Rd   | 20 (<10)                                     | 25 (<10)        | 20 (14)         | 25 (19)         | 20 (16)         | 26 (22)         |
| R2 | 881 Long Pocket Road     | 24 (<10)                                     | 30 (<10)        | 25 (20)         | 30 (26)         | 26 (24)         | 32 (30)         |
| R3 | Moranbah Township (S-W)  | 15 (<10)                                     | 19 (<10)        | 15 (11)         | 20 (16)         | 15 (11)         | 20 (16)         |
| R4 | Moranbah Township (S-C)  | 18 (<10)                                     | 22 (<10)        | 16 (<10)        | 21 (14)         | 16 (11)         | 20 (16)         |
| R5 | Moranbah Township (S-E)  | 15 (<10)                                     | 20 (<10)        | 15 (<10)        | 19 (14)         | 15 (10)         | 19 (15)         |
| R6 | Winchester Downs         | 18 (<10)                                     | 22 (<10)        | 15 (<10)        | 20 (<10)        | 15 (<10)        | 19 (<10)        |
| R7 | Skyville                 | 25 (<10)                                     | 31 (<10)        | 25 (<10)        | 31 (<10)        | 25 (<10)        | 31 (<10)        |

Values in (brackets) are the predicted noise level from the Project only

Project and total CVM noise emission levels were predicted to comply with the EPP(Noise) Acoustic Quality Objective derived external 37 dBA L<sub>Aeq</sub> criteria at all noise sensitive receptors. The highest predicted total CVM noise level was 32 dBA L<sub>Aeq</sub> at sensitive receptor R2 (881 Long Pocket Road) for the FY2050 scenario under adverse weather conditions (temperature inversion). Regarding this highest predicted Leq noise level, the following is noted:

- This represents a marginal 2 dBA exceedance of the existing CVM EA noise limit of 30 dBA L<sub>Aeq,adj,15 min</sub>.
- The contribution of the Project to this highest predicted L<sub>Aeq</sub> noise level was 30 dBA, which in isolation is compliant with the EA noise limit.
- The highest predicted noise level at R2 is dominated primarily by a D10 dozer working on the northern extent of the out of pit dump (OOPD) with clear line of sight to the north-west towards Long Pocket Road (i.e. a predicted noise level of 27 dBA). Options for the management of this predicted exceedance of the existing EA limits includes:
  - Management of mobile equipment to avoid operating in areas of the OOPD with clear line of sight to Long Pocket Road during adverse (i.e. temperature inversion) weather conditions,
  - Careful design and operation of the OOPD, such as constructing and maintaining an acoustic bund along the northern edge of the OOPD during the daytime period would allow OOPD operations during adverse (temperature inversion) weather conditions to occur with the required shielding.
  - Mobile mining equipment operating on the OOPD could be fitted with a noise suppression kit where line of sight cannot be avoided.

A marginal 1 dBA exceedance of the 30 dBA L<sub>Aeq, adj, 15 min</sub> CVM EA noise limit was predicted for noise sensitive receptor R7 (Skyville). This predicted exceedance is primarily attributable to the overland conveyor from PDM (i.e. not a direct result of the Project). SLR understands that BHP are committed to the progressive replacement of standard steel rollers with relatively quieter polymer rollers. Laboratory noise test data provided by an Australian manufacturer of conveyor systems indicates that polymer rollers are up to 5 dBA quieter than standard steel rollers.

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## EXECUTIVE SUMMARY

Taking into consideration the predicted noise limit exceedance is a marginal 1 dBA, SLR considers that the progressive replacement of steel rollers with quieter polymer rollers is a reasonable and practicable noise mitigation measure which will be effective in eliminating this marginal exceedance over time.

The highest LA1 noise level of 40 dBA was predicted at sensitive receptor R2 for the FY2050 scenario under adverse weather conditions (temperature inversion). This highest predicted LA1 noise level is compliant with the EPP(noise) derived external 45 dBA LA1 criterion and the existing CVM EA derived external noise limit of 50 dBA LA1, adj, 15 min.

Notwithstanding the above, a range of best practice noise management and mitigation measures have been provided in this assessment for consideration during the mine planning and operational stages of the Project.

### Cumulative Noise

The assessment has considered cumulative mine noise impacts for sensitive receptors exposed to noise emission from surrounding mines including PDM and Poitrel Mine (PTM). The assessment identified only one sensitive receptor (R6 - Winchester Downs) having potential to be impacted by mine noise emission from multiple mine sites including CVM.

Based on the cumulative noise impact assessment, cumulative mine noise emission levels from CVM, PDM and PTM have the potential to result in a cumulative noise level of 27 dBA LAeq at sensitive receptor R6. The predicted cumulative noise level complies with all forms of noise assessment criteria and therefore cumulative noise impacts are not anticipated as a result of this Project.

### Blasting

For the assessment of Project blast impacts, SLR has reviewed and analysed historical blasting results for CVM (supplied by BMA) as follows:

- Supplied log of site blasting details including shot ID, shot location (centroid coordinate) and maximum instantaneous charge (MIC, kgs).
- Blast log containing 184 blasts between 3 January 2019 and 16 November 2020, from which approximately 120 have been used in the analysis. Those 64 blast logs which were not included contained either incomplete information (i.e. blast parameters missing) or represented an extraneous results (i.e. outlying from the dataset in the form of an unusually high result), and were therefore excluded from the analysis.

Primarily analysing the relationship between blast centroid, blast MIC and measured airblast overpressure and/or ground vibration levels, CVM composite blast site laws were derived for the purpose of calculating airblast overpressure and ground vibration levels from future blasts within the Project disturbance area. Utilising the derived blasting site laws and MIC values (i.e. average and upper 10<sup>th</sup> percentile of the historical range in MICs recorded through the FY20 dataset), the Project blasting assessment indicated the following:

- The predicted airblast overpressure levels show that the 115 dBL (20% exceedance case) and 120 dBL (maximum) blasting criteria can be achieved for all Project blasts.
- The predicted ground vibration levels also achieve the 10 mm/s criteria for all Project blasts.

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# 1 Introduction

## 1.1 Overview

Caval Ridge Mine (CVM) is owned and operated by BM Alliance Coal Operations Pty Ltd (BMA), on behalf of the Central Queensland Coal Associates Joint Venture (CQCA JV) and is located approximately 6 km south of Moranbah in Central Queensland. Open cut mining operations (using dragline and truck/shovel equipment) takes place in two pits: Horse Pit (north of Peak Downs Highway) and Heyford Pit (north of Harrow Creek) and produces hard coking coal product for the export market. Operations at CVM are undertaken under the conditions of Environmental Authority (EA) EPML00562013 (in effect as of 10 August 2020), EPBC Act approval 2008/4417 and the Coordinator-General's imposed conditions.

Due to changes in mine sequencing, improvements in mining efficiency and further resource definition, an extension to the approved mining footprint of Horse Pit is required to continue mining. The Horse Pit Extension Project (the Project) is located in portions of (ML 1775, ML 70403 and ML 70462, north of the Peak Downs Highway. Associated infrastructure is located on ML 70403 and ML 70462, including the Goonyella System rail branch for rail-out of product coal.

## 1.2 Report Purpose and Structure

This Noise and Vibration Impact Assessment Technical Report (the Report) has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of BMA to provide supporting information to the EA Amendment Application under *Section 226* of the *Environmental Protection Act 1994* (EP Act). The structure of the Report is outlined in Table 1.

Table 1 Report Structure

| Section                                  | Description  |
|--|--|
| 1: Introduction                          | Provides an overview of the purpose of the Report and outlines the structure and supporting documentation.   |
| 2: Project Description                   | Provides an overview of the Project, including site description and key noise and vibration generating Project activities.   |
| 3: Existing Environment                  | Provides an overview of the assessed sensitive receptors (noise and vibration), and a summary of the baseline noise survey completed to support the Report.  |
| 4: Assessment Criteria                   | Provides an overview of the noise and vibration assessment criteria that have been prepared for the Report based primarily on reference to the existing EA, the EP Act, EPP(Noise) and the Model Mining Conditions (MMC) guideline (Department of Environment and Science (DES) 2017). |
| 5: Assessment Methodology                | Presents the noise and vibration impact assessment methodology including assumptions and inputs for both the operational noise modelling and the development of blast site laws to conduct the blasting assessment.  |
| 6: Noise and Vibration Impact Assessment | Presents the results from both the operational noise modelling and blast impact assessment, including the identification of any receptors where noise/vibration criteria are predicted to be exceeded under one (1) or more of the assessment scenarios.                               |
| 7: Recommendation                        | Provides noise and vibration management recommendations for the Project based on the outcomes of the noise and vibration impact assessment.  |

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| Section       | Description                                |
|---------------|--|
| 8: Conclusion | Summarises the key findings of the Report. |

Acoustic terminology used through this Report is explained in further detail in Appendix A.

## 2 Description of the Project

### 2.1 General

The Project proposes to extend the footprint of the existing Horse Pit at the CVM. As a result of identifying efficiencies in mine sequencing and planning, mining activities are currently scheduled to reach the limit of the approved Horse Pit extent during Financial Year (FY) 2025, with some existing site infrastructure potentially being relocated from FY2023. If approved, the extension is projected to extend the mine's life from the 2030's to the 2050's with exploration activities ongoing for the life of the mine.

BMA currently holds Surface Area (SA) rights to mine the remainder of ML 1775 exclusive of three areas of nil-SA to the east of Horse Pit and adjacent to the Peak Downs Highway. The nil-SA parcel in the east of ML 1775, immediately north of the Peak Downs Highway, will require an application for SA rights under the *Mineral Resources Act 1989* (MR Act). The nil SA adjacent to the Peak Downs Highway, will also require an application for SA rights under the MR Act. The nil-SA associated with the Moranbah Airport and Moranbah Access Road in the north-east of ML 1775 is not included within the scope of the Project.

The Project covers the existing MLs: ML 1775, ML 70403 and ML 70462 and will be confined to the Horse Pit area north of the Peak Downs Highway. The Project overview is shown on Figure 1 and key elements of the Project are summarised below.

#### 2.1.1 Mining

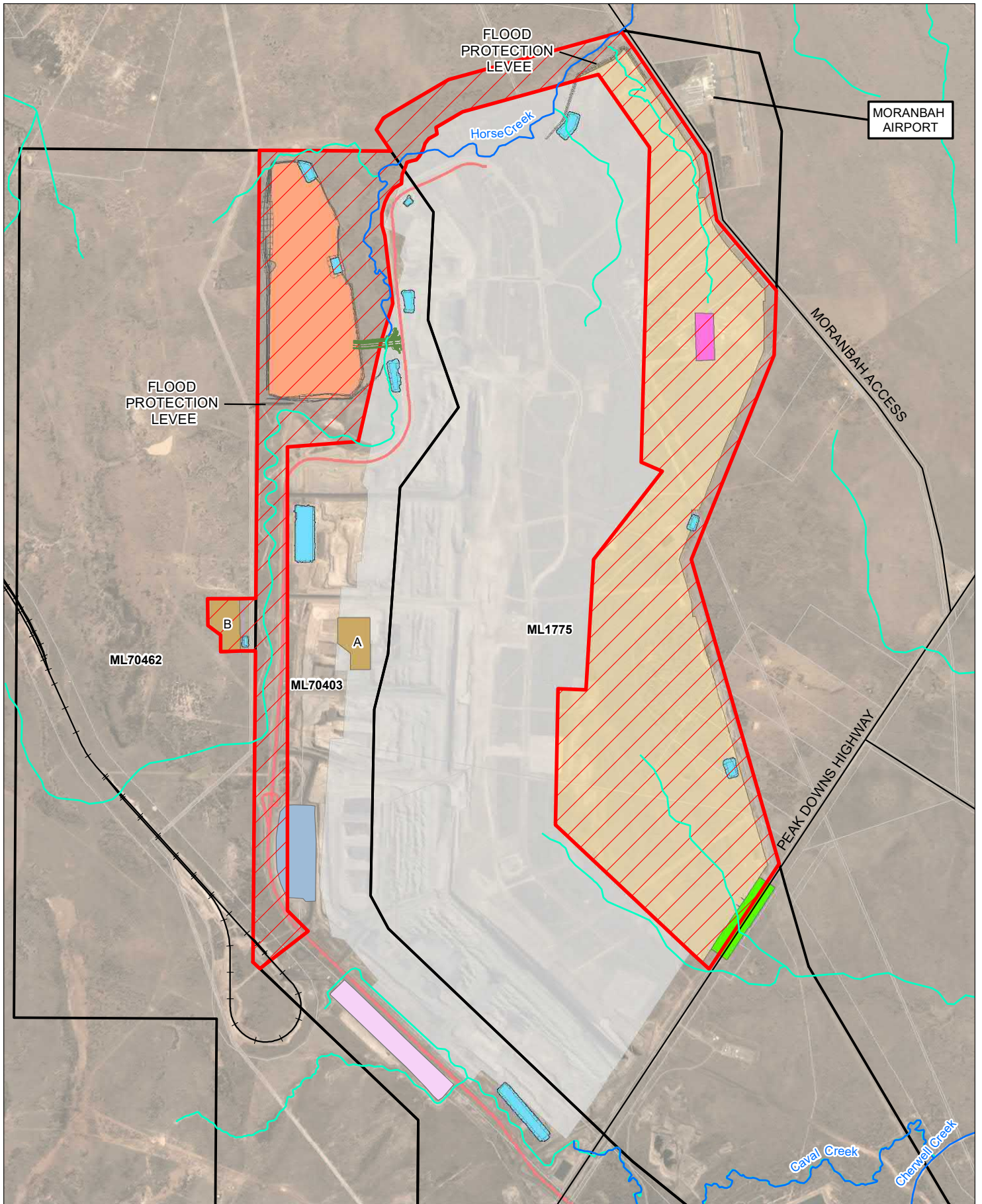
The key mining elements of the Project are summarised below:


- Extension of the existing Horse Pit beyond the approved extent during FY2025, exclusive of Moranbah Airport and the Moranbah Access Road
- Maximum CVM ROM coal production up to 15 Mtpa with revised CVM Life of Mine (LOM) to FY2056
- Development of an Out of Pit Dump (OOPD) in the north-west of ML 70403 (commencing in FY2028)
- Continuation of progressive rehabilitation of disturbed areas with the aim of progressing to a final landform design, including a final void of approximately 680 ha in the far east of ML 1775 at the conclusion of mining
- Continuation of current open cut mining techniques employed at CVM
- Continuation of progressive disposal of mining waste and CHPP rejects to In-pit Dumps (IPDs) and to the proposed OOPD (commencing in FY2028), and
- Continued use of the existing accommodation and workforce strategy.

#### 2.1.2 Mine Infrastructure

The key mine infrastructure elements of the Project are summarised below:

- 
- Relocation of enabling infrastructure, including: an EME Build Pad, blasting compound (two potential relocation options), go-lines, substations, back-access roads and powerlines as required by the progress of mining
  - Extension of the haul road to provide access to the proposed OOPD in the north-west of ML 70403 including the construction of a bridge over Horse Creek
  - Construction of two flood levees: the northern levee bounds a portion of Horse Pit and the western levee is located at the south-west extent of the proposed OOPD
  - Relocation of mine water dams and pipelines as required by the progress of mining
  - Expansion of sediment dam capacities and construction of new sediment dams, clean water diversion drains and mine affected water (MAW) drains to manage runoff associated with the proposed OOPD
  - Relocation of the Peak Downs Highway dragline crossing
  - Continued use of the CHPP complex, no upgrades to the CHPP are required as a result of the Project,
  - Continued disposal of dewatered tailings and rejects within spoil, and
  - Continued use of the conveyor from Peak Downs Mine (PDM), Caval Ridge rail spur, TLF, product coal stockpiles, ROM stockpiles, IPDs, water management system and supporting infrastructure (i.e. roads, powerlines, laydown, workshops and offices).



 0 0.5 1 km  
 Projection: GDA 1994 MGA Zone 55  
 Scale: 1:42,500 at A4  
 Project No.: 620.13593  
 Date: 01/02/2021  
 Drawn by: PM

- Existing Road
- Existing Rail
- Zone for Dragline Crossing
- Existing Horse ROM Stockpile
- Existing Train Load Out Stockpile
- Caval Ridge EIS Boundary (2010)
- BHP Tenements
- Cadastral
- Bridge over Horse Creek
- Haul Roads
- Watercourses (Water Act 2000)
- Drainage features
- Proposed Water Management Infrastructure
- Dams
- Proposed EME Build Pad
- Proposed Blast Compound Options
- Proposed Out of Pit Dump
- Horse Pit Extension
- Horse Pit Extension Project Area

**Horse Pit Extension Project**

**Project Overview**



**FIGURE 1**

H:\Projects-SLR\620-BNE\620-BNE\620.13593 BHP - Horse Pit Approvals\07 CAD\GIS\ArcGIS\Project Description\SLR62013593\_PD\_ProjectOverview\_001.mxd

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## 2.2 Noise and Vibration Generating Project Activities

The Project mining operations with the potential to generate noise emissions, which form the basis for this Assessment, are as follows:

- Progressive land clearing and topsoil removal
- Stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the site
- Drill and blasting of overburden/interburden material (including through seam blasting)
- Pre-stripping/excavation of overburden material using excavators/shovels and trucks, draglines and dozers
- Side casting of lower overburden into the previously mined strip using a dragline
- Removal of overburden/interburden and placement in either the IPD or OOPD
- Loading and hauling of ROM coal using a combination of excavators, loaders and trucks (CVM will continue to receive ROM coal via conveyor from PDM), and
- Progressive rehabilitation by backfilling the mined-out pit, reshaping dumps, topsoiling and revegetation.

As noted in Section 2.1.2, new or relocation of existing infrastructure will be required for the Project, however they are not considered acoustically significant sources of noise in the context of an operational mine and, in particular, due to the location of these sources relative to the surrounding receptors.

There is only one activity, namely blasting, that is capable of producing measurable or perceptible vibration levels at assessed sensitive receptors due to the offset distances between the Project operations and sensitive receptors. Section 6.3 includes assessment of blasting ground vibration impacts from the Project.

Potential impacts associated with cumulative mine noise emissions have also been considered in the assessment (Section 6.2) due to the proximity of PDM.

## 3 Existing Environment

### 3.1 Existing Sensitive Receptors

The CVM EA provides the following definitions regarding sensitive and non-sensitive places :

- a. *A sensitive place means any of the following:*
  - i. *a dwelling, residential allotment, mobile home or caravan park, residential marine or other residential premises; or*
  - ii. *a motel, hotel or hostel; or*
  - iii. *an educational institution; or*
  - iv. *a medical centre or hospital; or*
  - v. *a protected area under the Nature Conservation Act 1992, the Marine Parks Act 1992 or a World Heritage Area; or*
  - vi. *a public park or gardens.*
- b. *Despite paragraph (a), the following places are not sensitive places:*
  - i. *subject to paragraph (c), a place that is the subject of an alternative arrangement; or*

- ii. *a mining camp (i.e. accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority), whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the environmental authority holders for the mining project, or a related company; or*
  - iii. *a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.*
- c. *A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purposes of that type(s) of environmental nuisance, however remains a sensitive place for the purpose of other types of environmental nuisances.*

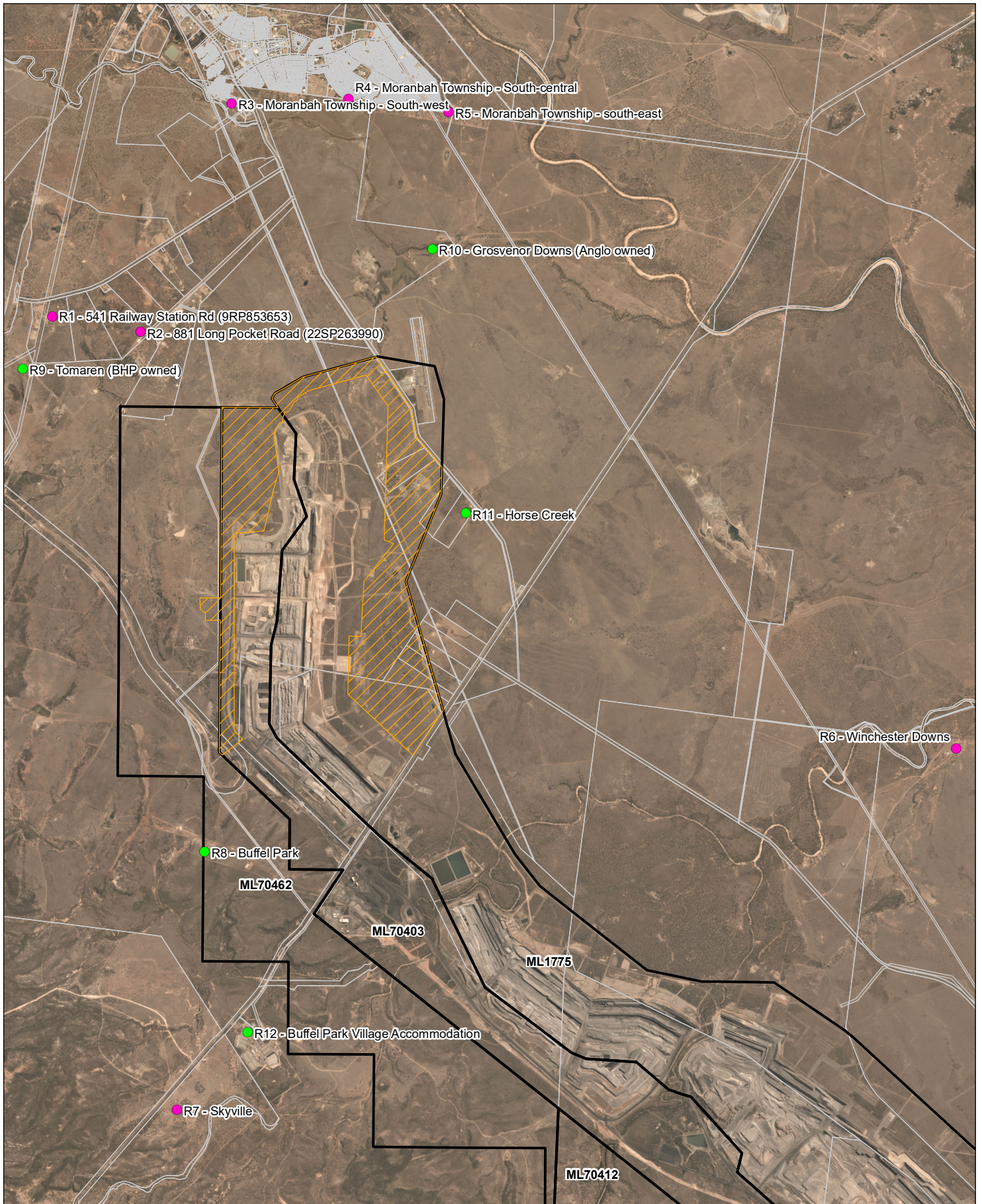
Based on the above definition, noise and vibration receptors surrounding and potentially impacted by the Project are listed in Table 2 and identified on Figure 2.

Table 2 Noise and Vibration Receptors

| ID  | Receptor                           | Easting (m) <sup>A</sup> | Northing (m) <sup>A</sup> | Ownership Status | Sensitive Receptor? | Distance to ML 1775 or 70403 |
|-----|------------------------------------|--------------------------|---------------------------|------------------|---------------------|------------------------------|
| R1  | 541 Railway Station Rd (9RP853653) | 603,655                  | 7,561,407                 | Privately owned  | Yes                 | 3.9 km                       |
| R2  | 881 Long Pocket Road (22SP263990)  | 605,416                  | 7,561,101                 | Privately owned  | Yes                 | 2.2 km                       |
| R3  | Moranbah Township (south-west)     | 607,232                  | 7,565,669                 | Privately owned  | Yes                 | 5.6 km                       |
| R4  | Moranbah Township (south-central)  | 609,572                  | 7,565,756                 | Privately owned  | Yes                 | 5.5 km                       |
| R5  | Moranbah Township (south-east)     | 611,564                  | 7,565,501                 | Privately owned  | Yes                 | 5.5 km                       |
| R6  | Winchester Downs                   | 621,706                  | 7,552,774                 | Privately owned  | Yes                 | 5.7 km                       |
| R7  | Skyville                           | 606,140                  | 7,545,570                 | Privately owned  | Yes                 | 4.8 km                       |
| R8  | Buffel Park                        | 606,693                  | 7,550,721                 | BMA owned        | No                  | 1.7 km                       |
| R9  | Tomaren                            | 603,063                  | 7,560,372                 | BMA owned        | No                  | 4.0 km                       |
| R10 | Grosvenor Downs (Anglo owned)      | 611,242                  | 7,562,768                 | Anglo owned      | No                  | 2.4 km                       |
| R11 | Horse Creek                        | 611,913                  | 7,557,483                 | BMA owned        | No                  | 0.6 km                       |
| R12 | Buffel Park Village Accommodation  | 607,554                  | 7,547,120                 | BMA owned        | No                  | 2.5 km                       |

<sup>A</sup> Based on GDA 1994 MGA Zone 55 coordinate reference.





Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM

- Sensitive Receptors
- Non-sensitive Receptors
- Horse Pit Project Area
- BHP Tenements
- Cadastre

**Horse Pit Extension Project**

**Assessment Receptor Locations**



**FIGURE 2**

H:\BNE\Projects-SLR\620-BNE\620.13593 BHP - Horse Pit Approvals\07 CADGIS\ArcGIS\ANV\SLR62013593\_ANV\_Receptors\_001.mxd

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## 3.2 Existing Noise Levels

Between 27 April and 11 May 2020, SLR conducted a baseline noise monitoring survey at four (4) receptor locations surrounding the CVM to determine the existing noise environment prior to the commencement of the Project. Short-term operator attended noise measurements were also undertaken at these four (4) monitoring locations.

### 3.2.1 Noise Monitoring Methodology




Baseline noise monitoring for the Project has been conducted through a combination of long-term unattended noise measurements and short-term operator attended noise measurements with reference to the following:


- EA EPML00562013,
- The Department of Environment and Science's (DES) Noise Measurement Manual (NMM), and
- Australian Standard 1055:2018 Acoustics - Description and measurement of environmental noise (AS 1055).

The noise monitoring locations are detailed in Table 3. The reason for selecting these noise monitoring locations is detailed as follows:

- R2 - 881 Long Pocket Road: representative of the closest noise sensitive receptor to the north-west of CVM, in particular, the proposed OOPD.
- R7- Boundary of Skyville and Buffel Park Village: Skyville is the closest noise sensitive receptor south-west of the Project. Permission to access Skyville was not granted, consequently noise monitoring was carried out at the property boundary (i.e. closer to CVM).
- R12 - Buffel Park Accommodation Village (adjacent to carpark): by definition of the EA this location is not regarded as a sensitive receptor, however, was chosen for the purpose of quantifying existing CVM mine noise west of the mine to assist with validating the noise model predictions from existing CVM fixed plant (i.e. unchanged under the Project).
- R6 - Winchester Downs: This monitoring location was selected as the closest sensitive receptor south-east of the Project as well as potentially experiencing cumulative mine noise emission from Peak Downs Mine (PDM) and Poitrel Mine (PTM).

Table 3 Noise Monitoring Locations

| Location  | Description   | Logger Location Photo  |
|---|---|--|
| <p>R2. 881 Long Pocket Road (Lot 22 on SP263990)</p>  | <p>Noise logger location SW of the homestead in an empty paddock at a similar offset to CVM as the homestead. Located approximately 2.2 km north-west of ML 70403.</p>  |    |
| <p>R7. Boundary of Buffel Park Village and 7812 Peak Downs Highway "Skyville" (Lot 1 on RP616025)</p> | <p>Noise logger installed at the boundary of Skyville and Buffel Park Village <sup>A</sup>. Located approximately 3.3 km south-west of ML 70403.</p>                    |   |
| <p>R12. Buffel Park Village adjacent to the carpark</p>   | <p>Noise logger installed adjacent to the front carpark at Buffel Park Village (unoccupied at time of survey). Located approximately 2.6 km south-west of ML 70403.</p> |  |

| Location   | Description   | Logger Location Photo  |
|--|---|--|
| R6. 831 Peak Downs Mine Road<br>"Winchester Downs" | Noise logger installed midway between Peak Downs Mine Road and the Winchester Downs homestead <sup>1</sup> . Located approximately 1.8 km south-west from the homestead and 3.7 km north-east of ML 1775. |  |

<sup>A</sup> Winchester Downs homestead (near residence) and Skyville property were unavailable as a noise monitoring location due to restricted access.

### 3.2.2 Monitoring Dates

Unattended and operator attended noise monitoring dates specific to each monitoring location are summarised in Table 4.

Table 4 Unattended and Operator Attended Noise Monitoring Dates

| Location   | Unattended Monitoring Dates            | Operator Attended Monitoring Dates   |
|--|--|--|
| R2. 881 Long Pocket Road                         | 27 April to 05 May 2020 <sup>A</sup>   | 27, 28, 29 April and 11 May 2020 during the day (7:00am to 6:00pm), evening (6:00pm to 10:00pm) and night (10:00pm to 7:00am) periods. |
| R7. Boundary of Skyville and Buffel Park Village | 28 April to 29 April 2020 <sup>B</sup> |  |
| R12. Buffel Park Village adjacent to carpark     | 27 April to 11 May 2020 <sup>A</sup>   |  |
| R6. Winchester Downs                             | 27 April to 06 May 2020 <sup>A</sup>   |  |

<sup>A</sup> Variation in end dates were due to the varying battery serviceability.

<sup>B</sup> Noise logger experienced a technical fault on 29 April and ceased functioning.

### 3.2.3 Noise Monitoring Equipment

The noise levels were continuously monitored with NGARA Sound Level Meters configured as noise loggers. To quantify the contribution of the existing sources of noise in the local environment the noise logging was supplemented by short-term noise measurements undertaken by SLR's acoustic consultant. A Brüel and Kjær Type 2250 Sound Level Meter was used for the short-term attended surveys. A summary of the noise monitoring equipment is provided in Table 5.

Each noise logger and the sound level meter were checked for calibration before and after the survey with a sound level calibrator. No significant drift in signal ( $\pm 0.5$  dB) was detected.

All items of acoustic instrumentation employed during the noise monitoring were set to A-weighted and Fast response in accordance with the relevant Australian Standards and the NMM. All acoustic instrumentation employed throughout the noise monitoring survey was designed to comply with the requirements of AS IEC 61672.1-2019 "*Electroacoustics - Sound Level Meters - Specifications*" and carried current manufacturer calibration certificates.

To ensure suitable analysis could be completed on the unattended and attended noise monitoring data (namely detection and removal of contributions from insects), one-third octave frequency data was captured by each noise logger and the attended sound level meter.

**Table 5 Noise Monitoring Equipment Summary**

| Location   | Monitoring Dates | Equipment                            |
|--|------------------|--------------------------------------|
| R2. 881 Long Pocket Road                         | April & May 2020 | NGARA SN:8781C7                      |
| R7. Boundary of Skyville and Buffel Park Village | April & May 2020 | NGARA SN:87801E                      |
| R12. Buffel Park Village adjacent to carpark     | April & May 2020 | NGARA SN:878049                      |
| R6. Winchester Downs                             | April & May 2020 | NGARA SN:8781BE                      |
| All (1 <sup>st</sup> site visit)                 | April 2020       | Brüel and Kjær Type 2250 SN: 3007914 |
| All (2 <sup>nd</sup> site visit)                 | May 2020         | Brüel and Kjær Type 2250 SN: 3007914 |

### 3.2.4 Meteorological Conditions

Meteorological data during the noise monitoring period was obtained from the Bureau of Meteorology weather station located at the Moranbah Airport (station ID 34035) adjacent to CVM, and was considered representative of the full study area. The meteorological data from the weather station was analysed to identify any periods of rainfall and periods where wind speed was in excess of 5.0 m/s (18 km/h). These periods were subsequently excluded from the noise monitoring data analysis in accordance with the NMM.

The meteorological data is summarised in Table 6 and plotted in 30-minute intervals on the noise monitoring results charts presented in Appendix B with the periods of excluded data (i.e. due to rain and/ or wind exceeding 5 m/s) shaded grey.

**Table 6 Summary of Meteorological Data Recorded During Noise Monitoring Survey Period**

| Time Period             | Average Meteorological Parameter per Period |                  |                      |              |                |                        |
|-------------------------|---|------------------|----------------------|--------------|----------------|------------------------|
|                         | Temperature (°C)                            | Wind Speed (m/s) | Wind Direction (deg) | Humidity (%) | Pressure (hPa) | Rain (mm) <sup>A</sup> |
| Day – 7 am to 6 pm      | 24  | 4                | 128                  | 43           | 1018           | 0                      |
| Evening – 6 pm to 10 pm | 21  | 3                | 101                  | 50           | 1018           | 0                      |
| Night – 10 pm to 7 am   | 16  | 2                | 122                  | 71           | 1019           | 0                      |

<sup>A</sup> The only periods of rainfall exceeding 0.5 mm were recorded at 2:30 pm on 29 April 2020 (i.e. 1.2 mm), 1:00 am and 8:30 am on 30 April 2020 (i.e. both 1.4 mm).

### 3.2.5 Noise Monitoring Results

The following section documents the attended and unattended noise monitoring results completed as part of this assessment.

#### 3.2.5.1 Unattended Noise Measurement Results

The ambient noise levels are the average monitored ( $L_{Aeq}$ ) noise levels for each period, which account for all sources of noise within the local environment and are also presented in Table 7.

CVM noise was observed by SLR to be audible (to varying degrees) at monitoring locations R2 (881 Long Pocket Road), R7 (Skyville/ Buffel Park Village boundary) and R12 (Buffel Park Village). Consequently, Rating background levels (RBL) have been reported in Table 7 for monitoring location R6 (Winchester Downs) only. The RBL is the median of the 90<sup>th</sup> percentile of the daily background ( $L_{A90}$ ) noise levels in each assessment period (day, evening and night) over the duration of the monitoring survey.

Table 7 Summary of Unattended Noise Logging Results

| Monitoring Location                          | Ambient $L_{Aeq}$ Noise Levels, dBA |         |            | Rating Background Level $L_{A90}$ , dBA <sup>A</sup> |         |            |
|--|-------------------------------------|---------|------------|--|---------|------------|
|  | Daytime                             | Evening | Night-time | Daytime  | Evening | Night-time |
| R2. 881 Long Pocket Rd                       | 51                                  | 51      | 45         | -  | -       | -          |
| R7. Skyville/ Buffel Park Village boundary   | 41                                  | 34      | 34         | -  | -       | -          |
| R12. Buffel Park Village adjacent to carpark | 50                                  | 45      | 43         | -  | -       | -          |
| R6. Winchester Downs                         | 41                                  | 59      | 49         | 26   | 24      | 24         |

<sup>A</sup> Where practicable, the seasonal influences of insect noise have been removed.

The evening and night-time period RBLs for Winchester Downs were below the threshold background noise level of 25 dBA recommended in the DES *Planning for Noise Control Guideline* (PNC).

The daily statistical noise levels for the baseline noise survey are presented graphically in Appendix B.

Road traffic noise, which was audible at the Buffel park Village (R12) and to a lesser degree at R7 (i.e. due to greater separation distance between the noise logger and the road), has not contributed to the RBLs due to the intermittent nature of road traffic noise from the Buffel Park Village traffic.

A review of one-third octave band noise level data captured by the unattended noise loggers indicated the presence of mine/industrial noise contributions at all four (4) noise monitoring locations, but to varying degrees. This would be expected given the proximity of the monitoring locations to CVM as well as the likelihood of noise enhancing weather conditions prevailing during the noise monitoring period (i.e. source to receiver wind, and/or temperature inversions), and is supported by the attended noise measurement results and observations.

