Appendix G

Noise and Vibration Assessment

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

WHITEHAVEN COAL

Resource Strategies

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

WINCHESTER SOUTH PROJECT

Noise and Vibration Assessment

20 May 2021

Whitehaven WS Pty Ltd

QB758-01F04 Noise Report (r1).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Brisbane Sydney Melbourne Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 16 123 509 884
U14, 205 Montague Road, West End QLD 4101 | PO Box 820 SPRING HILL QLD 4004
P (07) 3367 3131 F (07) 3367 3121 brisbane@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	QB758-01F04 Noise Report (r1).docx
Prepared for:	Whitehaven WS Pty Ltd
Address:	Level 22, 12 Creek Street Brisbane QLD 4000
Attention:	Brendan Dillon

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
24.11.2020	Issued to Whitehaven WS		r0	PJ		PJ
20.05.2021	Issued to Whitehaven WS		r1	PJ		PJ

Executive Summary

Renzo Tonin & Associates was engaged to prepare a noise and vibration impact assessment as part of an Environmental Impact Statement for the Winchester South Project (the Project).

This report assesses the potential noise and vibration levels from the Project against relevant noise and vibration objectives.

This report identifies and addresses the following items:

- sensitive receptors potentially affected by Project noise and vibration;
- existing noise and vibration environment at the nearest receptors;
- relevant noise and vibration objectives;
- types of fixed plant and mobile equipment that would be used and locations during key stages of Project mining operations;
- predicted Project noise and vibration levels at the nearest receptors; and
- recommendations for noise control measures, where required.

The Project is located approximately 200 kilometres (km) south-west of Mackay, Queensland, 30 km south-east of Moranbah and 50 km north of Dysart.

The Project is located within a sparsely populated area where the main land uses are large acreage grazing properties and mining activities. There are few near neighbours, with the closest located approximately 2.8 km from the Coal Handling and Preparation Plant (CHPP). A summary of the sensitive receptors relevant to the Project include:

- Olive Downs homestead (2.8 km north-east of the proposed CHPP);
- Winchester Downs homestead (11 km west of the proposed CHPP);
- Coolibah homestead (approximately 18.7 km north-west of the proposed CHPP); and
- Vermont Park homestead (approximately 20 km south-east of the proposed CHPP).

This noise and vibration assessment has been prepared in accordance with the Department of Environment and Science (formerly the Department of Environment and Heritage Protection [DEHP]) document *Guideline: Application requirements for activities with noise impacts* (DES, 2020).

Noise and vibration objectives for the Project were derived from a number of relevant guidelines. The noise and vibration objectives adopted for the Project include:

- 40dBA, 35dBA and 35 dBA $L_{Aeq,\ adj\ 15\ mins}$ for operational noise in the day, evening and night time periods, respectively;

- 52 dBA maxL_p for sleep disturbance;
- 55 dBZ for low frequency noise;
- 68 dBA $L_{eq,\ 18\ hour}$ for road traffic noise;
- 65 dBA $L_{eq\ 24hour}$ and Single Event Maximum 87 dBA maxL_p for rail noise;
- 115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time; and
- 5 millimetres per second (mm/s) Peak Particle Velocity for 9 out of 10 consecutive blasts and not greater than 10 mm/s PPV at any time.

A computer model was developed for the Project using Cadna software. Project operational noise levels were predicted for four modelling scenarios at each of these noise sensitive receptors. The operational scenarios modelled (Project Years 5, 9, 19 and 27) were selected in consideration of the scale of mining operations in each year of the Project, number of major mobile equipment and proximity of operations to sensitive receptors. The scenarios are expected to generate the highest noise levels at the nearest receptors based on the number of mining plant and locations.

Two weather scenarios were considered in modelling, namely neutral conditions (Stability Class D) and adverse weather conditions (Stability Class F). Modelling results are described below.

Neutral Weather Conditions

Operational noise levels are predicted to comply with the relevant noise objectives at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Noise levels are predicted to exceed the relevant noise objectives at Olive Downs homestead (NSR1) by up to 5 A-weighted decibels (dBA), despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS Pty Ltd (Whitehaven WS) intends to reach a mutually beneficial agreement with the owners of the Olive Downs homestead (NSR1).

Adverse Weather Conditions

Operational noise levels are predicted to comply with the relevant noise objectives at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Noise levels are predicted to exceed the relevant noise objectives at Olive Downs homestead (NSR1) by up to 12 dBA, despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the owners of the Olive Downs homestead (NSR1).

Although noise levels are predicted to comply with the relevant criteria at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead, noise monitoring would be conducted to validate the model predictions and inform the implementation of additional noise mitigation measures, if required. Additional noise mitigation measures could include modification of Project operations or at-receptor mitigation measures.

Low Frequency Noise

Operational noise predictions indicate low frequency noise (<200 Hertz) is expected to comply with the noise limits of 55 Z-weighted decibels (external location) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Operational noise levels are predicted to marginally exceed the noise limit of 55 dBZ (measured 4 m from the building facade) at Olive Downs homestead (NSR1) by up to 2 dBZ (neutral weather conditions) and by up to 4 dBZ (adverse weather conditions), despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the owners of the Olive Downs homestead (NSR1).

Sleep Disturbance

Based on predicted noise levels during neutral and adverse weather conditions, the Project is expected to comply with the sleep disturbance criterion (external location) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Operational noise levels are predicted to marginally exceed the sleep disturbance criterion (external location) at Olive Downs homestead (NSR1), despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the owners of the Olive Downs homestead (NSR1).

Blasting

Predicted Project ground vibration and airblast overpressure show that, with the use of typical explosive charge sizes and practices, the relevant vibration and overpressure objectives would not be exceeded at receptors.

Transport Noise

Based on predicted noise levels associated with Project-related road traffic and rail noise, compliance with the relevant criteria is expected.

Contents

List of tables

List of figures

1 Introduction

Renzo Tonin & Associates was engaged to prepare a noise and vibration impact assessment as part of an Environmental Impact Statement (EIS) for the Winchester South Project (the Project) which has been prepared in accordance with Part 4 of the *State Development and Public Works Organisation Act 1971*. This assessment has been prepared to satisfy the requirements of the *Terms of reference for an environmental impact statement – Winchester South Project* (Terms of Reference) issued by the Coordinator-General on 4 September 2019.

This report assesses the potential noise levels from the Project against relevant noise and vibration objectives in accordance with the Terms of Reference. Table 1 details the relevant noise and vibration requirements of the Terms of Reference and also highlights where each issue is addressed in this report.

Table 1: Winchester South Project Noise and Vibration Terms of Reference Reconciliation

Relevant Term of Reference	Section of this Report
Objective and performance outcomes	
The environmental objective to be met under the EP Act is that the activity will be operated in a way that protects the environmental values of the acoustic environment.	
The performance outcomes corresponding to the objectives are in Schedule 8, Part 3 of the EP Regulation. The proponent should supply sufficient evidence (including through studies and proposed management measures) that show these outcomes can be achieved.	
Existing environment	
11.79 Describe the existing noise and vibration environment that may be affected by the project in the context of the environmental values.	Section 3
11.80 Describe and illustrate on maps at a suitable scale, the location of all sensitive receptors adjacent to all project components and estimate typical background noise and vibration levels based on surveys at representative sites.	Sections 2.4, 3.1, and 3.2
11.81 If the proposed project could adversely impact on the noise and vibration environment, undertake baseline monitoring at a selection of sensitive receptors potentially affected by the project. Describe the results of any baseline monitoring.	Sections 3.1 and 3.2
Impact assessment	
11.82 The assessment of impacts on noise and vibration is to be in accordance with the DES Application requirements for activities with noise impacts (ESR/2015/1838) (or updates as they become available).	Sections 4 and 5
11.83 Fully describe the characteristics of the noise and vibration sources that would be emitted when carrying out the activity (point source and general emissions). Noise and vibration emissions (including fugitive sources) that may occur during construction, commissioning, upset conditions, operation and closure should be described.	Sections 5.3, 6.1 and 7.1
11.84 Predict the impacts of the noise emissions from the activity on the environmental values of the receiving environment, with reference to sensitive receptors, using recognised quality assured methods. Taking into account the practices and procedures that would be used to avoid or minimise impacts, the impact predictions is to address the:	

(a) activity's consistency with the objectives	Sections 5.1 to 5.3
(b) cumulative impact of the noise with other known emissions of noise associated with existing development and possible future development (as described by approved plans)	Section 8.1
(c) potential impacts of any low-frequency (<200 Hz) noise emissions.	Section 5.4
11.85 Describe the cumulative impacts of the proposed project, in conjunction with existing development and possible future development (as described by approved plans and existing project approvals), to the existing noise and vibration environment.	Section 8.1
Mitigation measures	
11.86 Describe how the proposed activity would be managed to be consistent with best practice environmental management for the activity. Where a government plan is relevant to the activity, or the site where the activity is proposed, describe the activity's consistency with that plan.	Section 6
11.87 Describe any expected exceedances of noise and vibration goals or criteria following the provision and/or application of avoidance and mitigation measures, and how any residual impacts would be addressed.	Sections 5 and 6
11.88 Describe how the achievement of the noise and vibration objectives would be monitored, audited and reported, and how corrective/preventative actions would be managed.	Sections 5 and 6

This report identifies and addresses the following items:

- sensitive receptors potentially affected by Project noise;
- existing noise environment at sensitive places;
- relevant noise objectives;
- types of fixed plant and mobile equipment that would be used and locations during key stages of Project mining operations;
- predicted Project noise objectives at sensitive places; and
- recommendations for noise control measures, where required.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard (AS) / New Zealand Standard (NZS) International Organisation for Standardisation (ISO) 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Overview of the Project

2.1 Site Location

Whitehaven WS Pty Ltd (Whitehaven WS), a wholly owned subsidiary of Whitehaven Coal Limited, proposes to develop the Project, a predominantly metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 30 kilometres (km) south-east of Moranbah, within the Isaac Regional Council Local Government Area (Figure 1).

The tenements relevant to the Project are Mineral Development Licence 183 and Mining Lease Application (MLA) 700049, MLA 700050, MLA 700051 and MLA 700065.

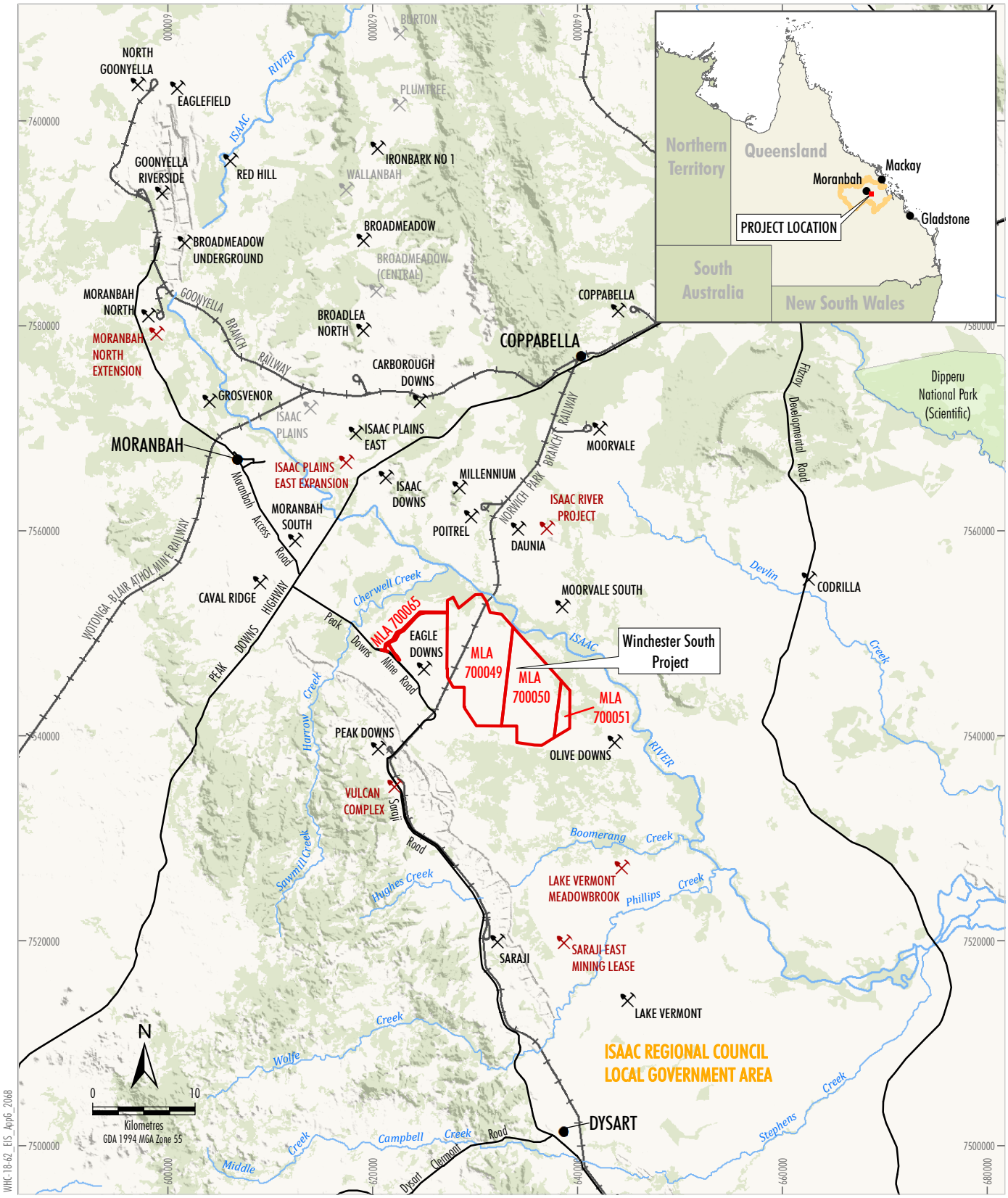
2.2 Brief Project Description

The Project involves the development of an open cut coal mine in an existing mining precinct for export of coal products. The Project would include construction and operation of a mine infrastructure area, including a Coal Handling and Preparation Plant (CHPP), train load-out facility and rail spur, which would be used for the handling, processing and transport of coal. An infrastructure corridor would also form part of the Project, including a raw water supply pipeline connecting to the Eungella pipeline network, an electricity transmission line and a mine access road (Figure 2).

The Project is forecast to extract approximately 15 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal, with a forecast peak extraction of up to 17 Mtpa, for approximately 30 years. The coal resource would be mined by open cut mining methods, with product coal to be transported by rail to port for export.

The mine would utilise shovels/excavators and trucks for the removal of overburden, interburden and coal. In general, the mining operation would involve:

- vegetation clearing of selected mining operation areas;
- soil stripping;
- stripping of some overburden;
- blasting of overburden and interburden;
- removal of overburden and interburden using loading equipment and trucks;
- ROM coal mining;
- ROM coal transport;
- coal handling and processing;
- train loading and rail-out of product coal; and
- site rehabilitation.



WHC-18-62_EIS_Apr06_206B

LEGEND
- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Local Government Area Boundary
- Railway
- Road

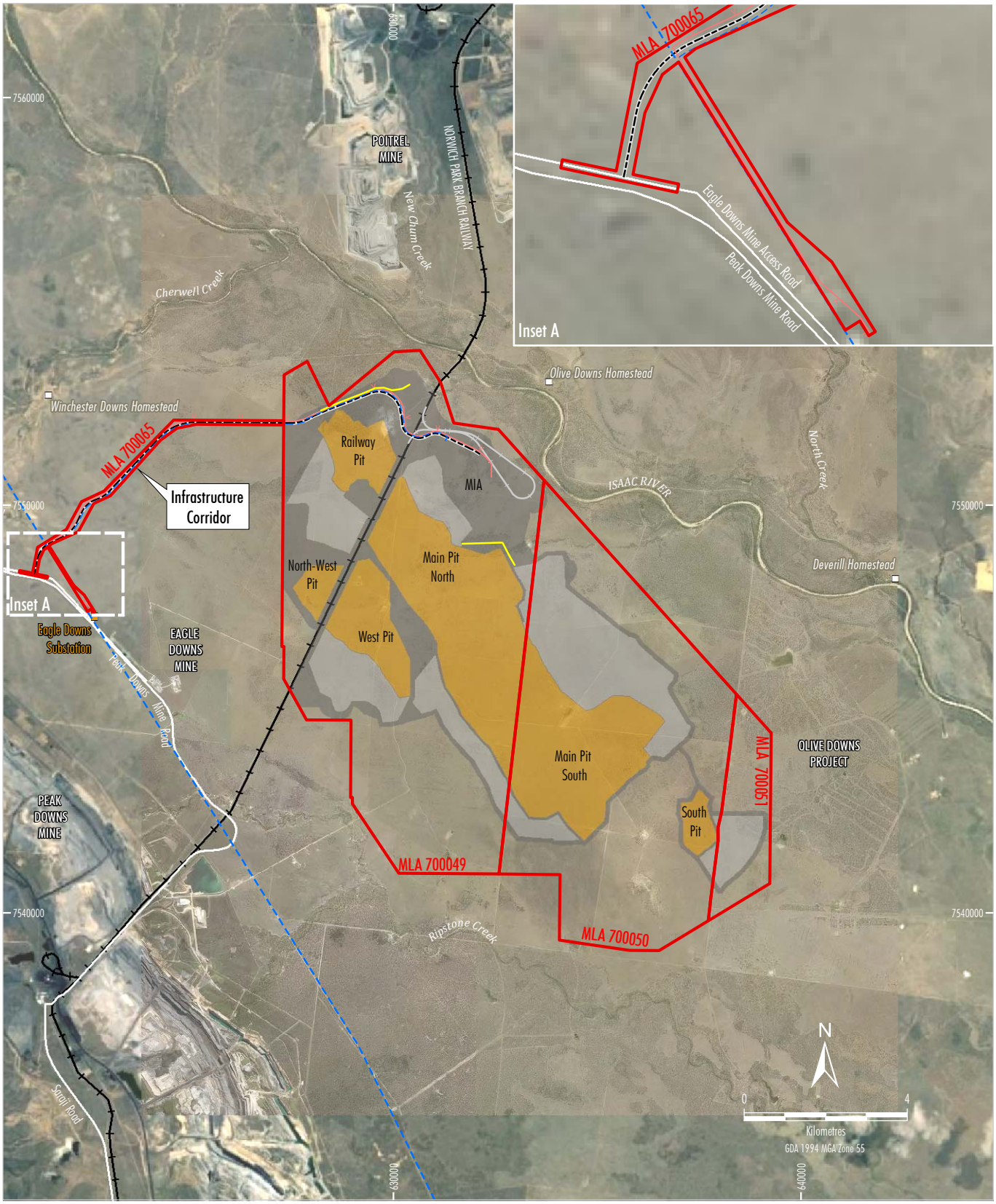
Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project Location

Figure 1



WHC-18-62_EIS_App6_207C

LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Homestead
- Substation

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project General Arrangement

Figure 2

A detailed description of the Project is provided in the Main Text of the EIS.

2.3 Hours of Operation

The proposed hours of operation are 24 hours per day, seven days per week.

2.4 Noise Sensitive Receptors

The Project is located approximately 30 km south-east of Moranbah and 50 km north of Dysart, in a sparsely populated area where the main land uses are large acreage grazing properties and mining activities. In addition, the Winchester Quarry is located within MLA 700049. There are few near neighbours with the closest located approximately 3 km from the CHPP. A summary of the sensitive receptors relevant to the Project include:

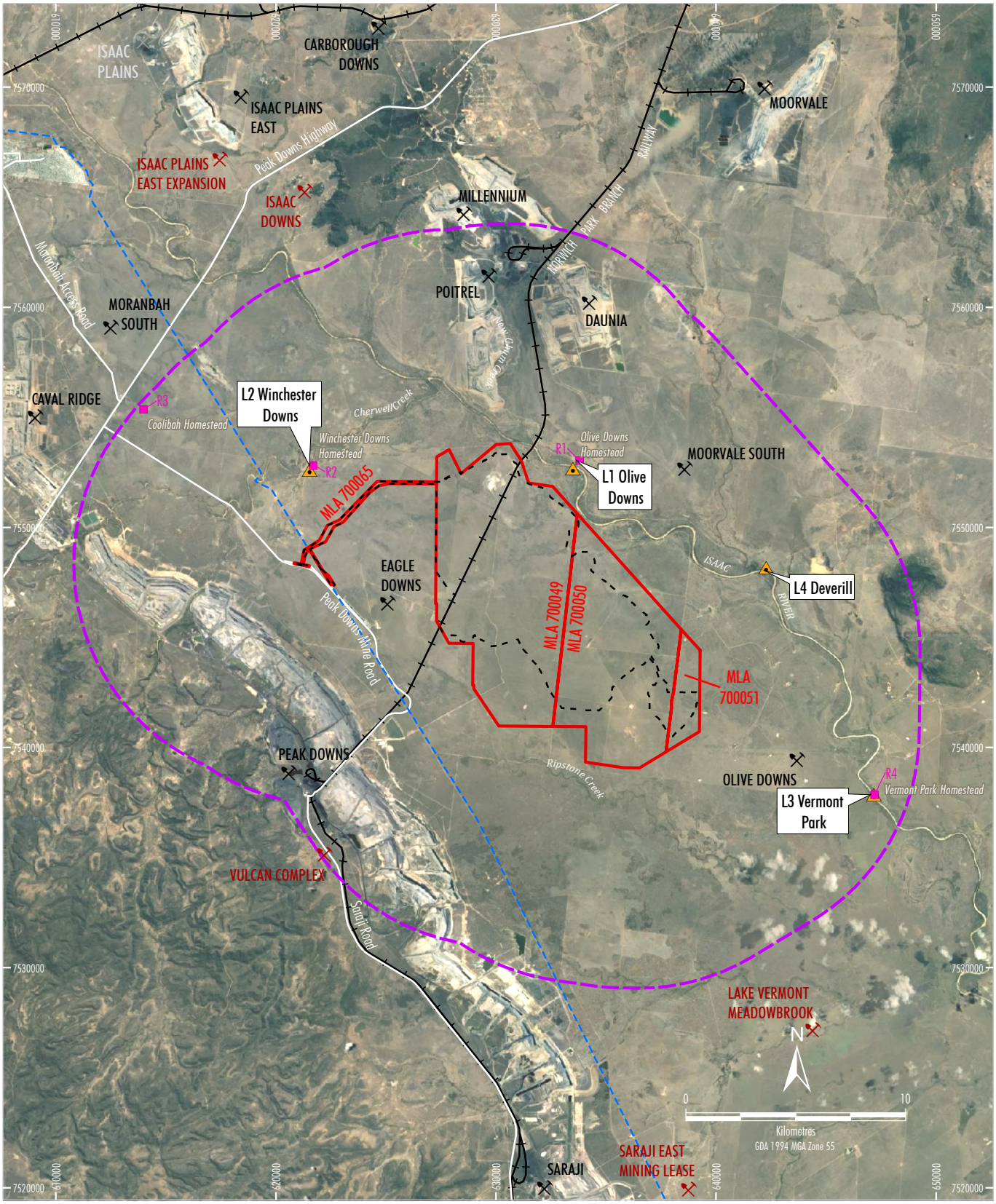
- Olive Downs homestead (2.8 km north-east of the proposed CHPP);
- Winchester Downs homestead (11 km west of the proposed CHPP);
- Coolibah homestead (approximately 18.7 km north-west of the proposed CHPP); and
- Vermont Park homestead (approximately 20 km south-east of the proposed CHPP).

The nearest noise sensitive receptors potentially affected by operational noise emissions from the Project are listed in Table 2.

Table 2: Nearest Noise Sensitive Receptors

Receptor ID	Receptor Address	Coordinates in Universal Transverse Mercator (UTM)	
		Easting (metres [m])	Northing (m)
NSR1	Olive Downs homestead	633510 E	7552682 S
NSR2	Winchester Downs homestead	621536 E	7552587 S
NSR3	Coolibah homestead	614000 E	7555360 S
NSR4	Vermont Park homestead	647210 E	7537870 S

The locations of the noise sensitive receptors are shown on Figure 3.



WHC-18-62_EIS_App6_209A

LEGEND

- Mining Lease Application Boundary
- Mining Lease Application Boundary Buffer (10 km)
- Indicative Surface Disturbance Extent
- Eungella Water Pipeline Southern Extension
- Railway
- Sensitive Receptor
- Noise Monitoring Location

Mine Status

- Approved/Operating
- Proposed
- Care and Maintenance

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2021). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Monitoring and Sensitive Receptor Locations

Figure 3

3 Existing Acoustic Environment

The existing acoustic environment was measured at three representative locations located near the Project. The following report sections describe noise measurement methodology, results and meteorology during the monitoring period.

3.1 Noise Measurement Methodology

Long term (unattended) background noise monitoring was conducted at two locations in the local area surrounding the Project between Tuesday 10 and Wednesday 18 September 2019.