### 3.2.5.2 Attended Noise Measurement Results

A minimum of five (5) 15-minute operator attended noise measurements were completed at each of the four (4) monitoring locations during the initial site visit from 27 April 2020 to 29 April 2020. An additional one (1) 15-minute attended noise measurement was also completed at each monitoring location during the second site visit conducted on 11 May 2020.

The attended noise measurement results are detailed in Table 8 to Table 11.

**Table 8 Attended Noise Measurement Results – R2 (881 Long Pocket Rd)**

| Date & Start Time    | Measured Noise Level in dB, 15-minute |      |     |                   |                               | Description of Acoustic Environment   |
|----------------------|---------------------------------------|------|-----|-------------------|-------------------------------|---|
|                      | LA90                                  | LA10 | LA1 | L <sub>Amax</sub> | L <sub>Aeq</sub> <sup>A</sup> |   |
| 27-April-20<br>12:27 | 40                                    | 46   | 49  | 57                | 44 (39)                       | Tree leaves rustling<br>Moderate wind<br>CVM noise inaudible  |
| 28-April-20<br>6:50  | 37                                    | 42   | 46  | 61                | 41 (39)                       | Birds and insects noise<br>Tree leaves rustling with light wind<br>Constant low level CVM noise (likely from Horse Pit), unable to be quantified due to other ambient noise sources |
| 28-April-20<br>20:12 | 43                                    | 56   | 58  | 59                | 51 (32)                       | Birds and cicada noise dominant<br>Cars pass by at distance<br>Constant low level CVM noise, unable to be quantified due to other ambient noise sources                             |
| 28-April-20<br>20:28 | 44                                    | 55   | 57  | 60                | 51 (30)                       | Birds and cicada noise dominant<br>Cars pass by at distance<br>Constant low level CVM noise (less than 30 dBA)  |
| 29-April-20<br>9:47  | 36                                    | 41   | 51  | 58                | 40 (35)                       | Birds and cicada noise<br>Light wind<br>Plane flyby<br>CVM noise inaudible  |
| 29-April-20<br>10:05 | 36                                    | 46   | 54  | 58                | 43 (39)                       | Birds and cicada noise<br>Light wind<br>CVM noise inaudible   |
| 11-May-20<br>12:02   | 35                                    | 40   | 43  | 58                | 38 (35)                       | Birds, light wind and low level CVM noise   |

<sup>A</sup> Where practicable, noise levels in brackets have been filtered to remove insect noise contribution.

Table 9 Attended Noise Measurement Results – R7 (Skyville and Buffel Park Village Boundary)

| Date & Start Time    | Measured Noise Level in dB, 15-minute |      |     |                   |                               | Description of Acoustic Environment  |
|----------------------|---------------------------------------|------|-----|-------------------|-------------------------------|--|
|                      | LA90                                  | LA10 | LA1 | L <sub>Amax</sub> | L <sub>Aeq</sub> <sup>A</sup> |  |
| 27-April-20<br>17:25 | 37                                    | 41   | 47  | 60                | 40 (34)                       | Birds and insect noise<br>Tree leaves rustling with light wind<br>Constant low level CVM noise.  |
| 28-April-20<br>3:28  | 37                                    | 41   | 42  | 61                | 39 (39)                       | Conveyor belt noise/low level mine noise (estimated at 27-28 dBA)<br>Few cars passby/Buffel Park Village traffic<br>Insect noise         |
| 28-April-20<br>18:00 | 35                                    | 38   | 45  | 56                | 37 (34)                       | Birds and cicada noise<br>Traffic noise/Buffel Park Village traffic<br>Light wind<br>CVM noise inaudible                                 |
| 29-April-20<br>12:11 | 35                                    | 40   | 43  | 55                | 38 (37)                       | Birds and cicada<br>Tree leaves rustling with light wind<br>Constant low level CVM noise (estimated at 27-28 dBA)<br>Traffic at distance |
| 29-April-20<br>12:26 | 34                                    | 50   | 56  | 62                | 45 (43)                       | Wind noise/windy conditions<br>Light shower started midway during the measurement<br>CVM noise inaudible                                 |
| 11-May-20<br>14:48   | 32                                    | 41   | 47  | 60                | 39 (35)                       | Helicopter flyby<br>Light wind, tree leaves rustling<br>Birds<br>CVM noise inaudible   |

<sup>A</sup> Where practicable, noise levels in brackets have been filtered to remove insect noise contribution.

Table 10 Attended Noise Measurement Results – R12 (Buffel Park Village adjacent to carpark)

| Date & Start Time    | Measured Noise Level in dB, 15-minute |      |     |                   |                               | Description of Acoustic Environment  |
|----------------------|---------------------------------------|------|-----|-------------------|-------------------------------|--|
|                      | LA90                                  | LA10 | LA1 | L <sub>Amax</sub> | L <sub>Aeq</sub> <sup>A</sup> |  |
| 27-April-20<br>15:57 | 37                                    | 49   | 52  | 63                | 45 (39)                       | Birds and insect noise<br>Few cars passby/Buffel Park Village traffic<br>Tree leaves rustling with light wind<br>Constant low level CVM noise (minimum noise level in the order of 28 dBA) |
| 28-April-20<br>4:35  | 39                                    | 44   | 46  | 54                | 42 (42)                       | Cicada noise<br>Buffel Park Village traffic noise<br>Constant low level CVM noise  |
| 28-April-20<br>18:28 | 47                                    | 59   | 63  | 71                | 55 (49)                       | Cicada noise   |



| Date & Start Time    | Measured Noise Level in dB, 15-minute |      |     |                   |                               | Description of Acoustic Environment  |
|----------------------|---------------------------------------|------|-----|-------------------|-------------------------------|--|
|                      | LA90                                  | LA10 | LA1 | L <sub>Amax</sub> | L <sub>Aeq</sub> <sup>A</sup> |  |
|                      |                                       |      |     |                   |                               | Buffel Park village traffic<br>Constant low level CVM noise  |
| 29-April-20<br>12:53 | 34                                    | 44   | 51  | 58                | 41 (37)                       | Bird noise<br>Few cars passby/Buffel Park Village traffic<br>Tree leaves rustling with medium to fast wind |
| 29-April-20<br>13:11 | 35                                    | 47   | 52  | 60                | 43 (37)                       | Bird noise<br>Few cars passby/Buffel Park Village traffic<br>Tree leaves rustling with medium to fast wind |
| 11-May-20<br>15:31   | 32                                    | 43   | 51  | 59                | 40 (36)                       | Tree leaves rustling with medium to fast wind<br>Constant low level CVM noise                              |

<sup>A</sup> Where practicable, noise levels in brackets have been filtered to remove insect noise contribution.

**Table 11 Attended Noise Measurement Results – R6 (Winchester Downs)**

| Date & Start Time    | Measured Noise Level in dB, 15-minute |      |     |                   |                               | Description of Acoustic Environment   |
|----------------------|---------------------------------------|------|-----|-------------------|-------------------------------|---|
|                      | LA90                                  | LA10 | LA1 | L <sub>Amax</sub> | L <sub>Aeq</sub> <sup>A</sup> |   |
| 27-April-20<br>14:18 | 35                                    | 45   | 49  | 65                | 42 (37)                       | Plane flyby<br>Tree leaves rustling with light wind                                 |
| 28-April-20<br>6:01  | 34                                    | 40   | 49  | 67                | 40 (39)                       | Bird and cicada noise<br>Constant low level mine noise likely from PTM and PDM      |
| 28-April-20<br>19:19 | 57                                    | 61   | 61  | 63                | 59 (31)                       | Cicada noise dominant<br>Cow noise  |
| 29-April-20<br>11:01 | 39                                    | 44   | 49  | 56                | 42 (38)                       | Bird and cicada noise<br>Wind noise<br>Plane flyby<br>Constant low level mine noise |
| 29-April-20<br>11:19 | 37                                    | 47   | 60  | 63                | 47 (43)                       | Bird and cicada noise<br>Wind noise<br>Constant low level mine noise                |
| 11-May-20<br>13:31   | 36                                    | 46   | 56  | 72                | 45 (40)                       | Tree leaves rustling with medium wind conditions<br>Flies buzzing noise             |

<sup>A</sup> Where practicable, noise levels in brackets have been filtered to remove insect noise contribution.

From the operator attended noise monitoring results presented in Table 8 to Table 11, the following is noted:

- All four (4) noise monitoring locations experienced extraneous noise sources, typically including wind-induced noise, insects, birds etc, that dominated the measured L<sub>Aeq</sub> and LA1 noise levels. Consequently, the L<sub>Aeq</sub> and LA1 noise levels summarised in Table 8 to Table 11 cannot be used for direct comparison (i.e. compliance assessment) against the noise limits for CVM.

- It is often practicable to isolate mine noise from insect and bird dominated noise levels due to the difference in frequency characteristic with mine noise being typically dominated by sound frequencies below 1 kHz particularly at receptors located kilometres away from the mine. Unfortunately, wind-induced noise (e.g. tree rustling) tends to affect a larger range of sound frequencies making it very difficult to filter this extraneous noise. It can be seen in Table 8 to Table 11, periods experiencing wind noise typically resulted in CVM noise being inaudible or difficult to detect and quantify.
- Based on the attended measurement results and observations at R2 (Long Pocket Road), CVM was audible at times albeit relatively low in noise level, with CVM noise levels estimated to be below 30 dBA LAeq.
- Based on the attended measurement results and observations at Locations R7 and R12 (Skyville boundary and Buffel Park Village), CVM noise was audible for the majority of the attended periods (particularly at R12) with the noise emission likely to be attributable to the overland conveyor from PDM, processing plant and stockpile area operations. During conditions favourable for measuring noise, CVM noise emission levels were estimated to be in the order of 27-28 dBA LAeq.
- Mine noise was just audible at R6 (Winchester Downs) however understood to have been attributable to PDM and PTM due to the directions the noise was approaching from. Noise emission from CVM could not be quantified at this location.
- All LA1 noise levels presented in Table 8 to Table 11 were not attributable to CVM but rather resulted from extraneous noise including bird calls, insects, car passbys etc.

## 4 Assessment Criteria

### 4.1 Noise

#### 4.1.1 CVM EA Noise Criteria

Under the current CVM EA, CVM is required to operate in accordance with Schedule C Noise and Vibration Conditions C1 to C10. Numerical noise limits are prescribed in Table C1 (Noise Limits) of the EA and are reproduced below in Table 12.

Table 12 CVM EA Schedule C Table C1 (Noise Limits)

| Noise Level (dBA)               | Monday to Sunday (including public holidays) |                      |                         |
|---------------------------------|--|----------------------|-------------------------|
|                                 | Daytime 7 am – 6 pm                          | Evening 6 pm – 10 pm | Night-time 10 pm – 7 am |
| Sensitive Place                 |  |                      |                         |
| LAeq, adj, 15mins <sup>1A</sup> | RBL <sup>C</sup> + 5                         | RBL <sup>C</sup> + 5 | RBL <sup>C</sup> + 5    |
| LA 1, adj, 15mins <sup>2B</sup> | 45   | 45                   | 45                      |

<sup>A</sup> External noise limit

<sup>B</sup> Internal noise limit

<sup>C</sup> RBL as defined in the administering authority's Planning for Noise Control Guideline

With reference to the RBLs presented in Table 7 in Section 3.2.5.1 for R6 (Winchester Downs), the following CVM external noise limits have been determined:

- Daytime 7 am – 6 pm: 31 dBA LAeq, adj, 15mins
- Evening 6 pm – 10 pm: 30 dBA LAeq, adj, 15mins
- Night 10 pm – 7 am: 30 dBA LAeq, adj, 15mins

Noting the marginal 1 dBA difference between the daytime and evening/night-time periods noise limits and mining operations are unlikely to vary between these time periods, it is considered prudent to apply a noise assessment limit of 30 dBA LAeq, adj, 15mins across all time periods. A limit of 30 dBA is also consistent with the day, evening and night-time periods noise limit nominated in BMA's *CVM Noise and Vibration Management Plan* (CVM-PLN-0016 dated 27 April 2016).

#### 4.1.2 Alternative Noise Assessment Criteria

This assessment considers and develops noise criteria aligned with current legislation, particularly given that the current EA refers to DES's Planning for Noise Control, which is currently under review and not publicly available.

The *Environmental Protection (Noise) Policy 2019* (EPP(Noise)) is subordinate legislation under the EP Act and the environmental values to be enhanced or protected under the EPP(Noise) are:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems.
- The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following: sleep, study or learn or be involved in recreation, including relaxation and conversation.
- The qualities of the acoustic environment which are conducive to protecting the amenity of the community.

The EPP(Noise) contains Acoustic Quality Objectives (AQO) for receptors potentially sensitive to noise. Where the overall level of noise at the receptors, from all sources but excluding road and rail transport noise, are within the AQO, the environmental values are considered to be achieved. The AQO for the noise sensitive receptors and land use surrounding the Project are presented in Table 13. Project operations require continuous operation of plant and equipment, as such this assessment has referenced the 1-hour LAeq and LA1 AQO to assess the noise emissions from Project noise sources.

Table 13 EPP(Noise) Acoustic Quality Objectives

| Receptor Type                   | Time of Day          | Acoustic Quality Objective (dBA) |             |             |
|---------------------------------|----------------------|----------------------------------|-------------|-------------|
|                                 |                      | LAeq,adj,1hr                     | LA10adj,1hr | LA1,adj,1hr |
| Residential dwelling (outdoors) | Day time and evening | 50                               | 55          | 65          |
| Residential dwelling (indoors)  | Daytime and evening  | 35                               | 40          | 45          |
|                                 | Night-time           | 30                               | 35          | 40          |

To assess noise levels to the internal (indoor) AQO at residential dwellings, the external noise levels predicted by the noise modelling are adjusted by a façade correction, which accounts for the reduction of noise achieved by the building (with windows open). For this assessment, a conservative 7 dB façade noise reduction has been applied in line with the DES guideline titled '*Noise and Vibration EIS Information Guideline*', where, at page 3, it states:

*When assessing outdoor to indoor noise attenuation at sensitive receptors ... use an outdoor to indoor attenuation value of 7dB, which is appropriate for typical Queensland buildings with open windows.*

Accordingly, internal residential noise levels would be expected to be within the indoor AQO where external noise levels are not more than:

- LAeq,adj,1hr 42 dB during the daytime and evening.
- LAeq,adj,1hr 37 dB during the night-time.
- LA1,adj,1hr 52 dB during the daytime and evening.
- LA1,adj,1hr 47 dB during the night-time.

### 4.1.3 Summary of Operational Mining Noise Criteria

While both criteria sources reference an LAeq assessment parameter, it is important to note that the AQO's within the EPP(Noise) are relevant to a 1-hour assessment period while the existing EA is based on a 15-minute assessment period. From a practical viewpoint, with appropriate noise management technology and processes in place, a 1-hour assessment period allows the potential for a mine to identify and accordingly manage an emerging noise issue within the 1-hour assessment period. Conversely, a 15-minute assessment period limits such an opportunity.

Assessment of the Project considers both fixed plant and mobile mining equipment and consequently it has been assumed that mining operations are quasi-steady and therefore noise emission levels would be consistent, whether the assessment period is over 15-minute or 1-hour duration. Table 14 outlines the operational mining noise criteria referenced in this assessment.

Table 14 Summary of Operational Mining Noise Criteria

| Reference                 | Noise Criteria dBA, Assessable at a Residential Noise Sensitive Receptor |                 |                 |
|---------------------------|--|-----------------|-----------------|
|                           | Daytime  | Evening         | Night-time      |
| CVM EA - LAeq, adj, 15min | 30   | 30              | 30              |
| CVM EA - LA1, adj, 15min  | 52 <sup>A</sup>  | 52 <sup>A</sup> | 52 <sup>A</sup> |
| EPP(Noise) – LAeq,15min   | 42 <sup>B</sup>  | 42 <sup>B</sup> | 37 <sup>B</sup> |
| EPP(Noise) – LA1,15min    | 52 <sup>B</sup>  | 52 <sup>B</sup> | 47 <sup>B</sup> |

<sup>A</sup> Internal criterion from CVM EA with a conservative 7 dB façade reduction to derive an externally assessable criterion.

<sup>B</sup> Internal criteria adopted from EPP(Noise) with a conservative 7 dB façade reduction to derive an externally assessable criterion. The derived daytime and evening criteria are lower than the reported 'outdoor' noise criteria for a residential receptor (by 10 dBA).

## 4.2 Blasting

### 4.2.1 CVM EA Blasting Airblast and Vibration Criteria

The CVM EA prescribes blasting vibration and airblast overpressure criteria in Tables C2 and C3 respectively. These criteria are reproduced below in Table 15.

Table 15 EA Table C2 and C3 - Blasting Vibration and Airblast Overpressure Limits

| Parameter                               | Sensitive or Commercial Place Blasting Limits  |
|---|--|
| Ground vibration peak particle velocity | For vibrations of more than 35 Hz – no more than 25 mm/s peak particle velocity at any time.   |
|   | For vibrations of no more than 35 Hz – no more than 10 mm/s peak particle velocity at any time.  |
| Airblast overpressure level             | 115 dB (Linear peak) for four (4) out of five (5) consecutive blasts regardless of the interval between blasts, and not greater than 120 dB (Linear peak) at any time. |

#### 4.2.2

Similar to the review of operational mining noise criteria in Section 4.1.2, this assessment involved a review of the current EA blasting limits within current legislation.

Section 440ZB of the EP Act, which is consistent with the existing CVM EA, states the following blasting criteria:

*A person must not conduct blasting if—*

*(a) the airblast overpressure is more than 115dB Z Peak for 4 out of any 5 consecutive blasts; or*

*(b) the airblast overpressure is more than 120dB Z Peak for any blast; or*

*(c) the ground vibration is—*

*(i) for vibrations of more than 35Hz—more than 25mm a second ground vibration, peak particle velocity; or*

*(ii) for vibrations of no more than 35Hz—more than 10mm a second ground vibration, peak particle velocity.*

No specific time intervals for blasting activities are stated under Section 440ZB of the EP Act.

The EPP(Noise) does not state any blasting criteria.

#### 4.2.3 Summary of Blasting Criteria

Since the current CVM EA blasting limits are aligned with the EP Act, blasting assessment criteria for the Project, outlined in Table 16, has been derived from these sources.

Table 16 Blasting Assessment Criteria

| Parameter                               | Sensitive or Commercial Place Blasting Limits  |
|---|--|
| Ground vibration peak particle velocity | For vibrations of more than 35 Hz – no more than 25 mm/s peak particle velocity at any time.   |
|   | For vibrations of no more than 35 Hz – no more than 10 mm/s peak particle velocity at any time.  |
| Airblast overpressure level             | 115 dB (Linear peak) for four (4) out of five (5) consecutive blasts regardless of the interval between blasts, and not greater than 120 dB (Linear peak) at any time. |

## 5 Assessment Methodology

### 5.1 Assessed Mining Activities and Assumptions




The selection of noise modelling/assessment scenarios for the Project was based on activities with the greatest potential to result in noise at the identified sensitive receptors. This included when plant and equipment (noise sources) would be at the closest proximity to receptors (i.e. due to active mining pits and waste dumps) and where there would be limited screening of noise from on-site structures or topography.

The assessment scenarios in Table 17 were developed to assess potential ‘typical worse-case’ noise levels with consideration of the following:

- Progressive mining within the Project area including the eastward progression of Horse Pit and adjacent waste dumps.
- BMA advised ROM and product coal output estimated over the life of the Project.
- Development of the new OOPD in the north-west corner of ML 70403 (commencing in FY2028).

As noted in Section 2, the Project is expected to require only minor “construction-type” activities (i.e. in comparison to the Project operational activities) and therefore the assessment has not included a construction phase scenario.

Table 17 Assessed Operational Scenarios and Associated Mining Activities

| Scenario/Year of Operation | Scenario Justification   | Mine Plan Diagram   |
|----------------------------|--|---|
| FY2030                     | Scenario modelled to assess the initial progression into the Project study area (i.e. southern end) as well as coinciding with the peak ROM tonnage (for CVM) post-commencement of mining in the Project area. |  <p>The diagram shows a mine plan with a red hatched area representing the mining boundary. A yellow/orange shaded area indicates the initial mining progression in the southern end. Labels include ML 70402, ML 70401, and ML 70399.</p>              |
| FY2040                     | Scenario modelled to assess the further extension eastward and into the northern tip of the Project area as well as the initial development of the OOPD.   |  <p>The diagram shows the mining boundary (red hatched) extending further eastward and into the northern tip compared to FY2030. The yellow/orange shaded area represents the mining progression. Labels include ML 70402, ML 70401, and ML 70399.</p> |
| FY2050                     | Scenario modelled to assess the bulk of Horse Pit operations within the Project area as well as the expansion of the OOPD towards the northern limit of ML 70403.  |  <p>The diagram shows the mining boundary (red hatched) at its maximum extent, covering most of the project area. The yellow/orange shaded area represents the bulk of operations. Labels include ML 70402, ML 70401, and ML 70399.</p>               |

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The noise assessment was based on the key assumptions and exclusions outlined below:

- The noise assessment involved the modelling of mine noise sources located within both the Project area as well as all remaining CVM noise sources including equipment operating in Heyford Pit, the CVM CHPP and the overland conveyor. Predicted mine noise emission levels, presented in Section 6.1, have been reported as both:
  - Project only noise emission levels, and
  - Total CVM noise emission levels (i.e. all CVM noise sources including the Project contribution)
- Further to the above, 3-D mine plans were provided by BMA for FY2030, FY2040 and FY2050 modelled scenarios inclusive of both Horse Pit and Heyford Pit.
- With regard to mobile mining equipment, BMA advised the type and quantity of equipment proposed to be operated for future CVM operations. For the purpose of modelling and assessment of the Project and total CVM noise emissions, the allocation of equipment between Horse Pit and Heyford Pit was based on the modelling conducted by SLR (then Heggies) for the EIS.
- Modelling of HPE haul trucks (waste or coal) was completed via line sources calculating a noise emission level for a typical path travelled over a 15-minute period (accounting for different speeds in/out of pits and on flat haul roads). To account for the total number of trucks proposed for each pit/activity, an assumption has been made that one (1) stationary haul truck would be located next to the active excavator and the remaining number of trucks are considered in calculating a total line source to simulate the haulage circuit.
- All remaining equipment has been modelled as point sources in a typical location for the pit/activity. For waste dozers, the modelled point source location was conservatively biased towards the more exposed end of the push journey.
- All operations will be continuous 24-hours a day and seven days a week. As such, no allowance was made for periods when plant would be temporarily idle or not in use.
- To assess LA1 noise levels, a +8 dB relationship between the LAeq and LA1 has been applied where mobile mining equipment was identified as the dominant noise source. This theoretical (+8 dB) relationship is considered conservative in that it works off the 'cumulative' LAeq noise level (i.e. all modelled equipment considered) where in reality, the LA1 is likely to result from more isolated events such as excessive engine revving from a single haul truck, overburden dumping or dozer track slap.
- Noting that the Project would not require any material change to existing fixed plant operating at CVM, modelling of these sources was based on modelling of the CHPP completed by SLR in 2013.
- Rail noise has been excluded from this assessment as rail operations are not proposed to change as a result of the Project. Further, given its an existing noise source, sensitive receptors are unlikely to associate future rail noise as part of the Project particularly given the large separation distance (i.e. at least 2.5 km) between the CVM rail line and the majority of the Project operations occurring in Horse Pit.
- Progressive rehabilitation activities are inherently assessed through the reported assessment of coal mining operations. Assessment of final rehabilitation activities (i.e. post mine closure) has not been considered. This would be minor in comparison to predicted noise levels from coal mining operations.



## 5.2 Noise Prediction Modelling

### 5.2.1 Modelling Software and Algorithm

A SoundPLAN (version 8.2) computer noise model was developed to predict mine noise levels at the nominated noise sensitive receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The model can calculate noise levels taking into account such factors as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The *Conservation of Clean Air and Water Europe* (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to  $\pm 2$  dBA in any one octave band between 63 hertz (Hz) and 4 kHz and  $\pm 1$  dBA overall.

### 5.2.2 Modelled Weather Parameters

Based on the meteorological analysis carried out for the CVM EIS, the default weather parameters recommended by PNC have been adopted to determine the effects of meteorology on noise emissions from the Project. The weather parameters applied to this study are summarised in Table 18.

Table 18 Modelled Meteorological Conditions – Neutral and Adverse Scenarios

| Parameter               | Neutral Weather | Adverse Weather – Temperature Inversion     |
|-------------------------|-----------------|---|
| Temperature             | 10°C            | 10°C  |
| Humidity                | 70%             | 90%   |
| Pasqual stability class | D               | F (representative of temperature inversion) |
| Wind speed              | 0 m/s           | 2 m/s                                       |

### 5.2.3 Noise Sources, Sound Power Levels and Location Allocation

With reference to the modelled mine scenarios (refer to Table 17), Table 19 and Table 20 summarise the following model inputs:

- Mine equipment make, model and numbers relevant to the assessed operational scenarios – provided by BMA.
- Assumed overall sound power level (SWL) data and source emission heights for each equipment item – developed by SLR based on details from similar recently assessed coal mining projects.

Appendix C contains figures identifying the assigned mobile mining equipment locations for each modelled scenario.

Table 19 Modelled Noise Sources and Sound Power Levels

| Equipment type   | Make and Model    | SWL<br>(dBA, LAeq) | Source Height <sup>A</sup><br>(m) | Quantity of Plant per Modelled Year |      |      |
|------------------|-------------------|--------------------|-----------------------------------|-------------------------------------|------|------|
|                  |                   |                    |                                   | 2030                                | 2040 | 2050 |
| Drill            | Sandvik PV235     | 118                | 3                                 | 5                                   | 5    | 5    |
|                  | Atlas Copco D90KS | 118                | 3                                 | 1                                   | 1    | 1    |
| Dragline         | Marion 8050       | 118                | 20                                | 4                                   | 4    | 4    |
| Shovel           | CAT 7495          | 123                | 15                                | 1                                   | 1    | 1    |
| Excavator (600t) | Liebherr R996B    | 125                | 6                                 | 3                                   | 3    | 3    |
| Excavator (400t) | CAT 6040BH        | 118                | 4                                 | 3                                   | 3    | 3    |
|                  | Komatsu PC4000    | 117                | 4                                 | 1                                   | 1    | 1    |
|                  | Hitachi EX3600    | 117                | 4                                 | 1                                   | 1    | 1    |
| Loader 200t      | CAT 994H          | 117                | 3                                 | 3                                   | 3    | 3    |
| Track dozer      | CAT D10T          | 116                | 3                                 | 8                                   | 8    | 8    |
|                  | CAT D11T          | 119                | 3                                 | 8                                   | 8    | 8    |
| Wheel dozer      | CAT 854K          | 118                | 3                                 | 2                                   | 2    | 2    |
| Haul truck       | CAT 797F          | 120                | 3                                 | 10                                  | 10   | 10   |
|                  | CAT 793F          | 119                | 3                                 | 23                                  | 23   | 23   |
|                  | CAT 789D          | 118                | 3                                 | 6                                   | 6    | 6    |
|                  | CAT 793C          | 119                | 3                                 | 14                                  | 14   | 14   |
|                  | CAT 789C          | 118                | 3                                 | 8                                   | 8    | 8    |

<sup>A</sup> Based on acoustic centre of equipment as distinct from the maximum height of the equipment.

Table 20 Octave Band SWL for Modelled Noise Sources (Construction and Operations)

| Source            | SWL, dBA LAeq |       |       |        |        |        |       |       |       |       |
|-------------------|---------------|-------|-------|--------|--------|--------|-------|-------|-------|-------|
|                   | Overall       | 31 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz |
| Sandvik PV235     | 118           | 83    | 97    | 102    | 110    | 113    | 113   | 110   | 105   | 94    |
| Atlas Copco D90KS | 118           | 83    | 97    | 102    | 110    | 113    | 113   | 110   | 105   | 94    |
| Marion 8050       | 118           | 83    | 97    | 102    | 110    | 112    | 113   | 109   | 102   | 94    |
| CAT 7495          | 123           | 86    | 94    | 112    | 116    | 117    | 117   | 115   | 111   | 99    |
| Liebherr R996B    | 125           | 86    | 94    | 113    | 117    | 119    | 119   | 117   | 112   | 99    |
| CAT 6040BH        | 118           | 78    | 86    | 106    | 109    | 112    | 111   | 111   | 105   | 97    |
| Komatsu PC4000    | 117           | 78    | 86    | 106    | 109    | 111    | 111   | 111   | 105   | 97    |
| Hitachi EX3600    | 117           | 78    | 86    | 106    | 109    | 111    | 111   | 111   | 105   | 97    |
| CAT 994H          | 117           | 78    | 86    | 105    | 109    | 111    | 111   | 109   | 104   | 97    |

| Source   | SWL, dBA LAeq |       |       |        |        |        |       |       |       |       |
|----------|---------------|-------|-------|--------|--------|--------|-------|-------|-------|-------|
|          | Overall       | 31 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz |
| CAT D10T | 116           | 78    | 89    | 104    | 106    | 110    | 113   | 107   | 101   | 97    |
| CAT D11T | 119           | 84    | 98    | 99     | 109    | 114    | 112   | 111   | 109   | 103   |
| CAT 854K | 118           | 84    | 98    | 99     | 109    | 114    | 112   | 111   | 105   | 97    |
| CAT 797F | 120           | 77    | 98    | 100    | 110    | 114    | 114   | 114   | 108   | 97    |
| CAT 793F | 119           | 77    | 98    | 100    | 108    | 113    | 113   | 113   | 107   | 97    |
| CAT 789D | 118           | 76    | 97    | 99     | 107    | 112    | 112   | 112   | 106   | 96    |
| CAT 793C | 119           | 77    | 98    | 100    | 108    | 113    | 113   | 113   | 107   | 97    |
| CAT 789C | 118           | 76    | 97    | 99     | 107    | 112    | 112   | 112   | 106   | 96    |

### 5.3 Cumulative Noise Impact Assessment

The assessment has also considered cumulative mine noise impacts for sensitive receptors exposed to noise emission from surrounding mines including PDM and PTM. From the initial review of sensitive receptors surrounding CVM, which included review of the baseline noise monitoring results, identified that only sensitive receptor R6 (Winchester Downs) has potential to be impacted by mine noise emission from multiple mine sites including CVM.

The cumulative noise assessment for sensitive receptor R6, presented in Section 6.2, has been based on the following information sources:

- Noise modelling predictions for the Project which quantifies the contribution from CVM.
- In the absence of relevant noise modelling for PDM, use of noise modelling predictions from the Project to estimate the contribution from PDM, given the mines are a comparable distance from sensitive receptor R6.
- Previous noise modelling conducted by SLR for PTM.

Daunia Mine and Millennium Mine have been excluded from the cumulative noise assessment because both mines are greater than 10 km from Winchester Dows and therefore are considered too far away to be acoustically relevant.

### 5.4 Blasting

Blasting will continue for the Project as currently employed at CVM, that is approximately one to two times per week. Blasting at CVM is utilised for overburden and interburden, including through seam blasting (collectively referred to herein as “composite” blasts), as necessary at depth ranges from 7 m – 40 m. Subject to operational requirements, blasting occurs on any day of the week prior to 5 pm.

BMA have advised that the quantities of explosives range from 500 tonnes to 2000 tonnes per shot and the potential blast size is approximately 200,000 bcm to 400,000 bcm for through seam blasts and 500,000 bcm to 1,500,000 bcm for overburden removal. The predominate explosive used in blasting activities at the CVM is ammonium nitrate/fuel oil (ANFO), which is the most common explosive used in the mining industry in Queensland.

For the assessment of potential Project blast impacts, SLR has reviewed and analysed historical blasting results for CVM (supplied by BMA) as follows:

- Supplied log of site blasting details including shot ID, shot location (centroid coordinate) and maximum instantaneous charge (MIC, kgs).
- Blast log containing 184 blasts between 3 January 2019 and 16 November 2020, from which approximately 120 have been used in the analysis. Those 64 blast logs which were not included contained either incomplete information (i.e. blast parameters missing) or represented an extraneous results (i.e. outlying from the dataset in the form of an unusually high result), and were therefore excluded from the analysis

Primarily analysing the relationship between blast centroid, blast MIC and measured airblast overpressure and/or ground vibration levels, CVM composite blast site laws presented in Table 21 were derived for the purpose of calculating airblast overpressure and ground vibration levels from future blasts within the Project disturbance area.

**Table 21 Derived Composite Blast Site Laws – CVM**

| Blast Category          | Exceedance Allowance         | Blast Site Laws – CVM          |                                       |
|-------------------------|------------------------------|--------------------------------|---------------------------------------|
|                         |                              | Ground Vibration (mm/s)        | Airblast Overpressure (dBL)           |
| All Project blast types | 20% (i.e. 4 out of 5 blasts) | $PVS(80\%) = 110 * SD^{-1.00}$ | $SPL(80\%) = -19.5 * LOG(SD) + 155.7$ |
|                         | 1% (i.e. maximum)            | $PVS(99\%) = 312 * SD^{-1.00}$ | $SPL(99\%) = -19.5 * LOG(SD) + 164.7$ |

'PVS' mean Vibration Velocity Peak Vector Sum in millimetres per second (mm/s). Vibration is discussed further in Appendix A.

'SPL' mean Sound Pressure Level and is defined in Appendix A.

'SD' means Scaled Distance, being a function of distance (between blast and measurement point) and MIC (in kgs).

In addition to the derived composite blast site laws, MICs to be used for this assessment are summarised in Table 22 and represent the average and upper 10<sup>th</sup> percentile of the historical range in MICs recorded through the BMA supplied dataset.

**Table 22 Project Blast Parameters – MICs for Assessment**

| Blast Category          | MIC (kg) |                                   |
|-------------------------|----------|-----------------------------------|
|                         | Average  | Upper 10 <sup>th</sup> Percentile |
| All Project blast types | 1,313    | 2,377                             |

For the purpose of this blast assessment, blasting occurring within the Project disturbance area forms the basis for the blast assessment due to this being the material change compared to existing blasting at CVM.

Due to the potential magnitude of total blast predictions for this blast assessment (i.e. locations x blast site laws x MICs), this blasting assessment is limited to predictions that focus on the nearest sensitive receptor to potential blast activities for the Project. That receptor is R2 (881 Long Pocket Road), which is located approximately 4.5 km from the closest blast location within the Project footprint, likely to occur around FY2031/32.

## 6 Noise and Vibration Impact Assessment

### 6.1 Mine Operational Noise Emission

#### 6.1.1 Predicted Operational Noise Levels

The predicted noise levels from the modelled operational scenarios (FY2030, FY2040 and FY2050) are summarised in Table 23 for neutral and adverse weather conditions, with corresponding noise level contours presented in Appendix D. As noted in Section 5.1, noise emission level predictions are presented for both the Project in isolation (noise levels presented in brackets in Table 23) and total CVM noise emissions for all noise sources including fixed plant and mobile equipment.

Table 23 Predicted Project and CVM Operational Noise Levels

| ID  | Receptor                | Predicted Noise Level (LAeq dBA) |                 |                 |                 |                 |                 |
|-----|-------------------------|----------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|     |                         | FY2030                           |                 | FY2040          |                 | FY2050          |                 |
|     |                         | Neutral Weather                  | Adverse Weather | Neutral Weather | Adverse Weather | Neutral Weather | Adverse Weather |
| R1  | 541 Railway Station Rd  | 20 (<10)                         | 25 (<10)        | 20 (14)         | 25 (19)         | 20 (16)         | 26 (22)         |
| R2  | 881 Long Pocket Road    | 24 (<10)                         | 30 (<10)        | 25 (20)         | 30 (26)         | 26 (24)         | 32 (30)         |
| R3  | Moranbah Township (S-W) | 15 (<10)                         | 19 (<10)        | 15 (11)         | 20 (16)         | 15 (11)         | 20 (16)         |
| R4  | Moranbah Township (S-C) | 18 (<10)                         | 22 (<10)        | 16 (<10)        | 21 (14)         | 16 (11)         | 20 (16)         |
| R5  | Moranbah Township (S-E) | 15 (<10)                         | 20 (<10)        | 15 (<10)        | 19 (14)         | 15 (10)         | 19 (15)         |
| R6  | Winchester Downs        | 18 (<10)                         | 22 (<10)        | 15 (<10)        | 20 (<10)        | 15 (<10)        | 19 (<10)        |
| R7  | Skyville                | 25 (<10)                         | 31 (<10)        | 25 (<10)        | 31 (<10)        | 25 (<10)        | 31 (<10)        |
| R8  | Buffel Park             | 41 (<10)                         | 47 (<10)        | 40 (14)         | 47 (20)         | 40 (18)         | 47 (24)         |
| R9  | Tomaren                 | 21 (<10)                         | 26 (<10)        | 20 (14)         | 26 (20)         | 21 (16)         | 26 (22)         |
| R10 | Grosvenor Downs         | 20 (<10)                         | 25 (<10)        | 21 (16)         | 27 (22)         | 22 (18)         | 27 (24)         |
| R11 | Horse Creek             | 30 (<10)                         | 36 (12)         | 33 (22)         | 39 (28)         | 32 (28)         | 38 (33)         |
| R12 | Buffel Park Village     | 33 (<10)                         | 39 (<10)        | 33 (<10)        | 39 (12)         | 33 (10)         | 39 (16)         |

"S-W" is south-west, "S-C" is south central, and "S-E" is south-east.

Noise levels in brackets represent the Project noise emission level.

Bold noise levels represent an exceedance of the EA 30 dBA LAeq, adj, 15 min noise limit for noise sensitive receptors only.

Where a noise level prediction is below 10 dBA, this has been reported as '<10'.

Receptors R8 to R12 are not regarded as noise sensitive receptors.

From the noise prediction modelling results presented in Table 23, the following is noted:

- Predicted Project and total CVM noise emission levels are compliant with the EPP(Noise) Acoustic Quality Objective derived external 37 dBA LAeq criteria at all noise sensitive receptors.

- 
- The highest predicted total CVM noise level was 32 dBA LAeq at sensitive receptor R2 (881 Long Pocket Road) for the FY2050 scenario under adverse weather conditions (temperature inversion). Regarding this highest predicted LAeq noise level, the following is noted:
    - This represents a marginal 2 dBA exceedance of the existing CVM EA noise limit of 30 dBA LAeq, adj, 15 min.
    - The contribution of the Project to this highest predicted LAeq noise level was 30 dBA, which in isolation is compliant with the EA noise limit.
    - The highest predicted noise level at R2 is dominated primarily by a D10 dozer working on the northern extent of the OOPD with clear line of sight to the north-west towards Long Pocket (i.e. a predicted noise level of 27 dBA). Mitigation of this noise source is discussed further in Section 7.1.
  - The predicted marginal 1 dBA exceedance of the 30 dBA LAeq, adj, 15 min CVM EA noise limit at noise sensitive receptor R7 (Skyville) is primarily attributable to the overland conveyor from PDM (i.e. a predicted noise level of 26 dBA). The Project is predicted to have a negligible effect on CVM noise emission levels at R7 even under adverse weather conditions. Mitigation of this noise source is discussed further in Section 7.1.
  - With regard to the two predicted marginal exceedances of the existing CVM EA noise limit, it is commonly accepted within the acoustics industry that differences in noise levels of 1 or 2 dB are negligible and imperceptible to the human ear.

Regarding LA1 noise level predictions, as noted in Section 5.1, a +8 dB relationship between the LAeq and LA1 noise level descriptor has been used where the noise modelling indicated mobile mining equipment to be the dominant noise source. Accordingly, the highest predicted LA1 noise level was 40 dBA at sensitive receptor R2 for the FY2050 scenario under adverse weather conditions (temperature inversion). This highest predicted LA1 noise level is compliant with the EPP(noise) derived external 47 dBA LA1 criterion and the existing CVM EA derived external noise limit of 52 dBA LA1, adj, 15 min.

Consideration of cumulative noise levels is discussed in Section 6.2.

### 6.1.2 Assessment of Noise Characteristics

The potential impacts from mine noise experienced at the sensitive receptors are not solely a function of the overall level of noise but also the characteristics of the noise. Consideration for the potential presence of tonal, impulsive and/or low frequency noise characteristics was investigated.

To complete a true tonal assessment, the inclusion of one-third octave data is required. As per Table 20, the spectrum data used for this assessment has been simplified at octave band data (which is widely accepted for an assessment of this nature). Consistent with the description of tonal noise in the PNC guideline and SLR's experience of noise from mine sites, there may be a distinguishable (non-tonal) "hum" associated with diesel powered equipment however the presence of tonal characteristics can often be attributed to mining plant with mechanical faults. For this assessment, no specific tonal correction has been considered on the assumption that all mining plant would be operated in good working order and that "buzzer", not "beeper", reversing alarms would likely be utilised on mobile equipment particularly if working in exposed areas of CVM such as the new OOPD.

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EPP(Noise) does not contain specific criteria for assessing low frequency noise (which can be defined as noise from the 10 Hz to 200 Hz frequency range<sup>1</sup>). In the absence of specific low frequency noise assessment requirements with regard to mining impact assessments, the following two (2) documents and associated criteria are referenced to provide consideration to potential low frequency noise impact from the Project onto the assessed noise sensitive receptors:

- The former Ecoaccess *Assessment of Low Frequency Noise* Guideline, which contains an initial screening test at noise sensitive receptors whereby the overall noise level should not exceed 50 dBL Leq (internal) and the difference between the overall dBL and dBA Leq (internal) noise levels should not exceed 15 dB. For this assessment, a (conservative) 5 dB façade reduction has been applied to convert the 50 dBL internal level to an external level (i.e. 55 dBL Leq external) given that building facades generally do not attenuate low frequency noise as well as broader spectrum noise.
- The DES *Streamlined Model Conditions for Petroleum Activities* Guideline, which is relevant to operations of industrial noise sources operating in rural Queensland, contains the following external and internal criteria that must not be exceeded (Leq unless noted otherwise). It is noted the internal criteria are generally consistent with the former Ecoaccess *Assessment of Low Frequency Noise* Guideline noted above.
  - 60 dBC measured outside the sensitive receptor; and
  - the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or
  - 50 dBZ measured inside the sensitive receptor; and
  - the difference between the internal A-weighted and Z-weighted (Max LpZ, 15 min) noise levels is no greater than 15 dB.

Consistent with the overall A-weighted predicted noise levels (i.e. Table 23), the highest predicted dBC and dBL external noise levels at a sensitive receptor are predicted to occur at R2 (881 Long Pocket Road) in FY2050 under adverse conditions. Predicted levels are 43 dBC and 44 dBL Leq and as expected, higher than the 32 dBA LAeq. Neither the dBC or dBL predicted noise levels exceed the respective overall 60 dBC or 55 dBL Leq external criteria. Accordingly, low frequency noise is not predicted to be an issue for the Project.

There is potential for impulsive noise from track slap associated with the dozers. Measures to mitigate such noise events from the operation of the dozer, and mitigate impulsive noise, are provided in Section 7.1. If these mitigation measures are implemented effectively, impulsive noise characteristics can be managed such that impulsive noise penalties may not apply.

### 6.1.3 Potential for Sleep Disturbance

The World Health Organisation's (WHO) *Night Noise Guidelines for Europe* 2009 recommends that noise levels within bedrooms do not exceed a 30 dBA LAeq and a maximum (LAmax) noise level of 42 dBA to minimise the risk of sleep disturbance.

SLR's experience in monitoring and assessing noise from mine operations has determined that the LA1/LAmax noise levels are conservatively 8 dB greater than the overall LAeq noise levels for mine operations. It is to be noted that the maximum noise level is the singular highest noise event and is not a cumulative noise level from all sources of mine noise.

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<sup>1</sup> With reference to DES Noise Measurement Manual and the former Ecoaccess *Assessment of Low Frequency Noise* Guideline.

Referencing the highest predicted external noise level of 32 dBA LAeq at a sensitive receptor, this predicted noise level complies with the conservatively derived external noise limit of 37 dBA LAeq. Further, referencing the highest predicted noise level of 32 dBA LAeq (i.e. for combined CVM operations and not a singular noise event/item of equipment which would likely be lower), the corresponding predicted external noise level would be 40 dBA LAmax at sensitive receptor R2. In this case, the internal 42 dBA LAmax criterion is achieved regardless of the noise attenuation provided by the façade of sensitive receptor R2.

Therefore, the above sleep disturbance assessment indicates compliance with the LAeq 30 dBA and LAmax 42 dB internal noise objectives at the closest sensitive receptor.

## 6.2 Cumulative Noise

The cumulative noise impact assessment completed as part of this assessment, in line with the methodology outlined in Section 5.3, is detailed in Table 24. The assessment has considered cumulative mine noise emissions at sensitive receptor R6 (Winchester Downs) based on the modelling results from the FY2030 adverse weather scenario (i.e. the highest predicted noise level at R6).

Table 24 Cumulative Mine Noise Under Adverse Weather Conditions at R6

| Receptor              | Predicted LAeq (dBA) Noise Level from: |                 |                 | Cumulative LAeq (dBA) Noise Level |
|-----------------------|--|-----------------|-----------------|-----------------------------------|
|                       | CVM (with Project)                     | PDM             | PTM             |                                   |
| R6 – Winchester Downs | 22                                     | 22 <sup>A</sup> | 22 <sup>B</sup> | 27                                |

<sup>A</sup> Estimated from CVM modelling

<sup>B</sup> From SLR predictive modelling of future PTM operations

Based on the cumulative noise impact assessment detailed in Table 24, cumulative mine noise emission levels from CVM, PDM and PTM have the potential to result in a combined noise level of 27 dBA LAeq at sensitive receptor R6. The predicted cumulative noise level complies with all forms of noise assessment criteria and therefore cumulative noise impacts are not anticipated as a result of this Project.

## 6.3 Blasting

### 6.3.1 Airblast Overpressure

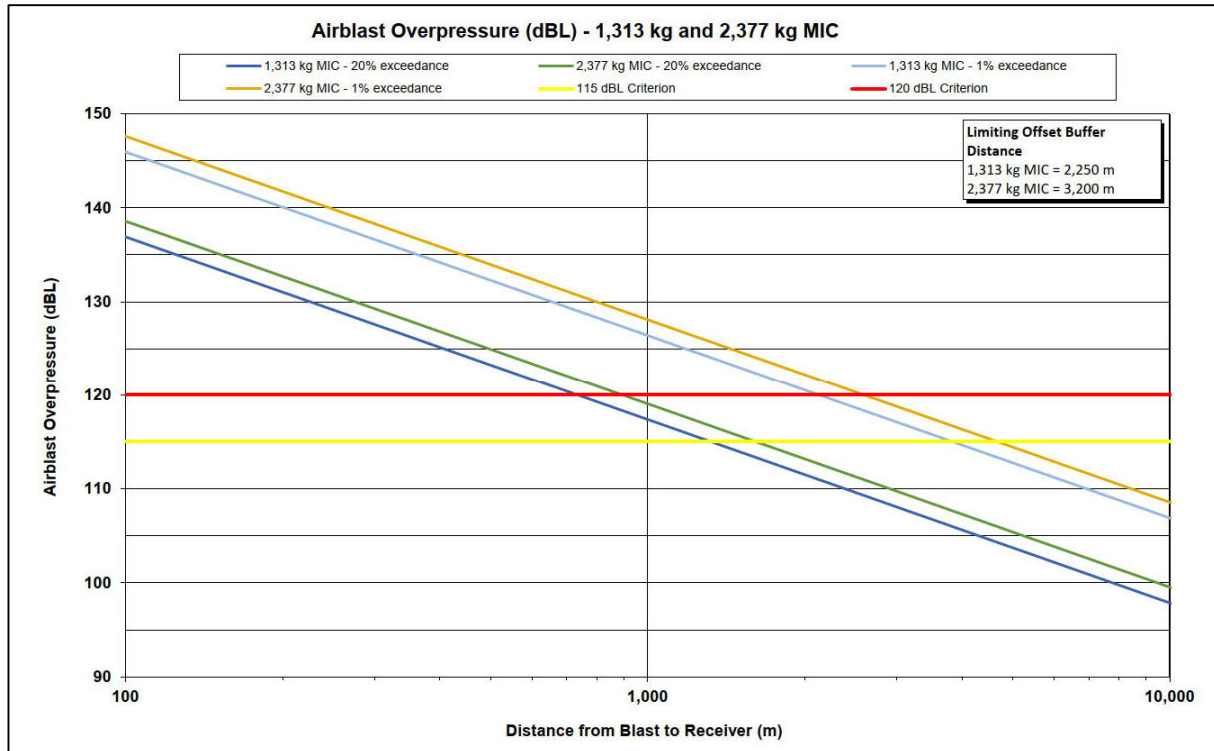
As noted in Section 4.2, the airblast overpressure reference criteria derived from the existing CVM EA (and EP Act) cater for the inherent variation in emission levels from a given blast design by allowing 20% (i.e. four (4) out of five (5) blasts) exceedance of the 115 dBL criterion and up to a 120 dBL maximum (assumed at 1% exceedance to facilitate predictions through the site law formula)<sup>2</sup>. Correspondingly, '1% exceedance' and '20% exceedance' airblast overpressure prediction formula was generated for the composite airblast site laws stated in Section 5.4.

<sup>2</sup> For both airblast overpressure and ground vibration predictions (see Section 6.3.2), this report references an 'exceedance' level being either 20% exceedance (relevant to four (4) out of five (5) blasts) or 1% exceedance (for absolute criterion). For absolute criterion, a '1%' exceedance has historically been adopted by SLR to complete similar mining blast assessments within Queensland. The 1% exceedance facilitates predictions through the site law formula, with a '0%' exceedance not allowing the equation to function.



Sound Pressure Level (SPL) represents the level of airblast overpressure (dBLinear or dBL), above which 1%/20% of the total population (of data points) will lie respectively, assuming that the population has the same statistical distribution as the underlying measured sample. The relationship between distance and peak airblast overpressure (1% and 20% exceedances) from proposed blasting within the Project disturbance area is presented Figure 3.

Figure 3 Peak Airblast Overpressure (1% and 20%) – 1,313 and 2,377 kg MIC



Based on the relationship in Figure 3, Table 25 summarises the predicted airblast overpressure levels at sensitive receptor R2 based on the calculated offset distance from the nearest anticipated blast point for the Project.

Table 25 Predicted Airblast Overpressure Levels at Sensitive Receptor R2

| Blast Category          | Assessed MIC (kg) | Distance to R2 (m) | Airblast Overpressure (dBL)                      |   |
|-------------------------|-------------------|--------------------|--|---|
|                         |                   |                    | 115 dBL Criterion<br>20% Exceedance<br>Allowance | 120 dBL Criterion<br>1% Exceedance<br>Allowance |
| All Project blast types | 1,313 – 2,377     | 4,500              | 105 - 106  | 114 - 115                                       |

The range in prediction represent the average and upper 10<sup>th</sup> percentile of MIC's for the Project.

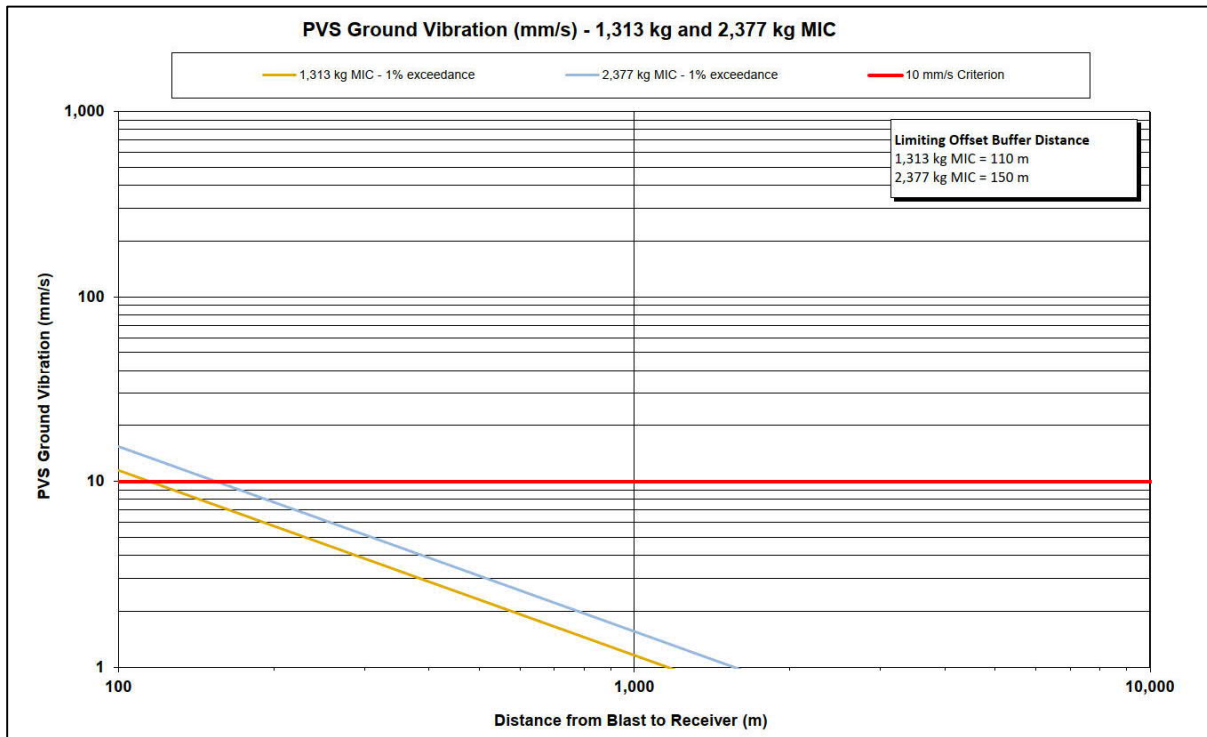
The predicted airblast overpressure levels presented in Table 25 show that both the 115 dBL (20% exceedance case) and 120 dBL (maximum) blasting criteria can be achieved during blasting for the Project.

### 6.3.2 Ground Vibration

As noted in Section 4.2, the ground vibration reference criteria derived from the existing CVM EA prescribes a maximum ground vibration of 10 mm/s (assumed at 1% exceedance to facilitate predictions through the site law formula). Correspondingly, '1% exceedance' ground vibration prediction formula was generated for the ground vibration site laws stated in Section 5.4.

Peak Vector Sum (PVS) represents the level of ground vibration (mm/s), above which 1% of the total population (of data points) will lie respectively, assuming that the population has the same statistical distribution as the underlying measured sample. The relationship between distance and ground vibration (1% exceedance) from the proposed composite blasting site laws is presented in Figure 4.

Figure 4 Ground Vibration (1%) – 1,313 and 2,377 kg MIC



Based on the relationship in Figure 4, Table 26 summarises the predicted ground vibration levels at sensitive receptor R2 based on the calculated offset distance from the nearest anticipated blast point for the Project.

Table 26 Predicted Ground Vibration Levels at Sensitive Receptor R2

| Blast Category          | Assessed MIC (kg) | Distance to R2 (m) | Ground vibration (mm/s)<br>10 mm/s Criterion (1% Exceedance Allowance) |
|-------------------------|-------------------|--------------------|--|
| All Project blast types | 1,313 – 2,377     | 4,500              | 0.3 – 0.4  |

The range in prediction represent the average and upper 10<sup>th</sup> percentile of MIC's for the Project.

---

The predicted ground vibration levels presented in Table 26 indicate that the 10 mm/s for the 1% exceedance allowance criterion can be achieved for all Project blasting.

While no specific mitigation measures regarding blast ground vibration from the Project are required, leading practice mitigation measurements are detailed in Section 7.3 for consideration.

## 7 Recommendations

The following sub-sections detail proven and/or leading practice noise and vibration recommendations for the Project.

### 7.1 Operational Mine Noise

With regard to the marginal 2 dBA exceedance at sensitive receptor R2 (881 Long Pocket Road) for the FY2050 modelled scenario under adverse weather, while this would tend not to warrant further investigation based on the points made in Section 6.1.1, in principle noise mitigation options are provided to target the reference noise assessment criterion of 30 dBA  $L_{Aeq}$ . These options primarily relate to the mitigation and/or management of mobile equipment operating at the OOPD in the north-west corner of ML 70403. The reference noise assessment criterion of 30 dBA  $L_{Aeq}$  would be expected to be achieved by one, or a combination of both, mitigation options.

- Management of mobile equipment to avoid operating in areas of the OOPD with clear line of sight to Long Pocket Road during adverse (i.e. temperature inversion) weather conditions. Careful design and operation of the OOPD, such as constructing and maintaining an acoustic bund along the northern edge of the OOPD during the daytime period would allow OOPD operations during adverse (temperature inversion) weather conditions to occur with the required shielding.
- If restriction of OOPD operating hours or the construction of an acoustic bund is not practicable, mobile mining equipment operating on the OOPD should be fitted with noise suppression kits. For this assessment, the modelling indicated a D10 dozer operating in the north-west corner of the OOPD was primarily responsible for the predicted 2 dBA noise limit exceedance. SLR understands that noise suppression kits for D10 dozers can reduce SWLs by up to 6 dBA, which in this case would result in the required reduction of overall CVM noise emission at R2 thereby achieving compliance with the 30 dBA assessment criterion.

Regarding the predicted marginal 1 dBA exceedance of the 30 dBA  $L_{Aeq, adj, 15 min}$  CVM EA noise limit at noise sensitive receptor R7 (Skyville), SLR understands that BHP are committed to the progressive replacement of standard steel rollers with relatively quieter polymer rollers. Laboratory noise test data provided by an Australian manufacturer of conveyor systems indicates that polymer rollers are up to 5 dBA quieter than standard steel rollers.

Taking into consideration the predicted noise limit exceedance is a marginal 1 dBA, SLR considers that the progressive replacement of steel rollers with quieter polymer rollers is a reasonable and practicable noise mitigation measure which will be effective in eliminating this marginal exceedance over time.

In addition to the above noise mitigation options, the following proven noise management advice is outlined for consideration during mine planning and operations over the life of the Project to minimise off-site noise levels:

- Avoid clustering of mobile equipment on haul roads and other exposed/elevated areas, such as during shift changeovers. Haul truck arrival and departures from go lines should be staggered where possible.

- 
- Dumping of material can include engineering controls to minimise the distance the material falls and lining bins and chutes with rubber to dampen the impact.
  - Equipment should be shut down when not in use.
  - All equipment should be operated in accordance with the manufacturer's instruction and in order to minimise noise impact events.
  - Broadband "buzzer", not tonal "beeper", reversing alarms should be utilised on all mobile plant.
  - In the event of a complaint regarding potential impulsive noise disturbance such as dozer track slap, this could be minimised through idle wheel modification, use of track slides and grousers, and management controls such as gear limitation (forward and reverse in 1st gear only).

It should be noted that the noise mitigation options discussed are preliminary in nature. Any actual noise mitigation measures implemented on site, if required based on actual mine noise emissions, will be subject to further detailed analysis in the future in accordance with the CVM Noise and Vibration Management Plan.

## 7.2 Cumulative Noise

No specific noise mitigation measures with respect to cumulative noise are warranted for the Project for the reasons noted in Section 6.2. In stating this, implementation of the Project should consider recommendations made in Section 7.1 to ensure noise level contributions to cumulative noise are minimised.

## 7.3 Blasting

As no airblast overpressure or ground vibration predictions are above the nominated criteria, no specific mitigation measures are warranted for Project blasting.

# 8 Conclusion

## 8.1 Mine Operations

The assessment has modelled Project and total CVM mine noise emission levels from three (3) representative operational mining scenarios coinciding with FY2030, FY2040 and FY2050. Through a review of supplied information as part of this assessment, these three (3) modelled scenarios approximately span the life of the Project as well as targeting the 'worst-case' year(s) for the Project based on ROM and product coal output as well as proximity of mining operations to adjacent noise sensitive receptors.

Project and total CVM noise emission levels were predicted to comply with the EPP(Noise) Acoustic Quality Objective derived external 37 dBA LAeq criteria at all noise sensitive receptors. The highest predicted total CVM noise level was 32 dBA LAeq at sensitive receptor R2 (881 Long Pocket Road) for the FY2050 scenario under adverse weather conditions (temperature inversion). Regarding this highest predicted noise level, the following is noted:

- This represents a marginal 2 dBA exceedance of the existing CVM EA noise limit of 30 dBA LAeq,adj,15 min.
- The contribution of the Project to this highest predicted LAeq noise level was 30 dBA, which in isolation is compliant with the EA noise limit.

- The highest predicted noise level at R2 is dominated primarily by a D10 dozer working on the northern extent of the OOPD with clear line of sight to the north-west towards Long Pocket Road (i.e. a predicted noise level of 27 dBA). Options for the management of this predicted exceedance includes:
  - Management of mobile equipment to avoid operating in areas of the OOPD with clear line of sight to Long Pocket Road during adverse (i.e. temperature inversion) weather conditions.
  - Careful design and operation of the OOPD, such as constructing and maintaining an acoustic bund along the northern edge of the OOPD during the daytime period would allow OOPD operations during adverse (temperature inversion) weather conditions to occur with the required shielding.
  - Mobile mining equipment operating on the OOPD could be fitted with a noise suppression kit where operating under adverse weather conditions and line of sight cannot be avoided.

A marginal 1 dBA exceedance of the 30 dBA  $L_{Aeq, adj, 15 min}$  CVM EA noise limit was predicted for noise sensitive receptor R7 (Skyville). This predicted exceedance is primarily attributable to the overland conveyor from PDM (i.e. not a direct result of the Project). SLR understands that BHP are committed to the progressive replacement of standard steel rollers with relatively quieter polymer rollers. Laboratory noise test data provided by an Australian manufacturer of conveyor systems indicates that polymer rollers are up to 5 dBA quieter than standard steel rollers.

Taking into consideration the predicted noise limit exceedance is a marginal 1 dBA, SLR considers that the progressive replacement of steel rollers with quieter polymer rollers is a reasonable and practicable noise mitigation measure which will be effective in eliminating this marginal exceedance over time.

A highest  $LA_1$  noise level of 40 dBA was predicted at sensitive receptor R2 for the FY2050 scenario under adverse weather conditions (temperature inversion). This highest predicted  $LA_1$  noise level is compliant with the EPP(noise) derived external 47 dBA  $LA_1$  criterion and the existing CVM EA derived external noise limit of 52 dBA  $LA_1, adj, 15 min$ .

## 8.2 Cumulative Noise

The assessment has considered cumulative mine noise impacts for sensitive receptors exposed to noise emission from surrounding mines including PDM and PTM. The assessment identified only one sensitive receptor (R6 - Winchester Downs) having potential to be impacted by mine noise emission from multiple mine sites including CVM.

Based on the cumulative noise impact assessment, cumulative mine noise emission levels from CVM, PDM and PTM have the potential to result in a cumulative noise level of 27 dBA  $L_{Aeq}$  at sensitive receptor R6. The predicted cumulative noise level complies with all forms of noise assessment criteria and therefore cumulative noise impacts are not anticipated as a result of this Project.

## 8.3 Blasting

SLR has reviewed and analysed historical blasting results for CVM (supplied by BMA) for the purpose of developing site-specific blast laws for CVM. Utilising the derived blasting site laws and MIC values, the Project blasting assessment indicated the following:

- The predicted airblast overpressure levels show that the 115 dBL (20% exceedance case) and 120 dBL (maximum) blasting criteria can be achieved for all Project blasts.

- 
- The predicted ground vibration levels also achieve the 10 mm/s criteria for all Project blasts.

## 9 References

### Legislation (Queensland)

Queensland Environmental Protection Act 1994

Queensland Environmental Protection (Noise) Policy 2019

Queensland Environmental Protection Regulation 2019

Guidelines, Standards, EAs etc

Queensland Department of Environment and Science's Environmental Authority EPML00562013 10 August 2020

Queensland Department of Environment and Science's Application Requirements for Activities with Noise Impacts Guideline 2017

Queensland Department of Environment and Science's Model Mining Conditions Guideline 2017

Queensland Department of Environment and Science's Noise and Vibration EIS Information Guideline 2020

Queensland Department of Environment and Science's Noise guideline: assessment of low frequency noise 2005 (Draft). Unpublished.

Queensland Department of Environment and Science's Noise Measurement Manual 2020

Queensland Department of Environment and Science's Planning for Noise Control Guideline 2004 (under review by DES – not currently an approved DES guideline)

Queensland Department of Environment and Science's Streamlined Model Conditions for Petroleum Activities Guideline 2016

Standards Association of Australia, 2004. Electroacoustics-Sound level meters– Part 1: Specifications AS IEC 61672.1-2004. Sydney: Standards Association of Australia. Accessed 1 June 2019).

Standards Association of Australia, 2018. Acoustics – Description and measurement of environmental noise AS 1055-2018. Sydney: Standards Association of Australia. Accessed 1 June 2019).

World Health Organisation's Night Noise Guidelines for Europe 2009

# APPENDIX A

## ACOUSTIC TERMINOLOGY

Explanation of the key technical terminology contained within this Report is provided below.

### Sound Level (or Noise Level)

The terms sound and noise are almost interchangeable, except that in common usage noise is often used to refer to unwanted sound. Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing.

The human ear (and those of other species) responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (dB or dBL) scale reduces this ratio to a more manageable size by the use of logarithms.

### A-weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to human hearing. There are numerous alternative frequency weightings available but none specifically designed for the assessment of noise affecting fauna. For the purposes of this Report, A-weighting has been used.

### Sound Power Level

The sound power of a source is the rate at which it emits acoustic energy. As with sound pressure, sound power levels (SWL) are expressed in dB units, but are identified by the symbols SWL. The relationship between sound power and sound pressure may be likened to an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

### Change in Sound Pressure Levels

For human perception, a change of 1 dBA or 2 dBA in the level of a sound is considered to be indiscernible, while a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

### Typical Sound Pressure Levels

The table below lists examples of typical sound pressure levels.



Table A1 Examples of Typical Sound Pressure Levels

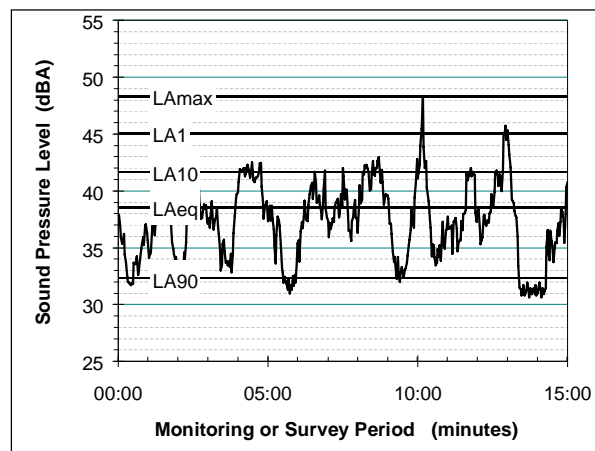
| Sound pressure level (dBA) | Typical example  | Subjective (human) evaluation |
|----------------------------|--|-------------------------------|
| 130                        | Threshold of pain  | Intolerable                   |
| 120                        | Metal hammering  | Extremely noisy               |
| 110                        | Grinding on steel  |                               |
| 100                        | Loud car horn at 3 metres (m)  | Very noisy                    |
| 90                         | Dog bark at 1 m  |                               |
| 80                         | Cicadas at 1 m   | Loud                          |
| 70                         | Noise level directly adjacent to a busy main road  |                               |
| 60                         | Ambient noise level in urban area close to main roads  | Moderate to quiet             |
| 50                         | Typical rural environment with high insect noise or close to a main road   |                               |
| 40                         | Ambient noise level in a rural environment with light breezes and some noise from insects, birds and distant traffic | Quiet to very quiet           |
| 30                         | Ambient noise level in a typical rural noise environment   |                               |
| 20                         | Ambient noise level in remote and quiet rural environment away from main roads with no wind and no insect noise      | Almost silent                 |

### Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels (LAN), where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time and LA10 the noise exceeded for 10% of the time.

The Figure below presents a hypothetical 15 minute noise measurement, illustrating various common statistical indices of interest.

Figure A1 Hypothetical 15 Minute Noise Measurement



Of particular relevance to this study, are:

- LAeq The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
- LA1 The noise level exceeded for 1 % of the measurement time interval.

## Noise Propagation

Provided the receiver is in the far-field of the noise source, noise levels will reduce as a receiver moves further away from the source. This is due to spreading of the noise source energy over distance. For a simple point source (for example, a motor) the theoretical reduction in noise levels is 6 dBA per doubling of distance. For a line source (for example, a busy road) the theoretical reduction is 3 dBA per doubling of distance. In reality however other factors affect noise propagation. These include ground absorption, air absorption, acoustic screening and meteorological effects.

## Meteorological Effects

At distances over 500 m, meteorological effects (for example, local weather and atmospheric conditions) can substantially enhance or impair noise propagation. The most influential meteorological conditions on noise propagation are wind speed and direction and the occurrence of temperature inversions. Ambient air temperature and humidity and atmospheric pressure also affect noise propagation although to a lesser extent than wind and temperature inversions.

## Wind Conditions

Wind conditions enhance noise propagation when the wind is blowing from a noise source towards a receiver and therefore noise levels at the receiver will be higher under these conditions. The wind can be thought to carry the noise in the direction it is heading. Where winds blow from the receiver towards the source, the propagation of noise is impaired and therefore lower noise levels will be experienced at the receiver.

It is important to consider the effect of prevailing wind conditions when assessing noise propagation over larger distances. Wind roses, which graph long term variations in wind speed and direction, are a useful tool for analysing prevailing wind conditions where available.

## Temperature Inversions

Temperature inversions are a meteorological phenomenon where a layer of cold air is trapped at the ground surface under a layer of warmer air. Temperature inversions enhance noise propagation because sound travelling away from the ground is reflected back down from where the colder air meets the warmer air due to the change in pressure between the two layers.