The following two noise logger locations were selected close to the nearest noise sensitive receptors as shown on Figures 3, 4 and 5:

- Logger L1: Olive Downs homestead, approx. 2.8 km north-east of the proposed CHPP.
- Logger L2: Winchester Downs homestead, approx. 11 km west of the proposed CHPP.

Long term (unattended) noise monitoring was also previously conducted in August 2017 at two noise sensitive receptors located south and east of the Project for another proposed mining project. The previous monitoring was conducted over nine days, between Tuesday 8 and Wednesday 16 August 2017, at the locations shown on Figure 6 and Figure 7.

- Logger L3: Vermont Park homestead, approx. 20 km south-east of the proposed CHPP.
- Logger L4: Deverill homestead, approx. 10.2 km east of the proposed CHPP.

Table 3 below presents the Global Positioning System (GPS) coordinates of the four long term noise monitoring locations.

Table 3: Long Term Noise Monitoring Locations

Logger	Description	Coordinates in UTM	
		Easting (m)	Northing (m)
L1	Olive Downs homestead	633510 E	7552682 S
L2	Winchester Downs homestead (close proximity)	621536 E	7552587 S
L3	Vermont Park homestead	647175 E	7537864 S
L4	Deverill homestead	642276 E	7548160 S

In each instance the logger's microphone was positioned at a height of 1.5 m above the ground and in the free field (well away from buildings and structures).

WHC-18-62_EIS_App6_210A

LEGEND

Noise Monitoring Location*

Note:
** Noise monitoring location is assumed to be indicative of the conditions at the Olive Downs Homestead.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Monitoring Location
L1 - Olive Downs Homestead

Figure 4

WHC-18-62_EIS_App6_211A

LEGEND

Noise Monitoring Location

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: ESRI (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Monitoring Location
L2 - Winchester Downs Homestead

Figure 5

WHC-18-62_EIS_App6_212A

LEGEND

Noise Monitoring Location

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: ESRI (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Monitoring Location
L3 - Vermont Park Homestead

Figure 6

WHC-18-62_EIS_App6_222A

LEGEND

Noise Monitoring Location

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: ESRI (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Monitoring Location
L4 - Deverill Homestead

Figure 7

The test instrumentation consisted of:

- Logger L1 - Portable noise logger NTi XL2 (S/N: A2A-03909-D1);
- Logger L2 - Portable noise logger NTi XL2 (S/N: A2A-02422-D0);
- Logger L3 - Portable noise logger NTi XL2 (S/N: A2A--03909-D1);
- Logger L4 - Portable noise logger NTi XL2 (S/N: A2A-02422-D0); and
- Acoustical calibrator Larson Davis / NTi Type CAL200 calibrator (S/N 15600).

A noise logger consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory.

Figures 4 to 7 present the long-term noise monitoring locations.

The equipment used for noise measurements were class 1 instruments having accuracy suitable for field and laboratory use.

The instrument was calibrated prior and subsequent to measurements using a Larson Davis / NTi Type CAL200 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS/NZS International Electrotechnical Commission (IEC) 61672.1:2019 *Electroacoustics – Sound Level Meters* and carries current National Association of Testing Authorities, Australia (NATA) certification (or if less than 2 years old, manufacturer's certification).

3.2 Noise Monitoring Results

Tables 4, 5, 6 and 7 presents ambient (i.e. all noise sources) noise levels measured over several days at logger locations L1, L2, L3 and L4, respectively.

Appendix A of this report presents a glossary of acoustical terminology used in this assessment.

Ambient noise levels at all noise logging locations were considered indicative of a rural area. Observations during our site inspections and playback of audio recordings noted that noise was mainly due to birds, insects and wind (rustling of leaves in trees).

Analysis of the evening noise data indicates that noise levels were heavily influenced by noise generated by insect activity typically between 6 pm and 10 pm. Noise from insects was removed from data analysis.

Appendix E of this report presents ambient noise levels measured over several days in graphical format.

Table 4: Summary of Ambient Noise Monitoring Results at Logger Location L1 (Olive Downs) (dBA)

Date (Year 2019)	$L_{eq,T}$			$L_{1,T}$			$L_{90,T}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Tuesday 10 September	46	32	39	55	37	36	26	23	24
Wednesday 11 September	50	33	41	59	37	41	31	25	28
Thursday 12 September	49	31	42	57	36	41	30	22	27
Friday 13 September	45	33	41	55	40	42	26	22	28
Saturday 14 September	43	34	40	53	41	42	26	23	26
Sunday 15 September	44	36	39	52	42	42	29	29	25
Monday 16 September	47	38	41	55	43	41	28	29	29
Tuesday 17 September	46	33	41	55	40	40	26	21	25
Wednesday 18 September	45	36	44	54	37	43	27	23	28
Thursday 19 September	47	43	43	56	47	43	30	34	28
Friday 20 September	48	39	42	56	44	41	34	32	27
Saturday 21 September	47	42	43	56	45	43	30	33	29
Sunday 22 September	45	40	44	54	47	41	30	32	25
Monday 23 September	48	38	45	57	44	41	32	31	25
Tuesday 24 September	49	47	34	58	50	38	31	33	29
Wednesday 25 September	-	-	-	-	-	-	-	-	-
Representative Levels	**47**	**37**	**41**	**55**	**42**	**41**	**29**	**27**	**27**

[1] Day = 7 am to 6 pm, Evening = 6 pm to 10 pm, Night = 10 pm to 7 am.

$L_{eq,T}$ = equivalent noise level over selected period of time, T.

$L_{1,T}$ = sound pressure level that is exceeded for 1 percent (%) of selected period of time, T.

$L_{90,T}$ = sound pressure level that is exceeded for 90% of selected period of time, T.

Table 5: Summary of Ambient Noise Monitoring Results at Logger Location L2 (Winchester Downs) (dBA)

Date (Year 2019)	$L_{eq,T}$			$L_{1,T}$			$L_{90,T}$		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Tuesday 10 September	41	29	34	48	37	37	27	18	19
Wednesday 11 September	45	34	38	51	44	41	29	23	23
Thursday 12 September	42	33	39	50	41	42	29	23	27
Friday 13 September	41	35	40	49	43	43	28	22	27
Saturday 14 September	43	36	39	51	41	43	26	29	29
Sunday 15 September	40	35	40	47	43	43	28	28	27
Monday 16 September	42	38	39	50	49	44	30	-	28
Tuesday 17 September	46	42	37	47	42	42	26	28	28
Wednesday 18 September	44	39	37	48	46	43	29	33	32
Representative Levels	**43**	**36**	**38**	**49**	**43**	**42**	**28**	**25**	**27**

Table 6: Summary of Ambient Noise Monitoring Results at Logger Location L3 (Vermont Park) (dBA)

Date (Year 2017)	$L_{eq, T}$			$L_{1, T}$			$L_{90, T}$		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Tuesday 8 August	47	34	39	54	36	32	27	22	19
Wednesday 9 August	50	30	42	54	30	32	28	19	18
Thursday 10 August	46	42	44	55	45	34	31	30	20
Friday 11 August	45	49	42	54	54	37	30	24	23
Saturday 12 August	45	48	44	55	52	34	31	24	18
Sunday 13 August	47	46	44	57	49	33	31	24	19
Monday 14 August	47	55	45	55	69	33	30	29	20
Tuesday 15 August	45	49	46	55	65	37	30	27	19
Wednesday 16 August	47	-	-	58	-	-	32	-	-
Representative Levels	**47**	**44**	**43**	**55**	**50**	**34**	**30**	**24**	**19**

Table 7: Summary of Ambient Noise Monitoring Results at Logger Location L4 (Deverill) (dBA)

Date (Year 2017)	$L_{eq, T}$			$L_{1, T}$			$L_{90, T}$		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Tuesday 8 August	37	28	37	46	27	31	23	20	20
Wednesday 9 August	41	28	37	48	28	30	25	20	20
Thursday 10 August	45	-	39	50	-	32	28	-	20
Friday 11 August	42	28	39	47	33	33	25	23	20
Saturday 12 August	40	23	41	49	25	32	25	21	20
Sunday 13 August	45	-	42	52	-	30	26	-	20
Monday 14 August	42	-	40	48	-	33	24	-	20
Tuesday 15 August	44	-	36	53	-	32	25	-	20
Wednesday 16 August	43	-	-	51	-	-	26	-	-
Representative Levels	**42**	**27**	**39**	**49**	**28**	**32**	**25**	**20**	**20**

3.3 Meteorology Effects

Weather information was obtained from the Iffley Weather Station for the monitoring periods. The meteorological conditions were conducive for measuring noise under typical conditions.

No rainfall and some light breezes (less than 5 metres per second [m/s]) were observed during the monitoring period. Noise data acquired during days that may have experienced wind conditions greater than 5 m/s conditions were compared to the data acquired during fine periods and where the data was found to be affected by adverse weather conditions, it was discarded from further analysis.

4 Noise & Vibration Objectives

The relevant noise legislation and guidelines for the Project include:

- *Environmental Protection Act 1994;*
- *Environmental Protection Regulation 2019;*
- *Environmental Protection (Noise) Policy 2019* (EPP [Noise]);
- *Model Mining Conditions Guideline* (Department of Environment and Science [DES], 2017);
- *EcoAccess Guideline - Planning for Noise Control Guideline* (Planning for Noise Control Guideline) (Department of Environment and Heritage Protection [DEHP], 2016);
- *EcoAccess Guideline - Assessment of Low Frequency Noise* (Assessment of Low Frequency Noise) (Queensland Environmental Protection Agency, 2004);
- *Guideline: Application requirements for activities with noise impacts* (DES, 2020);
- *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* (Department of Transport and Main Roads [TMR], 2013); and
- *Interim Guideline – Operational Railway Noise and Vibration* (TMR, 2019).

The *Environmental Protection Act 1994* and subordinate legislation (*Environmental Protection Regulation 2019* and EPP [Noise]) set environmental noise and vibration levels throughout Queensland.

The DES (formerly the DEHP) provides the *Model Mining Conditions Guideline* (DES, 2017) that provides example noise-related Environmental Authority conditions for mining projects, for the consideration by the relevant determining authority. The Model Mining Conditions document notes the example conditions can be modified to suit the circumstances of each project under consideration, where appropriate. The DES also provides other guidelines including the Planning for Noise Control Guideline (DEHP, 2016) and Assessment of Low Frequency Noise (Queensland Environmental Protection Agency, 2004).

4.1 Environmental Protection Regulation 2019

The environmental objective and performance outcomes specified in Schedule 8, Part 3, Division 1 of the *Environmental Protection Regulation 2019* are presented in Table 8.

Table 8: Operational Assessment as per the *Environmental Protection Regulation 2019*

Noise
Environmental Objective The activity will be operated in a way that protects the environmental values of the acoustic environment.
Performance Outcomes 1 Sound from the activity is not audible at a sensitive receptor. 2 The release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

After: *Environmental Protection Regulation 2019.*

4.2 Environmental Protection (Noise) Policy 2019

The statutory requirements for the control of environmental noise are set down in the EPP (Noise), which came into force on September 1, 2019. The EPP (Noise) sets *acoustic quality objectives* which are prescribed for enhancing or protecting the following environmental values:

> *(a) the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and*
>
> *(b) 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—*
>
> *(i) sleep;*
>
> *(ii) study or learn;*
>
> *(iii) be involved in recreation, including relaxation and conversation; and*
>
> *(c) the qualities of the acoustic environment that are conducive to protecting the amenity of the community.*

Acoustic quality objectives are nominated as indoor and outdoor goals for daytime (7 am to 6 pm) and evening (6 pm to 10 pm) periods. The quality objectives also nominate indoor goals during the quieter night time (10 pm to 7 am) periods to address potential sleep disturbance or awakenings.

Table 9 presents the EPP (Noise) acoustic quality objectives for daytime and evening periods, and the adjusted night time periods for dwellings.

For evaluation of noise predictions at the exterior of the building (i.e. outside), indoor objectives for night time periods are adjusted (i.e. increased) by 7 dBA (DEHP, 2016) to allow for the reduction of noise that would occur through the building with the windows open.

Table 9: Acoustic Quality Objectives

Location	Time of Day	Acoustic Quality Objectives (measured at the receptors) dBA			Environmental Value
		$L_{Aeq, adj, 1 hr}$	$L_{A10, adj, 1 hr}$	$L_{A1, adj, 1 hr}$	
Dwelling (for outdoors)	Daytime & evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime & evening	35	40	45	Health and wellbeing
	Night-time	30	35	40	Health and wellbeing in relation to the ability to sleep

After: EPP (Noise).

Notes: Daytime (7 am to 6 pm), evening (6 pm to 10 pm) and night time (10 pm to 7 am).

$L_{Aeq,adj, 1hr}$ = A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within a 1 hour period has the same mean square sound pressure of a sound that varies with time.

$L_{A10 ,adj,1 hr}$ = A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 10% of a 1 hour period when measured using a fast standardised response time.

$L_{A1 ,adj,1 hr}$ = A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 1% of a 1 hour period when measured using a fast standardised response time.

dBA = A-weighted decibels.

Table 10 presents operational noise limits outside a dwelling as adjusted from the acoustic quality objectives provided in Schedule 1 of the EPP (Noise).

Table 10: Operational Noise Limits Outside Dwellings

EPP (Noise) Schedule 1	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
$L_{eq, adj, 1 hr}$	35 + 7 = 42 dBA	35 + 7 = 42 dBA	30 + 7 = 37 dBA

Comparing the noise limits outside dwellings for daytime and evening calculated in Table 10 to those provided in Table 9 highlights that the 7 dBA adjustment used to calculate noise limit for night time is conservative.

Section 9 *Management Intent for Noise* of the EPP (Noise) states the following:

> *(2) To the extent it is reasonable to do so, noise must be dealt with in a way that ensures—*
>
> *(a) the noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and*
>
> *(b) background creep in an area or place is prevented or minimised.*
>
> *(3) Despite subsection (2)(b), if the acoustic quality objectives for an area or place are not being achieved or maintained, the noise experienced in the area or place must, to the extent it is reasonable to do so, be dealt with in a way that progressively improves the acoustic environment of the area or place.*
>
> *(4) In this section—*
>
> ***background creep**, for noise in an area or place, means a gradual increase in the total amount of background noise in the area or place as measured under the document called the 'Noise measurement manual' published on the department's website.*

Tables 4, 5, 6 and 7 show the representative measured background noise levels ($L_{A90, T}$) were lower than 30 dBA during the daytime, evening and night time periods. The *Model Mining Conditions Guideline* (DES, 2017) (discussed further in Section 4.3) nominates that in the event that measured background ($L_{A90, adj, 15 mins}$) is less than 30 dBA, then 30 dBA can be substituted for the measured background level.

Note the *Noise Measurement Manual* (DEHP, 2013) provides methodology on measuring background noise, but does not provide an assessment or quantification of background creep.

In regard to the application of background creep to mining projects, a notable Land Court of Queensland judgement (*New Acland Coal Pty Ltd v Ashman & Ors and Chief Executive, Department of Environment and Heritage Protection (No. 4) [2017] QLC 24*) considered the management intent for an activity under a now repealed version of the earlier EPP (Noise). That document fixed background creep for noise that varies over time measured by $L_{Aeq,adj,T}$ at 5 dBA greater than the existing acoustic environment measured by $L_{A90,T}$.

The background noise levels in that case were such that a minimum deemed background noise level of 30 dBA were applied. As noted above, that is also the case here. Table 11 presents background creep noise limits outside a dwelling based on the Land Court.

Table 11: Background Creep Noise Limits Outside Dwellings

Background Creep Noise Limit	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
$L_{eq, adj, 15 mins}$	35 + 5 = 40 dBA	30 + 5 = 35 dBA	30 + 5 = 35 dBA

It is noted that the background creep noise limits calculated in Table 11 are more conservative (i.e. less) than the operational noise limits calculated in Table 10[1].

Of relevance to the Project, the noise limits calculated in Table 11 are the same noise limits for evening and night time adopted for the assessment of the neighbouring Olive Downs Project, based on similar background noise levels. The evening and night time noise limits were described as stringent in the *Olive Downs project Coordinator-General's evaluation report on the environmental impact statement* (Department of State Development, Manufacturing, Infrastructure and Planning, 2019), with the Coordinator-General stating these limits were to be included in the Environmental Authority for the Olive Downs Project.

It is considered that the background creep noise limits set out at Table 11 are appropriate and conservative for the Project.

[1] As well as being consistent with the Land Court, the 'plus 5 dBA' allowable background creep is consistent with the New South Wales (NSW) *Noise Policy for Industry* which allows for a 'controlled increase' in background noise levels (NSW Environment Protection Authority, 2017).

4.3 Model Mining Conditions Guideline

Schedule D – Noise of the *Model Mining Conditions Guideline* (DES, 2017) sets noise limits for mining activities.

Condition D1 nominates that:

The holder of this environmental authority must ensure that noise generated by the mining activities does not cause the criteria in Table D1 – Noise limits to be exceeded at a sensitive place or commercial place.

Table D1, referred to in Condition D1, is reproduced below as Table 12.

Table 12: Noise Limits (Table D1 in Schedule D – Noise)

Sensitive Place						
Noise Level dBA measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7 am to 6 pm	**6 pm to 10 pm**	**10 pm to 7 am**	**9 am to 6 pm**	**6 pm to 10 pm**	**10 pm to 9 am**
$L_{Aeq, adj\ 15\ mins}$	CV = 50 AV = 5	CV = 45 AV = 5	CV = 40 AV = 0	CV = 45 AV = 5	CV = 40 AV = 5	CV = 35 AV = 0
$L_{A1, adj\ 15\ mins}$	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5
Commercial Place						
Noise Level dBA measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7 am to 6 pm	**6 pm to 10 pm**	**10 pm to 7 am**	**7 am to 6 pm**	**6 pm to 10 pm**	**10 pm to 7 am**
$L_{Aeq, adj\ 15\ mins}$	CV = 55 AV = 10	CV = 50 AV = 10	CV = 45 AV = 5	CV = 50 AV = 10	CV = 45 AV = 10	CV = 40 AV = 5

After: DES, 2017

Note: L_{Aeq} = A-weighted equivalent noise level.

Table D1 – Noise limits notes:

1. *CV = Critical Value*
2. *AV = Adjustment Value*
3. *bg = background noise level ($L_{A90, adj, 15\ mins}$) measured over 3-5 days at the nearest sensitive receptor*
4. *To calculate noise limits in Table D1:*

If bg ≤ (CV – AV): *Noise limit = bg + AV*

If (CV – AV) < bg ≤CV: *Noise limit = CV*

If bg > CV: *Noise limit = bg + 0*

5. *In the event that measured bg ($L_{A90, adj, 15\ mins}$) is less than 30 dB(A), then 30 dB(A) can be substituted for the measured background level*

6. *If the project is unable to meet the noise limits as calculated above alternative limits may be calculated using the processes outlined in the "Planning for Noise Control" guideline.*

Monitoring and reporting

Condition D3 nominates that:

Noise monitoring and recording must include the following descriptor characteristics and matters:

a) $L_{AN,T}$ (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins)

b) background noise LA90

c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels

d) atmospheric conditions including temperature, relative humidity and wind speed and directions

e) effects due to any extraneous factors such as traffic noise

f) location, date and time of monitoring

g) if the complaint concerns low frequency noise, Max LpLIN,T and one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range.

Example noise limits

Table 13 presents the example noise limits calculated based on the *Model Mining Conditions Guideline* (DES, 2017) noise limits shown in Table 12 and measured background levels shown in Tables 4, 5, 6 and 7.

Based on the rural land zoning, the example noise limits are 35 dBA $L_{eq,\ adj\ 15\ mins}$ during the day and evening periods and 30 dBA $L_{eq,\ adj\ 15\ mins}$ during the night time period at receptor locations.

Table 13: Example Noise Limits (based on Table D1 in Schedule D – Noise)

Sensitive Place						
Noise Level dBA measured as:	**Monday to Saturday**			**Sundays and Public Holidays**		
	7 am to 6 pm	**6 pm to 10 pm**	**10 pm to 7 am**	**9 am to 6 pm**	**6pm to 10 pm**	**10 pm to 9 am**
$L_{Aeq,\ adj\ 15\ mins}$	CV = 50 AV = 5 CV – AV = 45 Bg = 29 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 35	CV = 45 AV = 5 CV – AV = 40 Bg = 27 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 35	CV = 40 AV = 0 CV – AV = 40 Bg = 27 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 30	CV = 45 AV = 5 CV – AV = 40 Bg = 29 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 35	CV = 40 AV = 5 CV – AV = 35 Bg = 29 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 35	CV = 35 AV = 0 CV – AV = 35 Bg = 25 Take 30 dBA bg ≤(CV – AV) NL = bg + AV NL = 30

4.4 Blasting Noise & Vibration

The *Model Mining Conditions Guideline* (DES, 2017) includes noise and vibration limits for blasting operations. Table 14 presents an extract from the *Model Mining Conditions Guideline* (DES, 2017) showing noise and vibration limits for blasting operations.

Table 14: Blasting Noise & Vibration Limits (Table D2 in Schedule D – Model Mining Conditions Guideline)

Blasting Emission	Sensitive or Commercial Blasting Noise & Vibration Limits	
	7 am to 6 pm	**6 pm to 7 am**
Airblast overpressure	115 decibels (dB) (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time	Either no blasting or limits justified by proponent not less stringent than 7 am – 6 pm
Ground vibration (peak particle velocity [PPV])	5 millimetres per second (mm/s) PPV for 9 out of 10 consecutive blasts and not greater than 10 mm/s PPV at any time	Either no blasting or limits justified by proponent not less stringent than 7 am – 6 pm

After: *Model Mining Conditions Guideline* (DES, 2017).

4.5 Planning for Noise Control

The Planning for Noise Control Guideline (DEHP, 2016) is older than the *Model Mining Conditions Guideline* (DES, 2017) and includes some relevant guidance not included in the latter guideline.

Relevant parts of the Planning for Noise Control Guideline have been applied to the Project, including use of information regarding meteorological effects, noise adjustment factors and sleep disturbance.

Meteorological Effects

The Planning for Noise Control Guideline (DEHP, 2016) specifies that the prevailing and worst case meteorological conditions (wind, temperature, humidity and temperature inversions) at the planned development and receptor locations must be determined. The Planning for Noise Control Guideline describes that noise levels should be calculated at receptor locations for a range of typical operating scenarios and conditions that are representative of the proposed facility, including worst case meteorological conditions.

Wind effects should be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receptor winds (at 10 m height) of less than or equal to 3 m/s occur for 30% of the time or more in any assessment period (day, evening, night) in any season.

There are generally two methods to assess wind effects:

- Use available wind data or wind roses to determine the frequency of occurrence and wind speed, taking into account the various components of wind that are relevant.
- Simply assume that wind is a feature of the area (foregoing the need to use wind data or wind roses) and apply a 'maximum impact' scenario by using the default 3 m/s wind at 10 m height.

Where there is 30% or more occurrence of wind speeds below 3 m/s (source-to-receptor component), then the highest wind speed is used (below 3 m/s) instead of the default. Where there is less than a 30% occurrence of wind up to 3 m/s (source-to-receptor component), wind is not included in the noise prediction calculations.

An occurrence of temperature inversions of 30% of the total night time period during winter (June, July and August) is selected by the Planning for Noise Control Guideline as representing a significant noise impact warranting further assessment.

There are two options for determining temperature inversion parameters:

- use default parameters for temperature inversions and drainage flow wind speed where inversions are present for at least 30% of the total night time during winter as specified; or
- use parameters determined by direct measurement. Wind data should be collected at 10 m height.

The default inversion parameters for non-arid areas (annual average rainfall greater than 500 millimetres [mm]), as is the case for the Project, are:

- moderate (F-class stability category) inversions; and
- 3 degrees Celsius per 100 metres (°C/100 m) temperature inversion strength for all receptors plus a 2 m/s source to receptor component drainage flow wind speed for those receptors where applicable.

Noise Adjustment Factors

K_1= Tonal adjustment (noise contains distinguishable, discrete, continuous whine, hiss, screech, hum).

K_2= Impulsive adjustment (noise contains distinct impulses such as bangs, clicks, clatters or thumps).

Subjectively for K1 and K2:

If just detectable: add 2 dBA.

If prominent (clearly audible): add 5 dBA.

These factors are particularly relevant during the noise compliance (i.e. operational) stage of the Project. If the noise emissions are audible at the nearest receptor noise, adjustments may be necessary. If a tonal or impulsive characteristic is just detected at the measurement position, then 2 dBA should be added to the measured noise levels. If a tonal or impulsive characteristic is clearly detected at the measurement position, then 5 dBA should be added to the measured noise levels.

Sleep Disturbance

The Planning for Noise Control Guideline (DEHP, 2016) recommends that, for good sleep over eight hours, the indoor sound pressure level measured as an instantaneous value should not exceed approximately 45 dBA maximum instantaneous noise level ($maxL_{pA}$) more than 10 – 15 times per night.