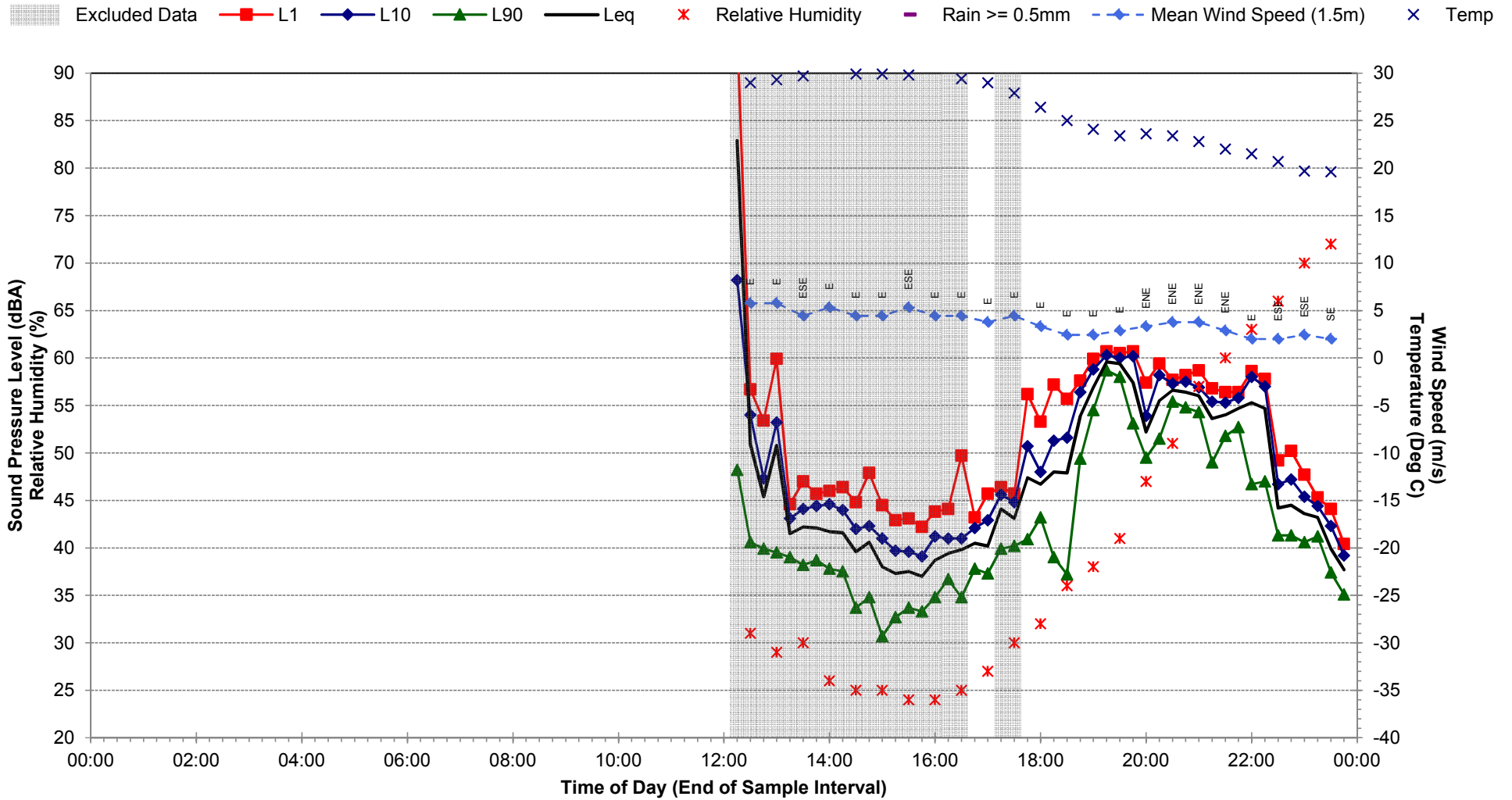
Conditions that favour the development of a strong surface inversion are nights with calm winds and clear skies. Calm winds prevent warmer air above the surface from mixing down to the ground, and clear skies increase the rate of cooling at the Earth's surface. It is therefore important to consider the effect of temperature inversions when assessing noise propagation over larger distances and during night-time periods.

# APPENDIX B

## DAILY STATISTICAL NOISE PLOTS

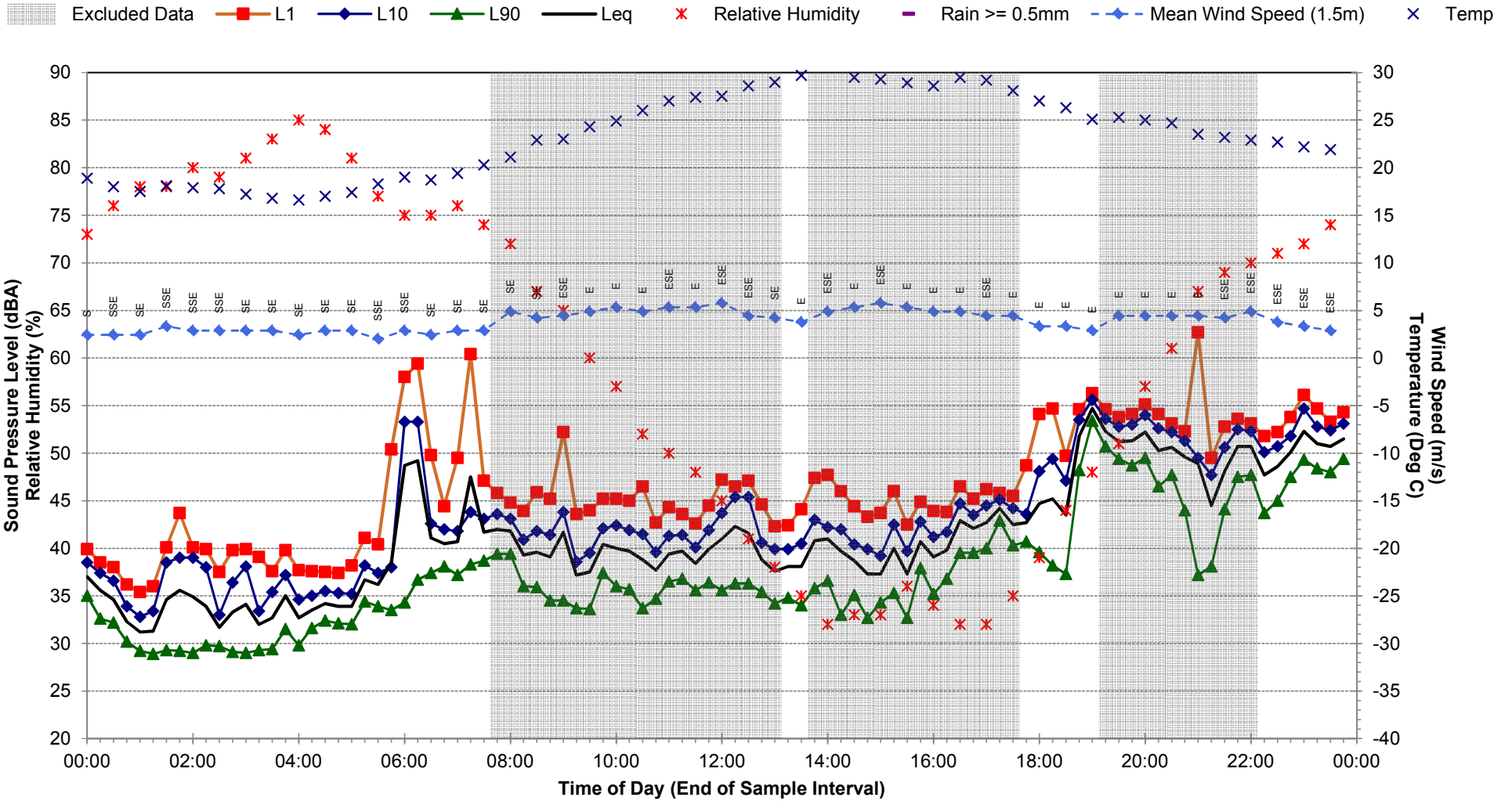
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Monday, 27 April 2020



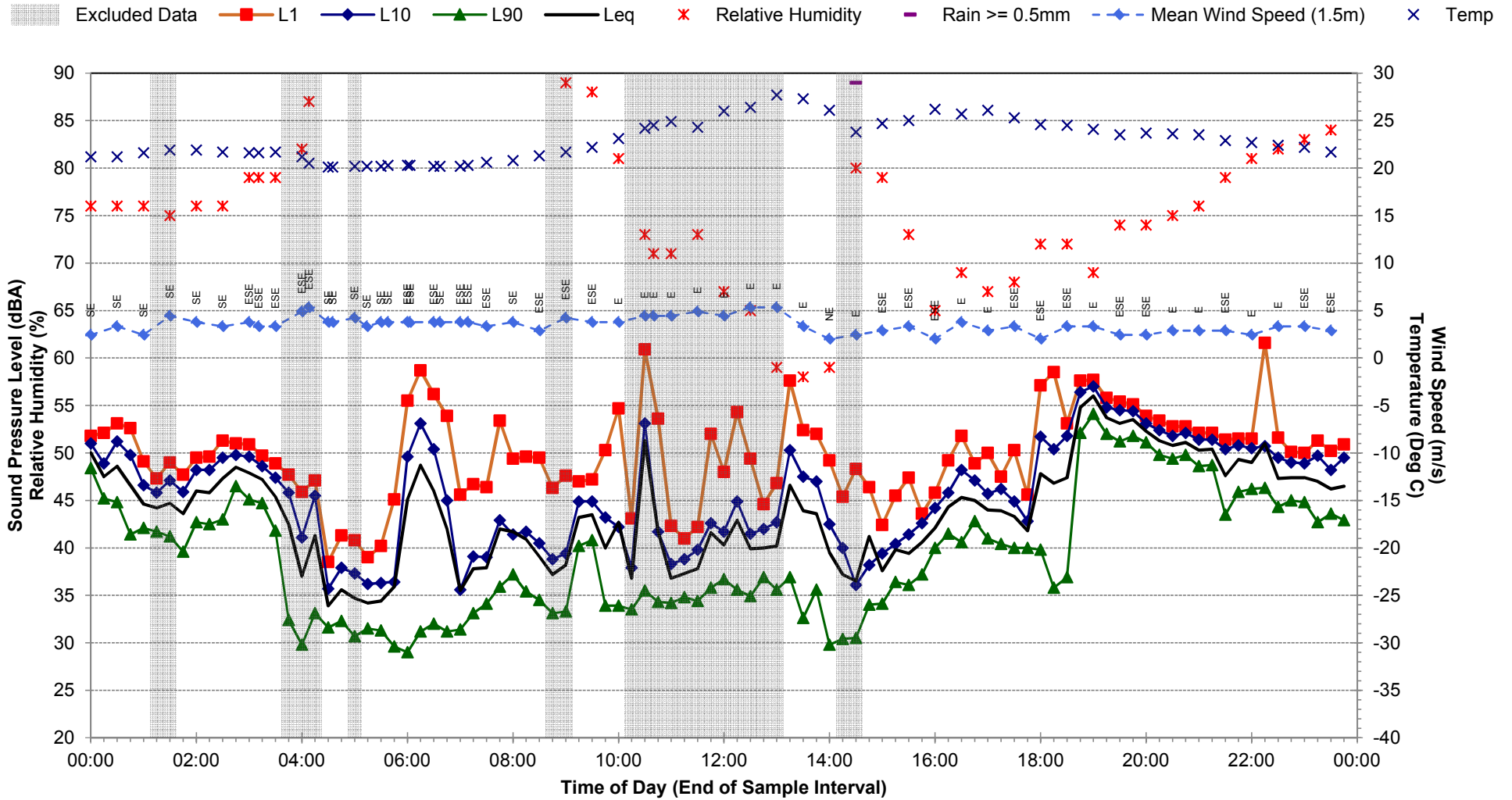
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Tuesday, 28 April 2020



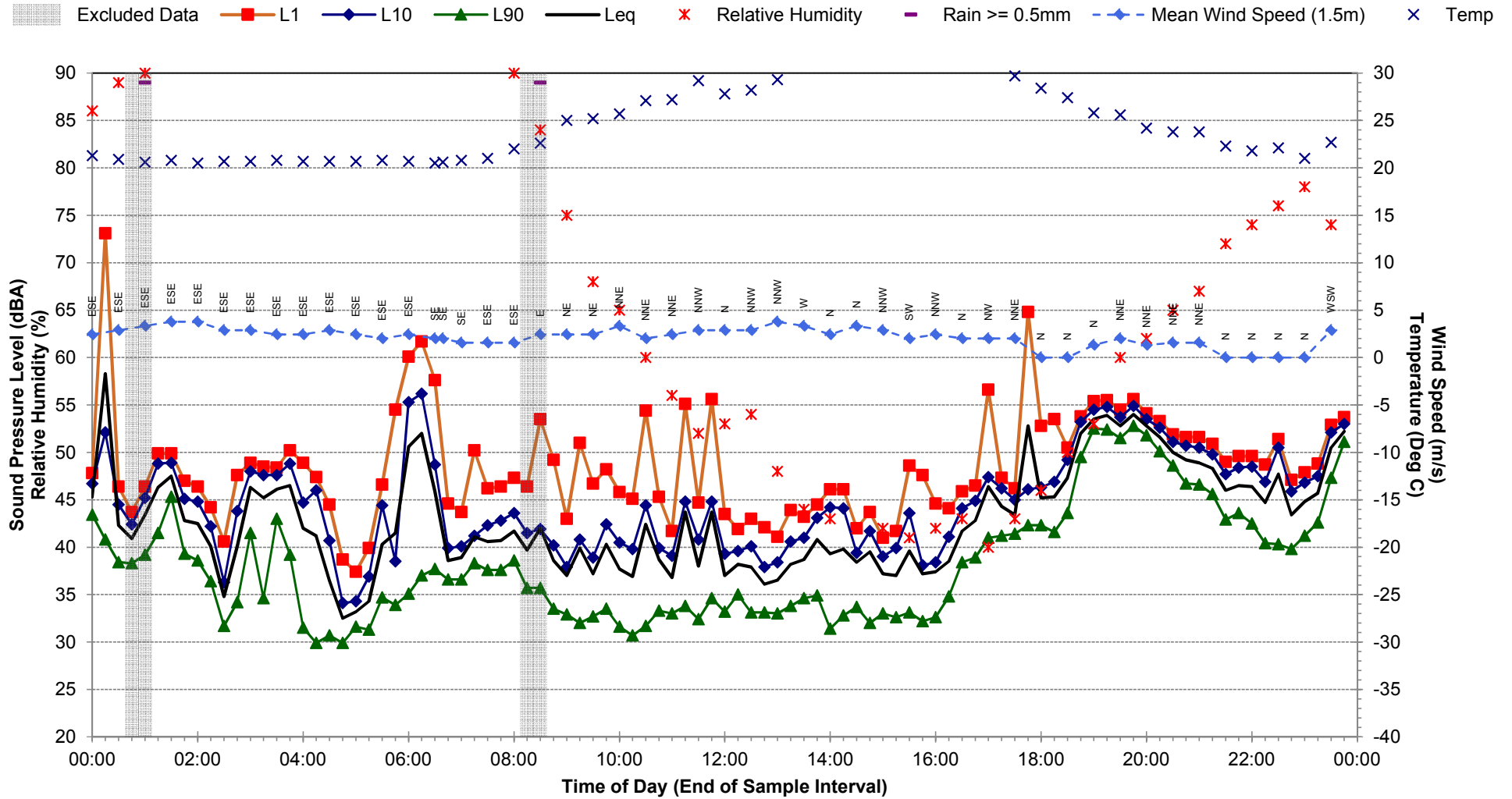
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Wednesday, 29 April 2020



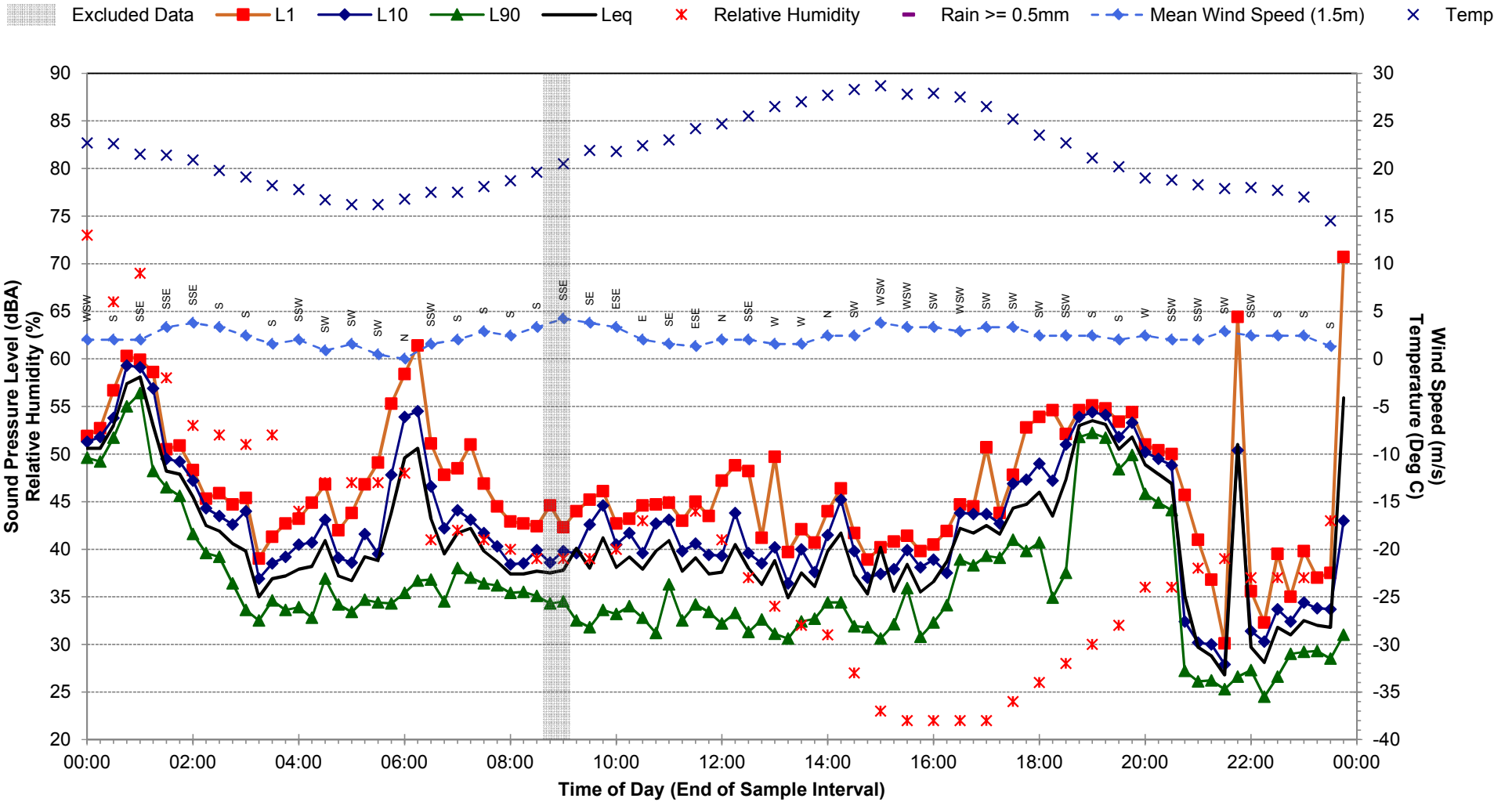
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Thursday, 30 April 2020



# Statistical Ambient Noise Levels

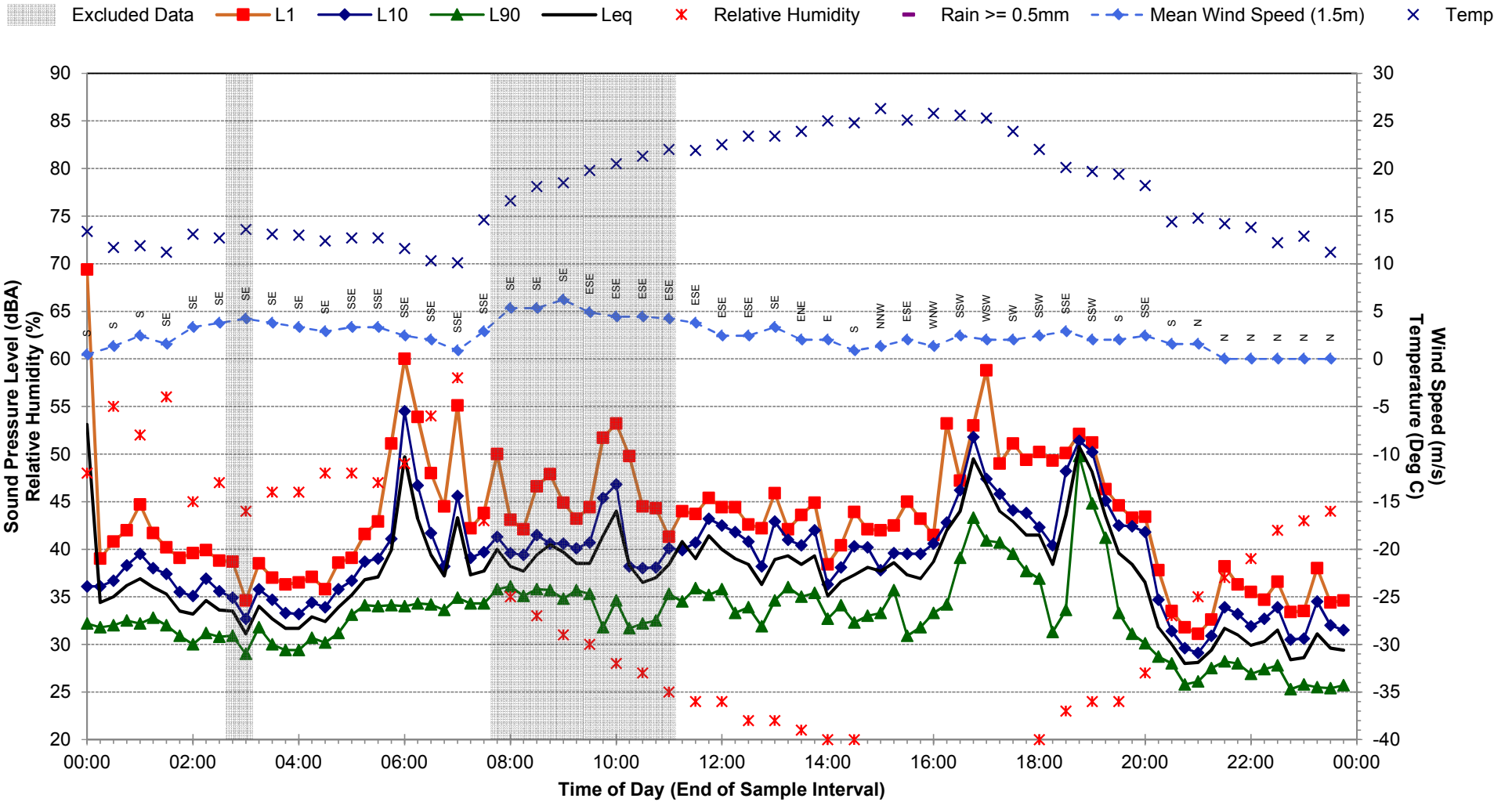
## Location 1 - 881 Long Pocket Rd - Friday, 1 May 2020





# Statistical Ambient Noise Levels

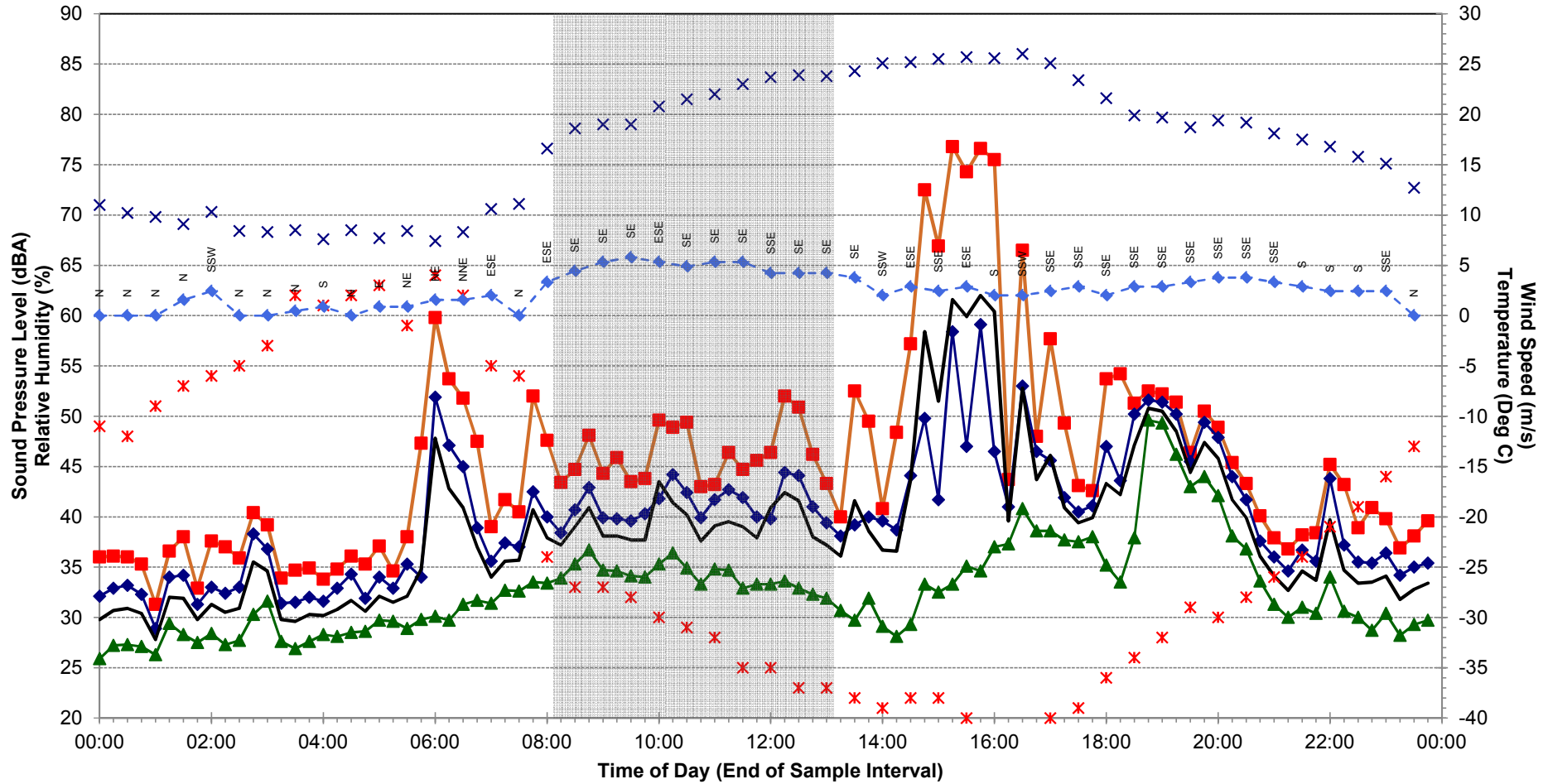
## Location 1 - 881 Long Pocket Rd - Saturday, 2 May 2020



# Statistical Ambient Noise Levels

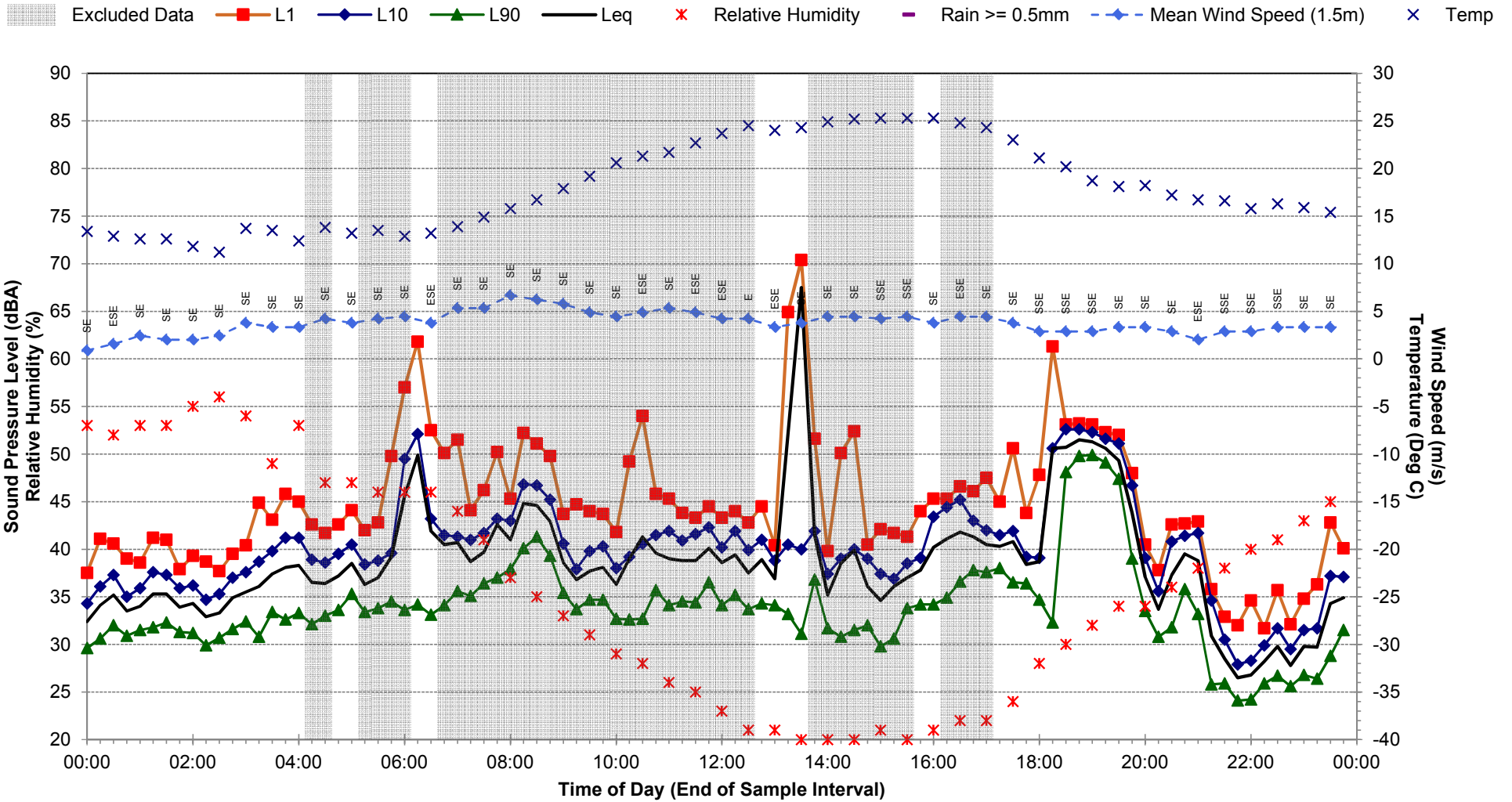
## Location 1 - 881 Long Pocket Rd - Sunday, 3 May 2020

Excluded Data
  L1
  L10
  L90
  Leq
  Relative Humidity
  Rain >= 0.5mm
  Mean Wind Speed (1.5m)
  Temp



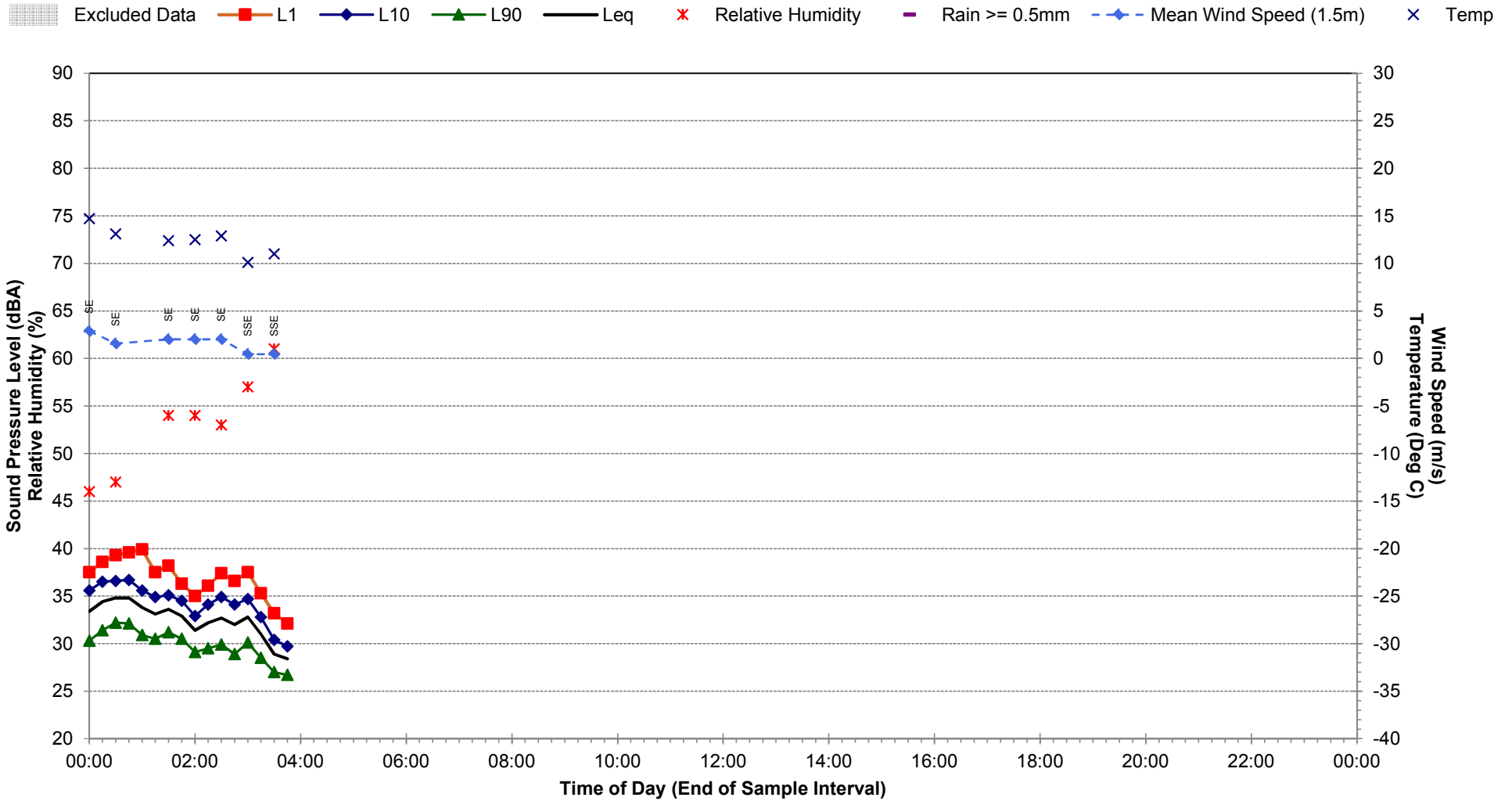
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Monday, 4 May 2020



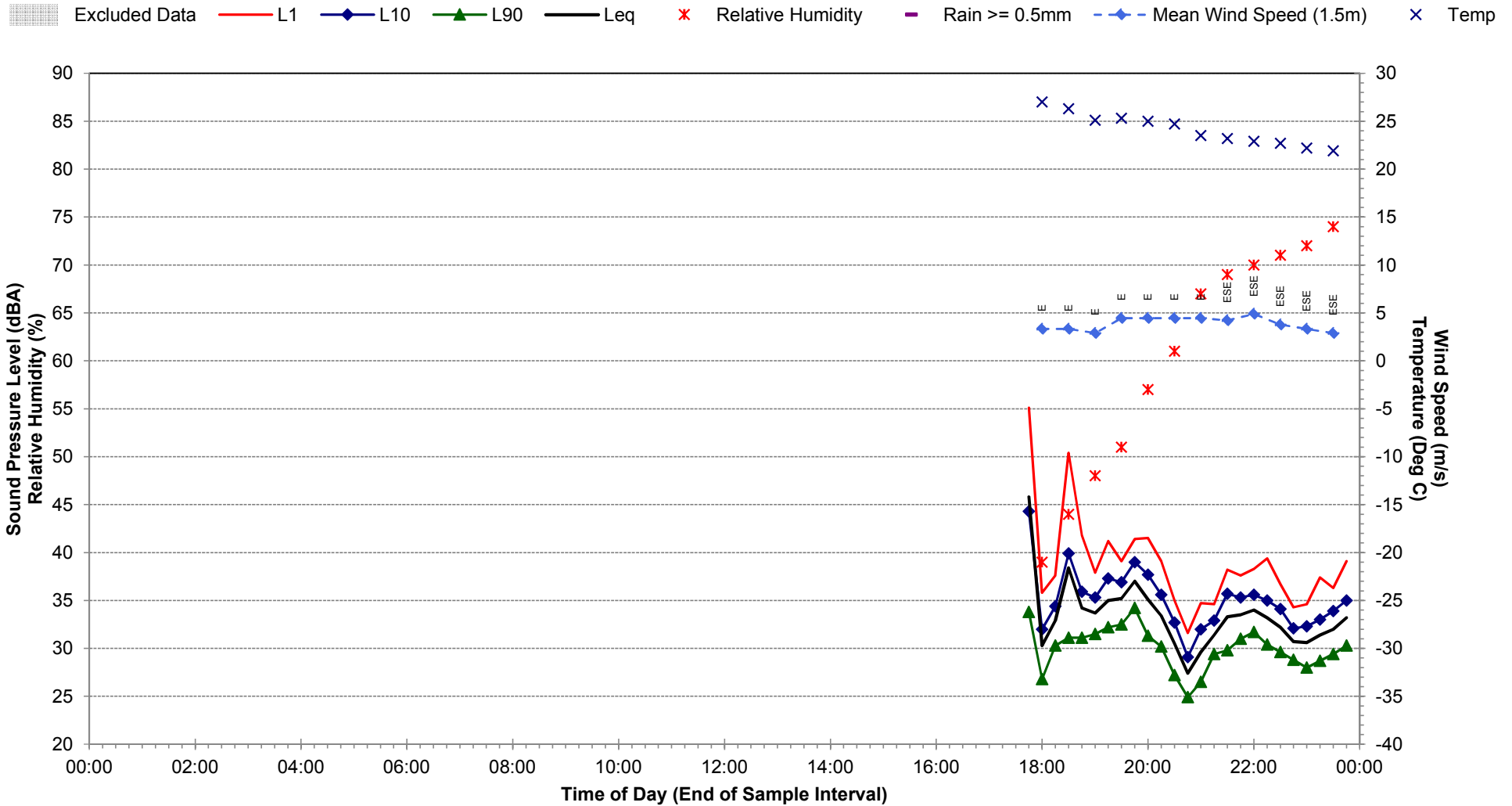
# Statistical Ambient Noise Levels

## Location 1 - 881 Long Pocket Rd - Tuesday, 5 May 2020



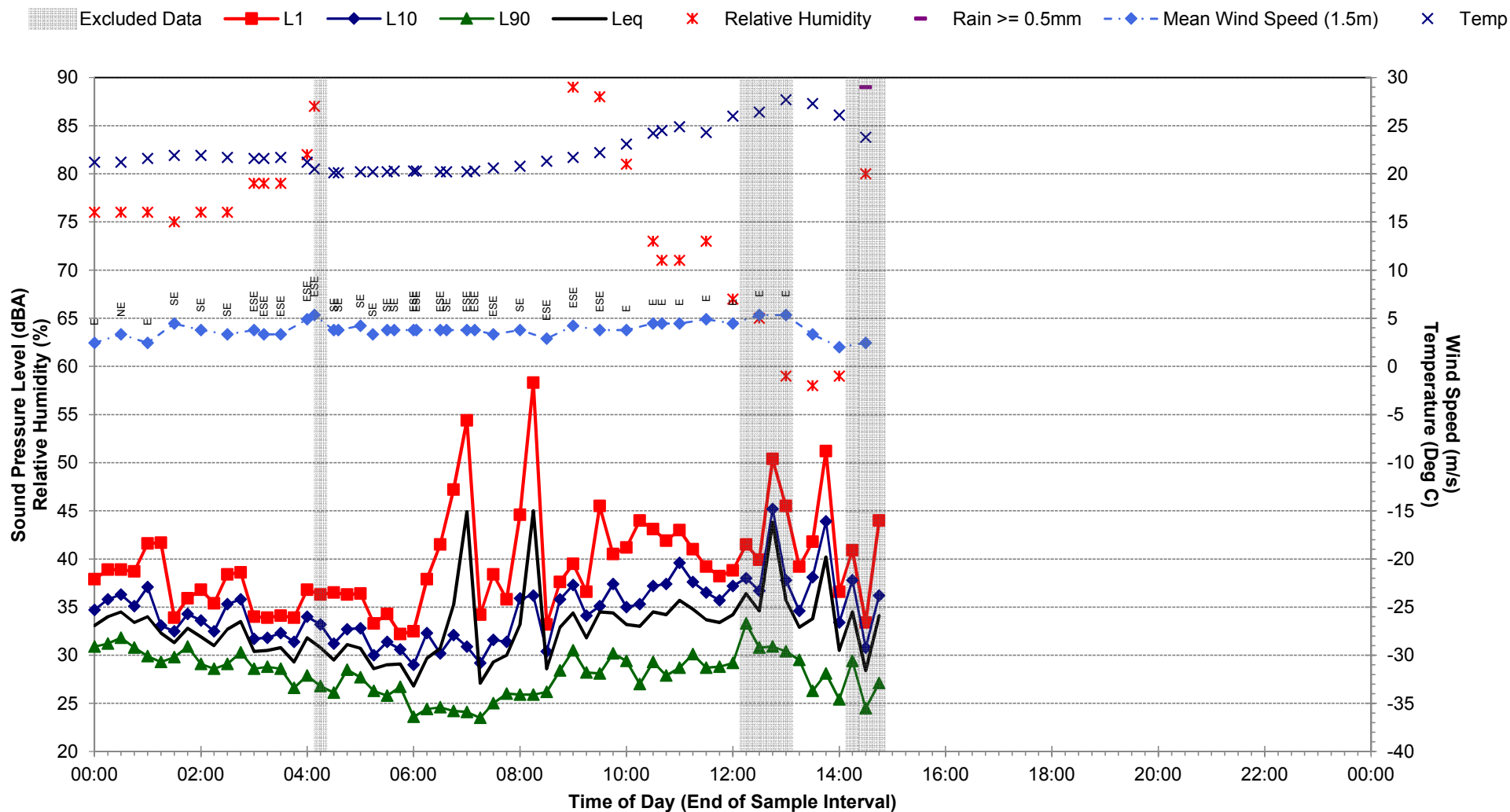
# Statistical Ambient Noise Levels

## Location 2 - Skyville Boundary - Tuesday, 28 April 2020



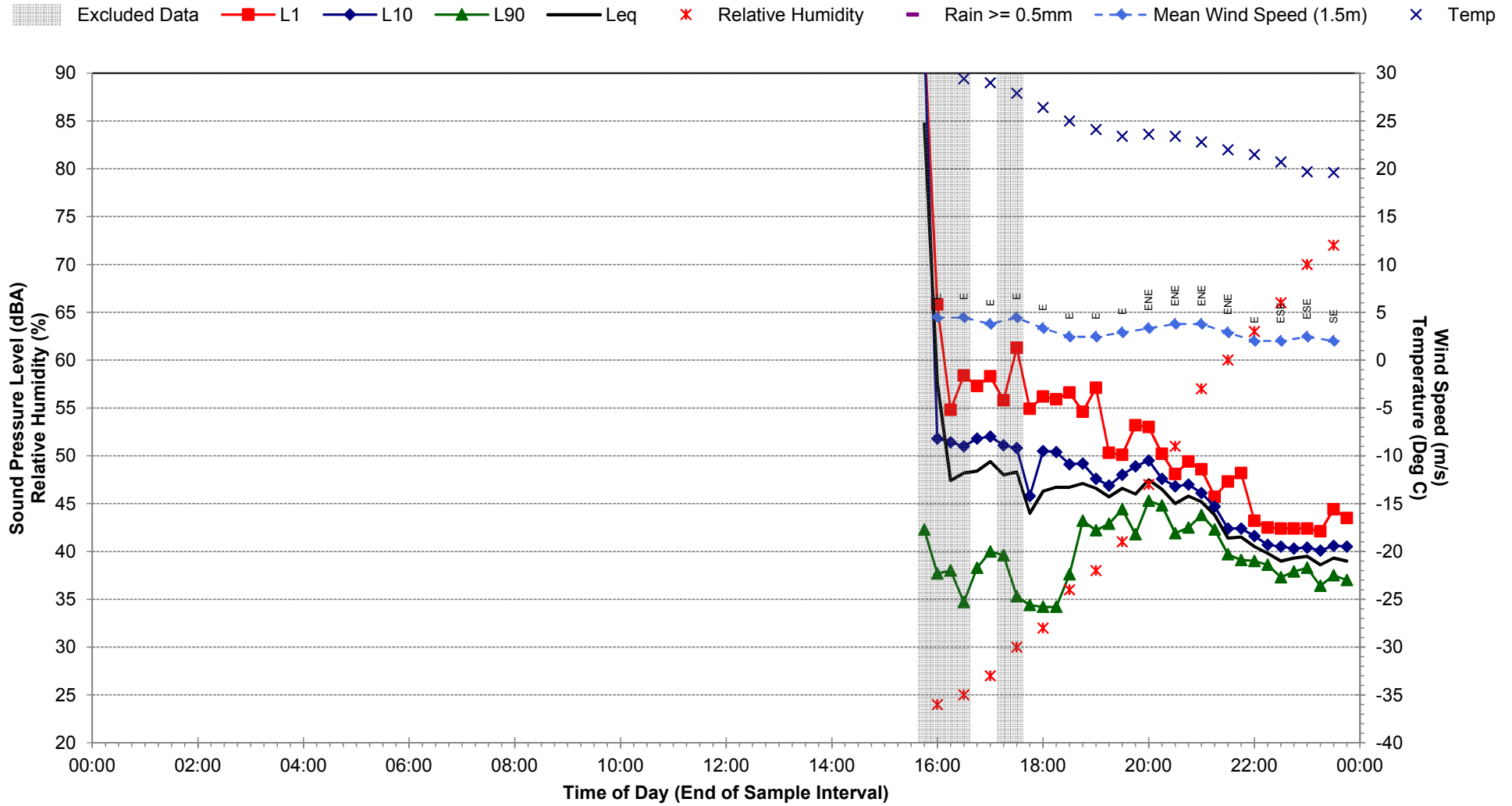
# Statistical Ambient Noise Levels

## Location 2 - Skyville Boundary - Wednesday, 29 April 2020



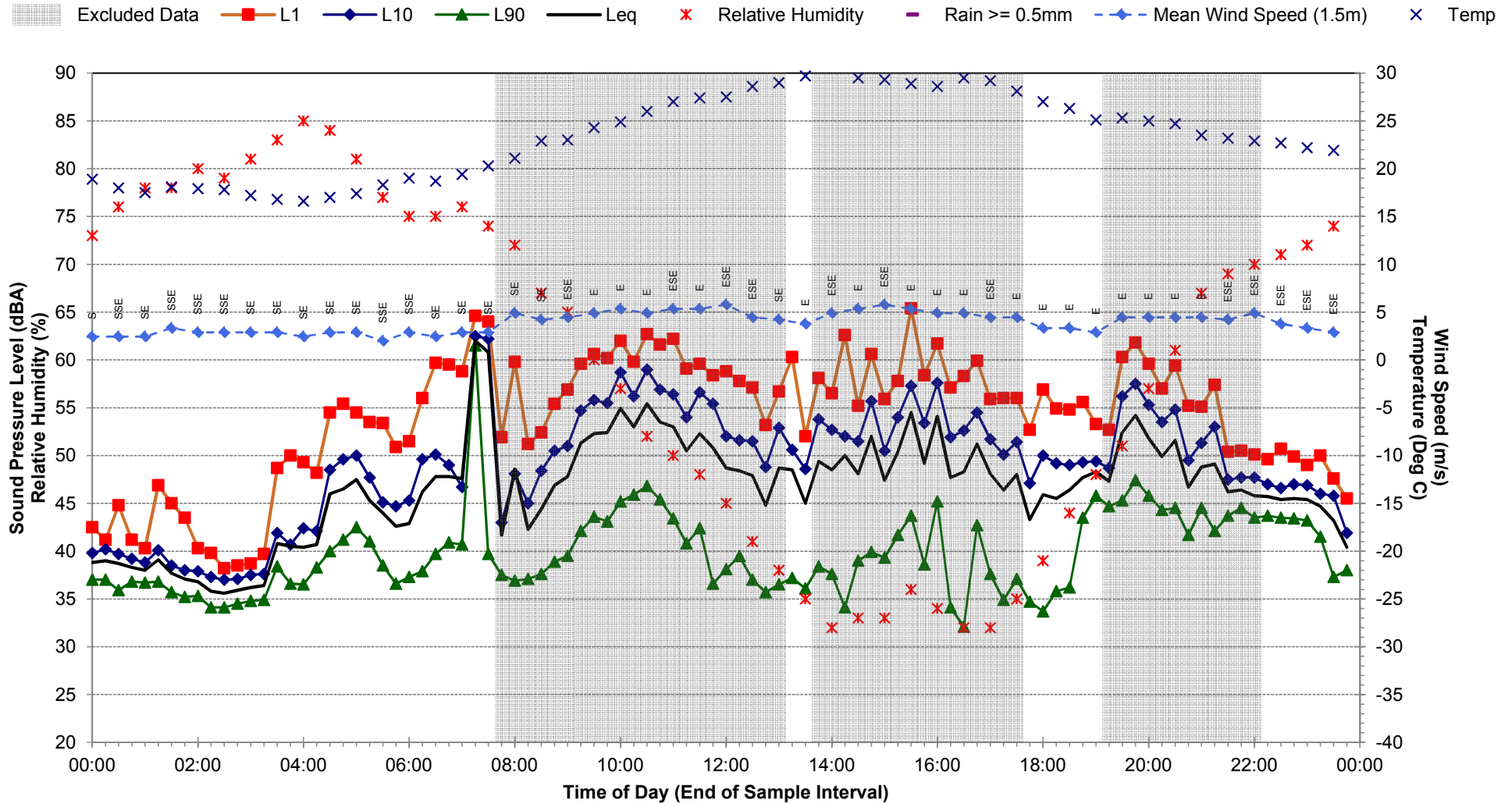
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Monday, 27 April 2020



# Statistical Ambient Noise Levels

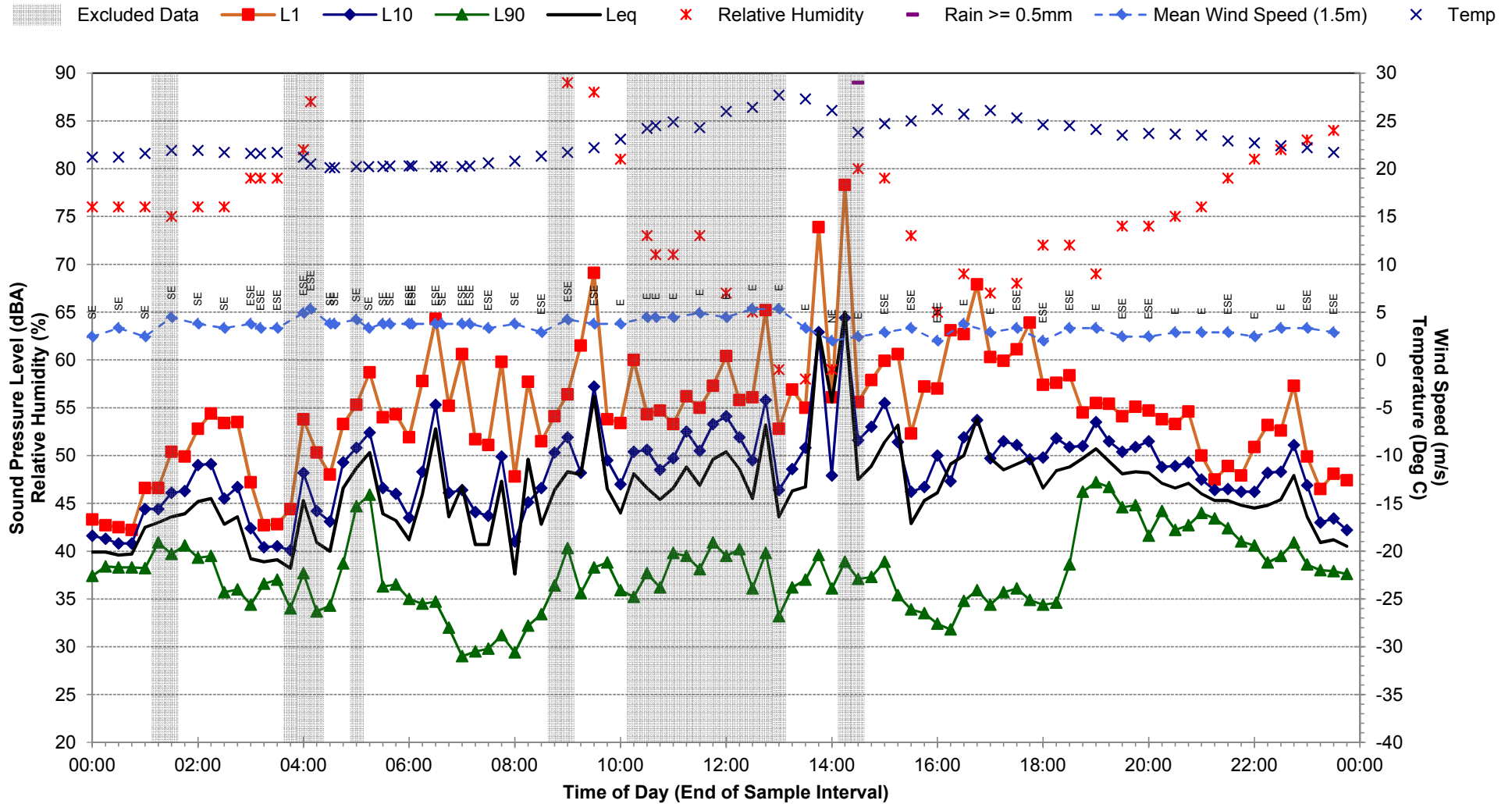
## Location 3 - Buffel Park Village - Tuesday, 28 April 2020





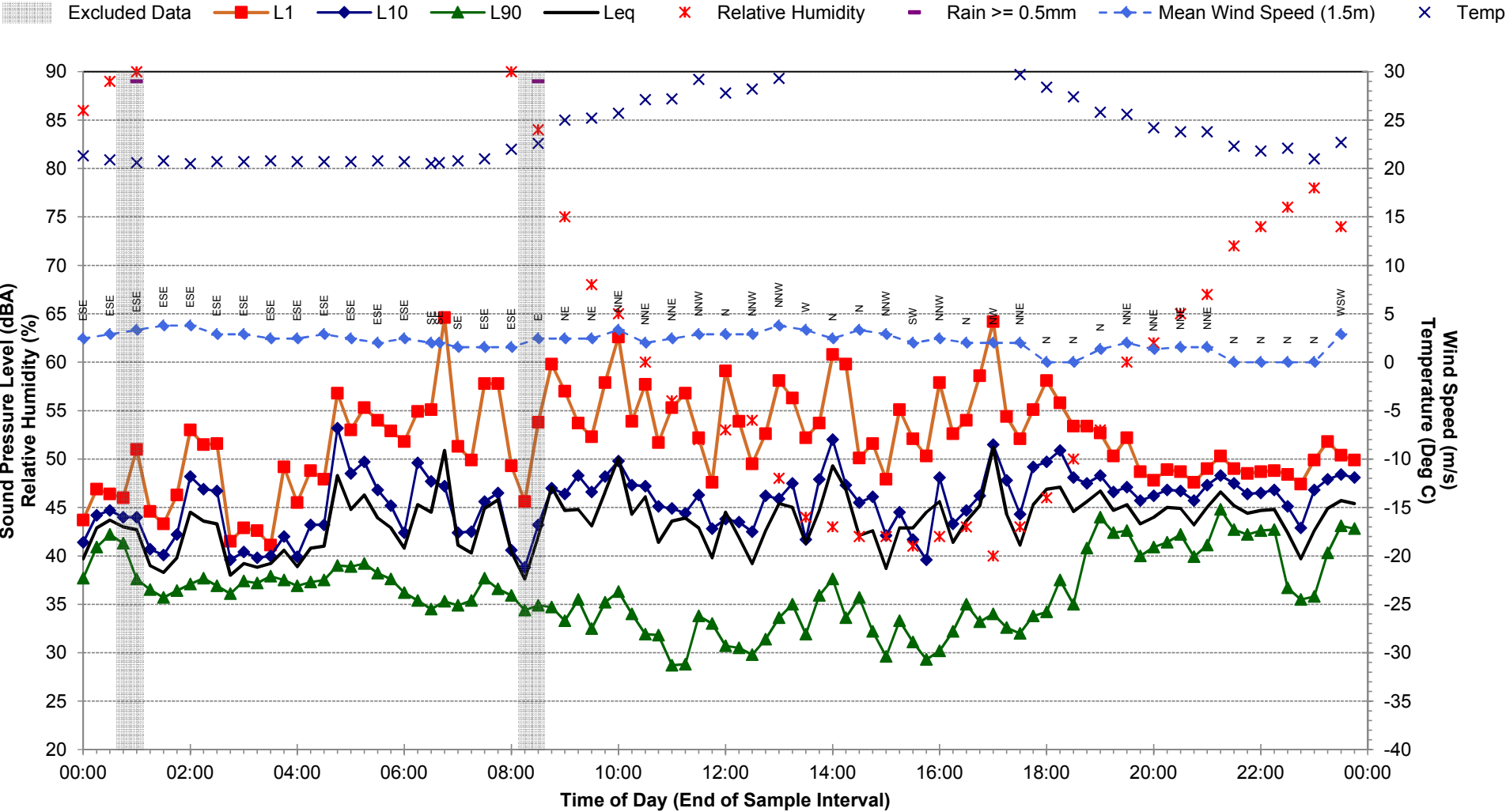
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Wednesday, 29 April 2020



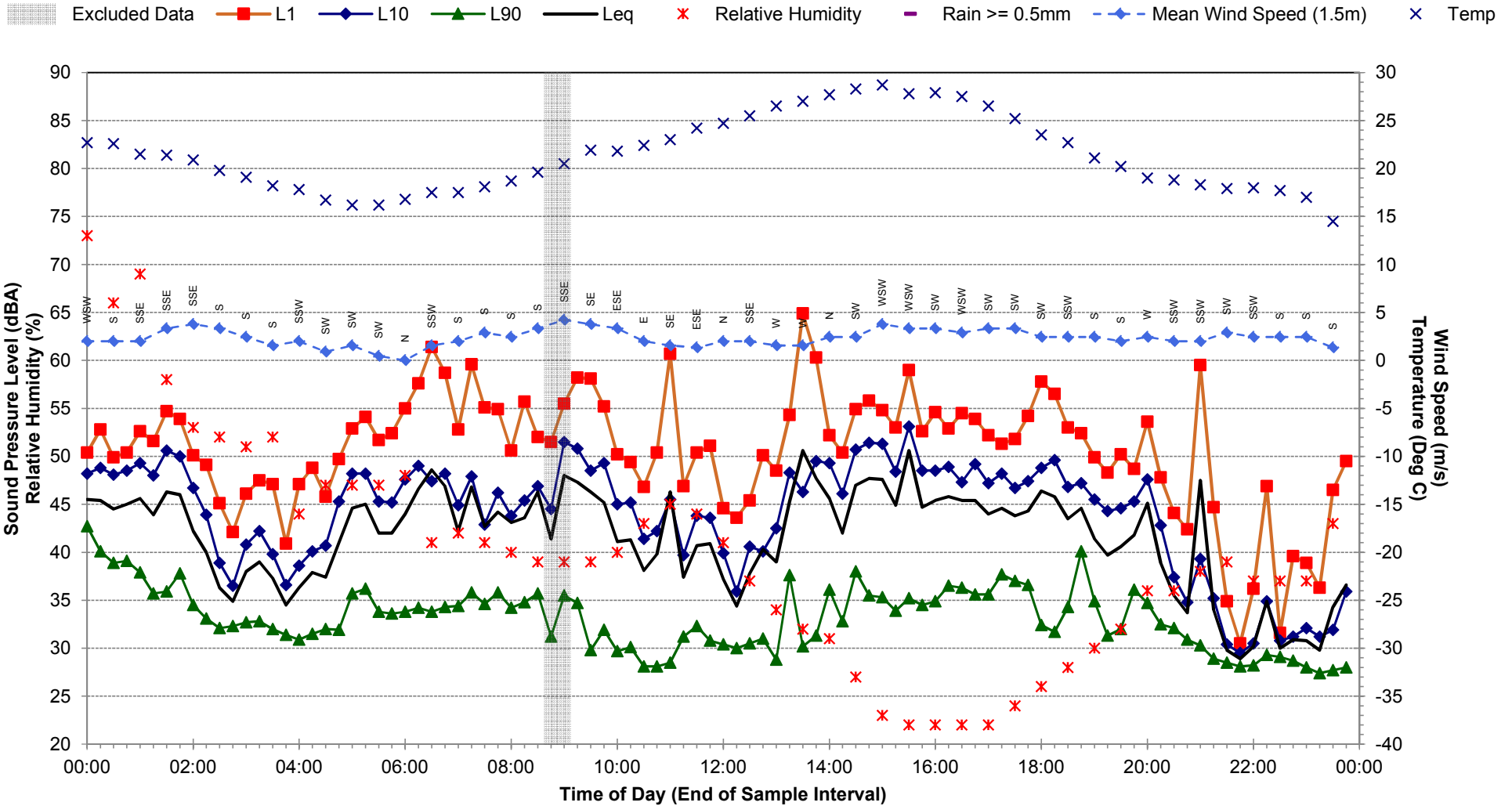
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Thursday, 30 April 2020



# Statistical Ambient Noise Levels

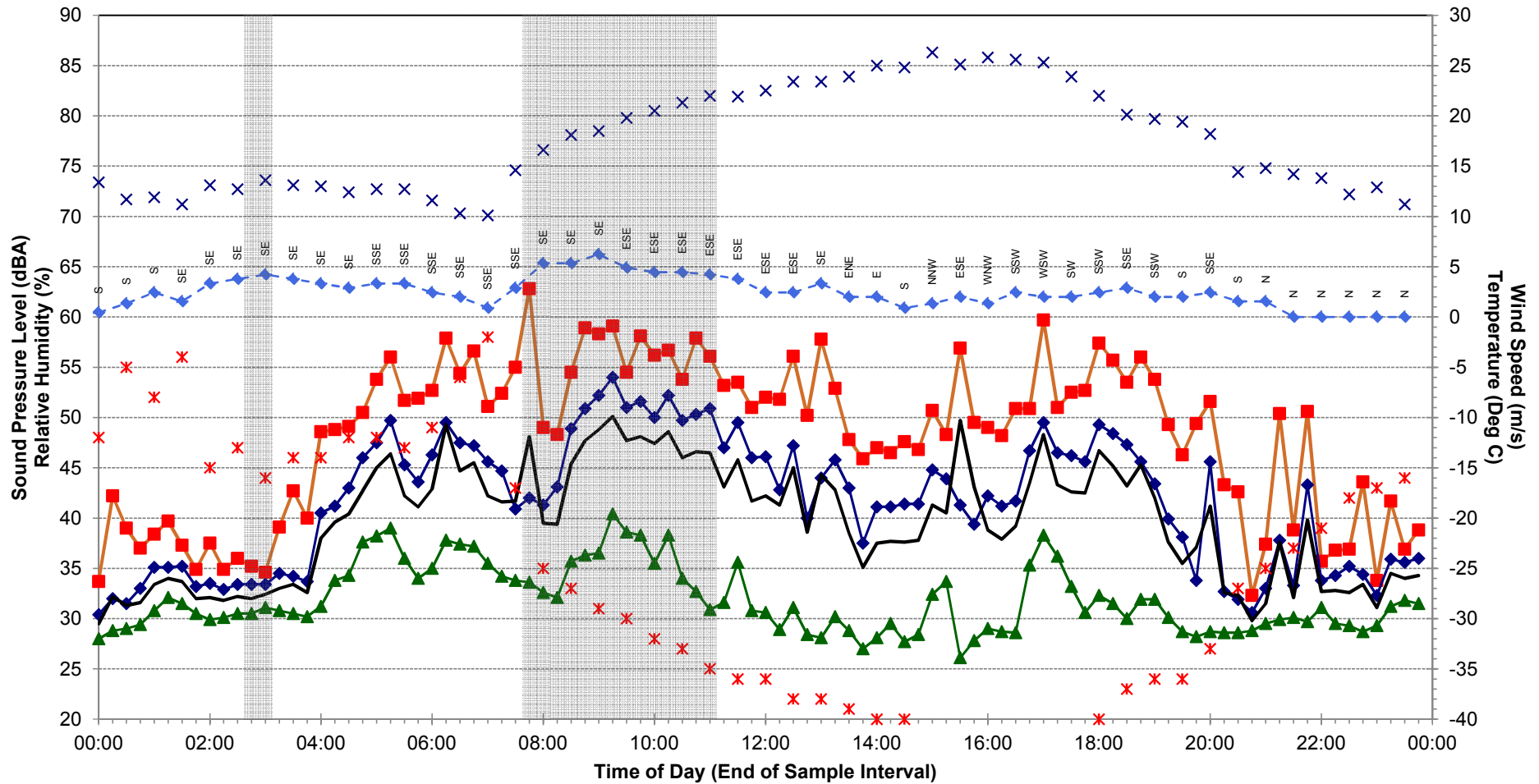
## Location 3 - Buffel Park Village - Friday, 1 May 2020



# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Saturday, 2 May 2020

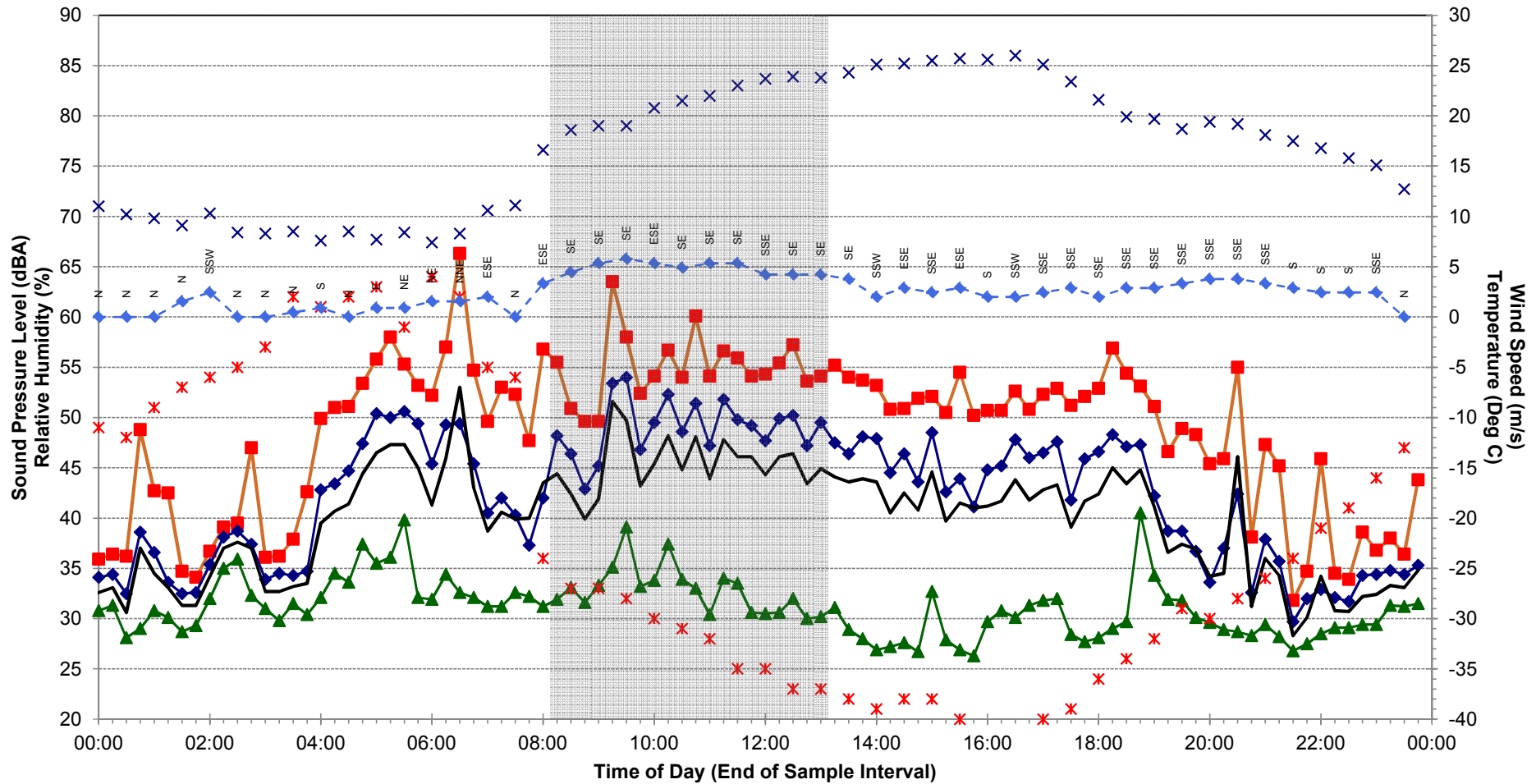
Excluded Data
  L1
  L10
  L90
  Leq
  Relative Humidity
  Rain >= 0.5mm
  Mean Wind Speed (1.5m)
  Temp



# Statistical Ambient Noise Levels

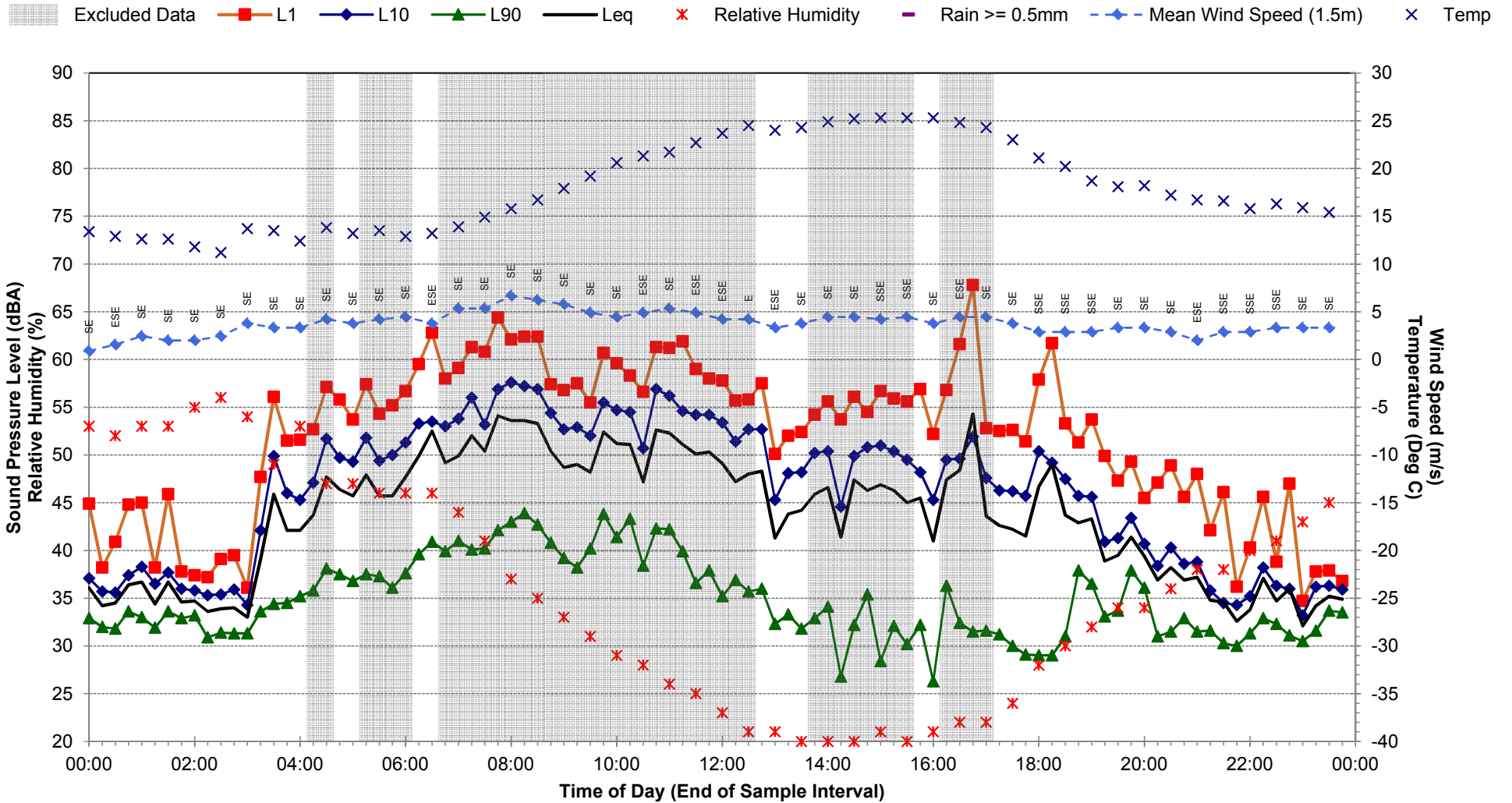
## Location 3 - Buffel Park Village - Sunday, 3 May 2020