The corresponding external noise level, assuming partially closed windows, is 52 dBA $maxL_{pA}$ measured in the free field (4 m from the façade of a building). This criterion only applies to the night time period between 10 pm and 7 am.

4.6 Low Frequency Noise Criteria

The Assessment of Low Frequency Noise guideline (Queensland Environmental Protection Agency, 2004) is applicable to low frequency noise (frequencies less than 200 Hertz [Hz]) emitted from commercial premises, industrial premises, mining and extractive operations.

Where noise emissions show low frequency, the overall sound pressure level inside residences should not exceed 50 Z-weighted decibels (dBZ) to avoid complaints of low frequency noise annoyance.

We note 50 dBZ is an internal noise limit. A correction of 5 dBZ (open window) is assumed for outside to inside the building through an open window. For low frequency noise (<200 Hz) the external noise limit should be 55 dBZ measured in the free field (4 m from the façade of a building).

4.7 Road Traffic Noise

The TMR *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* (2013) provides a noise limit of $L_{10\ (18hr)}$ 68 dBA at noise sensitive receptors for existing roads and road upgrades.

4.8 Rail Noise

The *Interim Guideline – Operational Railway Noise and Vibration* (TMR, 2019) operational railway noise criteria for airborne noise from railway activities (train movements) are $L_{eq\ (24hour)}$ 65 dBA and Single Event Maximum 87 dBA $maxL_p$ for existing railways.

4.9 Proposed Noise & Vibration Objectives for the Project

As described in Section 4.2, the operational noise criteria determined based on the background creep provisions of the EPP (Noise) are conservative, and are consistent with those adopted for assessment of the neighbouring Olive Downs Project. Given the Coordinator-General stated these criteria were stringent, and indicated they would be included in the Environmental Authority for the Olive Downs Project (Department of State Development, Manufacturing, Infrastructure and Planning, 2019), the same criteria have been adopted for assessment of the Project.

Table 15 summarises the noise limits adopted for assessment of the Project.

Table 15: Summary of Adopted Noise Limits (external)

Noise Issue	Applicable Time Period	Relevant Noise Limit
Operations	Daytime (7 am to 6 pm)	40 dBA $L_{Aeq,\ adj\ 15\ mins}$
	Evening (6 pm to 10 pm)	35 dBA $L_{Aeq,\ adj\ 15\ mins}$
	Night time (10 pm to 7 am)	35 dBA $L_{Aeq,\ adj\ 15\ mins}$
Sleep Disturbance	Night time (10 pm to 7 am)	52 dBA $maxL_p$
Low Frequency	All Periods	55 dBZ
Road Traffic	6 am to 12 midnight	68 dBA $L_{eq,\ 18\ hour}$
Rail Traffic	All Periods	65 dBA $L_{Aeq,\ 24\ hours}$ 87 dBA $maxL_p$

Table 16 summarises the blasting noise and vibration objectives for the Project.

Table 16: Summary of Blasting Noise & Vibration Objectives

Blasting Emission	Sensitive or Commercial Blasting Noise & Vibration Objectives	
	7 am to 6 pm	6 pm to 7 am
Airblast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 120 dB (Linear) Peak at any time	Either no blasting or limits justified by proponent not less stringent than 7 am – 6 pm
Ground vibration (PPV)	5 mm/s PPV for 9 out of 10 consecutive blasts and not greater than 10 mm/s PPV at any time	Either no blasting or limits justified by proponent not less stringent than 7 am – 6 pm

5 Noise Impact Assessment

5.1 Calculation Methodology

Noise levels were predicted by modelling the noise sources, receptor locations and topographical features of the intervening area using the Cadna (version 2020) noise prediction computer program. Cadna is an internationally recognised environmental noise prediction computer program that can be used to model transportation noise, construction noise and general industry noise. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.

The noise prediction models take into account:

- location of noise sources and receptor locations;
- height of sources and receptors;
- separation distances between sources and receptors;
- ground type between sources and receptors;
- attenuation from barriers (natural and purpose built); and
- meteorological effects.

All predictions have been conducted in accordance with ISO 9613-2:1996 *Acoustics – Attenuation of sound propagation outdoors – Part 2: General method of calculation*.

5.2 Meteorological Effects

Certain meteorological conditions may increase noise levels by focusing sound-wave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level) and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receptor.

Temperature inversions occurring within the lowest 50 m to 100 m of atmosphere can affect noise levels measured on the ground. Temperature inversions are most commonly caused by radiative cooling of the ground at night leading to the cooling of the air in contact with the ground. This is especially prevalent on cloudless nights with little wind. Air that is somewhat removed from contact with the ground will not cool as much, resulting in warmer air aloft than nearer the ground.

Similarly, when significant wind exists, the conditions can significantly affect noise levels at receptor points downwind of a noise source. This would depend, however, on the particular direction and the velocity of the wind at that time. It should also be noted that although wind can raise noise levels as perceived from a downstream assessment point, background noise also tends to increase as a result of increased wind activity. This often causes masking of potential increases in intrusive noise.

5.2.1 Wind Effects

Gradient wind differs from the drainage-flow wind associated with temperature inversions. Drainage-flow wind is the localised drainage of cold air under the influence of the local topography, and travels in one direction only (direction of decreasing altitude). Gradient wind is the regional wind determined by synoptic factors (high and low-pressure systems), and may originate from any direction.

Unlike temperature inversions, gradient winds may cause impacts during any assessment period, (day, evening and night), and not just the night period.

A review of long term wind effects in the local area was undertaken in order to determine predominant wind directions and flows.

Our analysis of the wind roses (refer to Appendix C) concluded that wind effects were not a particular feature of the area. That is, source to receptor winds (at 10 m height) of equal to or less than 3 m/s do not occur for 30% of the time or more in any assessment period (day, evening, night) in any season. For the Project we have therefore not used the default wind effects parameter of 3 m/s.

5.2.2 Temperature Inversions

An occurrence of 30% of the total night time period during winter (June, July and August) is selected by the Planning for Noise Control Guideline (DEHP, 2016) as representing a significant noise impact warranting further assessment.

There is no specific meteorological data available for the Project area to determine if temperature inversions occur for more than 30% of the total night time period during winter (June, July and August). The default inversion parameters have been conservatively adopted for modelling purposes as follows:

Non-arid areas (annual average rainfall greater than 500 mm):

- *Moderate (F-class stability category) inversions; and*
- *3°C/100 m temperature inversion strength for all receivers plus a 2 m/s source to receiver component drainage flow wind speed for those receivers where applicable.*

In the absence of specific data for temperature inversion around the site we have adopted the default inversion parameters listed above for assessment purposes. That is, a Moderate (F-class) stability category and a 2 m/s source-to-receptor component drainage flow wind speed have been adopted.

5.3 Operations Noise

5.3.1 Noise Modelling Scenarios

Four operational scenarios have been selected for noise modelling purposes, Project Years 5, 9, 19 and 27. These scenarios were selected in consideration of the scale of mining operations in each year of the Project, number of major mobile equipment and proximity of operations to sensitive receptors. Fleet locations showing the haul truck and excavator/shovel locations were provided for the selected years by Whitehaven WS.

The scenarios are expected to generate the highest noise levels at the nearest receptors based on the number of mining plant and locations. As the mine pit depth increases, noise emissions from some plant sources would decrease due to additional noise shielding from the pit walls. The selected operational scenarios are considered to be representative of the proposed mining operations in terms of noise emissions and therefore suitable for assessment purposes. It is noted that the selected scenarios exclude consideration of noise emissions generated from construction/commissioning activities (Project Years 1 to 3) and mine closure activities, as these activities would generate lower noise emissions than the selected operational scenarios (i.e. because they involve less numbers of mobile fleet than the selected operational scenarios). Given the impacts assessed would represent the "worst-case" scenarios, it is considered that any impacts associated with construction and mine closure activities would be considered as part of the assessment of the selected scenarios.

5.3.2 Fleet Locations & Numbers

Table 17 presents a summary of the typical Project mining fleet during the selected modelling years.

Table 17: Indicative Fleet Numbers for Selected Years

Fleet/ Infrastructure Item	Indicative Model	Location / Function	Number of Equipment			
			Year 5	Year 9	Year 19	Year 27
Excavators	Liebherr R9350	800 tonne (t) Waste Excavator	2	2	2	2
	Hitachi EX3600	350 t Coal Excavator	3	3	3	3
	Hitachi EX8000	Waste Rock/Coal Removal	4	5	5	2
Haul Trucks	Hitachi EH5000	Haul Roads	26	30	26	12
	Caterpillar CAT793	Haul Roads	25	27	30	22
Loader	Caterpillar CAT994	ROM	1	1	1	1
Drill	Sandvik D90KS	Waste Rock/Coal Removal	6	6	6	4
Dozers	Caterpillar D11T	Waste Emplacement	13	13	13	10
	Caterpillar D10T	Waste Emplacement	6	6	6	4
	Caterpillar Wheel Dozer	Coal and Partings Preparation	3	3	3	3
Graders	Caterpillar 24M	Haul Roads	4	4	4	3
	Caterpillar 16M	Haul Roads	2	2	2	2
Water Truck	80 kilolitre (kL)	Haul Roads	2	2	2	2
	120 kL	Haul Roads	4	4	4	2

Note: Assumed Project Year 1 is 2022.

5.3.3 Indicative Fleet Locations & Haul Routes

Appendix B presents the indicative fleet locations used for modelling Project Years 5, 9, 19 and 27.

5.3.4 Sound Power Levels

Noise data for the indicative Project mining equipment (both fixed and mobile) used in the model is presented in Table 18 as octave band frequency data (in dBZ) and overall sound power level (in dBA).

Table 18: Indicative Sound Power Levels for Project Mining Equipment

Plant Item[1]	Octave band centre frequency – Hz (dBZ)								Overall dBA
	63	125	250	500	1k	2k	4k	8k	
Liebherr R9350	115	126	122	121	119	114	108	103	123
Hitachi EX3600 Excavator	111	105	100	100	111	111	106	98	115
Hitachi EX8000 Excavator	115	126	122	121	119	114	108	103	123
Hitachi EH5000	128	128	123	119	114	111	105	100	121
Caterpillar 793	125	125	120	116	111	108	102	97	118
Sandvik D90KS Drill	117	124	116	114	113	113	108	104	119
Caterpillar D11T Dozer	121	111	112	119	112	113	103	92	119
Caterpillar D10T Dozer	111	117	113	114	112	108	102	97	116
Caterpillar 994 (Wheel Dozer)	117	123	119	111	107	101	91	83	115
Caterpillar 24M Grader	102	118	113	112	110	107	101	95	115
Caterpillar 16M Grader	102	111	104	109	110	105	100	100	113
Caterpillar 777 Water	118	116	112	109	106	104	97	90	112
CHPP	122	122	117	114	111	108	102	95	117
Train Loading Bin	107	109	103	99	97	94	92	82	103
Train on rail spur	108	105	101	100	101	103	100	97	108
Dump Hopper	109	107	107	108	105	100	93	83	109
Conveyor Drive Stations	115	111	105	103	99	93	86	79	105
Conveyor (per metre)	80	81	81	83	77	72	63	55	83
Tertiary Sizer	115	116	111	111	107	102	95	88	112
Secondary Sizer	115	116	111	111	107	102	95	88	112
Vibratory Feeder	115	116	111	111	107	102	95	88	112
Roller Screen	115	116	111	111	107	102	95	88	112
Stacker	105	106	102	102	98	97	90	84	104

[1] - Model numbers are indicative only.

5.3.5 Predicted Operational Noise Levels

Project noise levels for Project Years 5, 9, 19 and 27 were predicted at the nearest residential receptors previously discussed in Section 2.4.

Noise reductions from the source-to-receptor typically resulted from distance attenuation, air absorption, ground absorption and shielding afforded by intervening natural and constructed topography. Noise control treatment was also included in the noise modelling.

Appendix D presents noise contour maps for Project Years 5, 9, 19 and 27 modelling scenarios under neutral and adverse weather conditions.

5.3.6 Neutral Weather Conditions

Table 19 presents predicted operational noise levels at each receptor. The $L_{eq, adj\ 15\ mins}$ values are A-weighted and correspond to the way the human ear responds to sounds at different frequencies.

Table 19 shows noise levels during neutral weather conditions (i.e. calm conditions) are predicted to comply with the day, evening and night noise objectives (Table 15) at Winchester Downs homestead (NSR 2), Coolibah homestead (NSR3) and Vermont Park homestead (NSR4). Noise levels are predicted to exceed the relevant noise objectives during the evening and night time periods at Olive Downs homestead (NSR1) by up to 5 dBA despite reasonable and feasible mitigation measures (Section 6.1).

Table 19: Predicted Operational Noise Levels ($L_{eq, adj\ 15\ mins}$) at the Nearest Noise Sensitive Receptors (Neutral Weather Conditions) - dBA

Receptor ID	Property Name	Operational Noise Levels, $L_{eq, adj\ 15\ mins}$			
		Year 5	Year 9	Year 19	Year 27
NSR1	Olive Downs homestead	40	40	40	40
NSR2	Winchester Downs homestead	24	20	19	20
NSR3	Coolibah homestead	14	11	11	11
NSR4	Vermont Park homestead	12	14	14	16

5.3.7 Adverse Weather Conditions

Table 20 presents predicted operational noise levels at each receptor.

Table 20 shows noise levels during adverse weather conditions are predicted to comply with the day, evening and night time noise objectives (Table 15) at Winchester Downs homestead (NSR 2), Coolibah homestead (NSR3) and Vermont Park homestead (NSR4). Noise levels are predicted to exceed the relevant noise objectives at Olive Downs homestead (NSR1) by up to 12 dBA despite reasonable and feasible mitigation measures.

Table 20: Predicted Operational Noise Levels ($L_{eq, adj\ 15\ mins}$) at the Nearest Noise Sensitive Receptors (Adverse Weather Conditions) - dBA

Receptor ID	Property Name	Operational Noise Levels, $L_{eq, adj\ 15\ mins}$			
		Year 5	Year 9	Year 19	Year 27
NSR1	Olive Downs homestead	47	47	46	46
NSR2	Winchester Downs homestead	32	28	27	28
NSR3	Coolibah homestead	20	19	18	18
NSR4	Vermont Park homestead	19	21	22	23

5.4 Low Frequency Noise

Table 21 presents predicted low frequency operational noise levels for neutral weather conditions at each receptor. The values represent Z-weighted L_{eq} for frequencies less than 200 Hz.

Table 21: Predicted Operational Noise Levels (L_{eq}) at the Nearest Noise Sensitive Receptors (Neutral Weather Conditions), dBZ (<200 Hz)

Receptor ID	Property Name	Operational Noise Levels, L_{eq}			
		Year 5	Year 9	Year 19	Year 27
NSR1	Olive Downs homestead	56	57	56	56
NSR2	Winchester Downs homestead	42	40	39	40
NSR3	Coolibah homestead	39	35	35	35
NSR4	Vermont Park homestead	35	37	37	39

Table 21 shows low frequency noise (<200 Hz) is expected to comply with the noise limit of 55 dBZ (measured 4 m from the building facade) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Noise levels are predicted to marginally exceed the noise limit of 55 dBZ (measured 4 m from the building facade) at Olive Downs homestead (NSR1) by up to 2 dBZ despite reasonable and feasible mitigation measures.

Table 22 presents predicted low frequency operational noise levels for adverse weather conditions at each receptor. The values represent Z-weighted L_{eq} for frequencies less than 200 Hz.

Table 22 shows low frequency noise (<200 Hz) is expected to comply with the noise limit of 55 dBZ (measured 4 m from the building facade) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Table 22: Predicted Operational Noise Levels (L_{eq}) at the Nearest Noise Sensitive Receptors (Adverse Weather Conditions), dBZ (<200 Hz)

Receptor ID	Property Name	Operational Noise Levels, L_{eq}			
		Year 5	Year 9	Year 19	Year 27
NSR1	Olive Downs homestead	59	59	59	59
NSR2	Winchester Downs homestead	47	45	44	44
NSR3	Coolibah homestead	43	39	39	39
NSR4	Vermont Park homestead	39	41	41	43

Noise levels are predicted to exceed the noise limit of 55 dBZ (measured 4 m from the building facade) at Olive Downs homestead (NSR1) by up to 4 dBZ despite reasonable and feasible mitigation measures.

6 Noise Mitigation Measures

The assessment methodology involved a review of reasonable and feasible mitigation measures that could be implemented to reduce noise emissions from the Project. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of various stages of the Project (including stages when noise levels at sensitive receptors would be expected to be greatest) to identify the potential for noise exceedances.

2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.

3. Review of the effectiveness of these measures and assessment of their feasibility by Whitehaven WS.

4. Adoption of management and mitigation measures to appreciably reduce noise emissions associated with the Project.

The adopted mitigation and management measures are described below.

Potential noise management and mitigation measures that would achieve a reduction in Project noise levels under neutral and adverse meteorological conditions were evaluated with respect to the feasibility of implementing the measures for the Project. These measures included attenuation of the CHPP and associated processing areas.

While technically feasible, measures to achieve the objective of reducing noise levels at the most-affected receptors were then evaluated in light of the relative costs and benefits that would arise, including potential receptor amenity benefits and corresponding capital and operating costs.

Analysis of the noise model and noise source locations indicated the CHPP is the dominant noise source contributing to noise levels at the nearest receptor, Olive Downs homestead.

With the adoption of reasonable attenuation for the CHPP and associated processing areas, noise levels at Olive Downs homestead are predicted to remain above the Project noise limits. Further mitigation of the CHPP and other sources were not considered feasible.

Whitehaven WS recognises the importance of noise compliance at all sensitive receptors. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the owner of the Olive Downs homestead and has proposed environmental authority conditions that would give effect to the agreed position.

6.1 Operation Management

To manage noise impacts at the nearby sensitive receptors, Whitehaven WS would implement noise mitigation on fixed plant at the CHPP. Whitehaven WS consider the mitigation measures to be reasonable and feasible for the Project.

Whitehaven WS would also implement proactive and reactive noise control measures. These measures would include the use of weather forecasting and real-time measurement of meteorological conditions to modify mining operations as required in order to detect any upset conditions and achieve compliance with applicable noise limits at the nearest sensitive receptors (including the Olive Downs homestead, which would be managed in accordance with an agreement with the landowner and relevant environmental authority conditions).

Modifying mining operations could include reducing the intensity of particular operations, relocating particular operations or halting particular operations.

7 Blasting

The Project mining operations would include drilling and blasting overburden and interburden material. Potential blasting impacts from ground vibration and airblast overpressure are assessed below.

7.1 Ground Vibration

The 'minimum distance limits' from blasting in terms of the vibration have been determined using the attenuation formula in AS 2187.2-2006: *Explosives – Storage, Transport and Use – Part 2 Use of Explosives*. The standard presents information for estimating free face blasting in 'average field conditions'. Estimation of 'minimum distance limits' is based the following equation:

$$V = K\left(\frac{R}{Q^{1/2}}\right)^{-1.6}$$

where

V = ground vibration as PPV in mm/s.

K = constant related to site and rock properties for estimation purposes. K = 1140 for free face blasting in 'average field conditions'.

R = distance between charge and point of measurement in m.

Q = effective charge mass per delay or maximum instantaneous charge (MIC) in kilograms (kg).

Table 23 presents allowable MIC at various distances required to comply with blasting vibration limit of 5 mm/s PPV shown in Table 15. The minimum distance limits have been determined for free face blasting in 'average field conditions'.

Table 23: Calculated MIC based on various separation distances to comply with 5 mm/s PPV

Distance from blasting (m)	MIC (kg)
1,000	1,129
1,500	2,540
2,000	4,515
2,500	7,054

Based on Table 23 above and expected separation distance to the nearest sensitive receptors, typical MIC sizes (in the range of 3,000 kg to 6,000 kg) would be expected to be below the vibration objective for the Project at the sensitive receptors such as the Olive Downs homestead located approximately 4.2 km from the open cut pit. It is noted that blast design would be informed by site-specific blast monitoring.

MIC sizes during other stages of the Project (e.g. construction, commissioning and closure) (if required) would be expected be lower than during operations. As such, blasting during other stages of the Project is also expected to be below the vibration objectives at the sensitive receptors.

7.2 Airblast Overpressure

The 'minimum distance limits' from blasting in terms of the airblast overpressure have been determined using the attenuation formula in AS 2187.2-2006: *Explosives – Storage, Transport and Use – Part 2 Use of Explosives*. The standard presents information for estimating free face blasting in 'average field conditions'. Estimation of 'minimum distance limits' is based the following equation:

$$P = Ka\left(\frac{R}{Q^{1/3}}\right)^{-1.45}$$

where

P = pressure, in kilopascals.

Ka = site constant.

R = distance (m) between charge and point of measurement.

Q = effective charge mass per delay or MIC in kg.

For confined blasthole charges, when using a site exponent of -1.45, the site constant Ka is commonly in the range of 10 to 100.

A second methodology was also used to calculate potential airblast overpressure levels based on research and analysis conducted by Renzo Tonin & Associates at Rix's Creek Coal Mine located 5 km north-west of Singleton, New South Wales. The following equation was developed from the Rix's Creek Coal Mine data:

$Lp = 167 + 6.5 \times \log_{10}Q - 23 \times \log_{10}R$

where

Lp = airblast overpressure sound level in dBZ.

R = distance (m) between charge and point of measurement.

Q = effective charge mass per delay or MIC in kg.

Table 24 presents allowable MIC at various distances required to comply with the *Model Mining Conditions Guideline* (DES, 2017) blasting airblast overpressure objective of 115 dBZ shown in Table 15.

Table 24: Calculated MIC based on various separation distances to comply with 115 dBZ

Distance from blasting (m)	AS 2187.2-2006		MIC (kg) (Renzo Tonin & Associates equation based on Rix's Creek Coal Mine data)
	Ka = 10	Ka = 100	
1,000	792	7	412
1,500	2,673	23	1,732
2,000	6,335	54	4,793
2,500	12,375	106	10,556

Table 24 shows a large range of MICs for various distances based on the equation used in the calculation process. The prediction equation developed by Renzo Tonin & Associates indicates that the MIC sizes (typically in the range of 3,000 kg to 6,000 kg) would be expected to be below the airblast overpressure objective for the Project at the sensitive receptors such as the Olive Downs homestead located approximately 4.2 km from the open cut pit. It is noted that blast design would be informed by site-specific blast monitoring.

7.3 Flyrock

Flyrock is any material ejected from the blast site by the force of the blast. Given the proximity of mining areas to the Norwich Park Branch Railway, Whitehaven WS would consult with Aurizon, operators of the railway, regarding potential flyrock impact and, if necessary, temporary closure of the railway during blast events.

8 Miscellaneous Issues

8.1 Cumulative Impact with Other Existing/Approved Industry

Ambient noise monitoring determined existing background noise levels for daytime, evening and night-time periods. This noise impact assessment has set applicable noise limits based on both the ambient noise monitoring and the background creep provisions of the EPP (Noise).

8.1.1 Existing Industry

Winchester Quarry is located in the northern part of the Project area and is operated by Quarrico Products Pty Ltd (Quarrico). Quarrico currently operates Winchester Quarry under an environmental authority (EPPR00930713) which allows for the extraction and screening of 5,000 t to 100,000 t of material per year.

Long-term noise monitoring and numerous site inspections found that existing industrial noises (including operation of the Winchester Quarry) were generally inaudible within the Project area. Notwithstanding, it is noted that the Olive Downs homestead is in proximity to approved open cut mining operations at Poitrel and Daunia mines, which is further discussed below.

The existing Poitrel Mine is operated by BHP Mitsui Coal and is located approximately 5.8 km north-west of Olive Downs homestead (NSR1). Review of Poitrel documentation indicates the extent of the open cut of Poitrel reaches approximately 2 to 3 km from the Olive Downs homestead.

The existing Daunia Mine is located approximately 5.6 km north of Olive Downs homestead (NSR1). Review of Daunia EIS documentation (Sinclair Knight Merz, 2008) indicates Year 15 of the mine life corresponds to 2024 and Year 20 corresponds to 2029. It appears that the mining operations at the Daunia Mine may have ceased after Year 9 of the Project scenario and therefore cumulative impacts after this time would be limited to potential cumulative impacts from the neighbouring Olive Downs Project or Moorvale South Project (Section 8.1.2).

Table 25 shows a comparison of the Project scenarios versus estimated cumulative noise impacts from both the Daunia and Poitrel mines (for similar year scenarios). This information was sourced from Tables 12-16 and 12-17 (page 12-22) of the Daunia Coal Mine Project – Environmental Impact Statement (Sinclair Knight Merz, 2008).