Excluded Data
  L1
  L10
  L90
  Leq
  Relative Humidity
  Rain >= 0.5mm
  Mean Wind Speed (1.5m)
  Temp



# Statistical Ambient Noise Levels

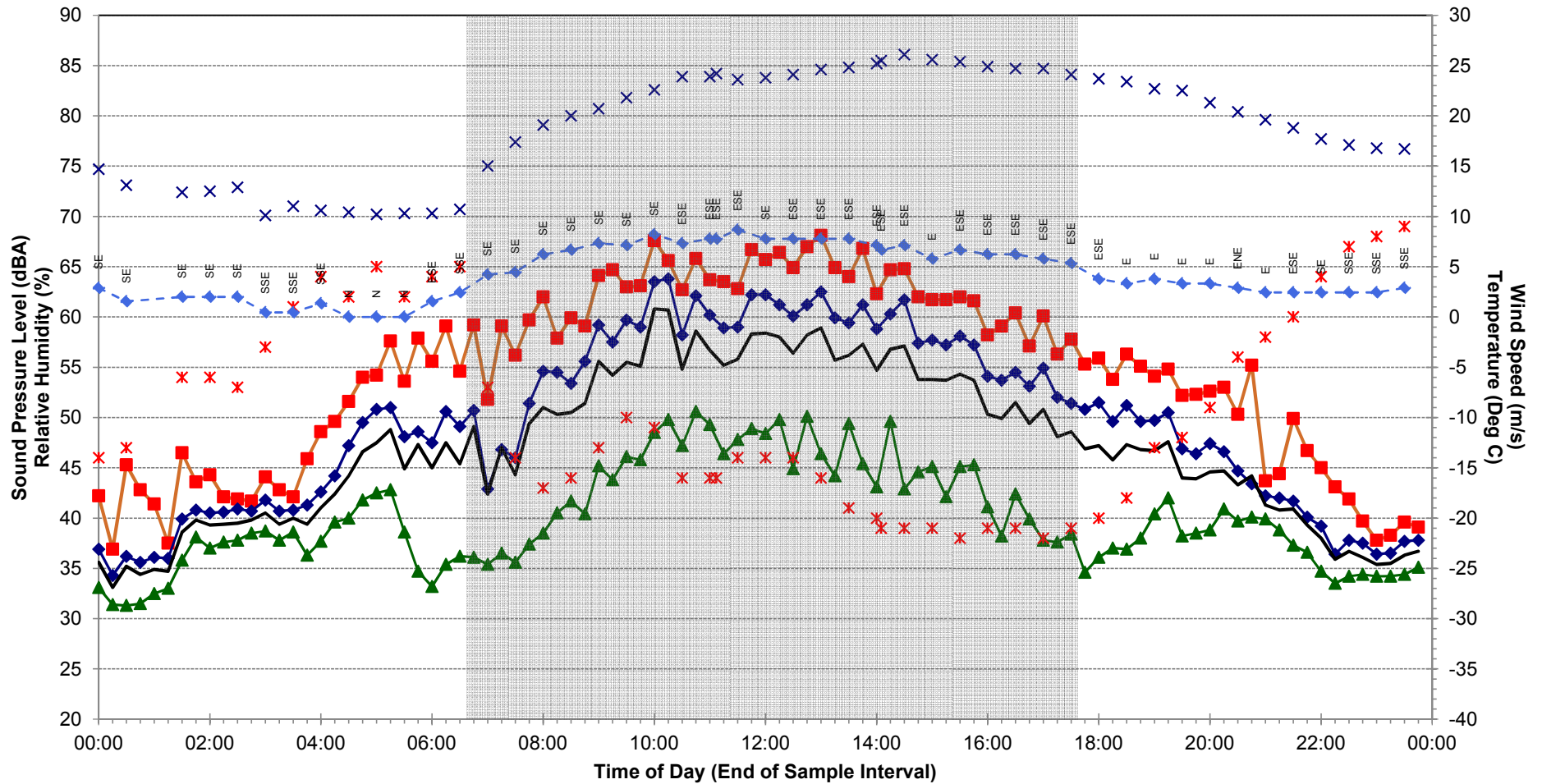
## Location 3 - Buffel Park Village - Monday, 4 May 2020



# Statistical Ambient Noise Levels

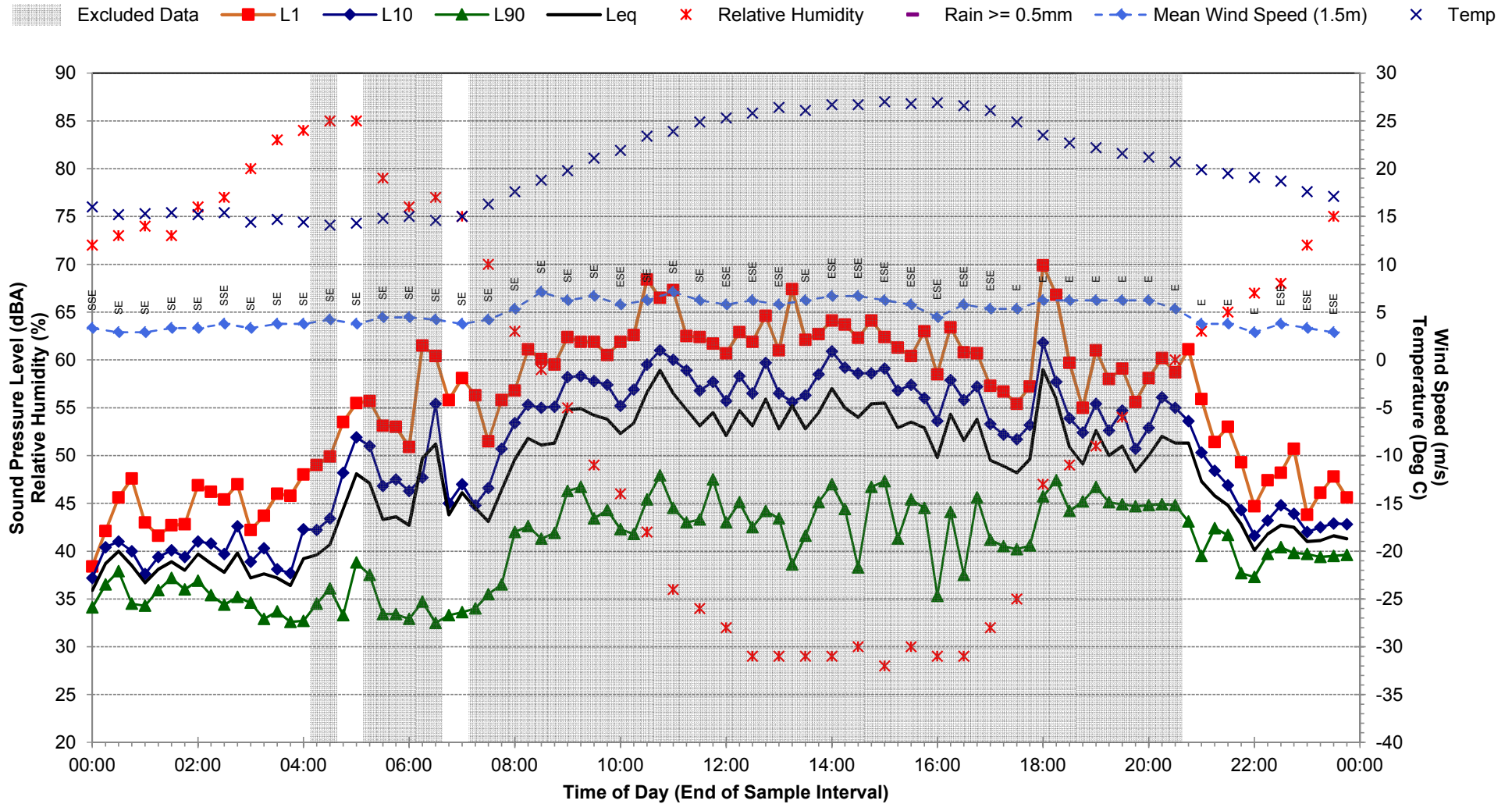
## Location 3 - Buffel Park Village - Tuesday, 5 May 2020

Excluded Data
  L1
  L10
  L90
  Leq
  Relative Humidity
  Rain >= 0.5mm
  Mean Wind Speed (1.5m)
  Temp



# Statistical Ambient Noise Levels

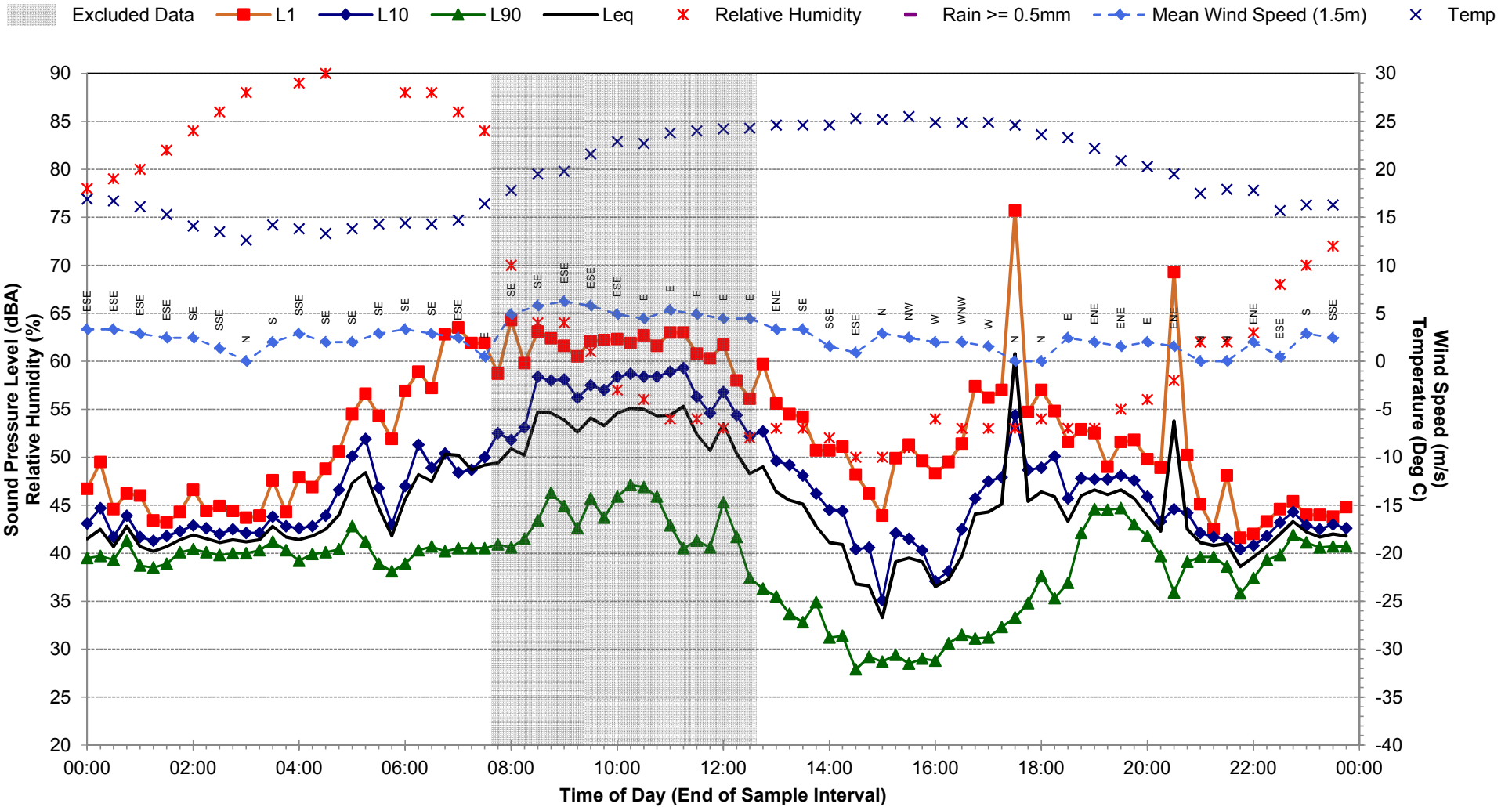
## Location 3 - Buffel Park Village - Wednesday, 6 May 2020





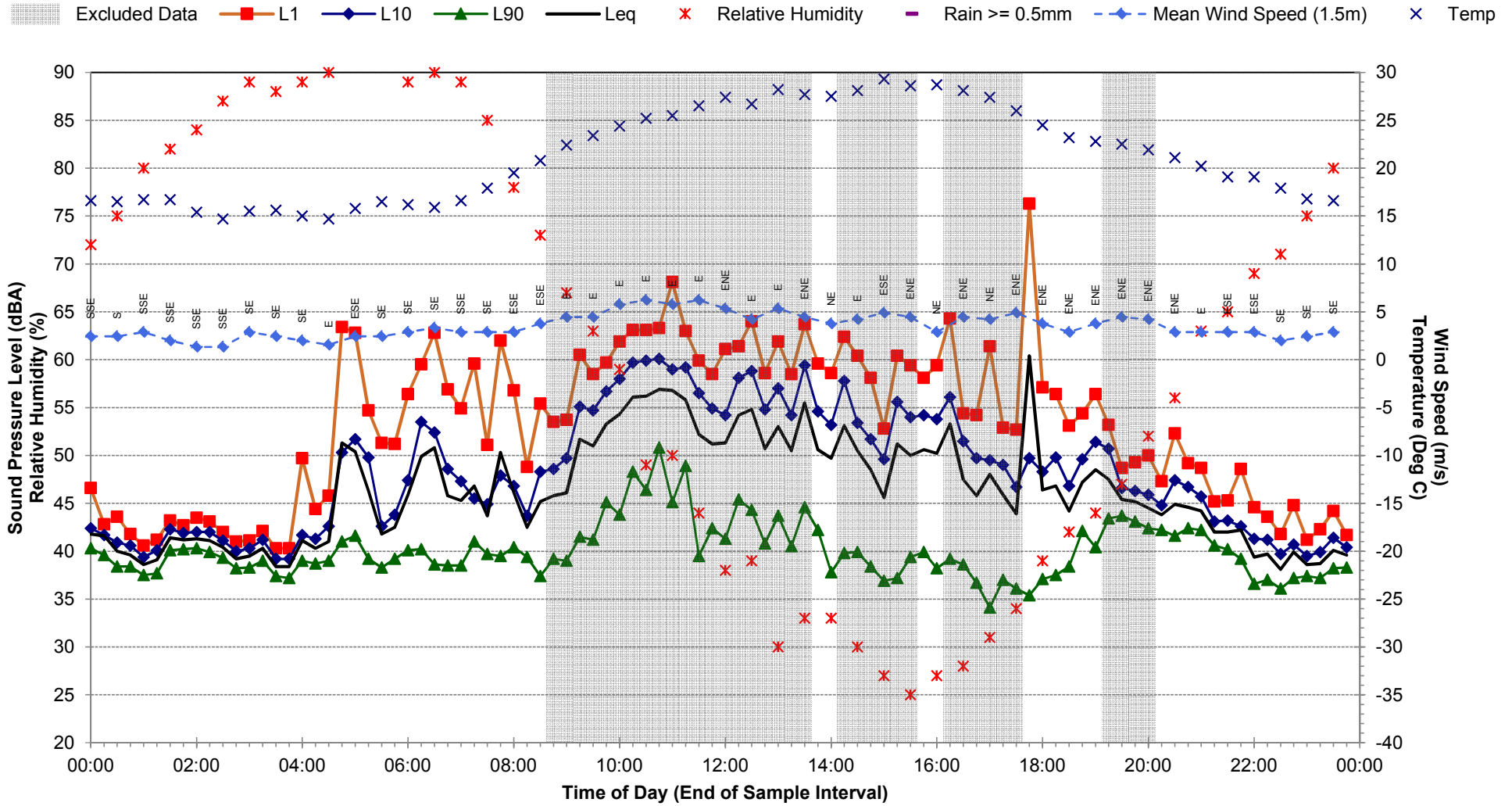
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Thursday, 7 May 2020



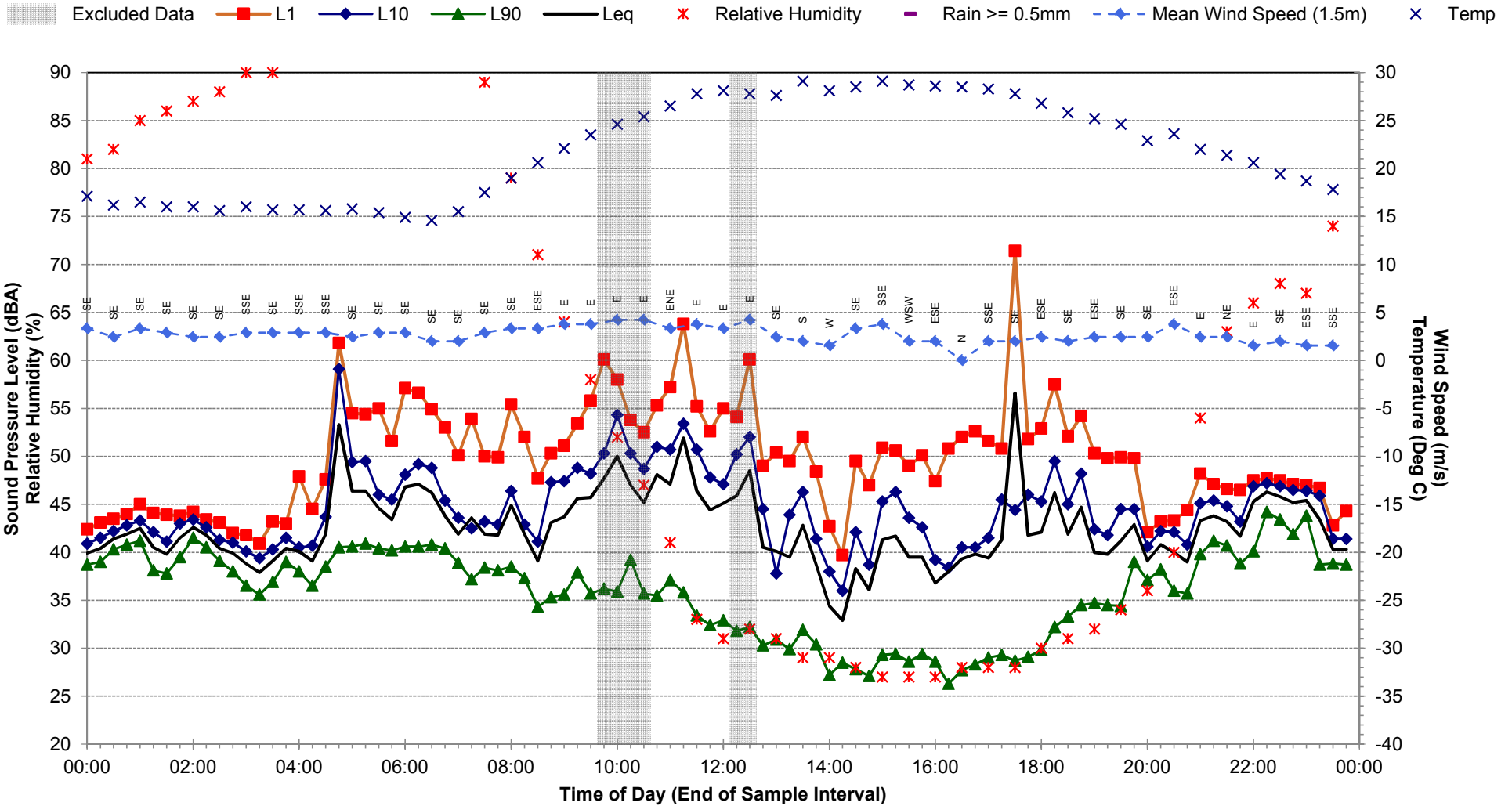
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Friday, 8 May 2020



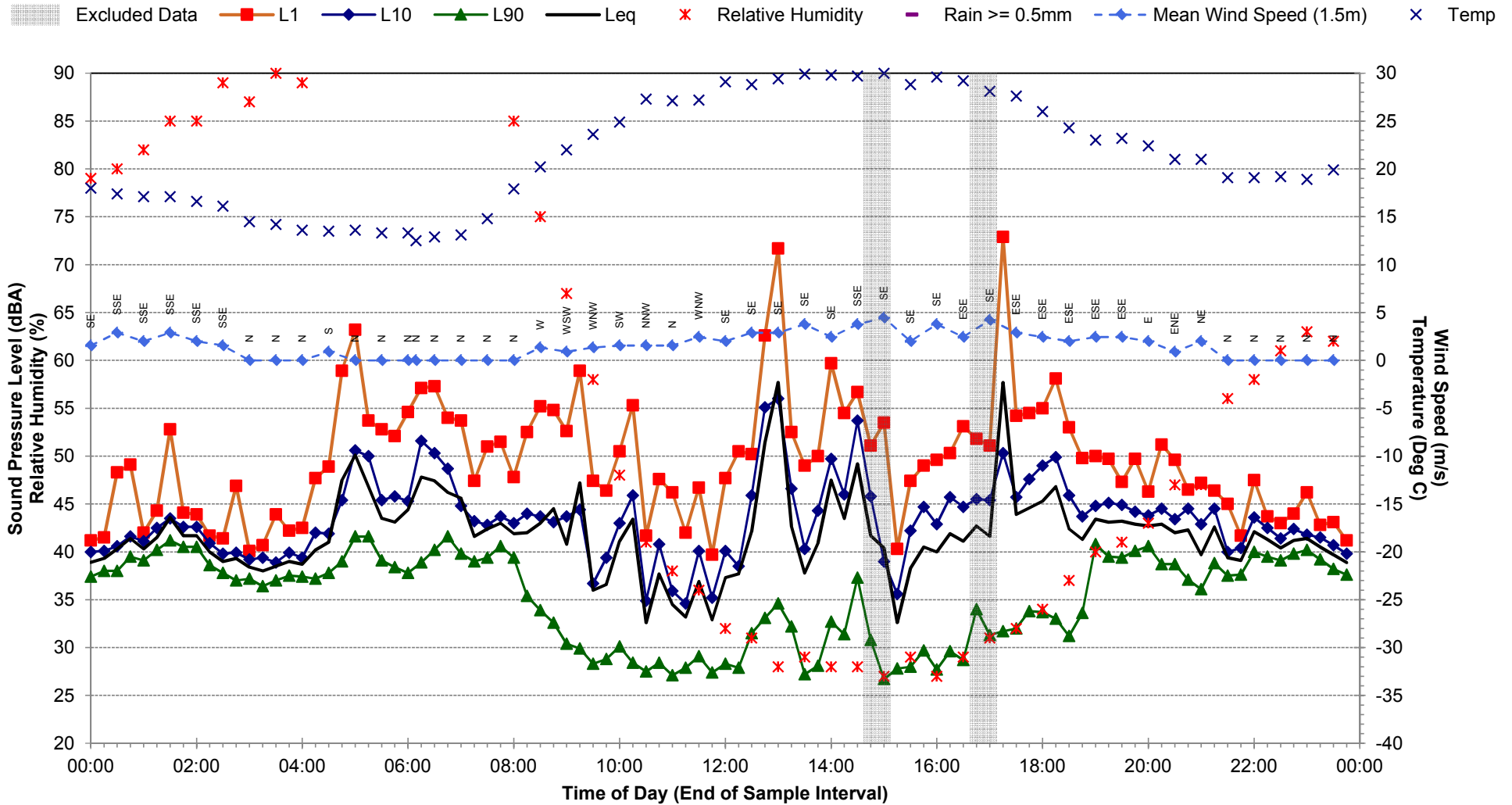
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Saturday, 9 May 2020



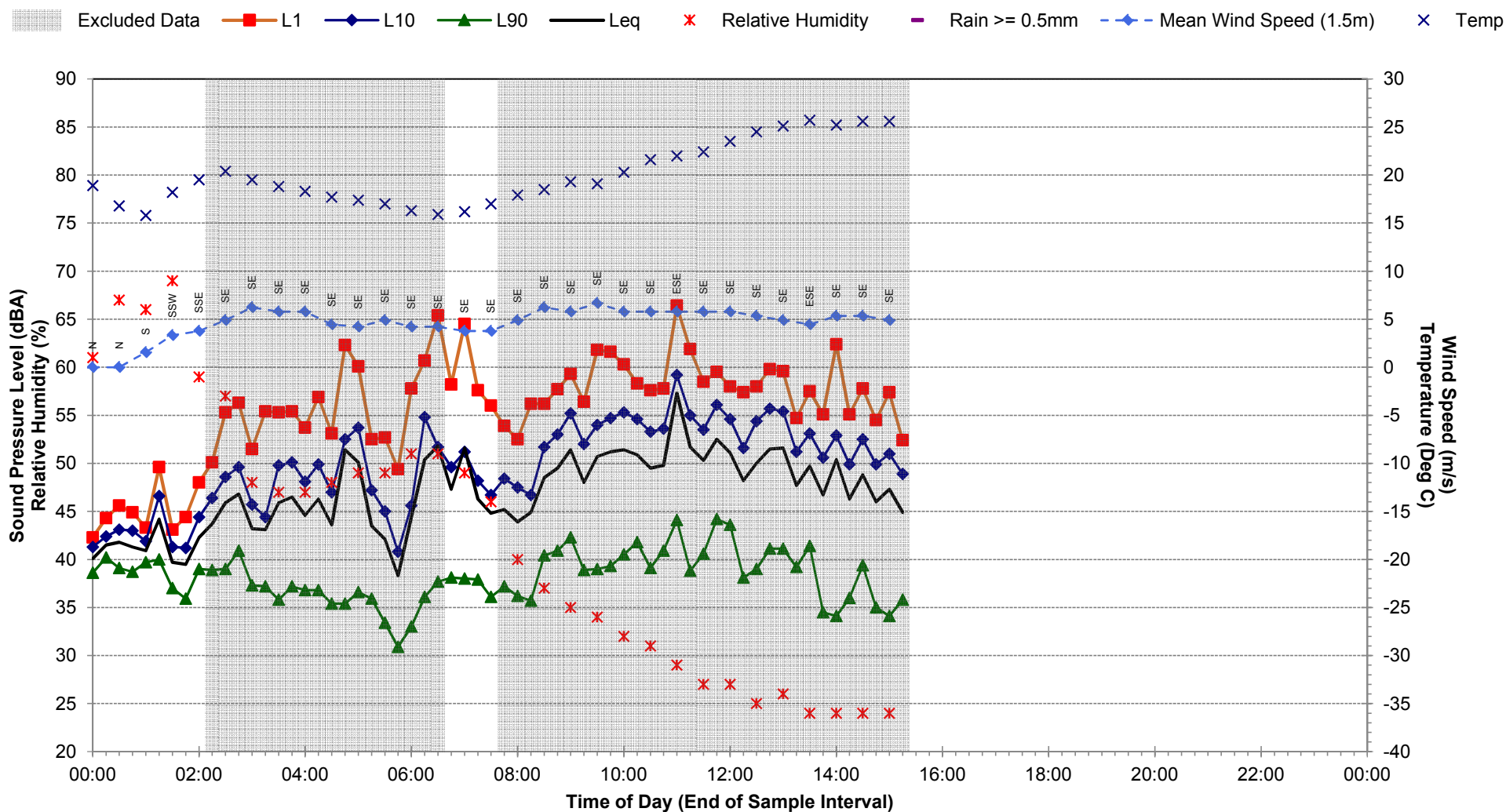
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Sunday, 10 May 2020