Table 25 shows predicted operational noise levels of 36 dBA (neutral weather) and 41 dBA (adverse weather) with both mines operating (Daunia and Poitrel). The worst-case contribution from the Poitrel Mine at the Olive Downs homestead would be 25 dBA (BHP Billiton, 2005) (i.e. the primary noise contribution from the Daunia and Poitrel Mines would be from the Daunia Mine).

Table 25: Cumulative Noise Impacts at Olive Downs homestead from both Daunia & Poitrel Mines

Winchester South Mine Year Scenario	Daunia and Poitrel Mines (indicative year)	Predicted Operational Noise Levels from Daunia & Poitrel Mines (L_{eq} dBA)	
		Neutral Weather	Adverse Weather
Year 5 (2027)	Year 20 (2029)	36	41
Year 9 (2031)	Year 20 (2029)	36	41
Year 19 (2041)	N/A	N/A	N/A
Year 27 (2049)	N/A	N/A	N/A

In comparison, Tables 19 and 20 showed predicted operational noise levels of 40 dBA (neutral weather) and 47dBA (adverse weather) at the Olive Downs homestead for both Year 5 and Year 9 of the Project. Accordingly, the Project would be the primary noise contribution at the Olive Downs homestead.

Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner regarding acoustic treatment of the building or other suitable measures.

8.1.2 Approved Industry

The Olive Downs Project is an approved metallurgical coal mine development proposed by Pembroke Olive Downs Pty Ltd. The Olive Downs Project is located adjacent to the east and south-east of the Project. The Olive Downs Project will extract up to 20 Mtpa over a mine life of approximately 79 years, commencing approximately in 2020.

Potential noise impacts from the Olive Downs Project at the Olive Downs homestead would be less than 25 dBA under neutral and adverse conditions for all modelled years (Renzo Tonin Ron Rumble, 2018). In addition, predicted noise emissions associated with the Olive Downs Project at other receivers were similarly expected to be low. Therefore, potential cumulative impacts between the approved Olive Downs Project and the Project would be negligible.

The Moorvale South Coal mine (previously known as the Olive Downs Project) is an approved metallurgical coal mine development. The project is located approximately 4 km east of the Olive Downs homestead. Key details of the project are (Olive Downs Coal Pty Ltd, 2005):

The action is the construction and operation of the Olive Downs Project which is proposed to be an open cut coal mine. The mine is expected to produce approximately 7.5 million tonnes of multi product coal for export markets. The annual output is expected to be up to 1 million tonnes per annum of raw coal, which will be transported [to] the nearby Moorvale Mine for processing with production of up to 750,000 tonnes of product coal. The anticipated mine life is approximately 10 years, however ongoing exploration may result in further resource identification and consequent extension of mine life.

Although approved in 2004, this mine site has not commenced operation.

As an additional exercise, we have predicted indicative noise levels during operation of the Moorvale South Project. The project is smaller in scale (1 Mtpa) than surrounding mine sites (Daunia and Poitrel mines) and consequently is likely to operate fewer plant items. We understand there will be no processing at Moorvale South, rather product will be transported to the main processing area at the larger Moorvale Mine further north of the site.

There is no information available relating to the proposed mine for noise calculation purposes and therefore we have assumed a number of plant items and potential locations.

For this exercise we have assumed all plant items will be positioned at the closest pit area (shortest separation distance) to Olive Downs homestead.

For this exercise we have assumed plant items will include excavators (4), dozers (4), loaders (2), haul trucks (2), water truck (1), grader (1) and drill (1) and all plant items will operate concurrently.

Based on the assumptions listed above, our calculations at Olive Downs homestead indicate noise levels around 26 dBA under neutral weather conditions and 33dBA under adverse weather conditions.

In comparison, Tables 19 and 20 showed predicted operational noise levels of 40 dBA (neutral weather) and 47 dBA (adverse weather) at the Olive Downs homestead. Accordingly, the Project would be the primary noise contribution at the Olive Downs homestead.

Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner regarding acoustic treatment of the building or other suitable measures.

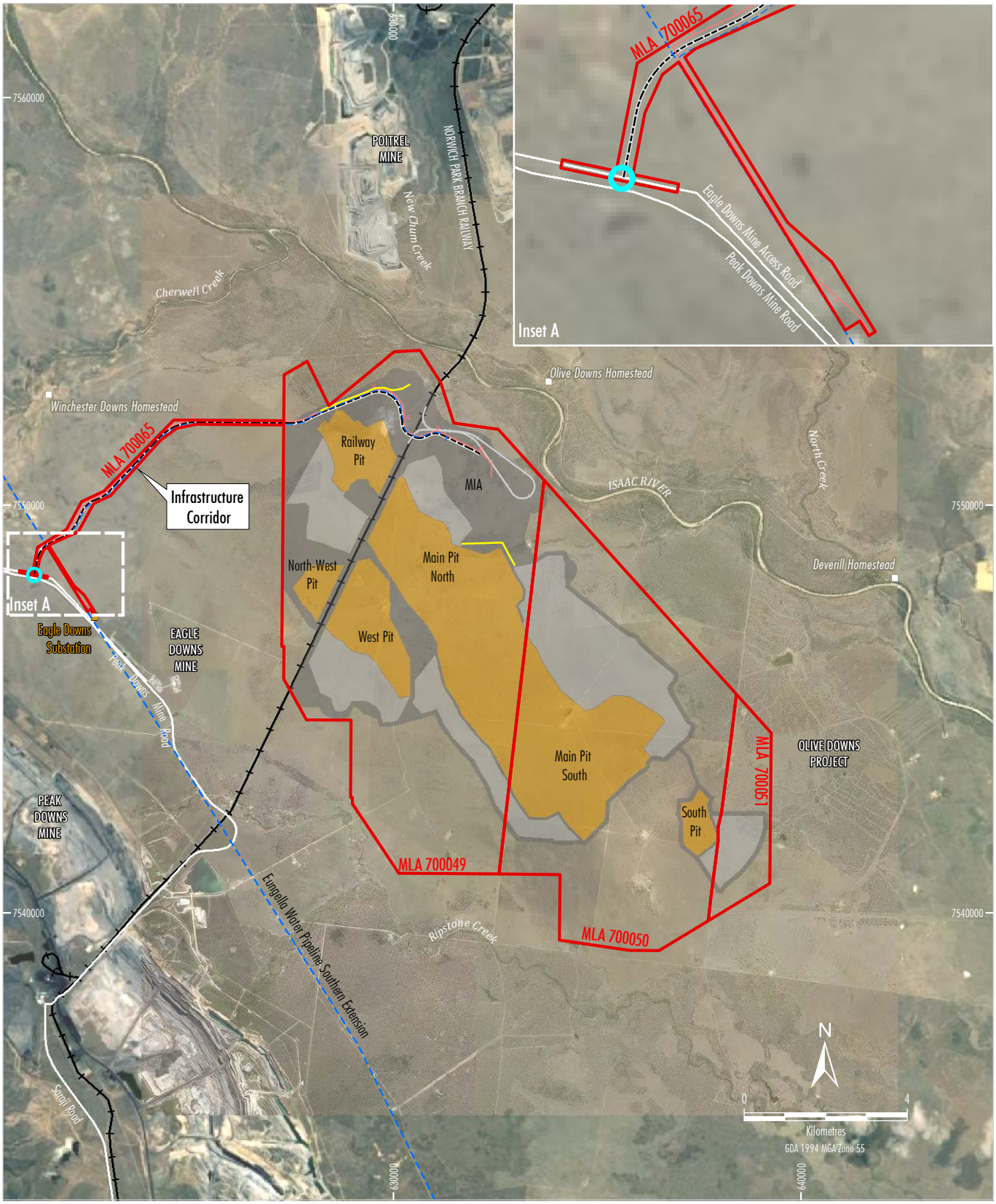
8.2 Health and Biodiversity of Ecosystems

Noise emissions from mining operations and processing plant are expected to be continuous and steady state in nature. Impulsive type noises on site are expected to be minimal and therefore there is a limited potential to startle local fauna, including livestock.

8.3 Road Traffic Noise

The TMR (2013) *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* provides a noise limit of $L_{10\ (18hr)}$ 68 dBA at noise sensitive receptors for existing roads and road upgrades.

Mine access is proposed from Eagle Downs Mine Access Road, off Peak Downs Mine Road. Figure 8 shows the access point.



WHC-18-62_EIS_App6_208A

LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Road Access Point
- Homestead
- Substation

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Road Access Point

Figure 8

The Road Transport Assessment prepared for the Project EIS (The Transport Planning Partnership [TTPP], 2021) identifies the following Project milestones:

- Construction activities for the Project would commence in Year 1 of the Project (nominally 2022).
- Peak construction activities and initial coal production commence in Year 2 of the Project.
- Operational activities for the Project would occur between Year 2 to Year 30.

Table 26 presents characteristics of Eagle Downs Mine Access Road (TTPP, 2021).

Table 26: Characteristics of the Road in the Vicinity of the Project

Characteristic	Eagle Downs Mine Access Road
Trending Direction	North – South
Jurisdiction	Isaac Regional Council
Cross-section	Two way / undivided
Pavement	Sealed
Average Annual Daily Traffic (AADT)	Data not available
Speed Limit	60 kilometres per hour (km/h) – 80 km/h

Whitehaven WS would operate shuttle bus services for its workforce between the Project and Moranbah. Shuttle bus services have the potential to reduce the number of vehicle trips made by the workforce. The nearest noise sensitive receptor near Eagle Downs Mine Access Road and Peak Downs Mine Road is Winchester Downs homestead, located approximately 4 km set back from the road. Peak Downs Mine Road has an AADT volume of approximately 3,861 vehicles per day (2018 data). The percentage of heavy vehicles is approximately 31% or 1,195 vehicles per day (TTPP, 2021).

A daily total of 150 inbound and 150 outbound vehicles per day is predicted during the Project's peak operation phase. A daily total of 338 inbound and 338 outbound vehicles per day is predicted during the Project's peak operation and construction phase. The construction activities would be temporary in nature (e.g. approximately six months). The nearest noise sensitive receptor along the access road to the Project is Winchester Downs homestead, located approximately 2.6 km set back from the new access road.

Based on the expected traffic volumes detailed in the *Winchester South Project Road Transport Assessment* (TTPP, 2021), traffic noise levels are predicted to be less than 50 dBA $L_{10,\ 18\ hours}$ at the nearest noise sensitive receptor. Eagle Downs Mine Access Road falls under the jurisdiction of Isaac Regional Council. The *Isaac Regional Planning Scheme 2021* (which covers the Eagle Downs Mine Access Road) does not provide specific noise limits for traffic along local roads. In the absence of specific noise limits the predicted traffic noise levels are shown to comply with TMR's noise limit of $L_{10\ (18hr)}$ 68 dBA.

The increase in traffic noise due to the Project is predicted to be less than 1 dBA and unlikely to be perceived by the nearest noise sensitive receptors located near Eagle Downs Mine Access Road.

8.4 Rail Noise

The Project would utilise the Norwich Park Branch Railway. The Norwich Park Branch Railway runs approximately north-south through the Project site. This branch forms part of the Goonyella Branch Railway line which transports coal from the Bowen Basin to the Hay Point and Dalrymple Bay Coal Terminals south-east of Mackay.

The operational noise criteria for airborne noise from railway activities (train movements) are 65 dBA $L_{eq\ 24hour}$ and Single Event Maximum 87 dBA maxL_p (TMR, 2019).

The nearest noise sensitive receptor is Olive Downs homestead (NSR1), located approximately 1.6 km from the rail line. Figures 2 and 8 show the proposed rail spur and nearest noise sensitive receptor.

Annual volumes of product coal to be transported by rail would vary over the life of the Project, with a peak rate of approximately 11 Mtpa. An average of 6 train movements per day would be required (i.e. three arrivals and departures) with a maximum of 16 train movements per day (i.e. eight arrivals and departures). Train arrivals and departures would occur 24 hours per day.

Based on separation distance of approximately 1.6 km (from the Olive Downs homestead to the Project rail spur) and a peak of 16 train movements per day (eight unloaded and eight loaded), noise levels from peak rail movements are predicted to comply with both the 65 dBA $L_{eq,\ 24hour}$ and Single Event Maximum 87 dBA maxL_p noise limits at the Olive Downs homestead.

8.5 Sleep Disturbance

The external noise limit of 35 dBA L_{Aeq} is significantly lower than the sleep disturbance criterion of 52 dBA maxL_p (external location) previously discussed in Section 4.5. Given the constant nature of the noise emissions from the Project (i.e. generally continuous operation of the process plant and mining equipment), the sleep disturbance criterion is considered unlikely to be exceeded at the nearest receptors as the difference between the two criteria (i.e. L_{Aeq} and maxL_p), is unlikely to exceed 10 to 15 dBA.

Based on predicted noise levels during neutral and adverse weather conditions, the Project is expected to comply with the sleep disturbance criterion (external location) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Operational noise levels are predicted to marginally exceed the sleep disturbance criterion of 52 dBA maxL_p (external location) at Olive Downs homestead (NSR1), even with the implementation of reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner regarding acoustic treatment of the building or other suitable measures.

9 Conclusion

Renzo Tonin & Associates has completed a noise and vibration impact assessment as part of an EIS for the Project.

The objective of this report is to assess noise and vibration levels from the Project against relevant noise and vibration objectives.

The following modelling results were determined:

Neutral Weather Conditions

Operational noise levels are predicted to comply with the relevant noise objectives at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park homestead (NSR4) for all modelling scenarios (Years 5, 9, 19 and 27).

Noise levels are predicted to exceed the relevant noise objectives at Olive Downs homestead (NSR1) by up to 4 dBA despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner.

Adverse Weather Conditions

Operational noise levels are predicted to comply with the relevant noise Environmental Noise & Vibration Assessment objectives at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park homestead (NSR4) for all modelling scenarios (Years 5, 9, 19 and 27).

Noise levels are predicted to exceed the relevant noise objectives at Olive Downs homestead (NSR1) by up to 12 dBA despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner.

Although noise levels are predicted to comply with the relevant criteria at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park homestead (NSR4), noise monitoring would be conducted to validate the model predictions and inform the implementation of additional noise mitigation measures, if required. Additional noise mitigation measures could include modification of Project operations or at-receptor mitigation measures.

Low Frequency Noise

Operational noise predictions indicate low frequency noise (<200 Hertz) is expected to comply with the noise limits of 55 Z-weighted decibels (external location) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Operational noise levels are predicted to marginally exceed the noise limit of 55 dBZ (measured 4 m from the building facade) at Olive Downs homestead (NSR1) by up to 2 dBZ (neutral weather conditions) and by up to 4 dBZ (adverse weather conditions) despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner.

Sleep Disturbance

Based on predicted noise levels during neutral and adverse weather conditions, the Project is expected to comply with the sleep disturbance criterion (external location) at Winchester Downs homestead (NSR2), Coolibah homestead (NSR3) and Vermont Park (NSR4) homestead for all modelling scenarios (Years 5, 9, 19 and 27).

Operational noise levels are predicted to marginally exceed the sleep disturbance criterion (external location) at Olive Downs homestead (NSR1) despite reasonable and feasible mitigation measures. Accordingly, Whitehaven WS intends to reach a mutually beneficial agreement with the land owner.

Blasting

Predicted Project ground vibration and airblast overpressure show that with the use of typical explosive charge sizes and practices, the relevant vibration and overpressure objectives for the Project would not be exceeded at receptors.

Transport Noise

Based on predicted noise levels associated with Project-related road traffic and rail noise, compliance with the relevant criteria is expected.

References

1. BHP Billiton (2005) – Poitrel Coal Mine Project – Environmental Impact Statement.
2. Department of Environment and Heritage Protection (2013) – Noise Measurement Manual.
3. Department of Environment and Heritage Protection (2016) – Ecoaccess Guideline: Planning for Noise Control Guideline.
4. Department of Environment and Science (2017) – Model Mining Conditions Guideline. Version 6.02.
5. Department of Environment and Science (2020) – Guideline: Application requirements for activities with noise impacts.
6. Department of State Development, Manufacturing, Infrastructure and Planning (2019) - Olive Downs project Coordinator-General's evaluation report on the environmental impact statement.
7. Department of Transport and Main Roads (2013) – Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise.
8. Department of Transport and Main Roads (2019) – Interim Guideline – Operational Railway Noise and Vibration.
9. Katestone Environmental Pty Ltd (2021) – Air Quality and Greenhouse Gas Assessment of the Winchester South Project.
10. New South Wales Environment Protection Authority (2017) – A guide to the Noise Policy for Industry.
11. Olive Downs Coal Pty Ltd (2005) Commonwealth Environmental Protection And Biodiversity Conservation (EPBC) Act Referral.
12. Queensland Environmental Protection Agency (2004) – Ecoaccess Guideline: Assessment of Low Frequency Noise.
13. Renzo Tonin Ron Rumble (2018) – Olive Downs Noise & Blasting Assessment – Environmental Noise & Vibration Assessment [Report Reference: QB025-01F03 Noise Report (r2)] dated 17 May 2018.
14. Sinclair Knight Merz (2008) – Daunia Coal Mine Project Environmental Impact Statement. Prepared for BHP Billiton Mitsubishi Alliance.
15. The Transport Planning Partnership (2021) – Winchester South Project Road Transport Assessment.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

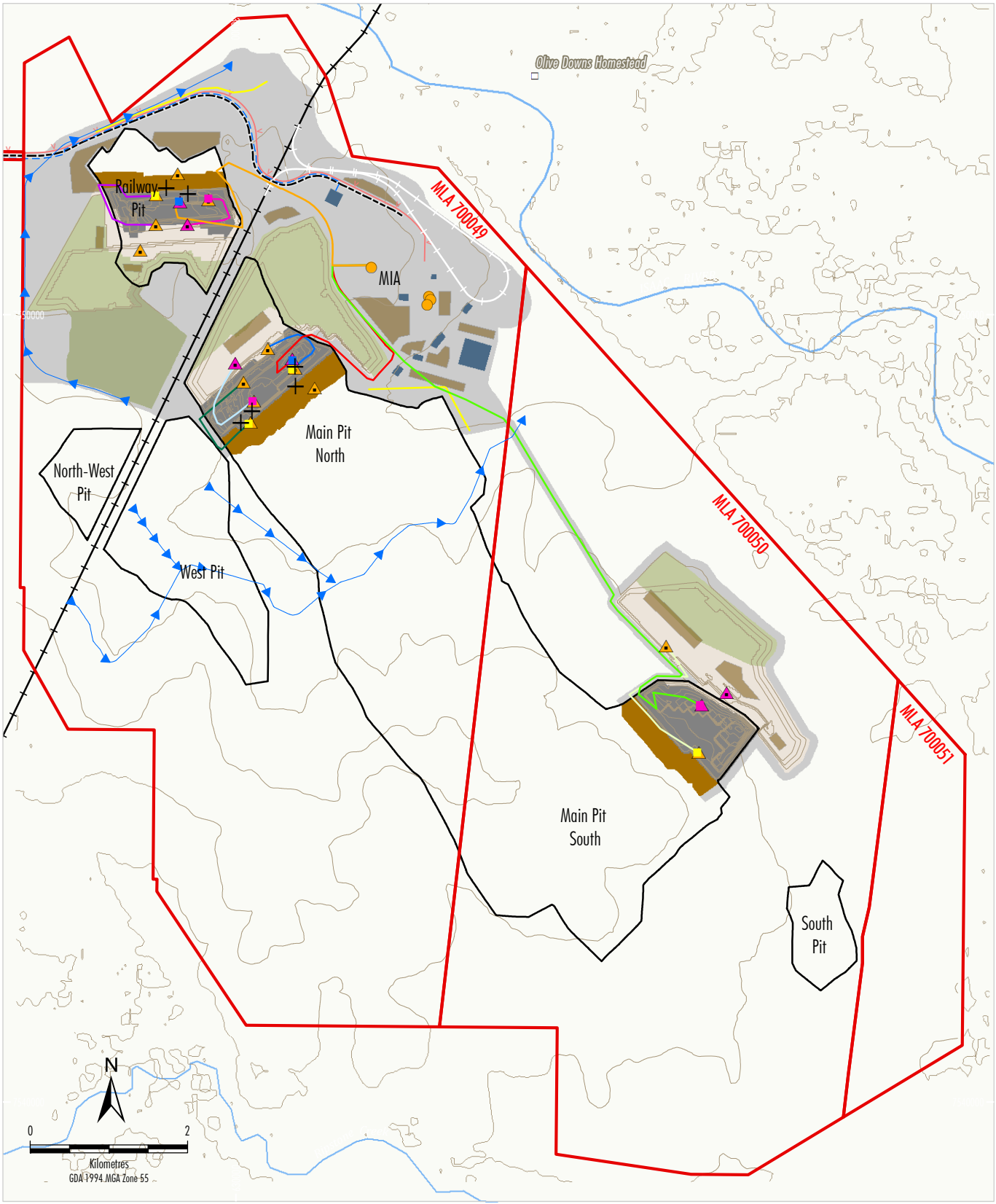
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receptor.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard.
Assessment period	The time period in which an assessment is made e.g. Day 7 am-6 pm, Evening 6pm -10pm & Night 10 pm-7 am.
Assessment point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receptor and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.

Decibel (dB)	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:		
	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100 m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25 m away
dBA	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dBA. Practically all noise is measured using the A filter.		
dBZ	Z-weighting is a flat frequency response of 0.5 Hz to 20 kHz ±1.5 dB. This response replaces the older "Linear" or "Unweighted" responses. Z-weighted measurements are expressed as dBZ. Z-weighting is typically used to measure explosive sounds and in the assessment of low frequency noise.		
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test'. The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.		
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.		
Free field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5 m from any acoustic reflecting structures other than the ground.		
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.		
Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.		
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).		
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.		

Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dBA.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
$L_{10(18hr)}$	The arithmetic average of the $L_{10(1hr)}$ levels for the 18 hour period between 6 am and 12 midnight on a normal working day.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dBA.
L_{Aeq} or L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the L_{Aeq}.
$L_{Aeq(1hr)}$	The L_{Aeq} noise level for a one-hour period. In the context of the NSW Environment Protection Authority's Road Noise Policy it represents the highest tenth percentile hourly A-weighted L_{eq} during the period 7 am to 10 pm, or 10 pm to 7 am (whichever is relevant).
$L_{Aeq\ (24hr)}$	The L_{Aeq} noise level during a 24 hour period, usually from midnight to midnight.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.
maxL	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the maxLA.
Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
Noise	Unwanted sound.
Rw	Weighted Sound Reduction Index. A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australia. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.

Spoil	Soil or materials arising from excavation activities.
STC	Sound Transmission Class. A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by Rw.
Structure-borne noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Fleet Locations for Modelling Years 5, 9, 19 & 27



LEGEND

Equipment Location
- EX3600
- EX8000
- R9350
- D10
- D11
- Drill
- WDZ

Haul Route
- Coal Route 1
- Coal Route 2
- Waste Route 1
- Waste Route 2
- Waste Route 3
- Waste Route 4
- Waste Route 5
- Waste Route 6
- Waste Route 7

- Mining Lease Application Boundary
- Railway

Project Component*
- Indicative Infrastructure Area
- Indicative Water Storage
- Indicative Maximum Extent of Open Cut Pit
- Indicative Up-catchment Diversion
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

Mine/Rehabilitation Status
- Indicative Advanced Soil Stripping
- Indicative Active Mining
- Indicative Active Emplacement
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Soil Stockpile

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

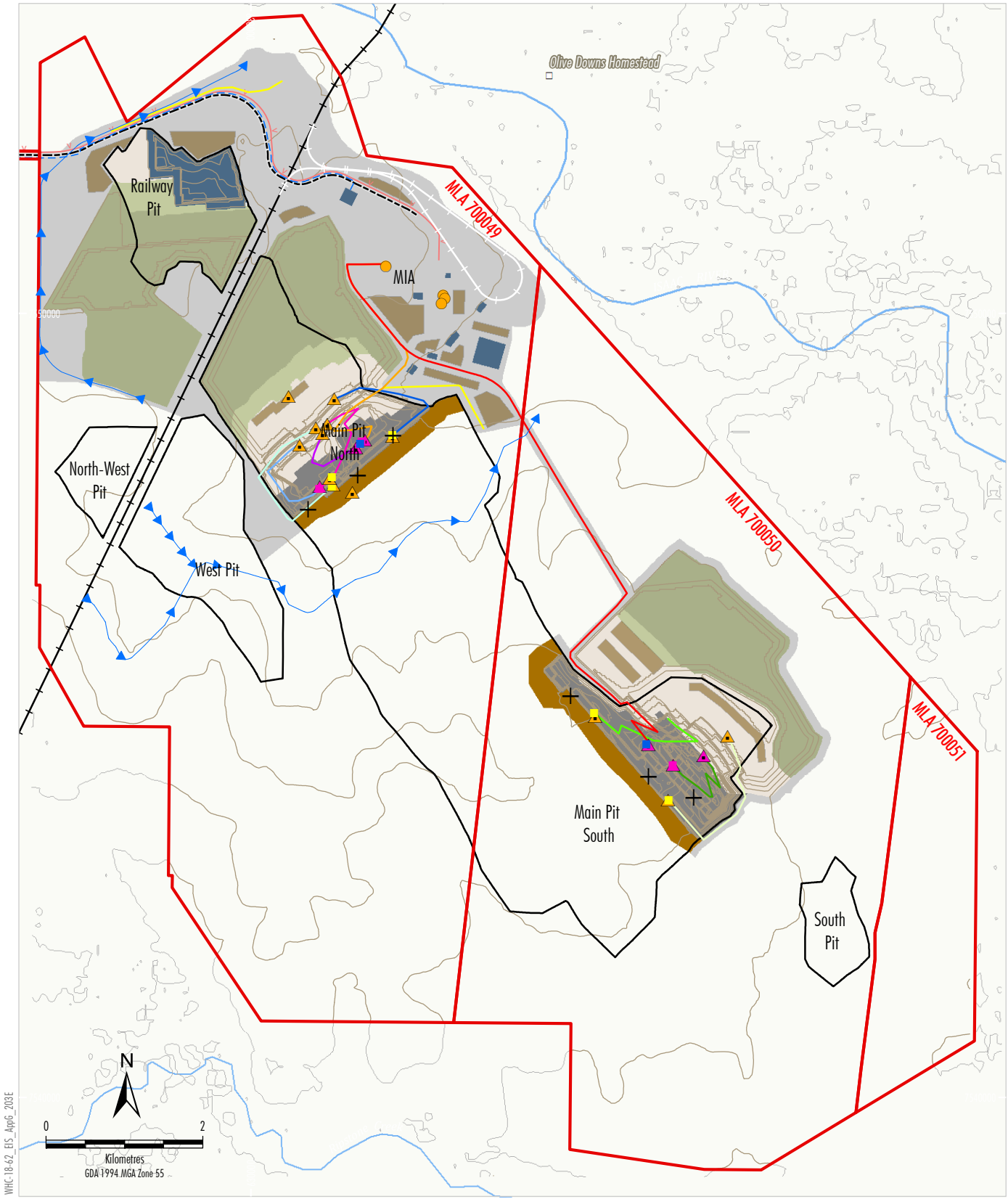
Source: The State of Queensland (2018 - 2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Fleet Locations - Project Year 5

Figure B-1



LEGEND

Equipment Location
- EX3600
- EX8000
- R9350
- D10
- D11
- Drill
- WDZ

Haul Route
- Coal Route 1
- Coal Route 2
- Waste Route 1
- Waste Route 2
- Waste Route 3
- Waste Route 4
- Waste Route 5
- Waste Route 6
- Waste Route 7
- Waste Route 8

- Mining Lease Application Boundary
- Railway

Project Component*
- Indicative Infrastructure Area
- Indicative Water Storage
- Indicative Maximum Extent of Open Cut Pit
- Indicative Up-catchment Diversion
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

Mine/Rehabilitation Status
- Indicative Advanced Soil Stripping
- Indicative Active Mining
- Indicative Active Emplacement
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Soil Stockpile

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

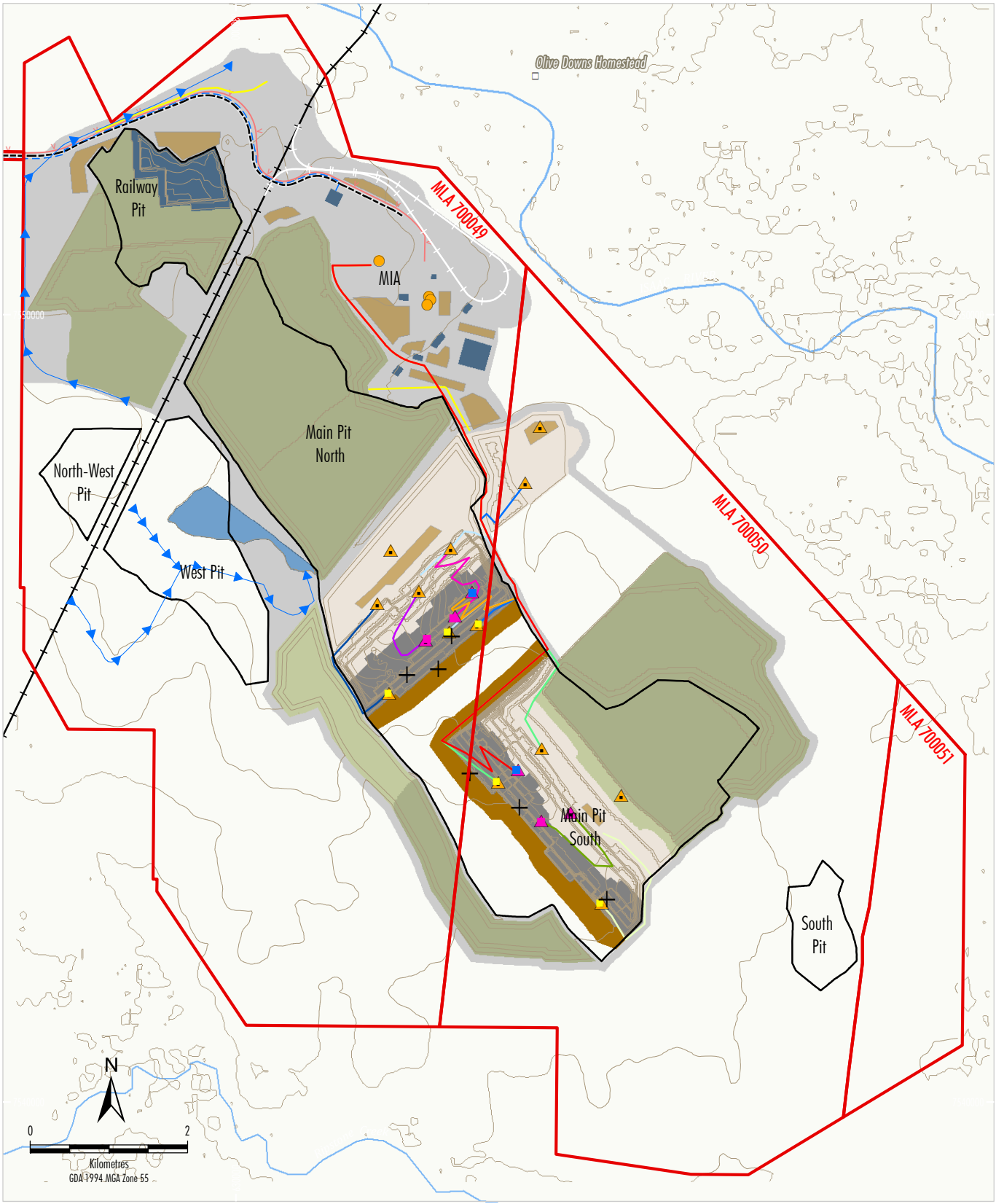
Source: The State of Queensland (2018 - 2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Fleet Locations - Project Year 9

Figure B-2



LEGEND

Equipment Location
- EX3600
- EX8000
- R9350
- D10
- D11
- Drill
- WDZ

Haul Route
- Coal Route 1
- Coal Route 2
- Waste Route 1
- Waste Route 2
- Waste Route 3
- Waste Route 4
- Waste Route 5
- Waste Route 6
- Waste Route 7
- Waste Route 8

- Mining Lease Application Boundary
- Railway

Project Component*
- Indicative Infrastructure Area
- Indicative Water Storage
- Indicative Clean Water Storage
- Indicative Maximum Extent of Open Cut Pit
- Indicative Up-catchment Diversion
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

Mine/Rehabilitation Status
- Indicative Advanced Soil Stripping
- Indicative Active Mining
- Indicative Active Emplacement
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Soil Stockpile

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

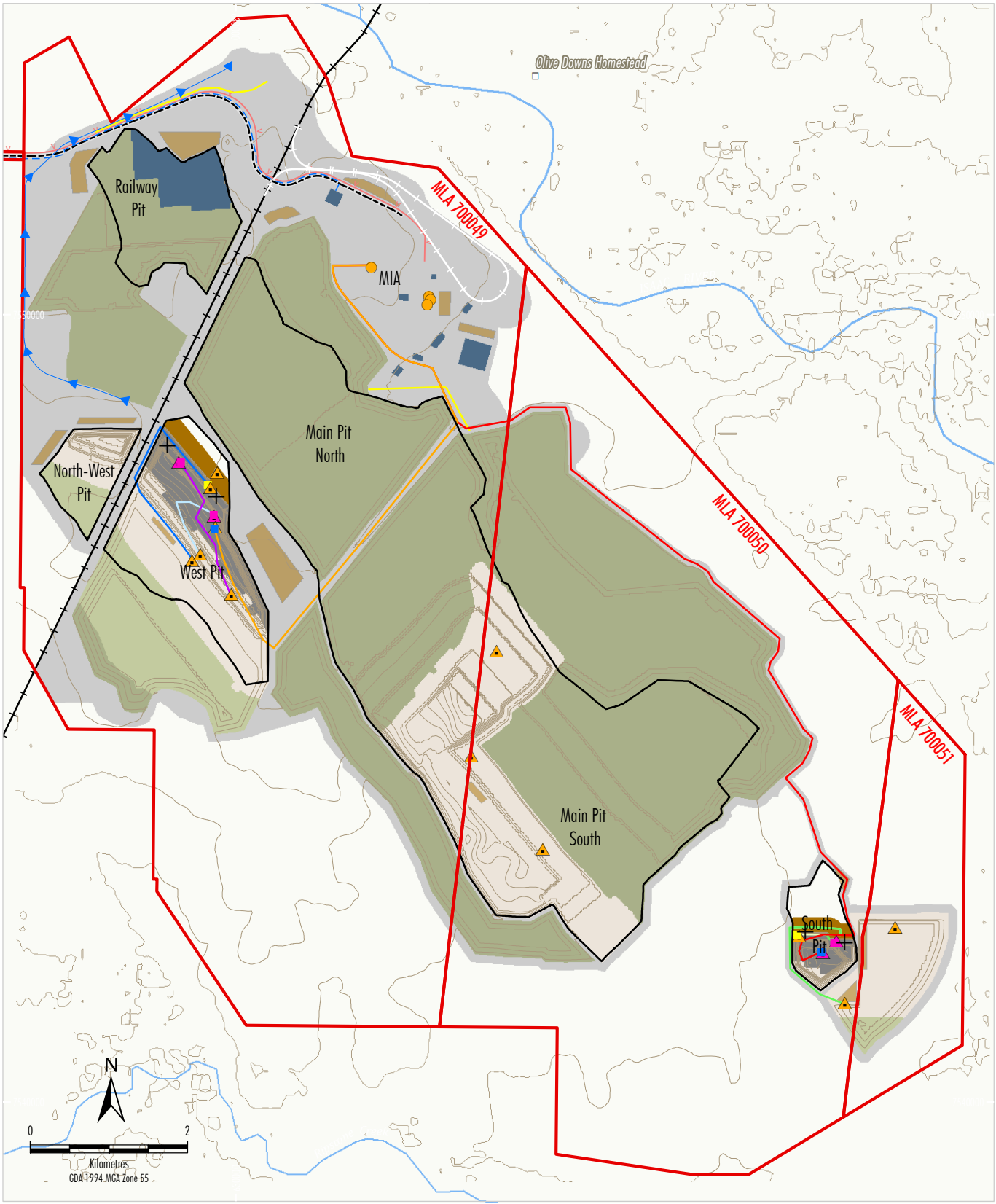
Source: The State of Queensland (2018 - 2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Fleet Locations - Project Year 19

Figure B-3



LEGEND

Equipment Location
- EX3600
- EX8000
- R9350
- D10
- D11
- Drill
- WDZ

Haul Route
- Coal Route 1
- Coal Route 2
- Waste Route 1
- Waste Route 2
- Waste Route 3
- Waste Route 4
- Waste Route 5

- Mining Lease Application Boundary
- Railway

Project Component*
- Indicative Infrastructure Area
- Indicative Water Storage
- Indicative Maximum Extent of Open Cut Pit
- Indicative Up-catchment Diversion
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

Mine/Rehabilitation Status
- Indicative Advanced Soil Stripping
- Indicative Active Mining
- Indicative Active Emplacement
- Indicative Initial Rehabilitation
- Indicative Established Rehabilitation
- Indicative Soil Stockpile

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Indicative Fleet Locations - Project Year 27

Figure B-4

APPENDIX C Analysis of Meteorological Data

An Air Quality and Greenhouse Gas Assessment was prepared for the Project by Katestone Environmental Pty Ltd [Document Reference: Air Quality and Greenhouse Gas Assessment of the Winchester South Project] dated May 2021.

Section 4.2.1 of the Katestone assessment summarises the following information for wind speed and wind direction potentially affecting the Project:

> *Wind speed and wind direction can determine the rate of dispersion of dust emissions from sources such as wheel generated dust, material transfers, material processing and wind erosion. Wind speed also determines the amount of dust lifted into the air by wind erosion. The annual, seasonal and diurnal frequency of winds at the Project site are shown as wind roses in* ***Figure C1****,* ***Figure C2*** *and* ***Figure C3****, respectively.*
>
> *On average 70% of winds at the site are from the northeast through to the southeast. During the year winds vary with season, with south-easterlies most frequent during autumn and winter, and north-easterlies most frequent during spring. The highest frequency of winds above 6 m/s occur during summer, from the east and east-southeast which are also the most frequent wind directions. There is a diurnal variation in the wind distribution, with a higher frequency of light winds occurring overnight (6pm – 6am) compared to the day. Winds from the east and east-southeast are most frequent during the afternoon (midday – 6pm), whilst winds from the northeast quadrant are most frequent during the evening. Winds from midnight – midday are predominantly from the southeast.*

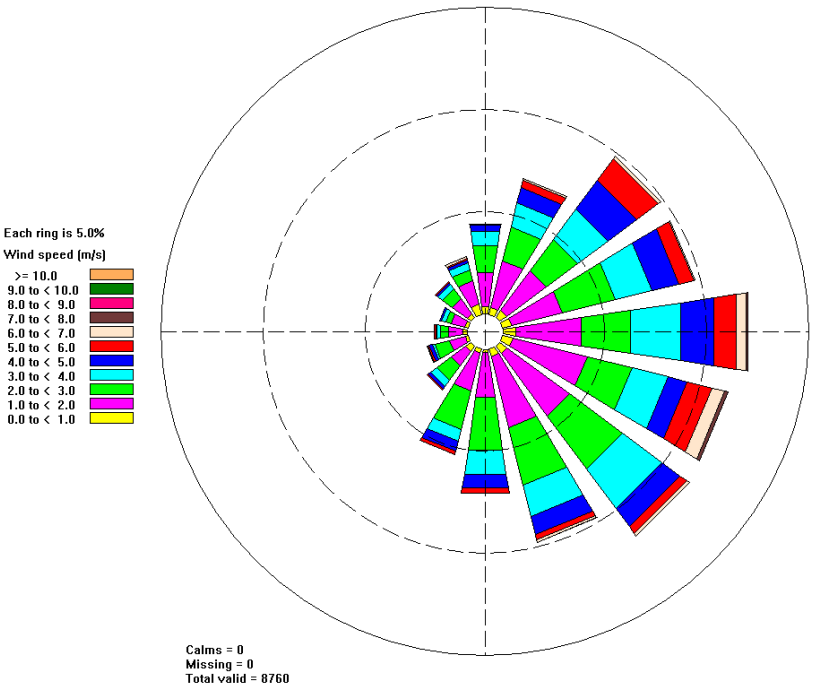


Figure C1 Annual wind rose for the Project site (extracted from CALMET)

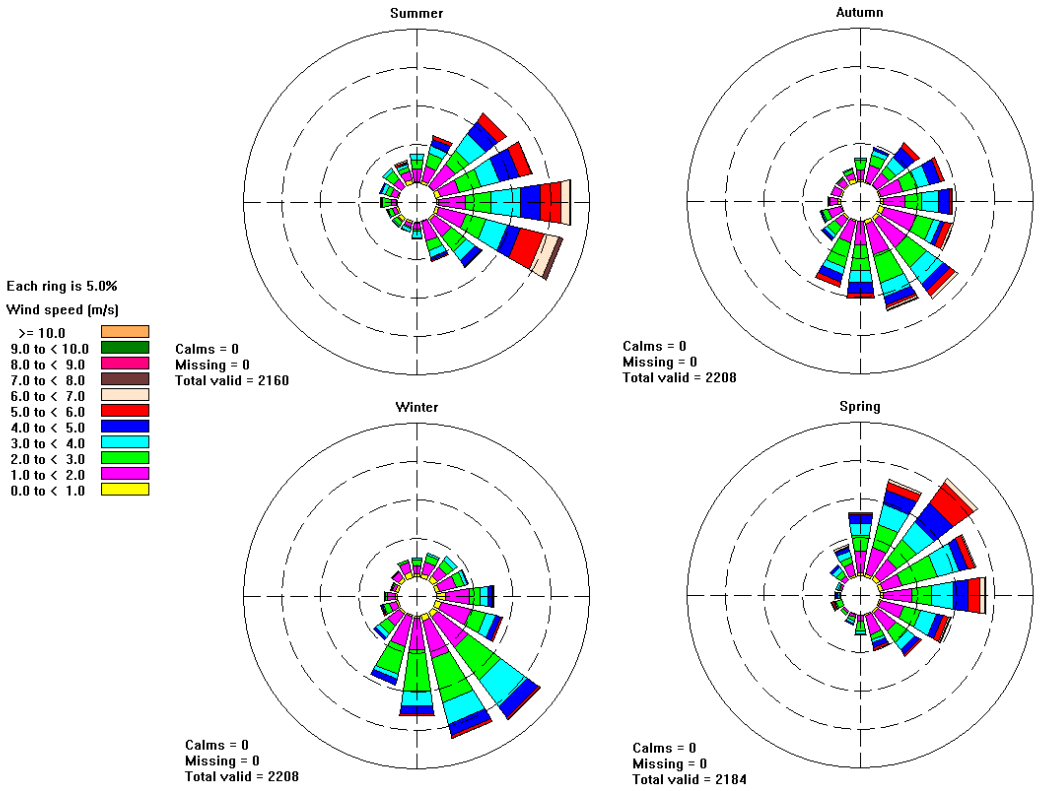


Figure C2 Seasonal wind rose for the Project site (extracted from CALMET)

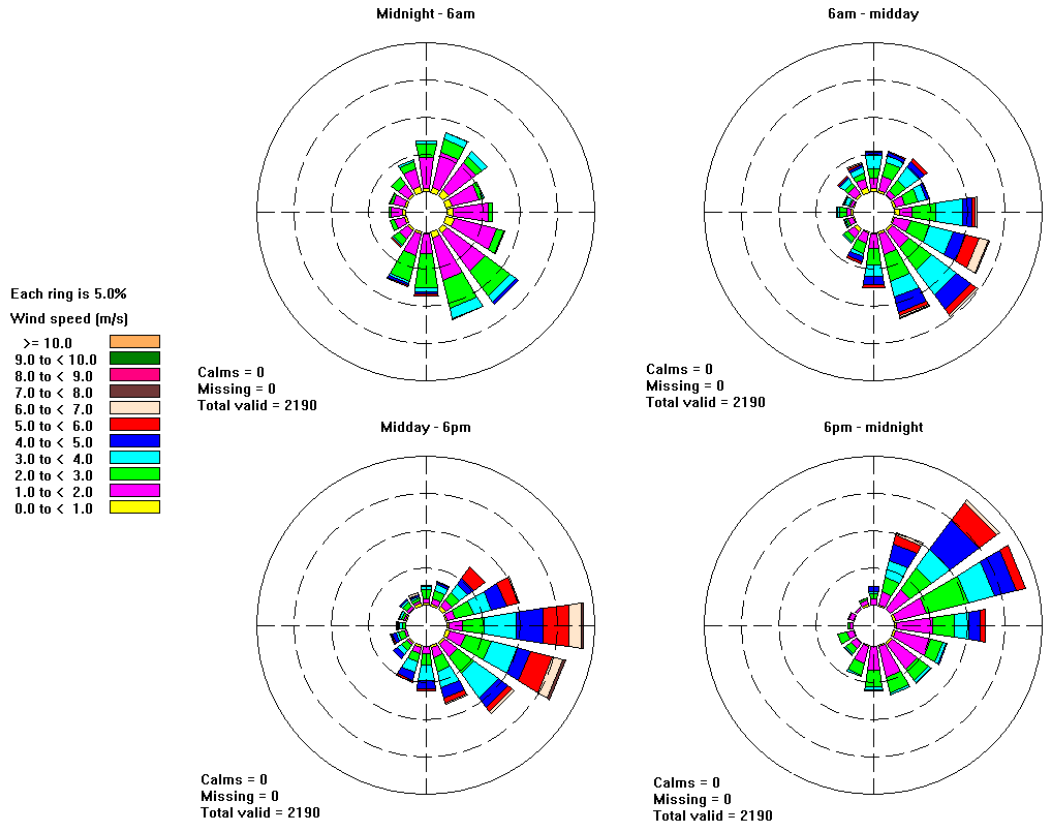
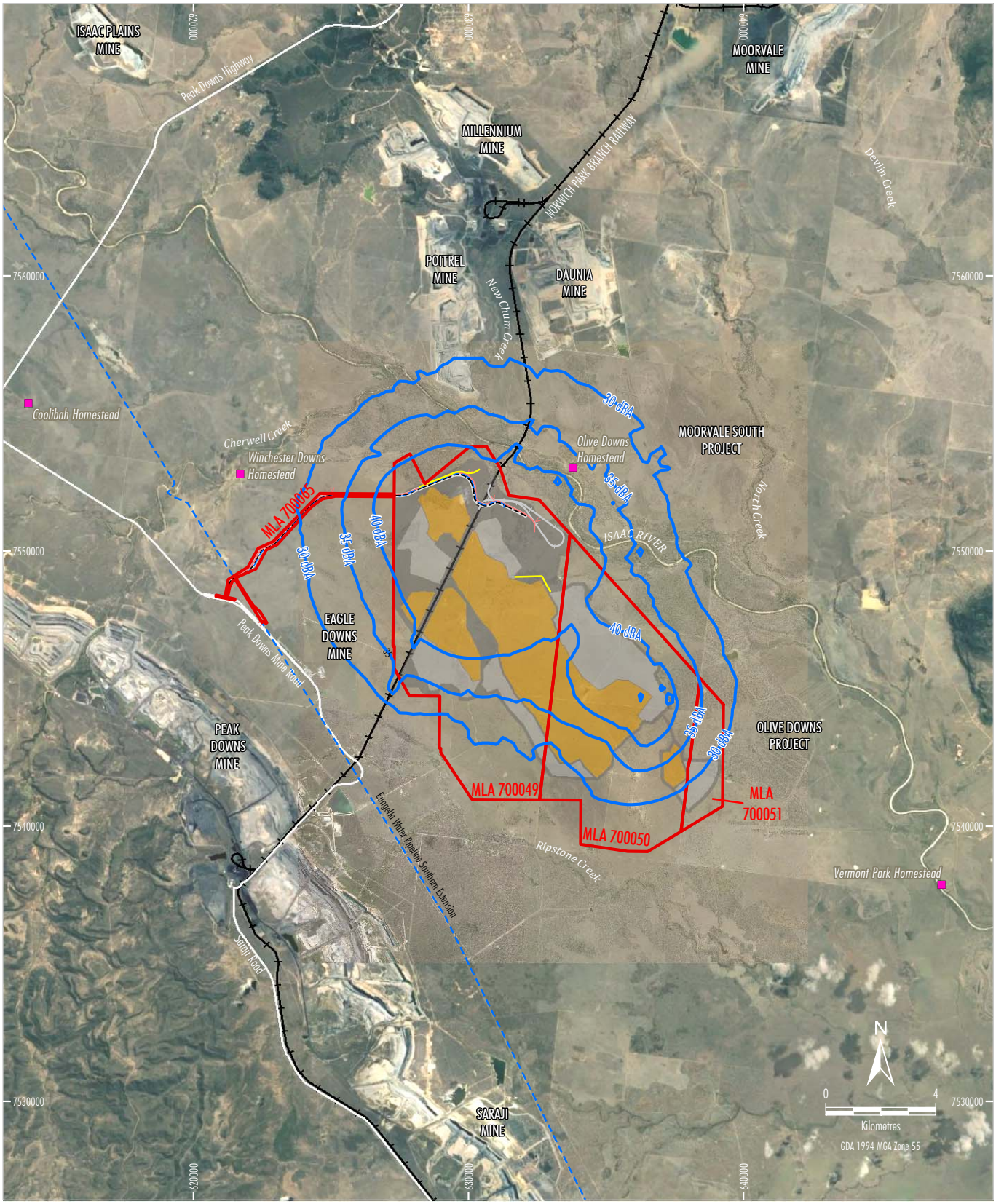


Figure C3 Diurnal wind rose for the Project site (extracted from CALMET)

Our analysis of the wind roses concluded that wind effects were not a particular feature of the area. That is, source-to-receptor winds (at 10 m height) of equal to or less than 3 m/s do not occur for 30% of the time or more in any assessment period (day, evening, night) in any season. For the Project we have therefore not used the default wind effects parameter of 3 m/s.