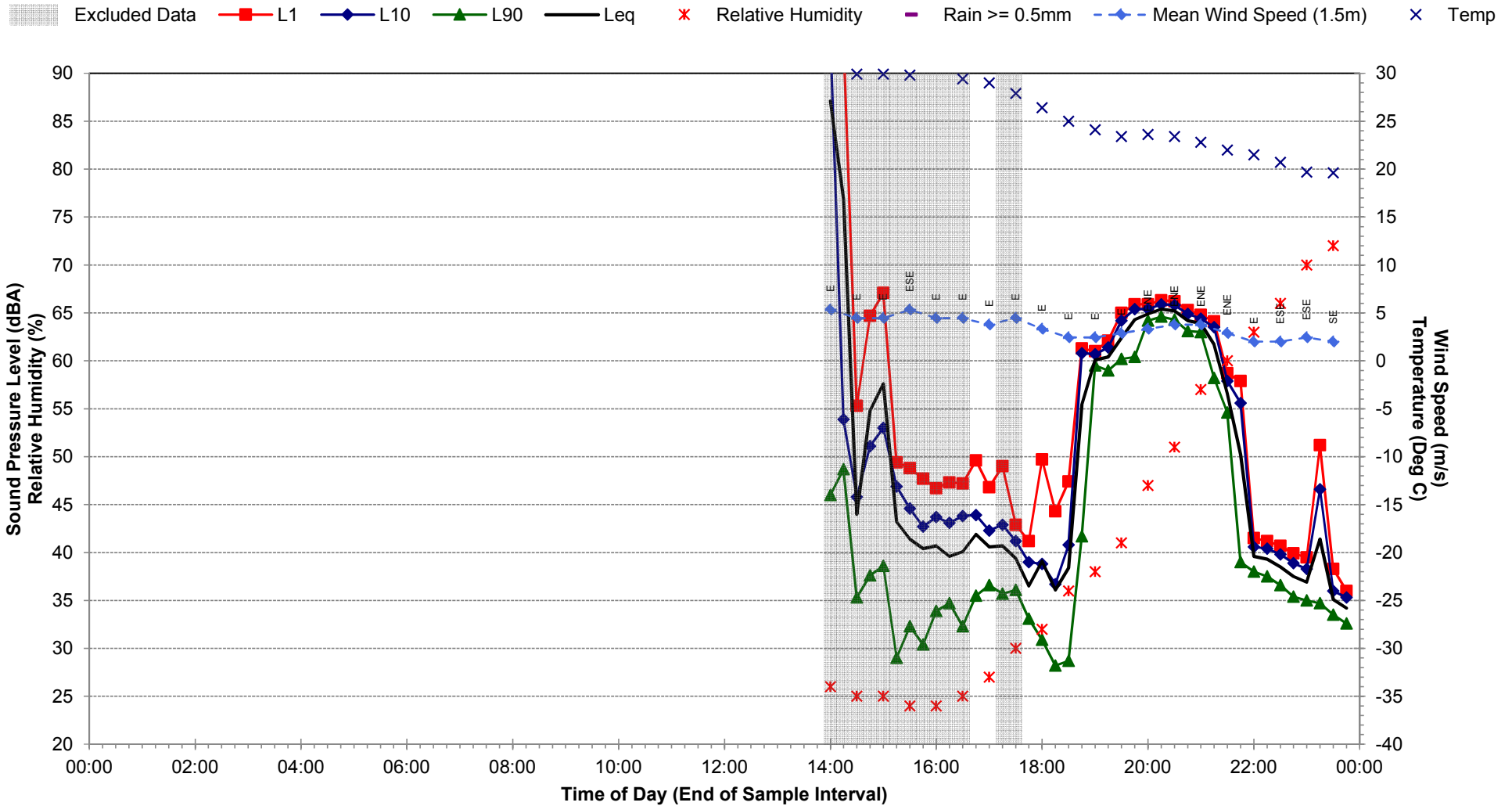
# Statistical Ambient Noise Levels

## Location 3 - Buffel Park Village - Monday, 11 May 2020



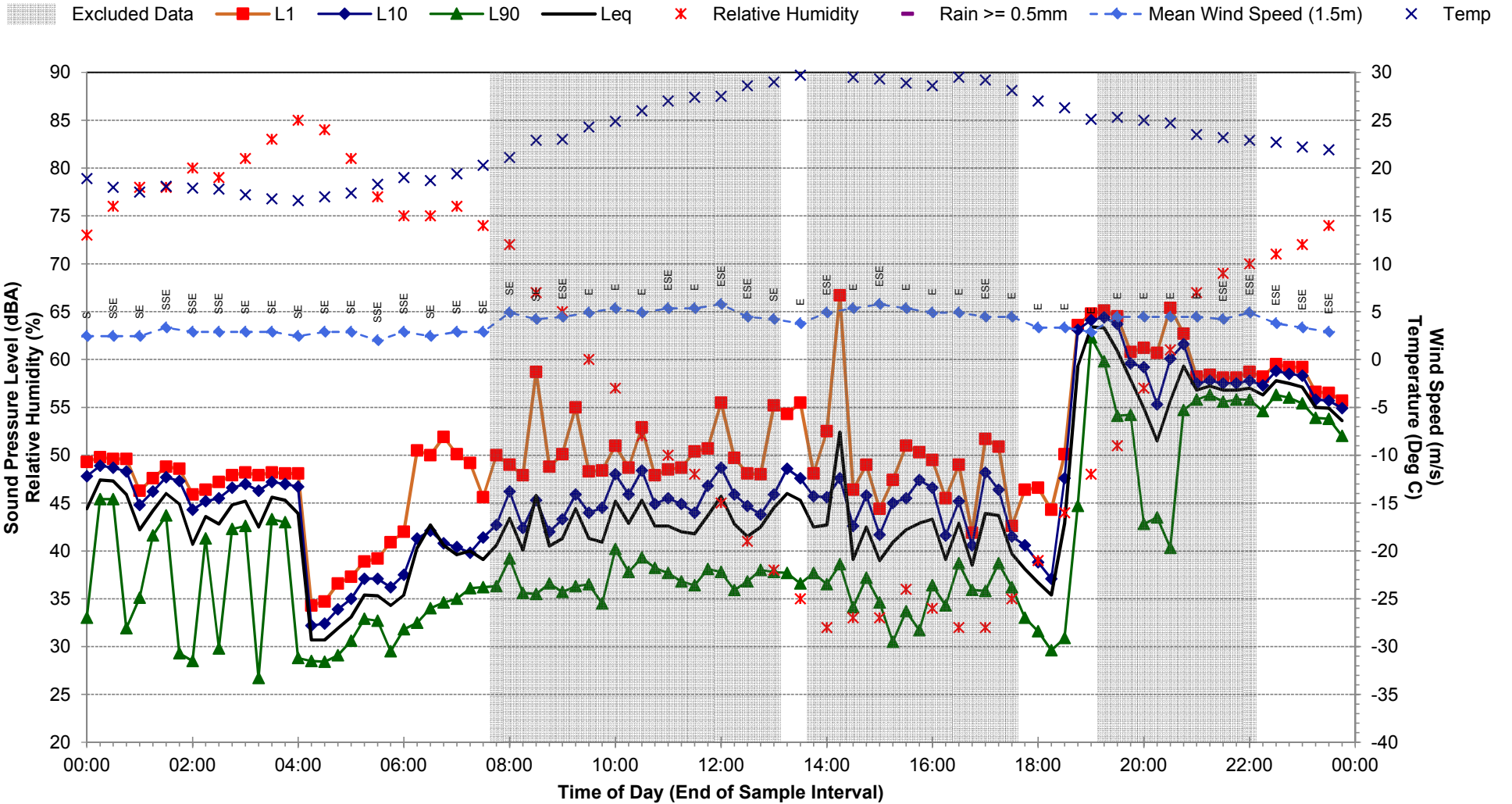
# Statistical Ambient Noise Levels

## Location 4 - Winchester Downs - Monday, 27 April 2020



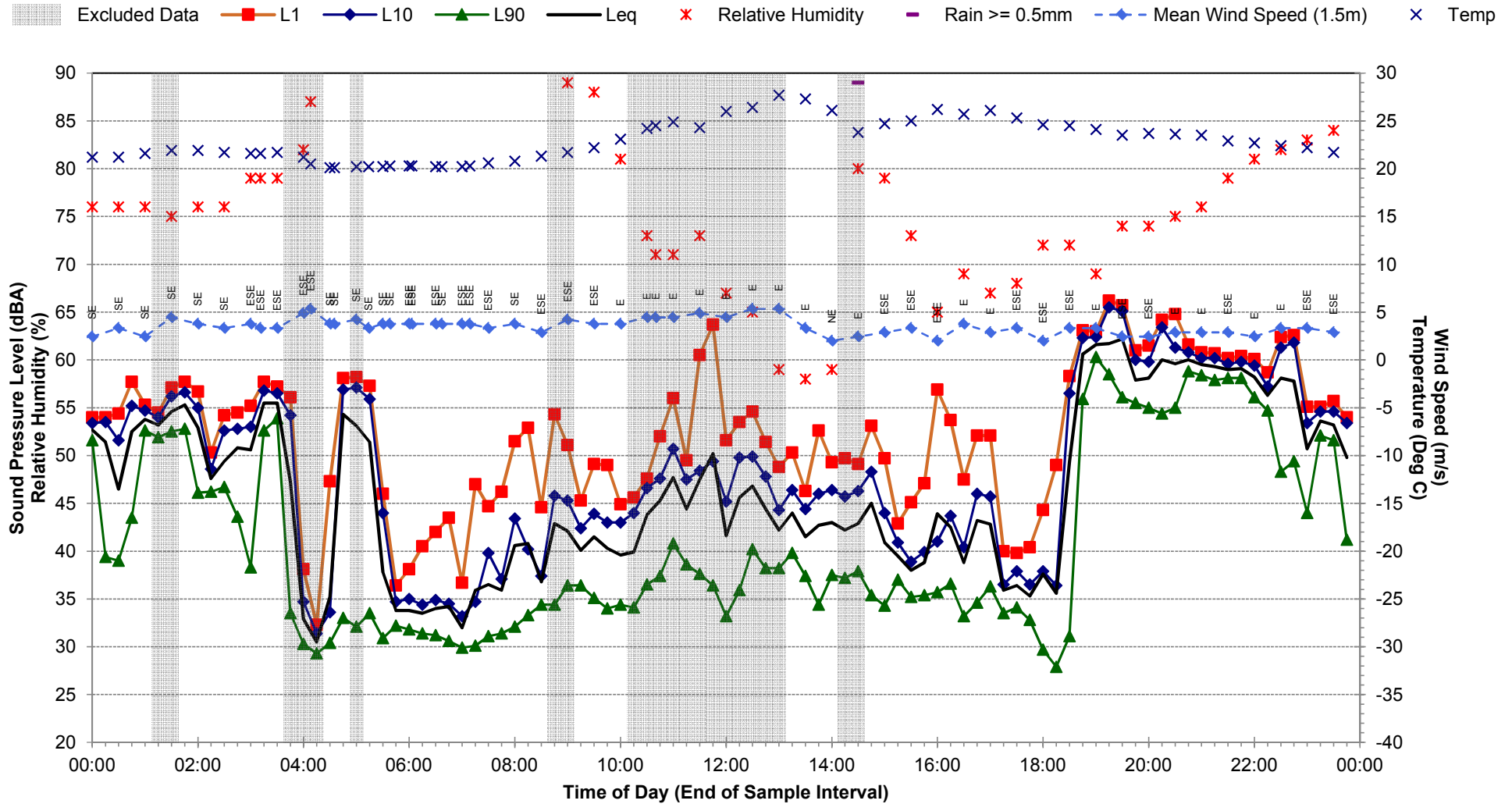
# Statistical Ambient Noise Levels

## Location 4 - Winchester Downs - Tuesday, 28 April 2020



# Statistical Ambient Noise Levels

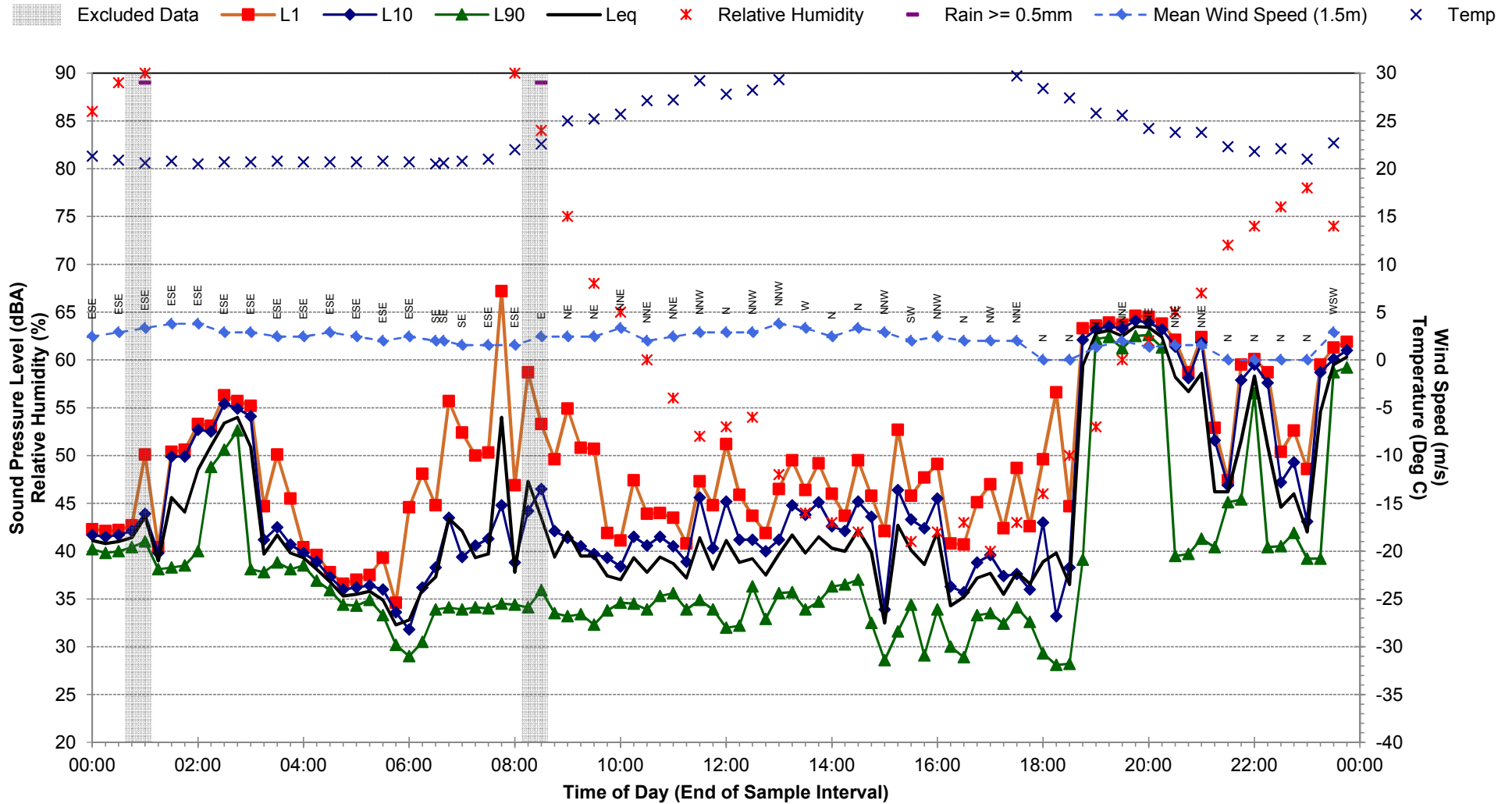
## Location 4 - Winchester Downs - Wednesday, 29 April 2020





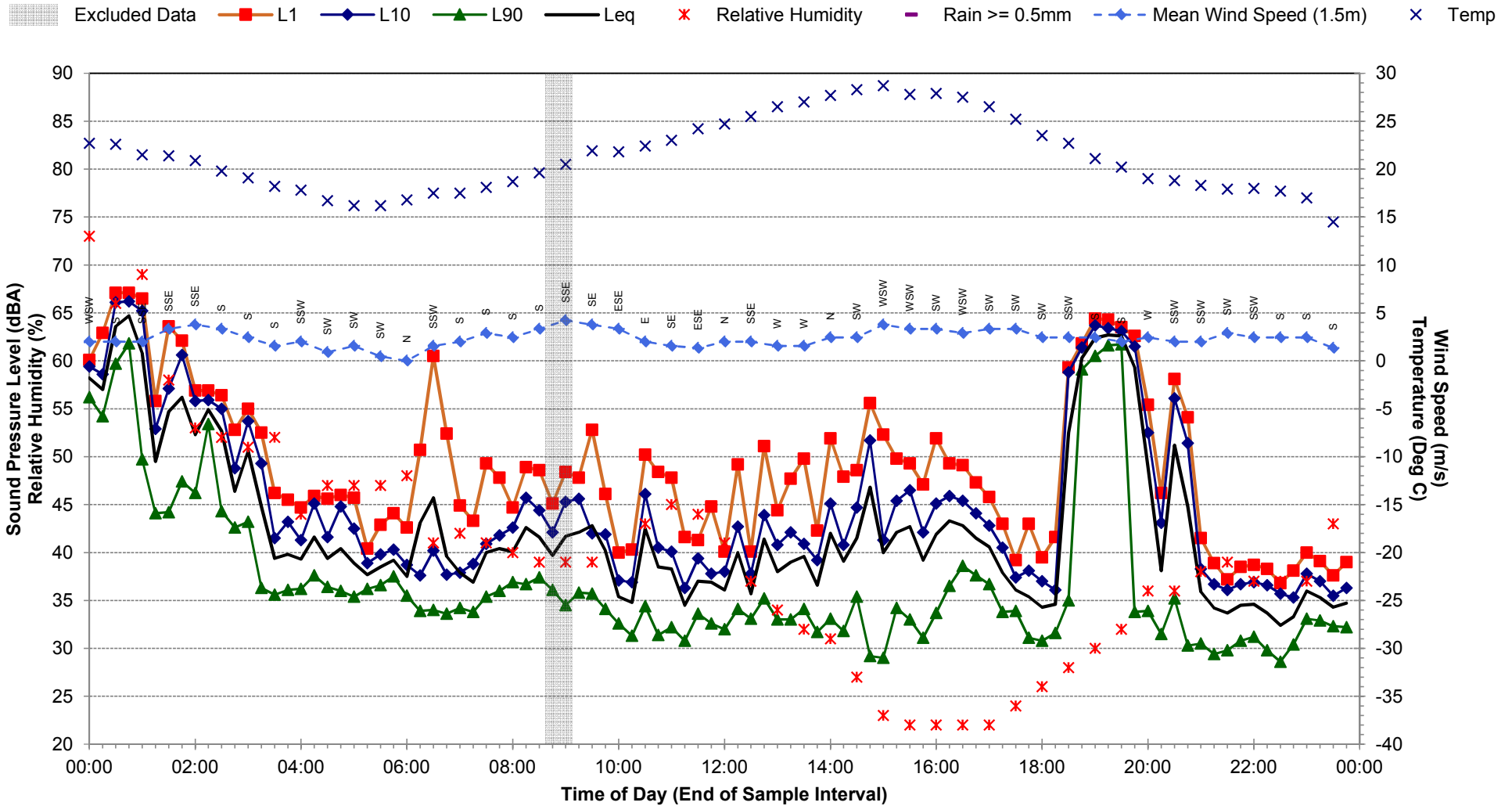
# Statistical Ambient Noise Levels

## Location 4 - Winchester Downs - Thursday, 30 April 2020



# Statistical Ambient Noise Levels

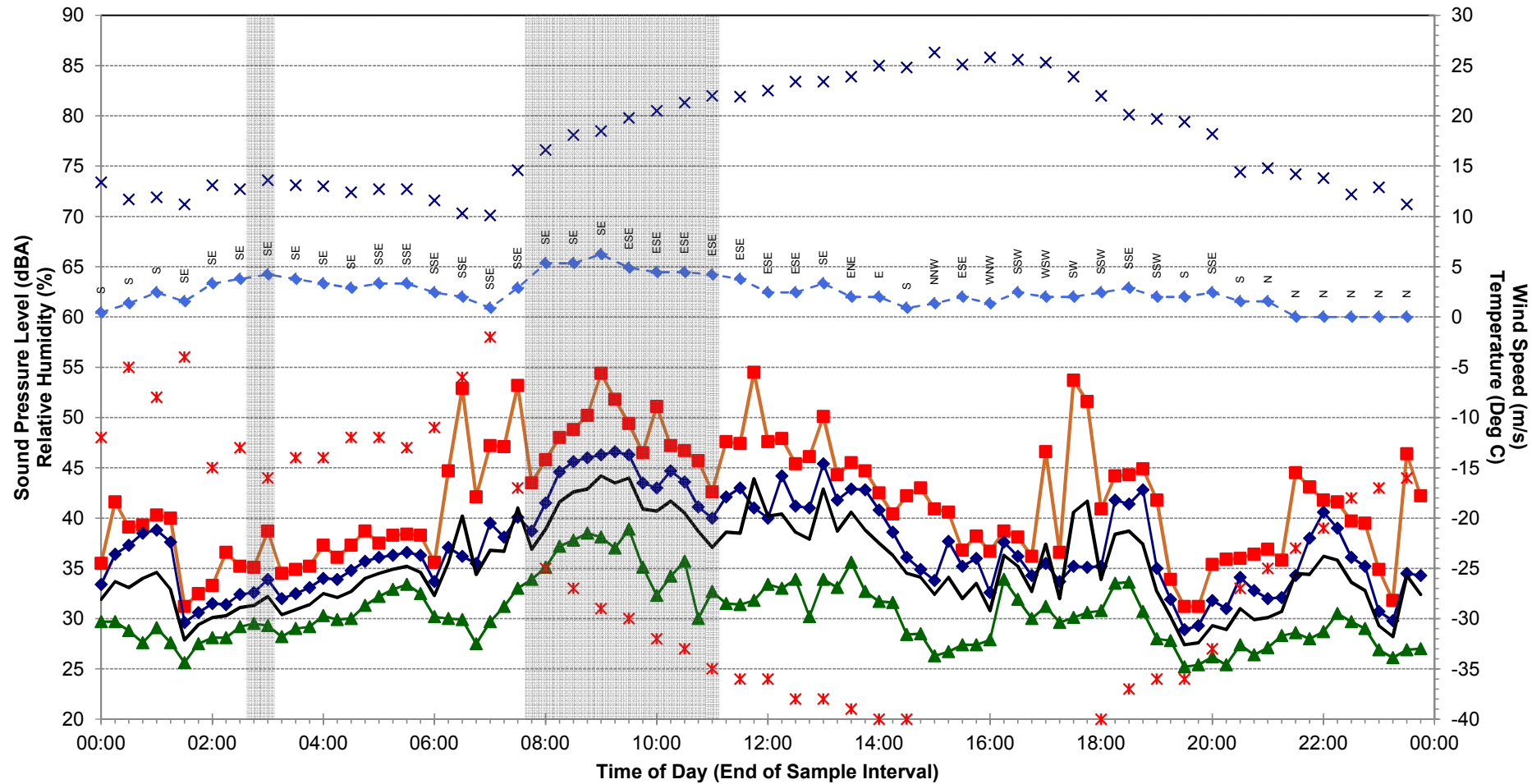
## Location 4 - Winchester Downs - Friday, 1 May 2020



# Statistical Ambient Noise Levels

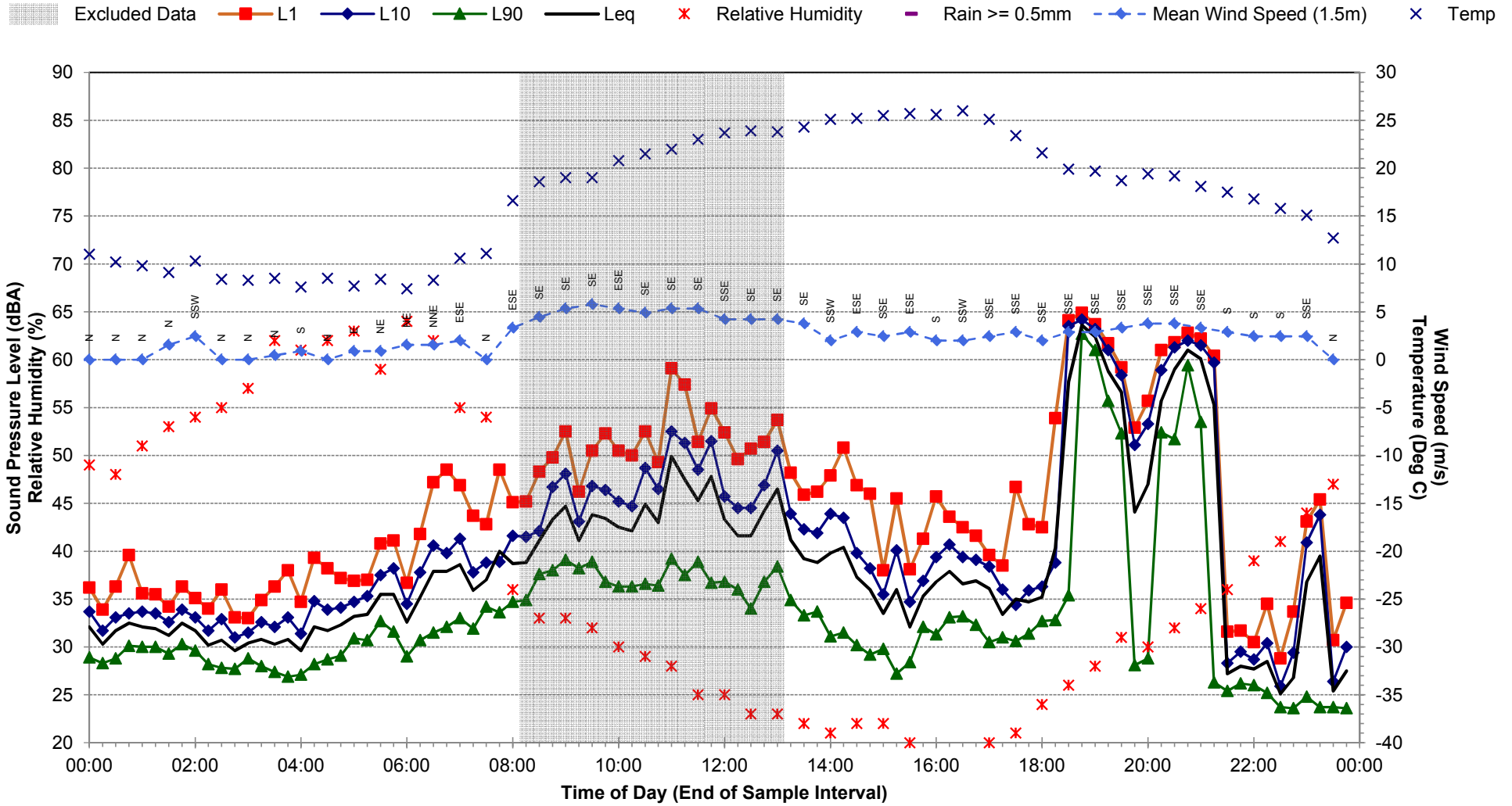
## Location 4 - Winchester Downs - Saturday, 2 May 2020

Excluded Data  
  L1  
  L10  
  L90  
  Leq  
 \* Relative Humidity  
  Rain >= 0.5mm  
 - ◆ Mean Wind Speed (1.5m)  
 x Temp



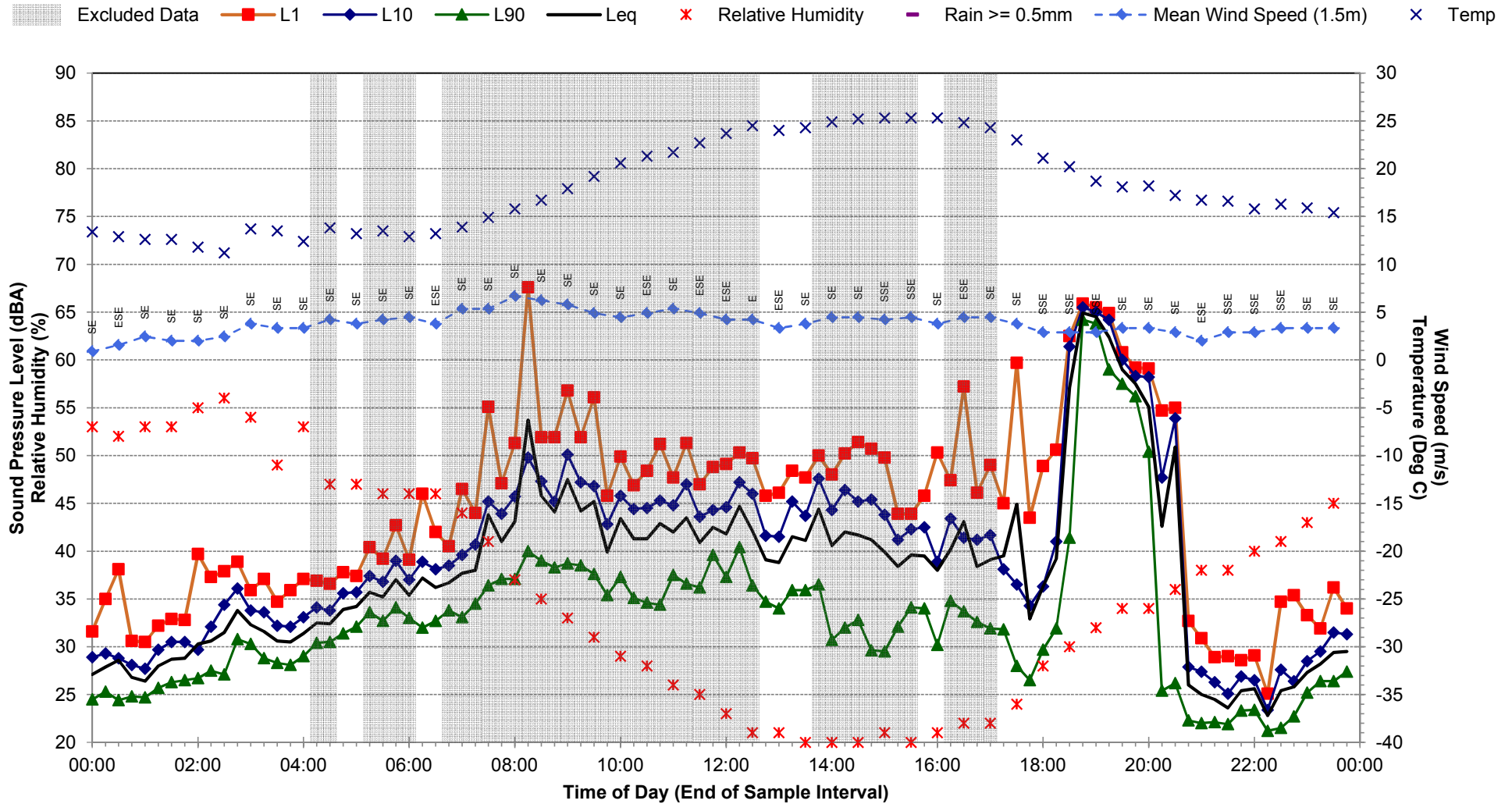
# Statistical Ambient Noise Levels

## Location 4 - Winchester Downs - Sunday, 3 May 2020



# Statistical Ambient Noise Levels

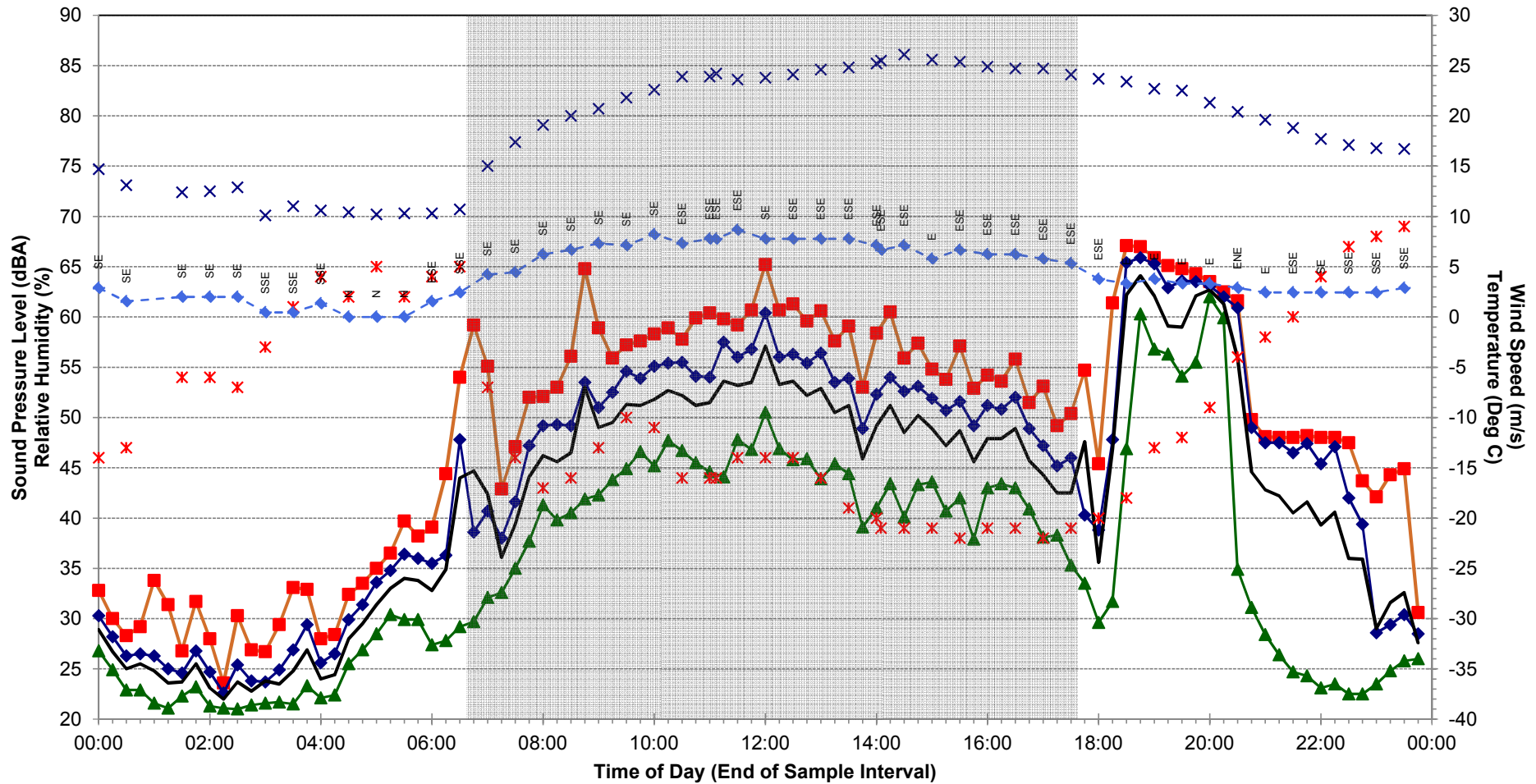
## Location 4 - Winchester Downs - Monday, 4 May 2020



# Statistical Ambient Noise Levels

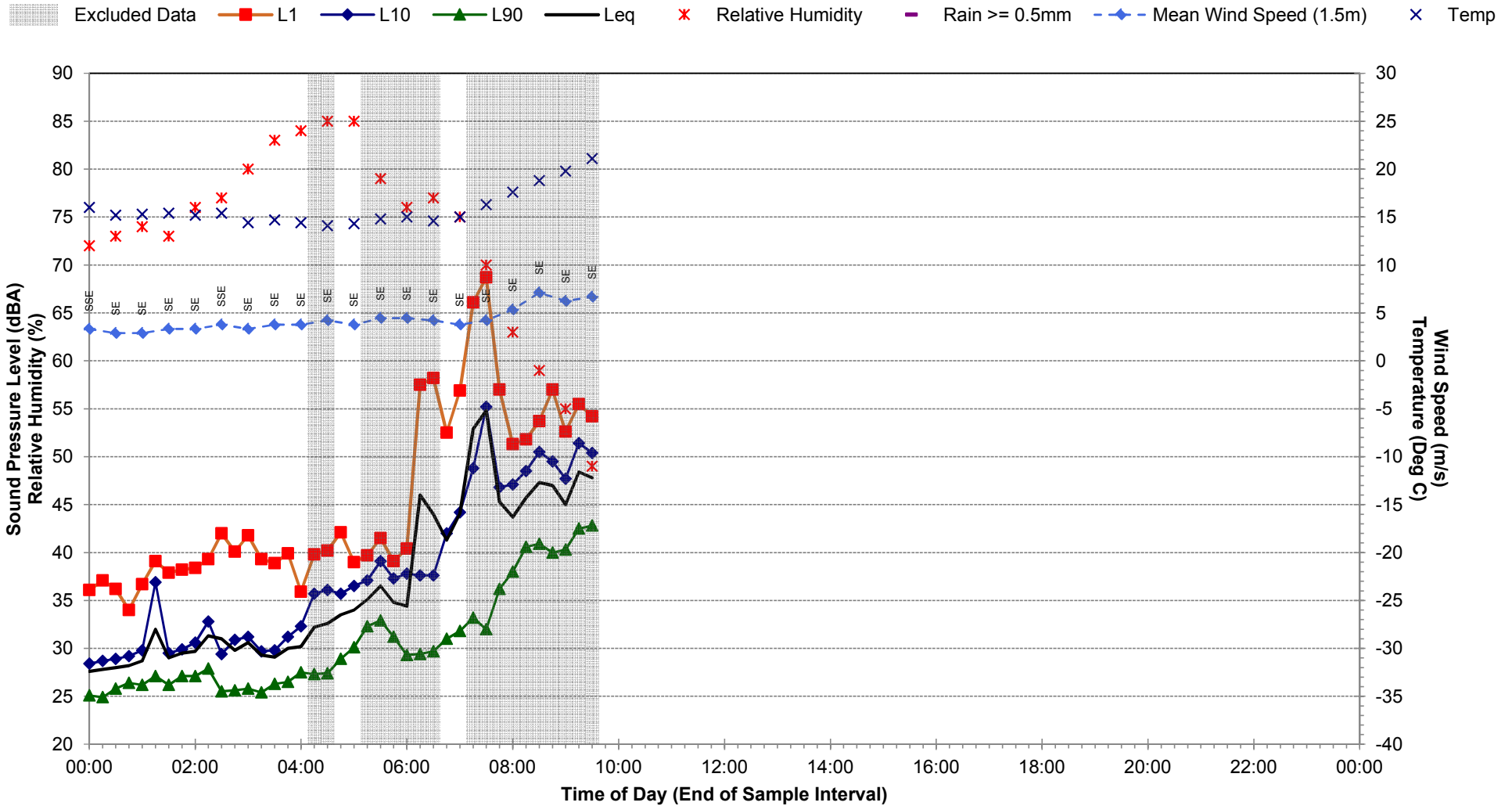
## Location 4 - Winchester Downs - Tuesday, 5 May 2020

Excluded Data
  L1
  L10
  L90
  Leq
  Relative Humidity
  Rain >= 0.5mm
  Mean Wind Speed (1.5m)
  Temp