APPENDIX D Noise Contour Maps

The following contour maps show predicted noise levels for modelling Years 5, 9, 19 and 27 under both neutral and adverse weather conditions.



WHC-18-62_EIS_App6_214A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

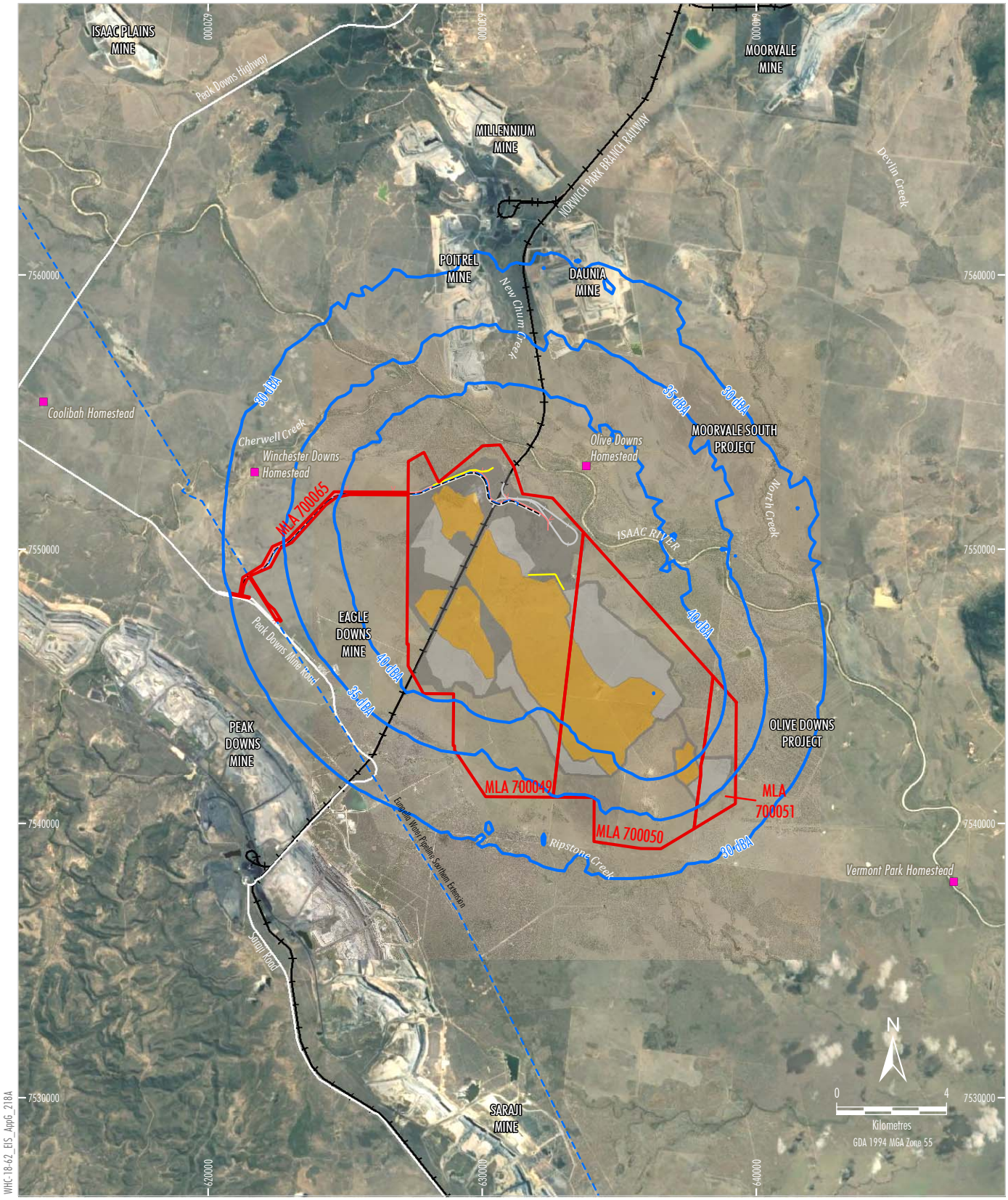
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 5
Neutral Meteorological Conditions

Figure D-1



WHC-18-62_EIS_App6_218A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

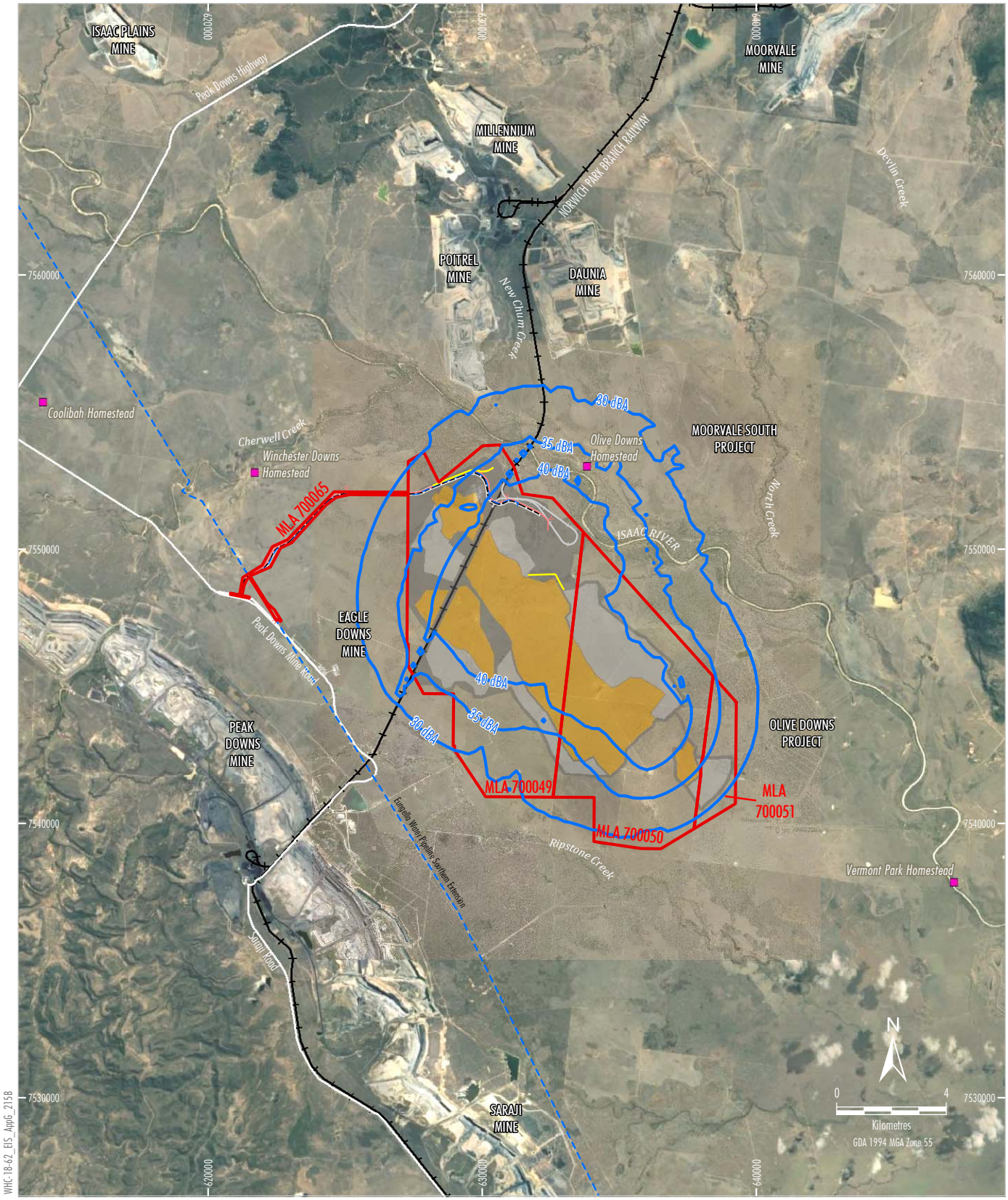
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 5
Adverse Meteorological Conditions

Figure D-2



WHC-18-62_EIS_App6_215B

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

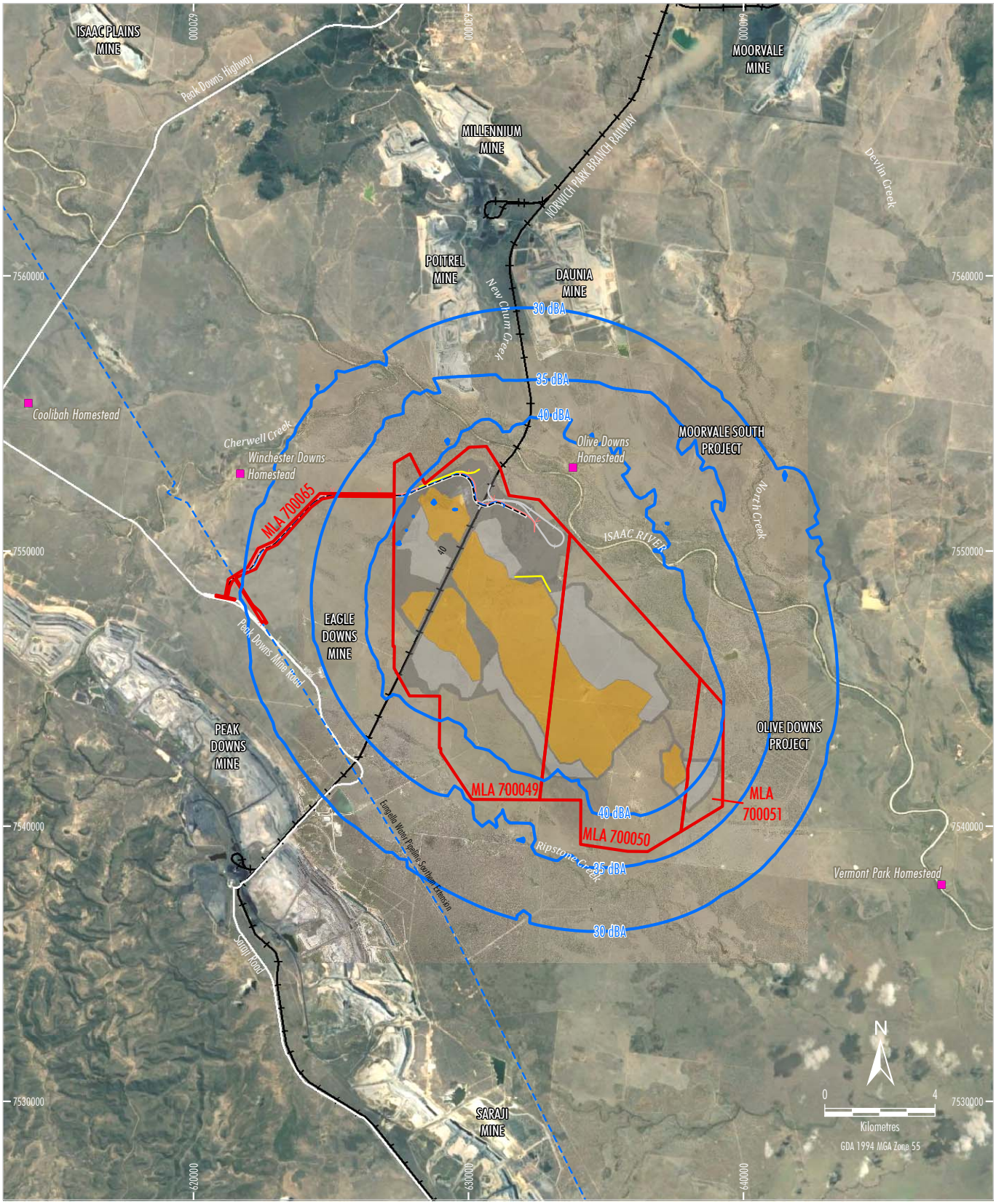
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 9
Neutral Meteorological Conditions

Figure D-3



WHC-18-62_EIS_App6_219A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

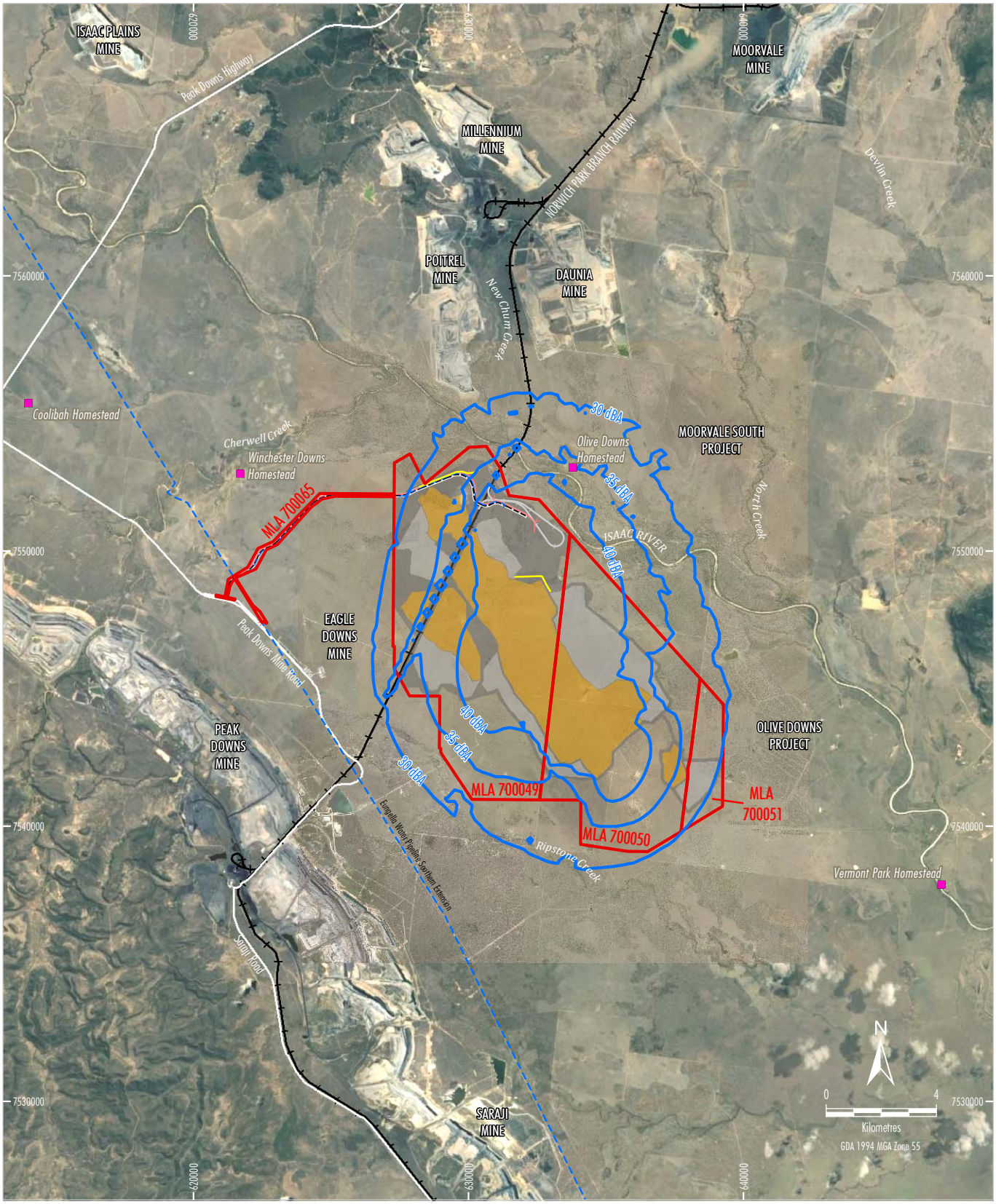
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 9
Adverse Meteorological Conditions

Figure D-4



WHC-18-62_EIS_App6_216A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

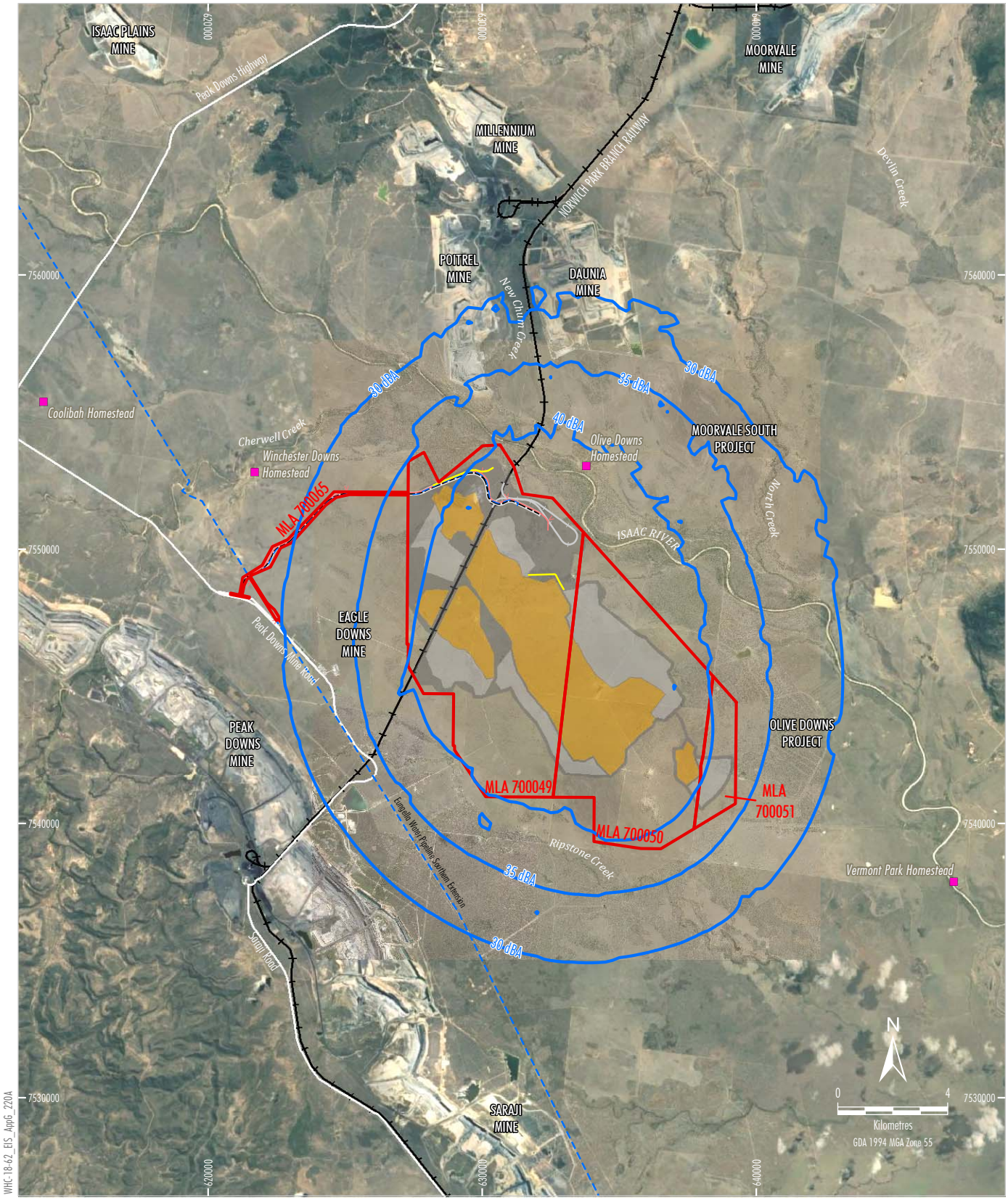
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 19
Neutral Meteorological Conditions

Figure D-5



WHC-18-62_EIS_App6_220A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

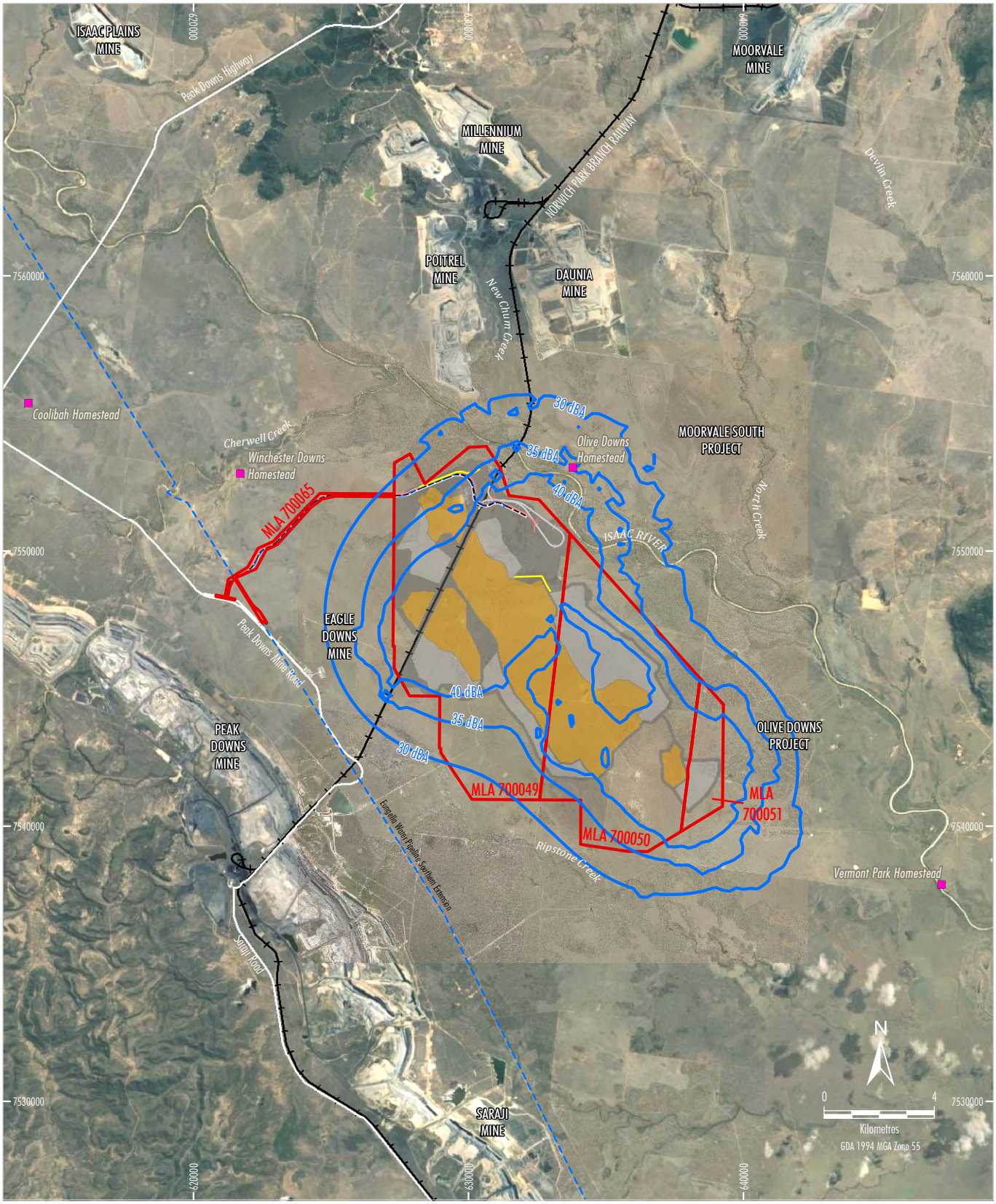
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 19
Adverse Meteorological Conditions