# Statistical Ambient Noise Levels

## Location 4 - Winchester Downs - Wednesday, 6 May 2020

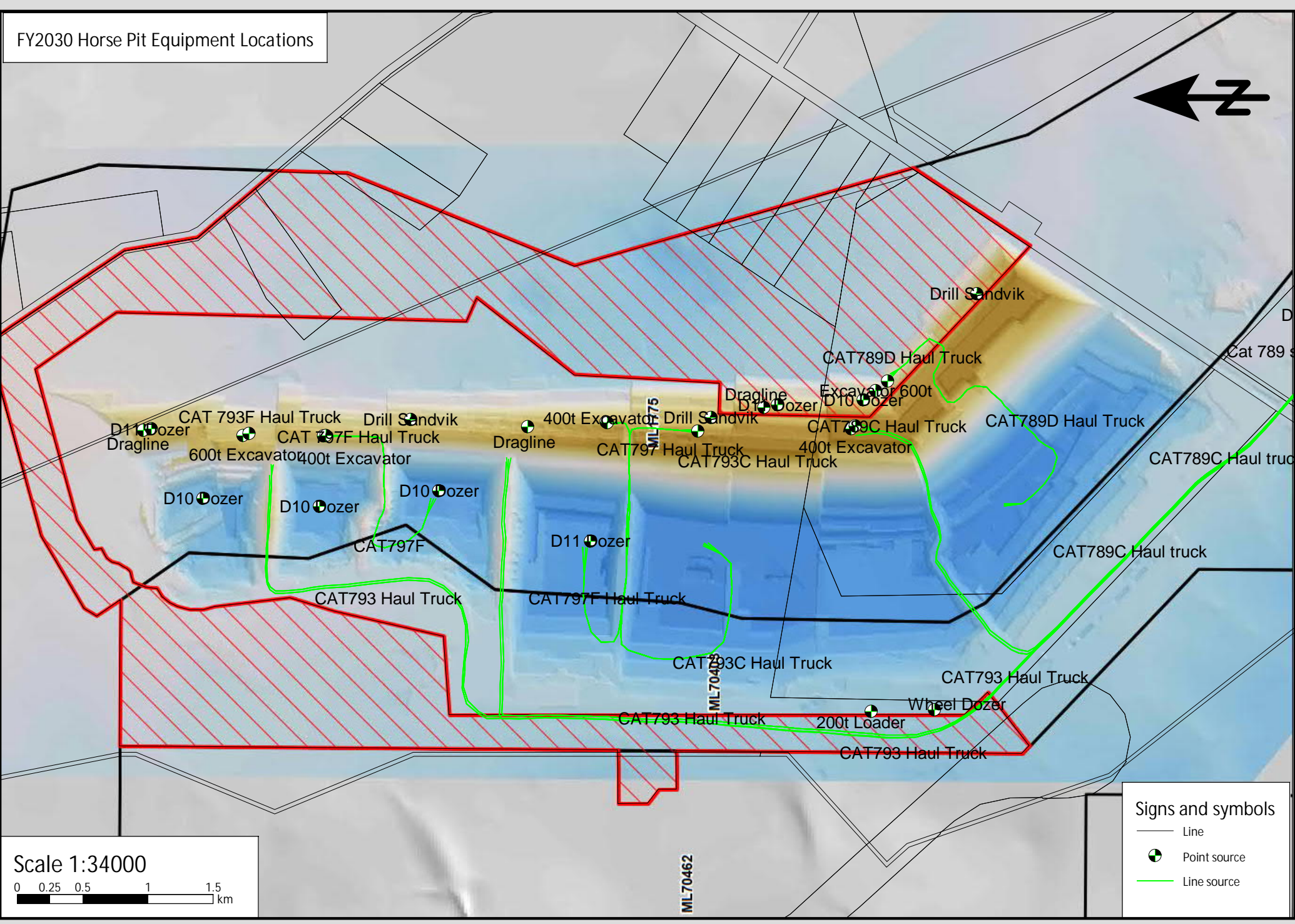


# APPENDIX C

## MODELLED OPERATIONAL EQUIPMENT LOCATIONS



FY2030 Horse Pit Equipment Locations



Scale 1:34000

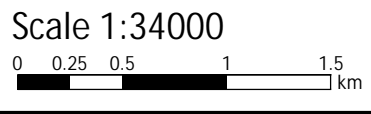
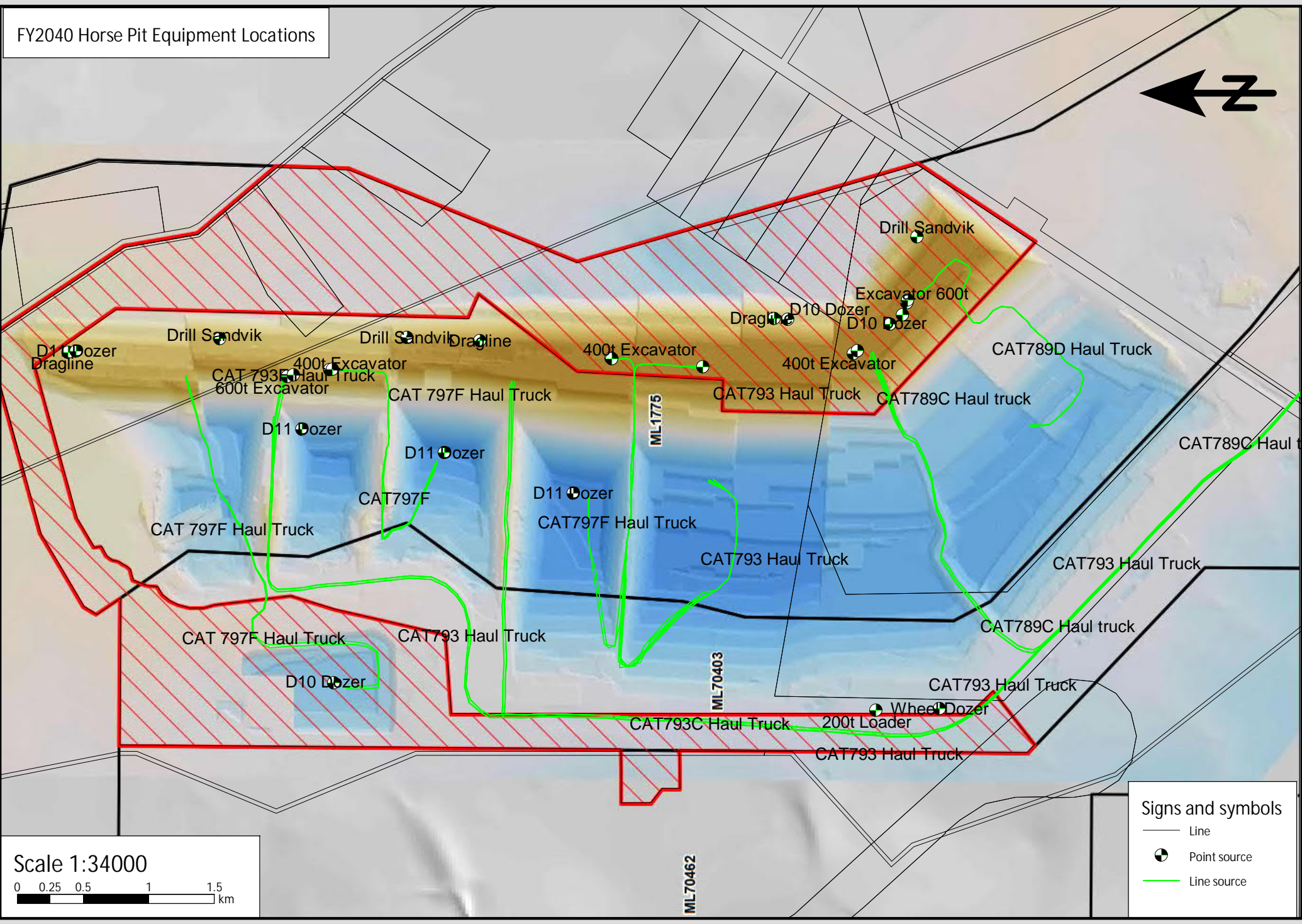


ML70462

**Signs and symbols**

- Line
- Point source
- Line source

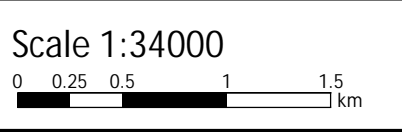
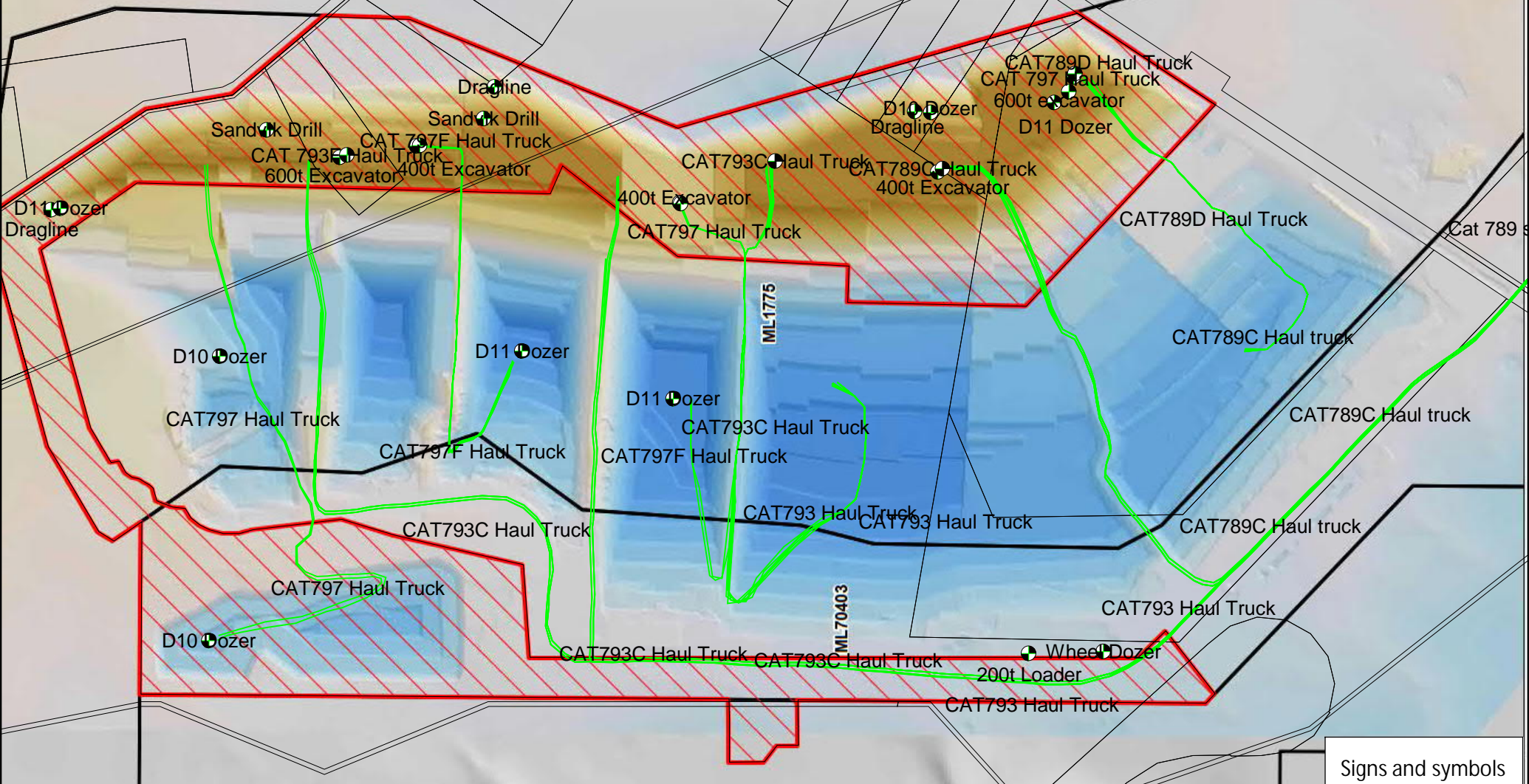
FY2040 Horse Pit Equipment Locations



Signs and symbols

- Line
- Point source
- Line source

FY2050 Horse Pit Equipment Locations

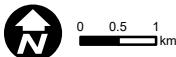
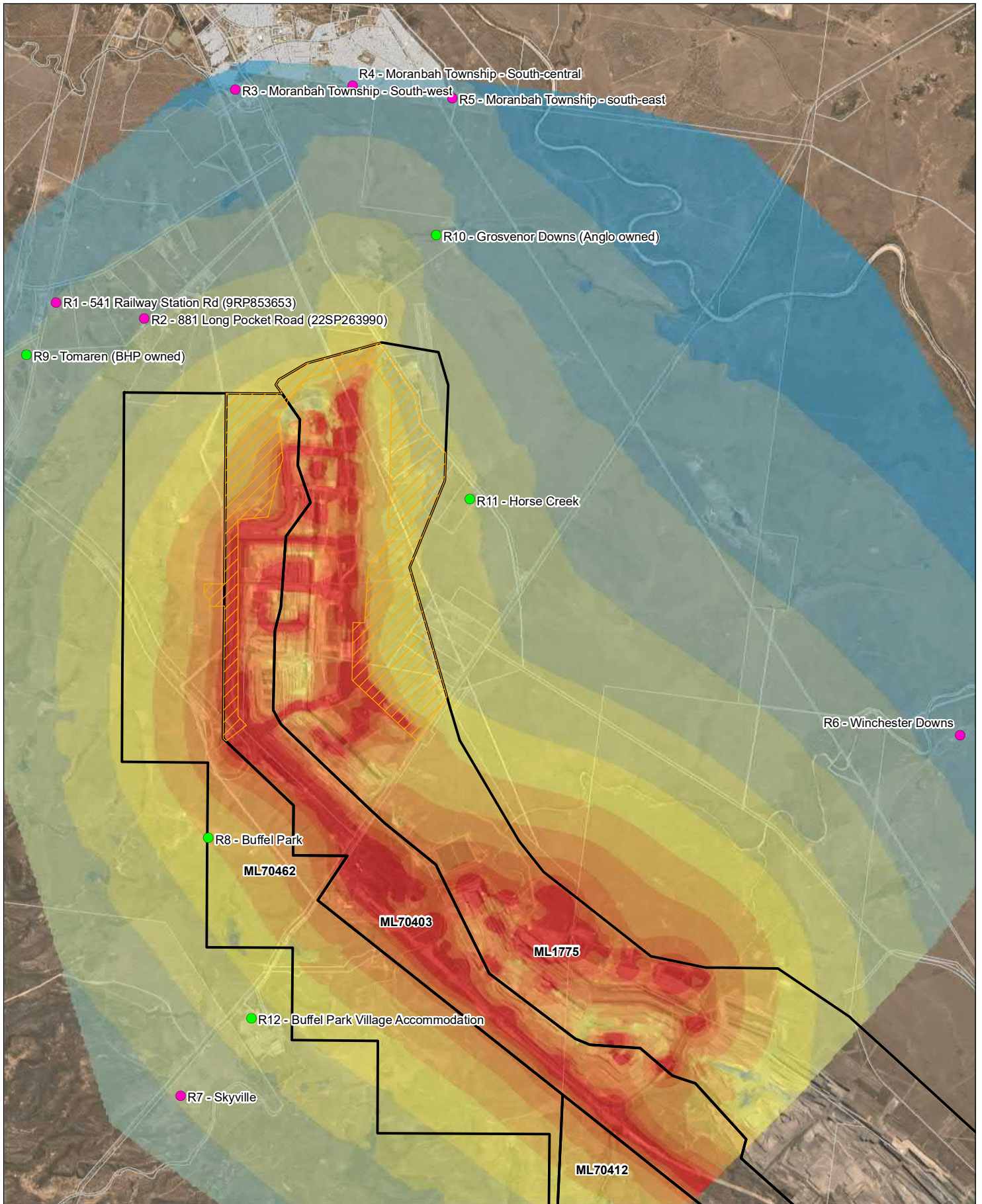


Signs and symbols

- Line
- Point source
- Line source

# APPENDIX D

## PREDICTED OPERATIONAL NOISE CONTOURS



Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



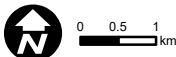
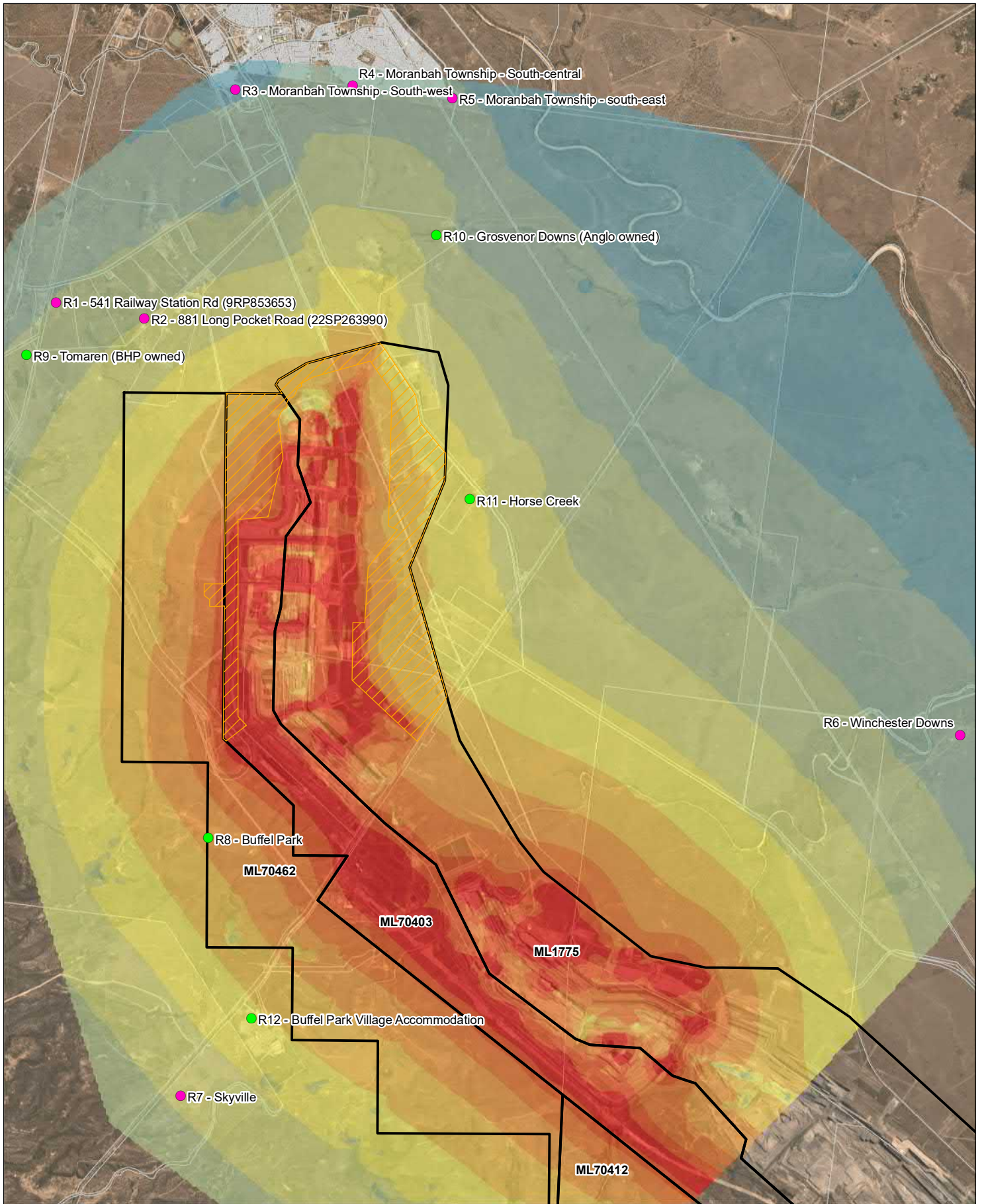
- |                           |  |               |
|---------------------------|--|---------------|
| ● Sensitive Receptors     | <b>Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)</b> | ■ >25 to <=30 |
| ● Non-sensitive Receptors | ■ <=10   | ■ >30 to <=35 |
| ▨ Horse Pit Project Area  | ■ >10 to <=15  | ■ >35 to <=40 |
| ▭ BHP Tenements           | ■ >15 to <=20  | ■ >40 to <=45 |
| ▭ Cadastre                | ■ >20 to <=25  | ■ >45 to <=50 |
|                           |  | ■ >50 to <=55 |
|                           |  | ■ >60         |

**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2030 Neutral Weather**

H:\BNE\Projects-SLR\620-BNE\620.13593 BHP - Horse Pit Approvals\07 CADGIS\ArcGIS\ANV\SLR62013593\_ANV\_NoiseContours\_FY2030\_Neu\_001.mxd



Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



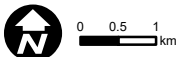
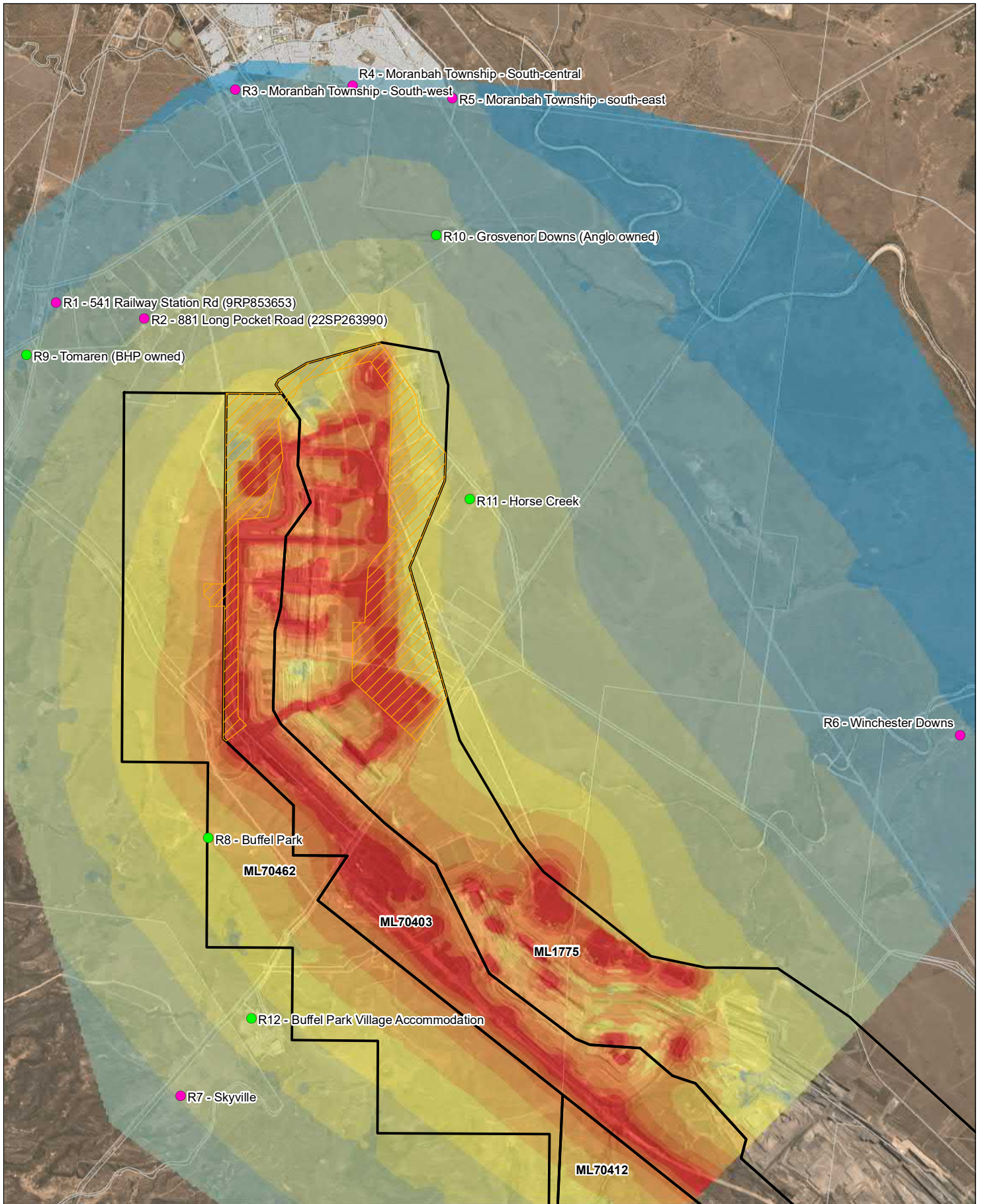
|                           |  |               |
|---------------------------|--|---------------|
| ● Sensitive Receptors     | <b>Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)</b> | ■ >25 to <=30 |
| ● Non-sensitive Receptors |  | ■ >30 to <=35 |
| ▨ Horse Pit Project Area  | ■ <=10   | ■ >35 to <=40 |
| ▭ BHP Tenements           | ■ >10 to <=15  | ■ >40 to <=45 |
| ▭ Cadastre                | ■ >15 to <=20  | ■ >45 to <=50 |
|                           | ■ >20 to <=25  | ■ >50 to <=55 |
|                           |  | ■ >60         |

**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2030 Adverse Weather**

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Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



- Sensitive Receptors
- Non-sensitive Receptors
- Horse Pit Project
- BHP Tenements
- Cadastre

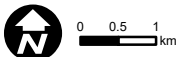
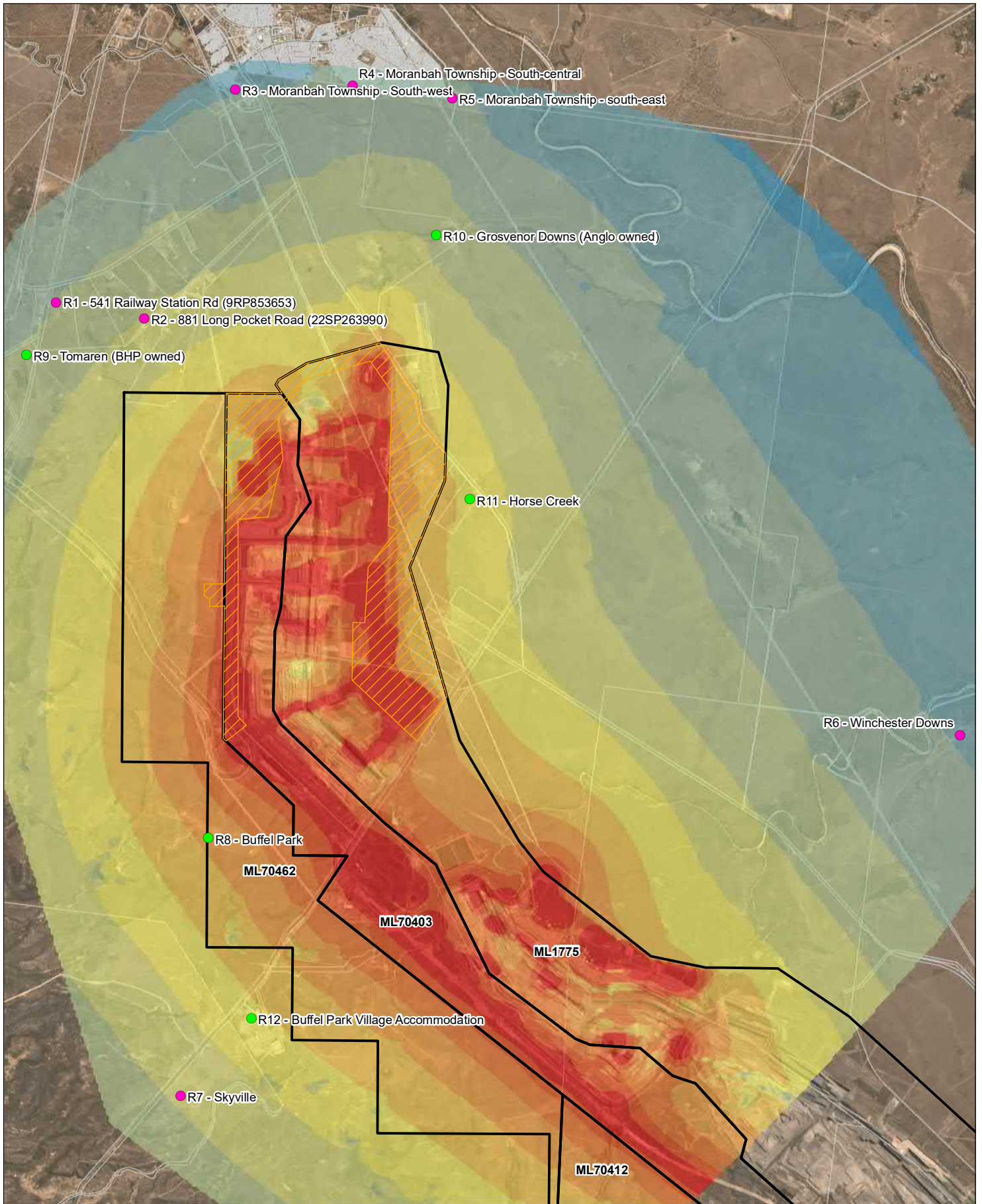
- Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**
- <=10
  - >10 to <=15
  - >15 to <=20
  - >20 to <=25
  - >25 to <=30
  - >30 to <=35
  - >35 to <=40
  - >40 to <=45
  - >45 to <=50
  - >50 to <=55
  - >55 to <=60
  - >60

**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2040 Neutral Weather**

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Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



|                           |  |               |
|---------------------------|--|---------------|
| ● Sensitive Receptors     | <b>Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)</b> | ■ >25 to <=30 |
| ● Non-sensitive Receptors |  | ■ >30 to <=35 |
| ▨ Horse Pit Project Area  | ■ <=10   | ■ >35 to <=40 |
| ▭ BHP Tenements           | ■ >10 to <=15  | ■ >40 to <=45 |
| ▭ Cadastre                | ■ >15 to <=20  | ■ >45 to <=50 |
|                           | ■ >20 to <=25  | ■ >50 to <=55 |
|                           |  | ■ >60         |

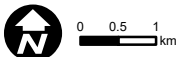
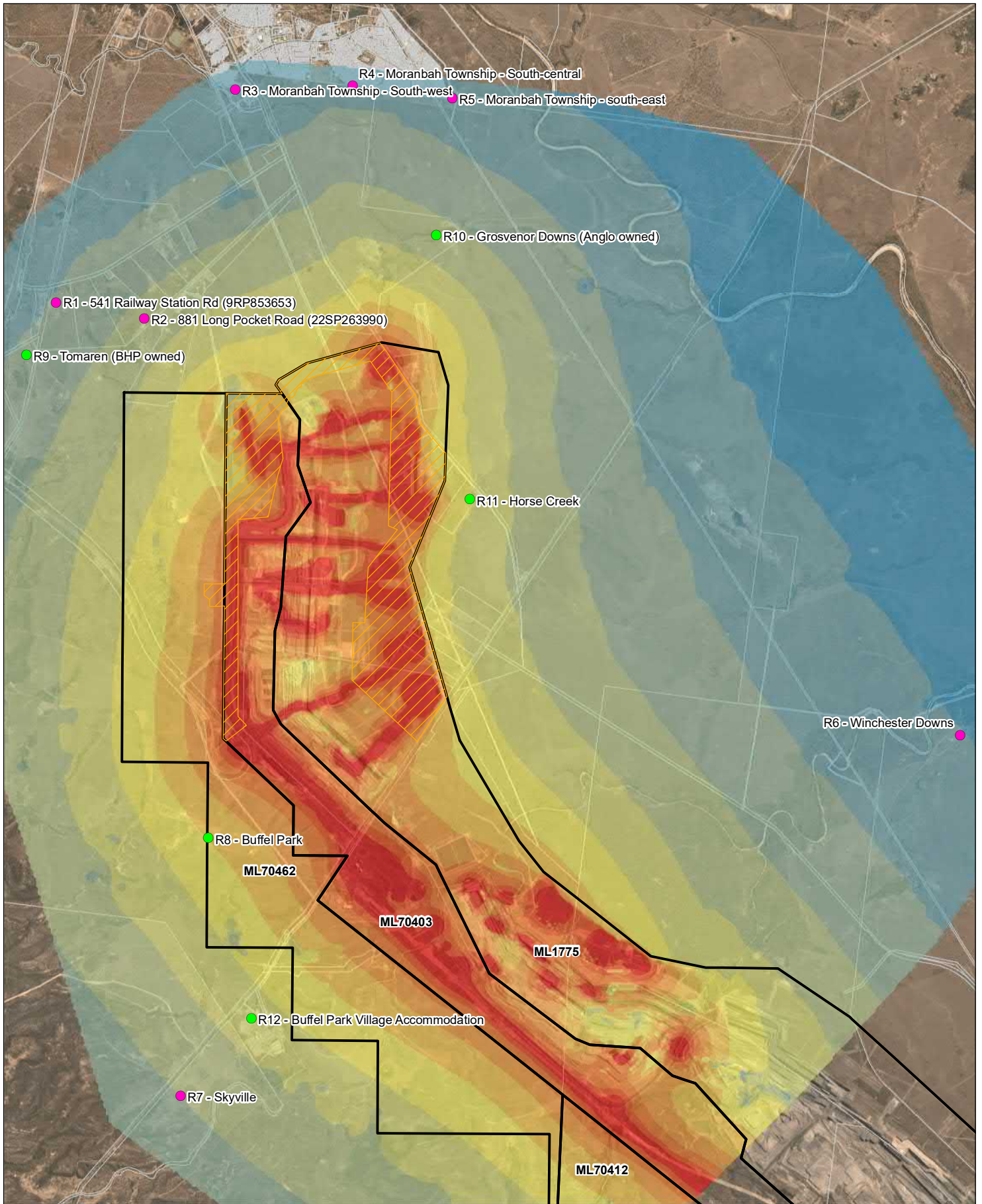
**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2040 Adverse Weather**

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Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



- Sensitive Receptors
- Non-sensitive Receptors
- Horse Pit Project Area
- BHP Tenements
- Cadastre

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

|   |
|---|
| <span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> <=10        |
| <span style="background-color: #87ceeb; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >10 to <=15 |
| <span style="background-color: #c8e6c9; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >15 to <=20 |
| <span style="background-color: #e2efda; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >20 to <=25 |

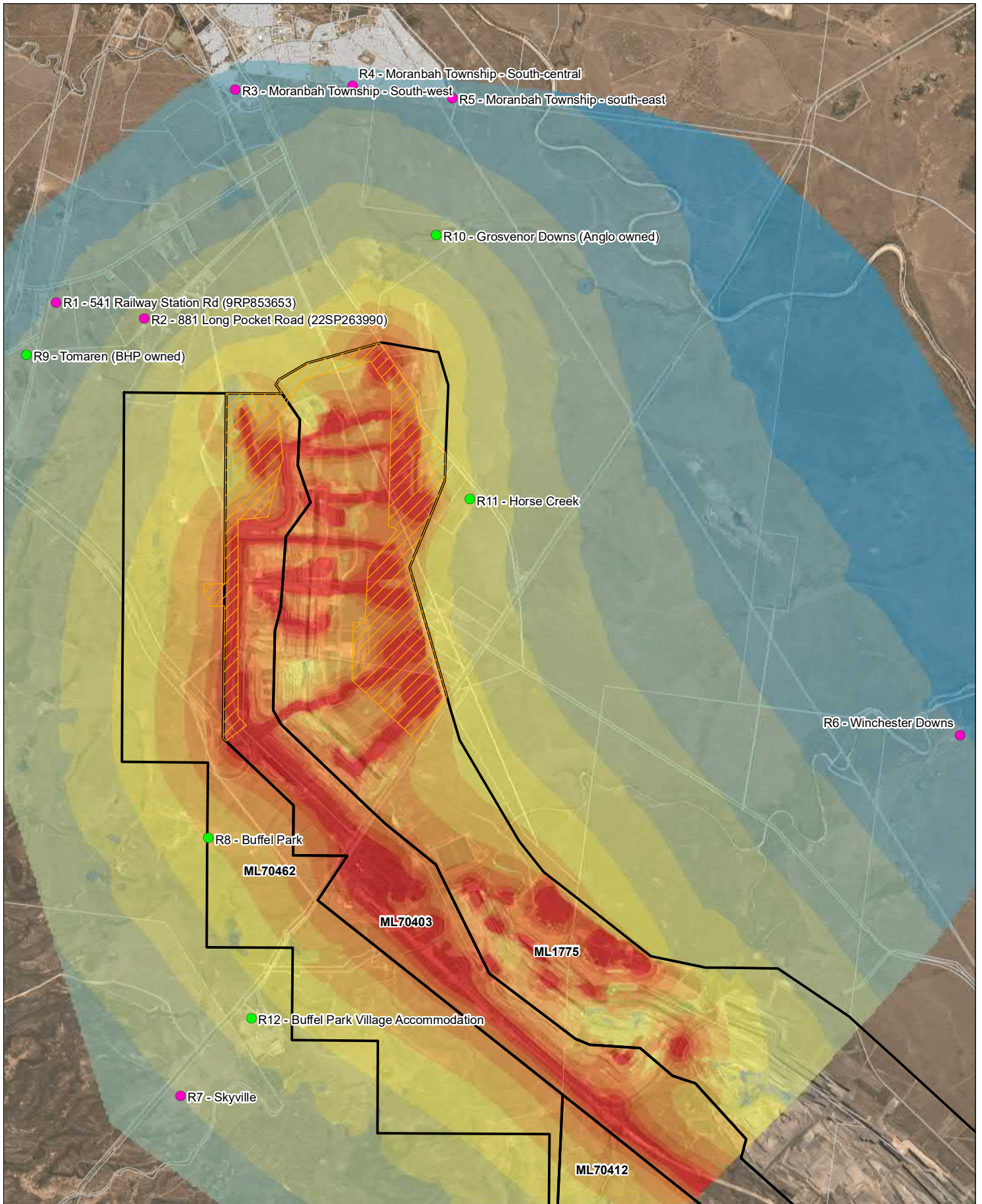
|   |
|---|
| <span style="background-color: #e2efda; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >25 to <=30 |
| <span style="background-color: #fff9c4; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >30 to <=35 |
| <span style="background-color: #fff176; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >35 to <=40 |
| <span style="background-color: #ffcc80; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >40 to <=45 |
| <span style="background-color: #ffb74d; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >45 to <=50 |
| <span style="background-color: #ff8a65; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >50 to <=55 |
| <span style="background-color: #ff5252; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> >60         |

**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2050 Neutral Weather**

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Projection: GDA 1994 MGA Zone 55  
 Scale: 1:100,000 at A4  
 Project No.: 620.13593  
 Date: 23-Mar-2021  
 Drawn by: PM



- Sensitive Receptors
- Non-sensitive Receptors
- Horse Pit Project
- BHP Tenements
- Cadastre

- Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**
- <=10
  - >10 to <=15
  - >15 to <=20
  - >20 to <=25

- >25 to <=30
- >30 to <=35
- >35 to <=40
- >40 to <=45
- >45 to <=50
- >50 to <=55
- >60

**Horse Pit Extension Project**

**Predicted Operational Noise Level Contours (dBA LAeq,adj,15min)**

**FY2050 Adverse Weather**

H:\BNE\Projects-SLR\620-BNE\620.13593 BHP - Horse Pit Approvals\07 CADGIS\ArcGIS\ANV\SLR62013593\_ANV\_NoiseContours\_FY2050\_Adv\_001.mxd

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