Figure D-6



WHC-18-62_EIS_App6_217A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

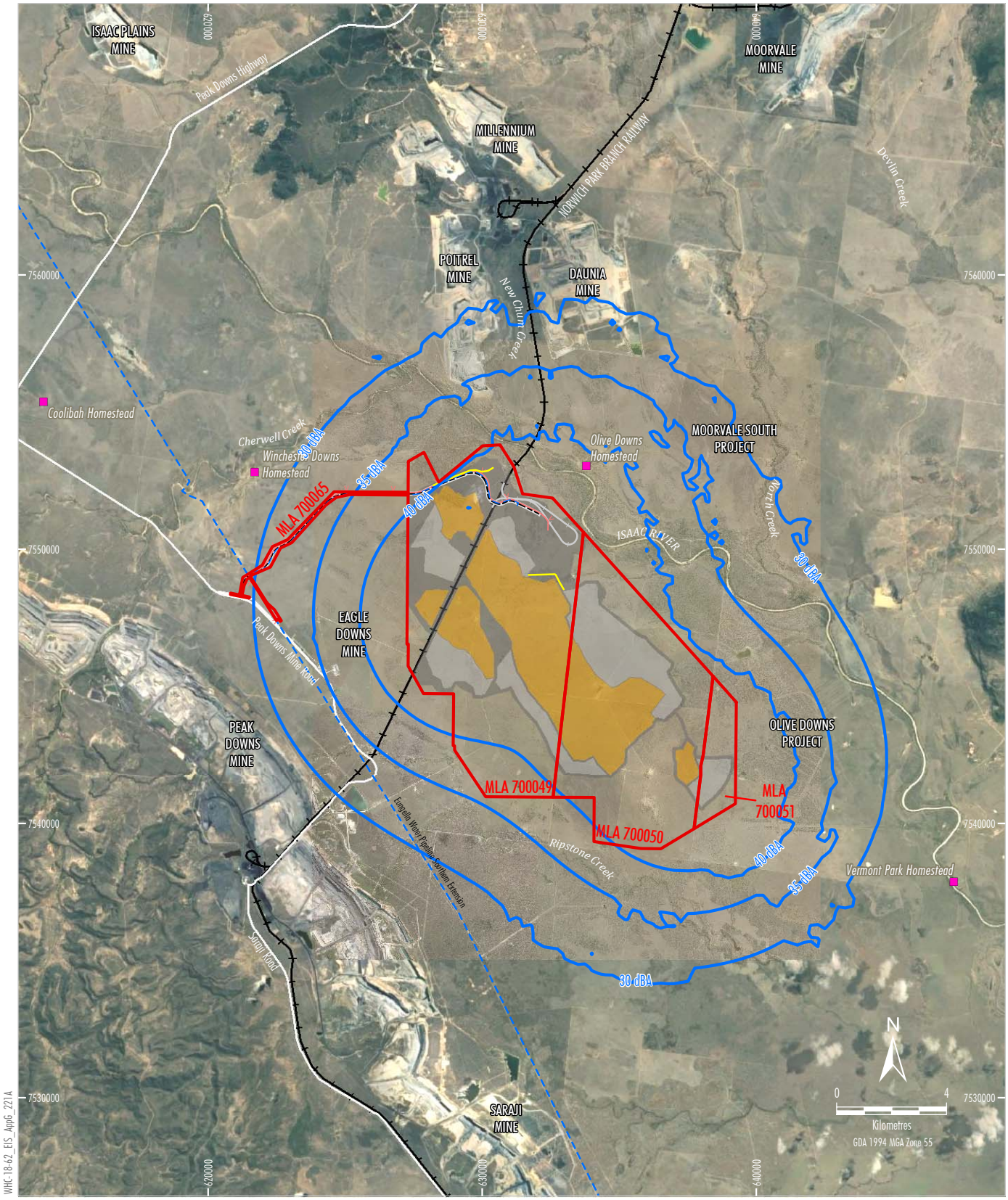
Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 27
Neutral Meteorological Conditions

Figure D-7



WHC-18-62_EIS_App6_221A

LEGEND

- Mining Lease Application Boundary
- Sensitive Receptor
- $L_{Aeq\ (15\ Minute)}$ Noise Contour
- Eungella Water Pipeline Southern Extension
- Railway

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020); Renzo Tonin (2020). Orthophoto: Google Image (2019); Whitehaven (2017).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Noise Contours - Year 27
Adverse Meteorological Conditions

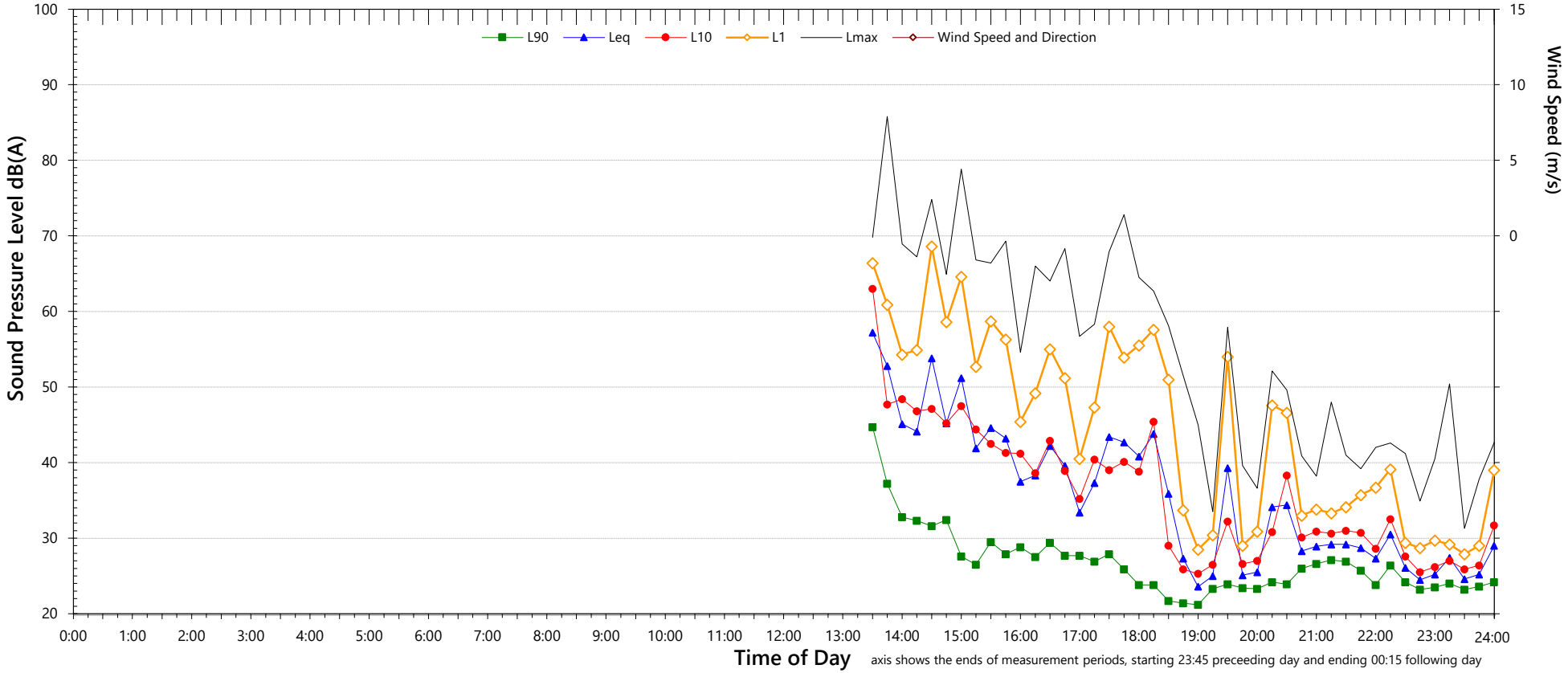
Figure D-8

APPENDIX E Noise Monitoring Results

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Tuesday, 10 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	68	46	43
L_1	55	38	36
L_{10}	44	31	32
L_{90}	27	23	24
Leq	48	35	39

Notes:

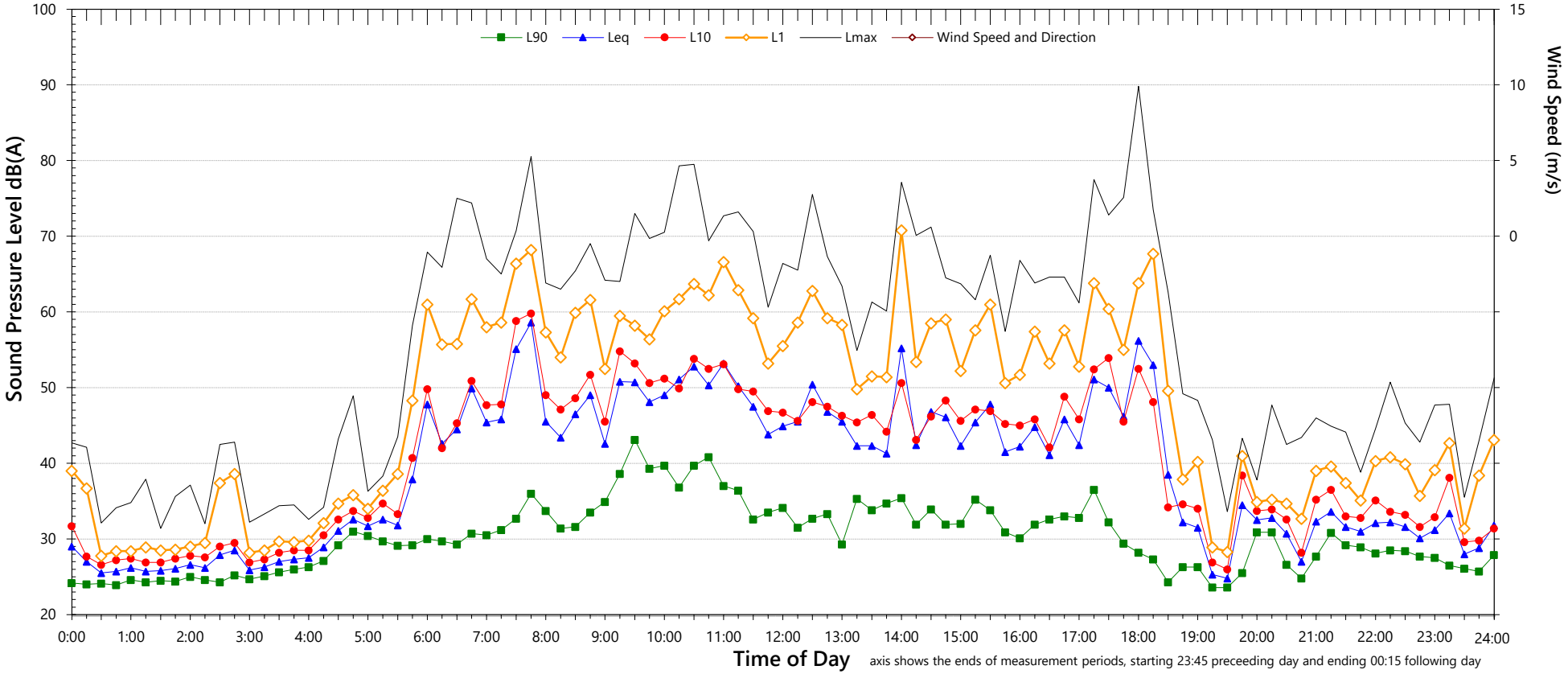
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Wednesday, 11 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	68	46	47
L_1	58	39	40
L_{10}	49	34	36
L_{90}	32	25	28
Leq	50	42	40

Notes:

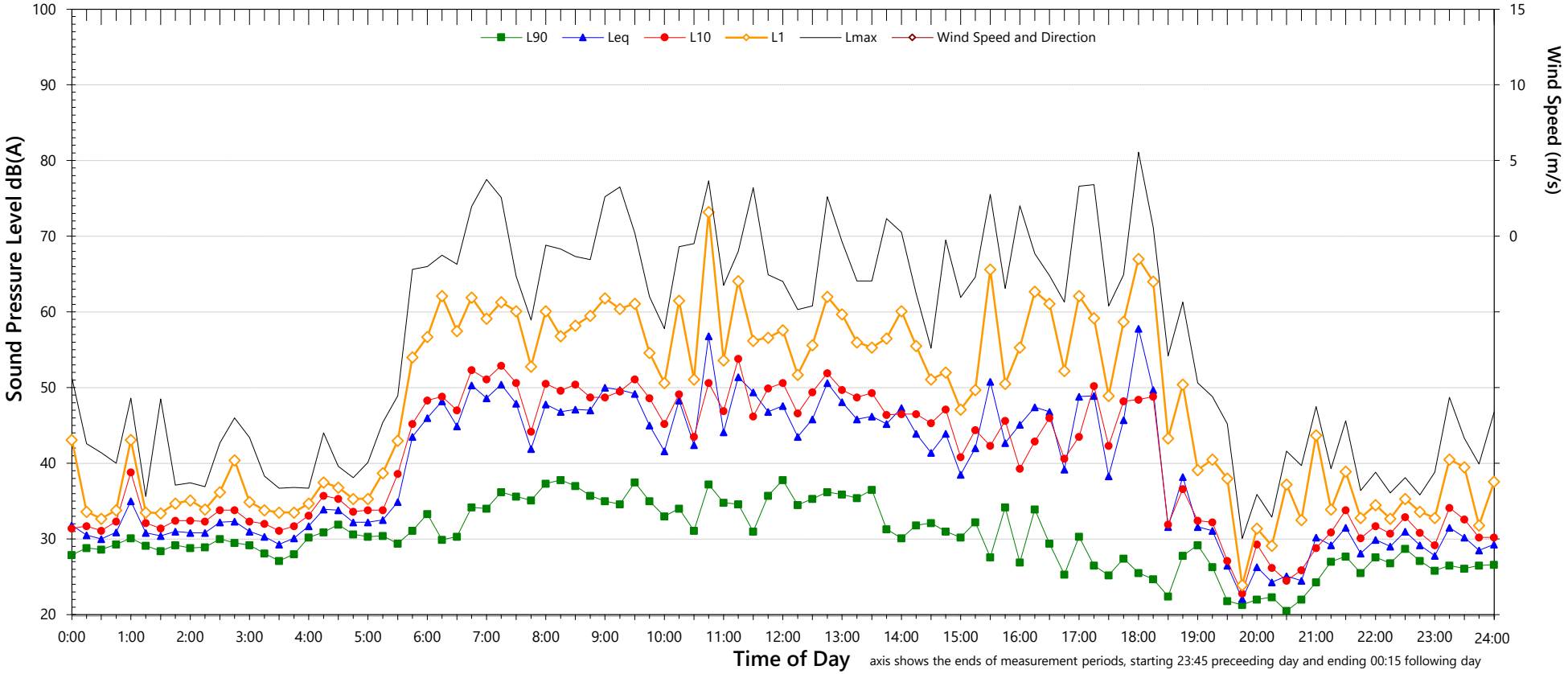
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Thursday, 12 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	68	45	48
L_1	57	38	40
L_{10}	47	31	34
L_{90}	30	22	27
Leq	49	38	39

Notes:

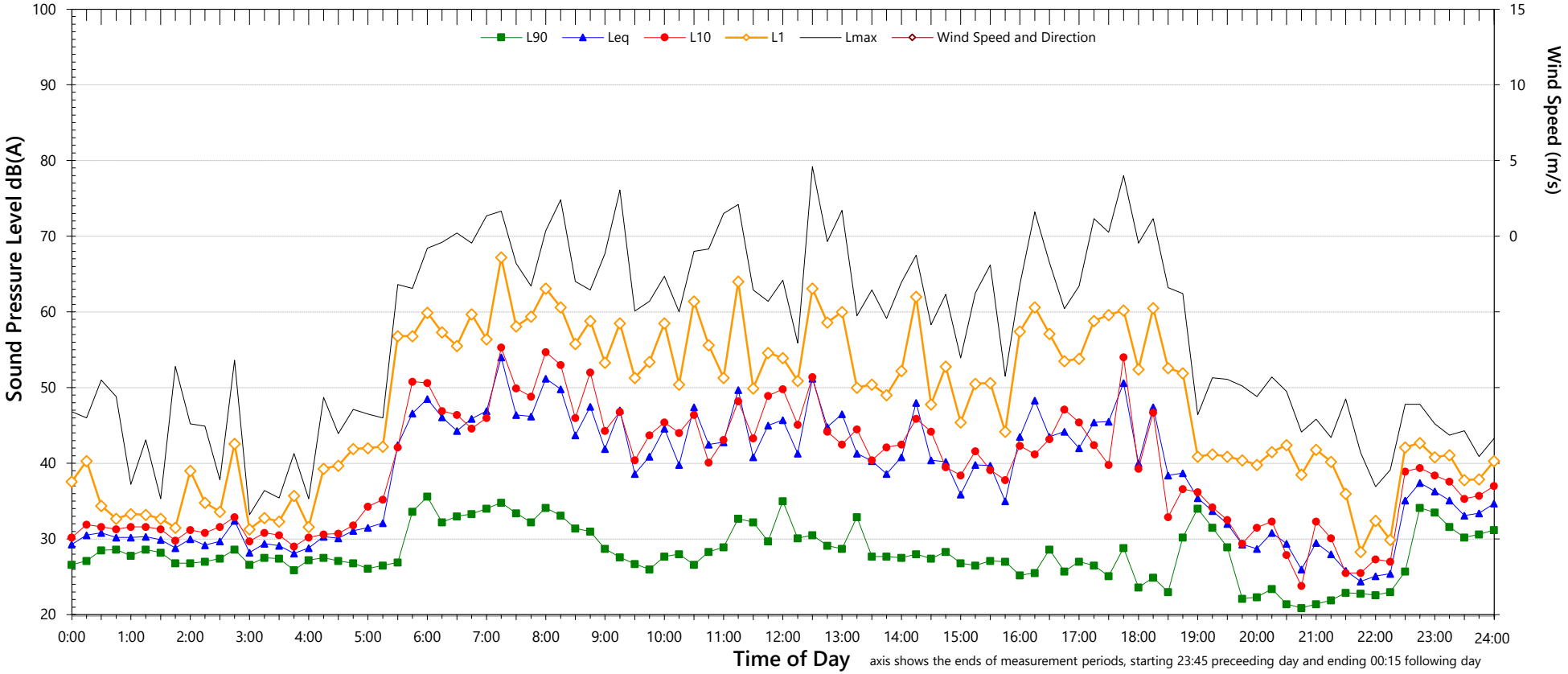
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Friday, 13 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	66	50	48
L_1	55	42	42
L_{10}	45	32	37
L_{90}	27	22	28
Leq	46	37	41

Notes:

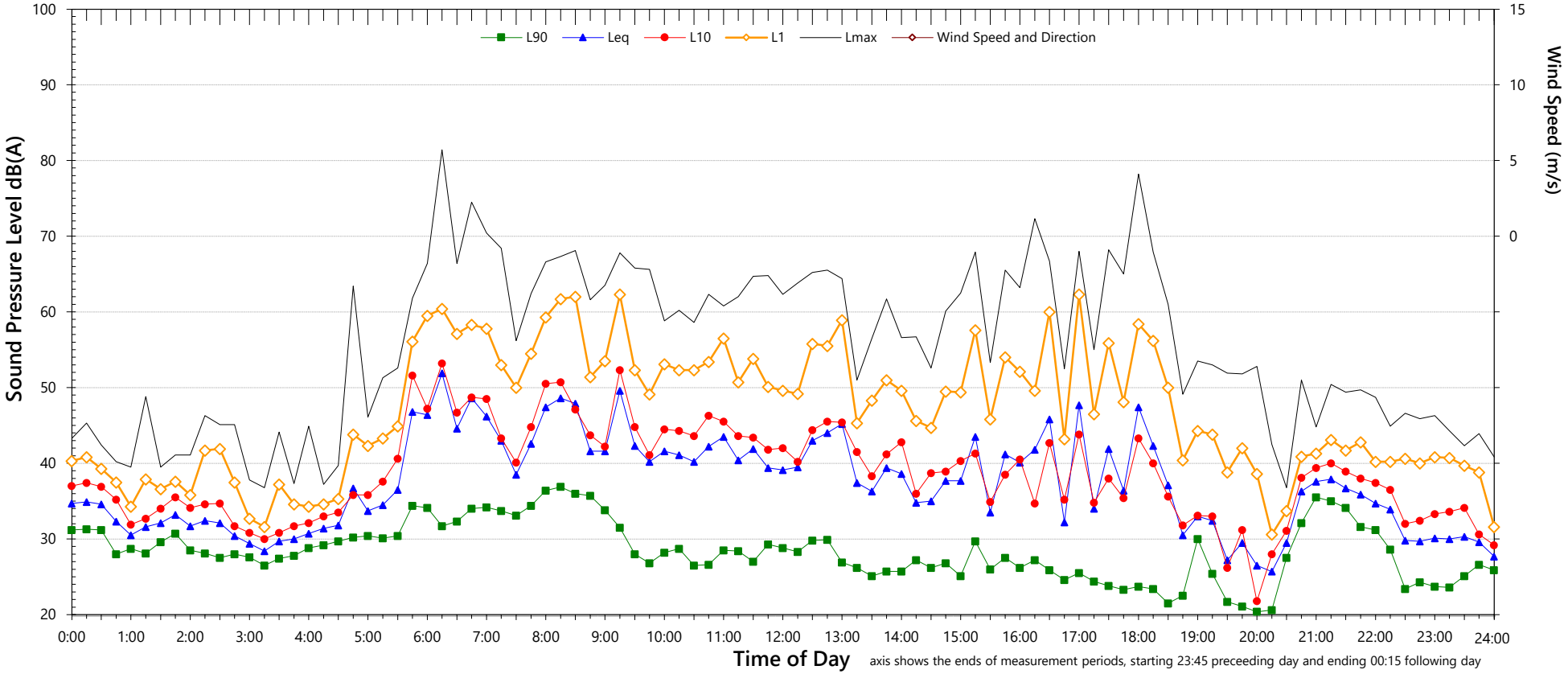
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Saturday, 14 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	63	51	49
L_1	53	42	42
L_{10}	42	34	35
L_{90}	26	22	26
Leq	43	36	40

Notes:

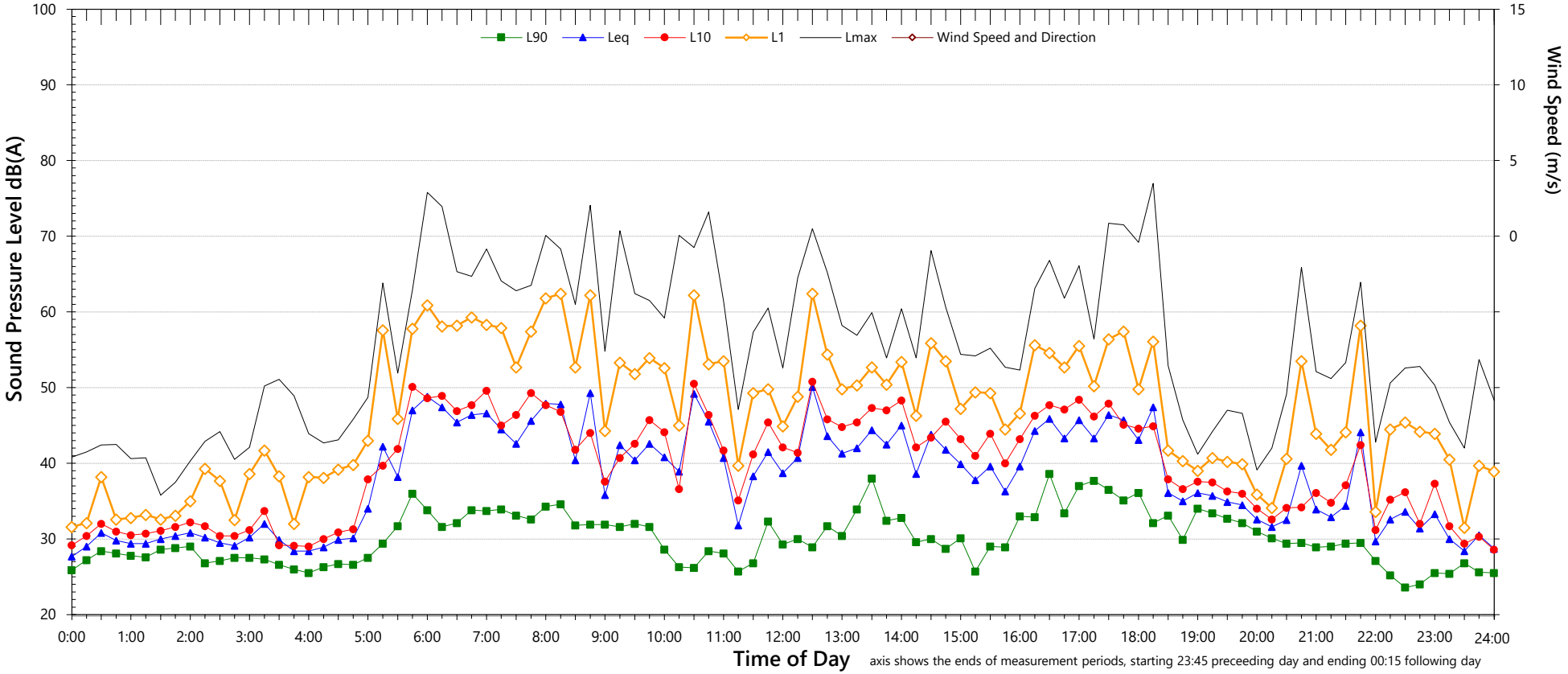
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Sunday, 15 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	62	51	50
L_1	52	43	42
L_{10}	44	36	34
L_{90}	29	29	25
Leq	44	39	39

Notes:

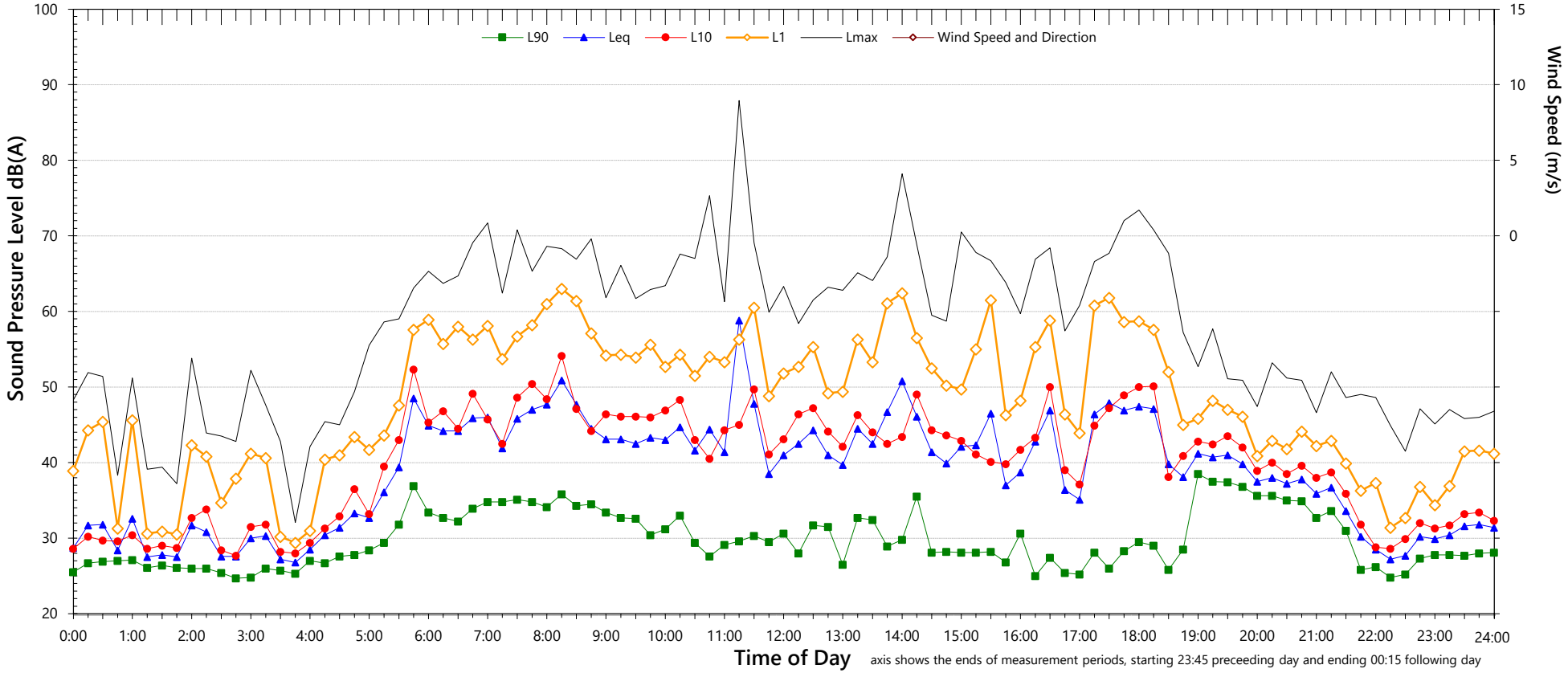
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Monday, 16 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	66	53	48
L_1	55	44	41
L_{10}	45	39	36
L_{90}	28	29	28
Leq	47	40	40

Notes:

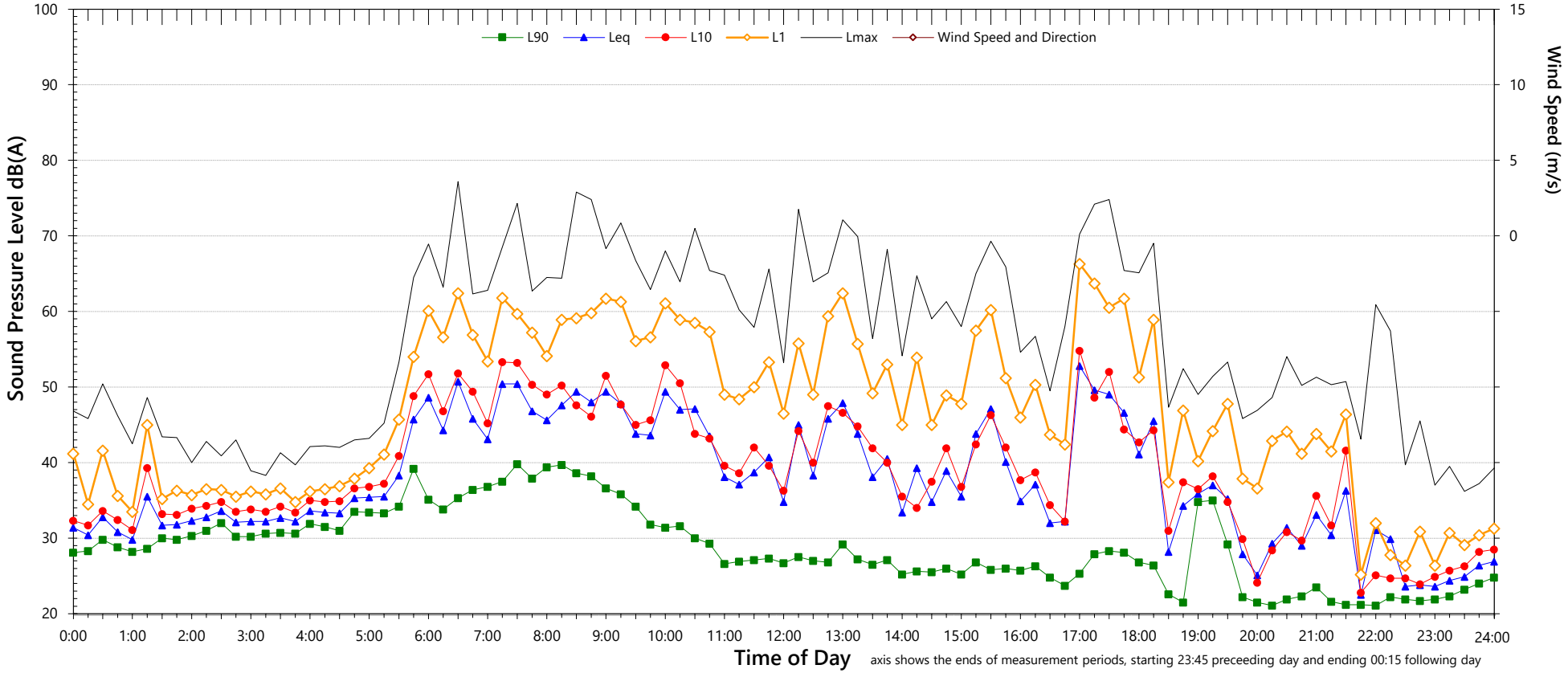
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Tuesday, 17 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	65	52	48
L_1	55	42	39
L_{10}	44	33	34
L_{90}	26	21	25
Leq	46	36	40

Notes:

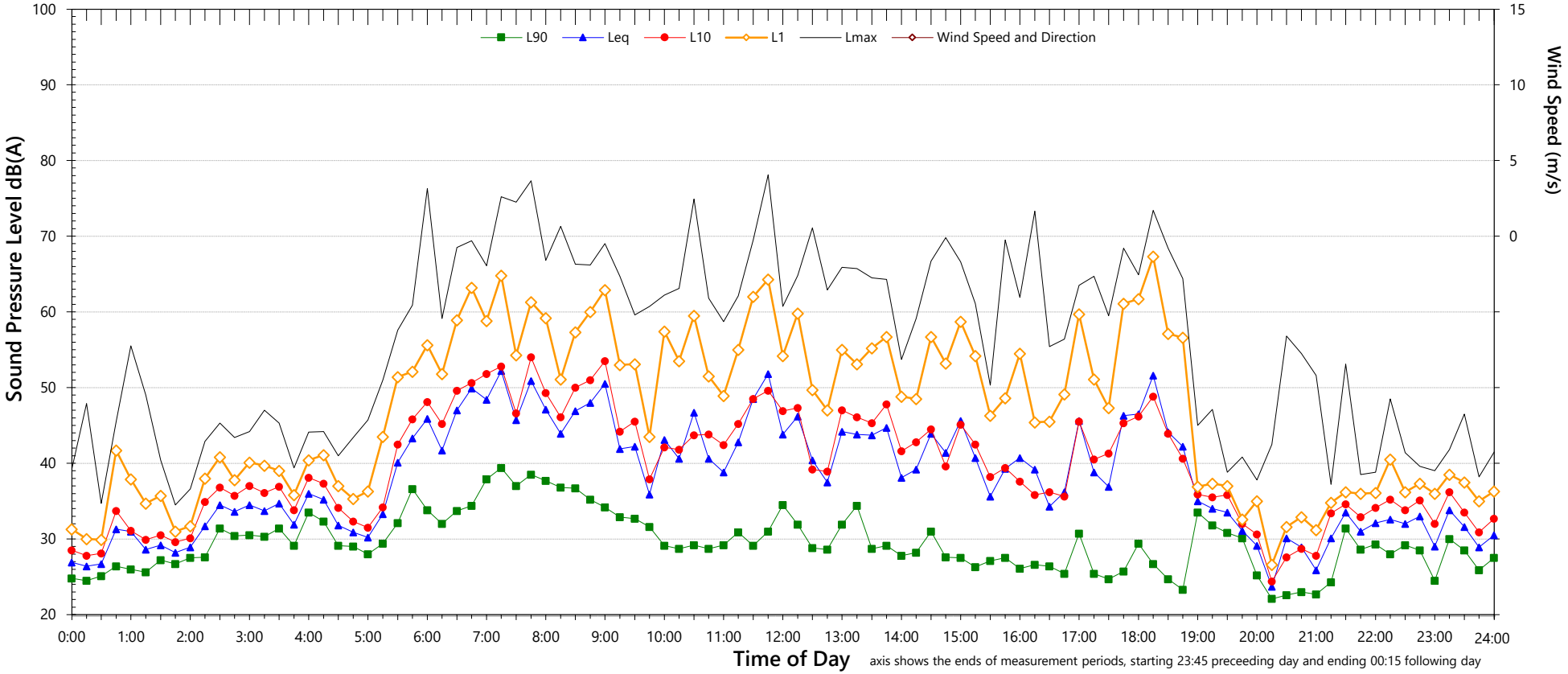
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Wednesday, 18 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	65	49	49
L_1	54	39	43
L_{10}	44	34	38
L_{90}	27	23	28
Leq	45	41	43

Notes:

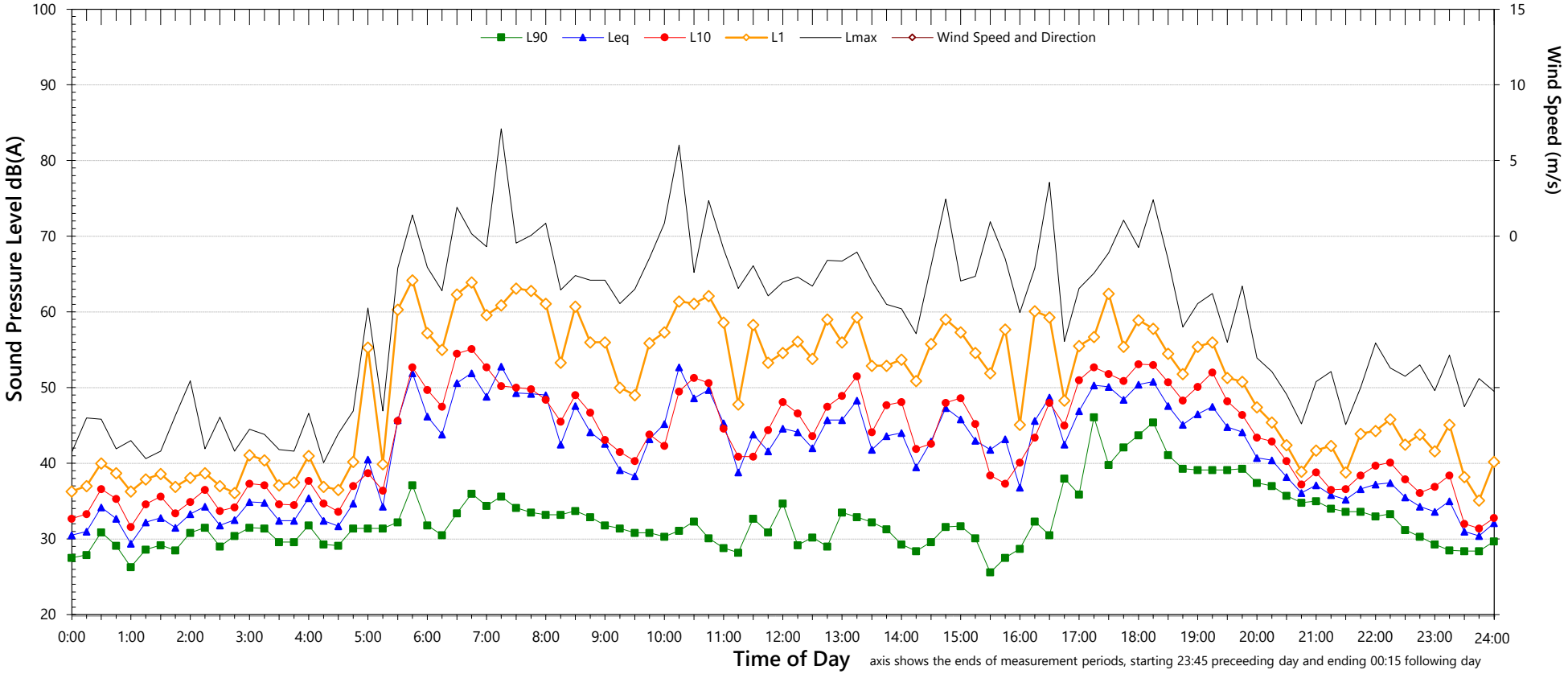
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Thursday, 19 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	67	56	51
L_1	56	48	43
L_{10}	46	44	37
L_{90}	30	35	28
Leq	47	44	43

Notes:

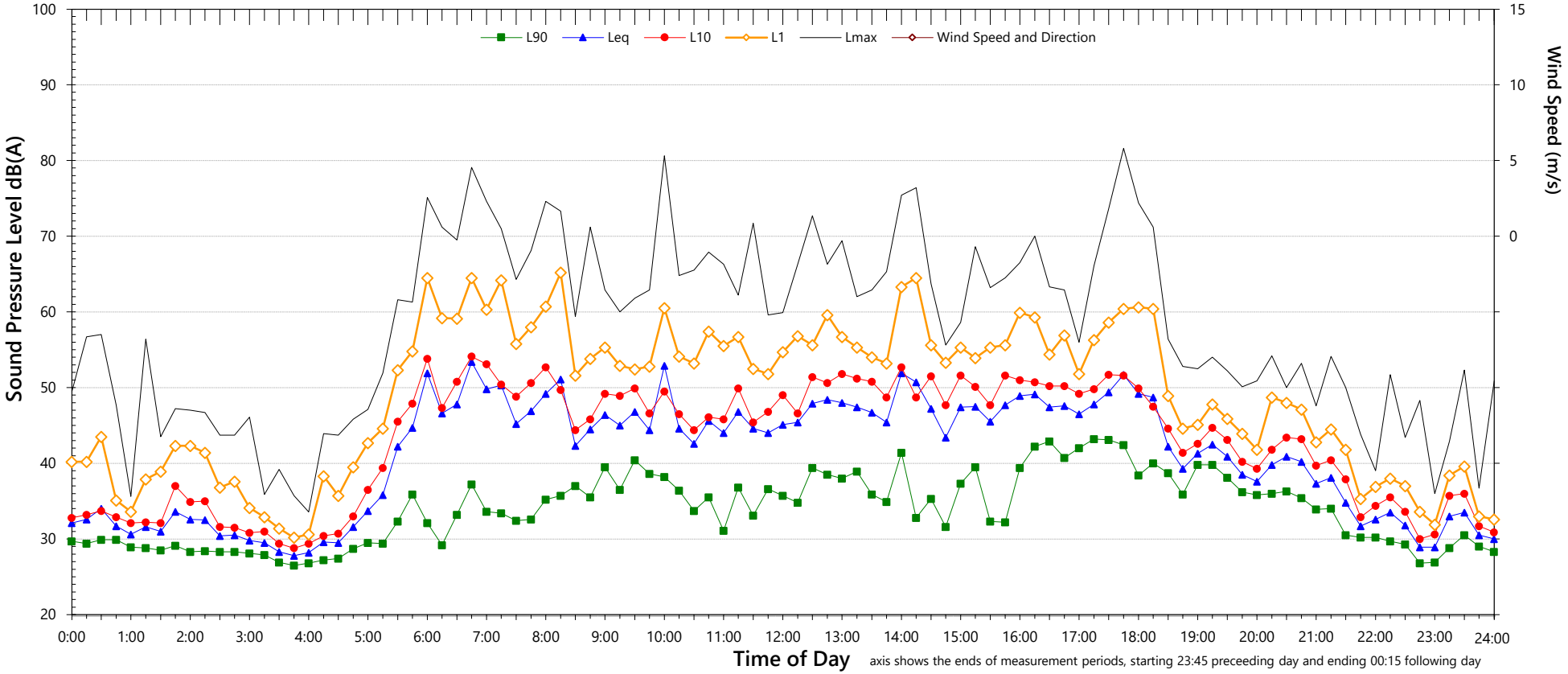
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Friday, 20 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	67	52	49
L_1	56	45	41
L_{10}	49	41	35
L_{90}	34	33	27
Leq	48	41	41

Notes:

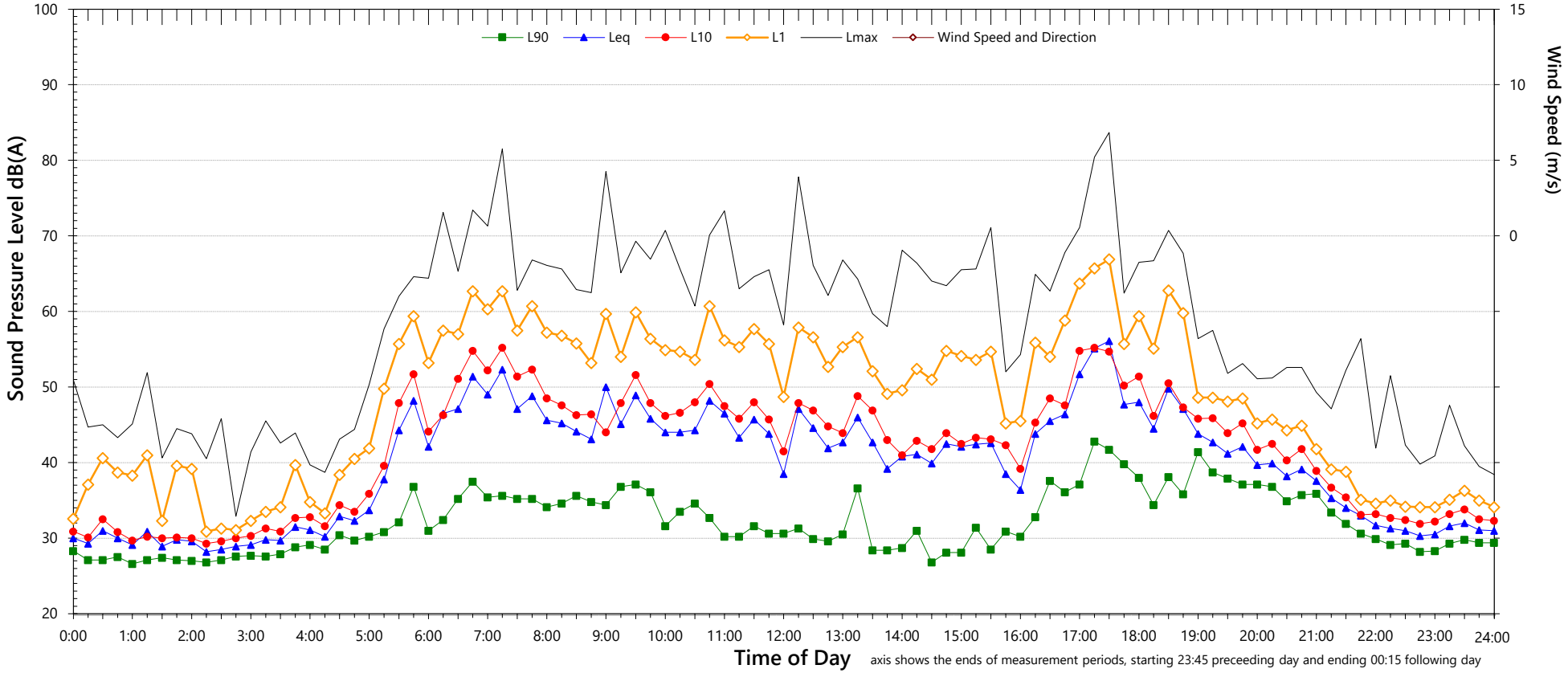
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Saturday, 21 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	66	55	50
L_1	56	46	43
L_{10}	47	42	37
L_{90}	30	33	29
Leq	47	43	43

Notes:

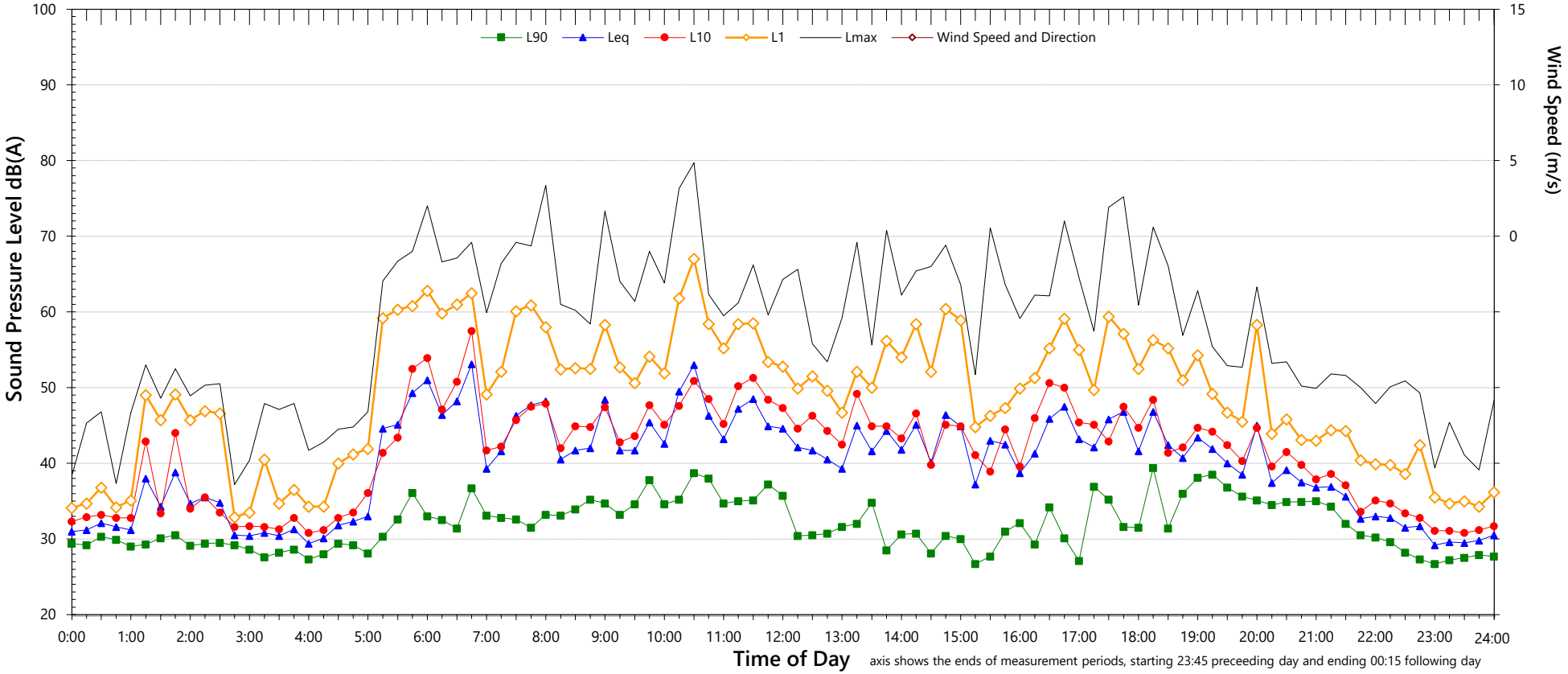
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Sunday, 22 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	65	56	49
L_1	54	48	41
L_{10}	46	41	35
L_{90}	30	33	25
Leq	45	41	43

Notes:

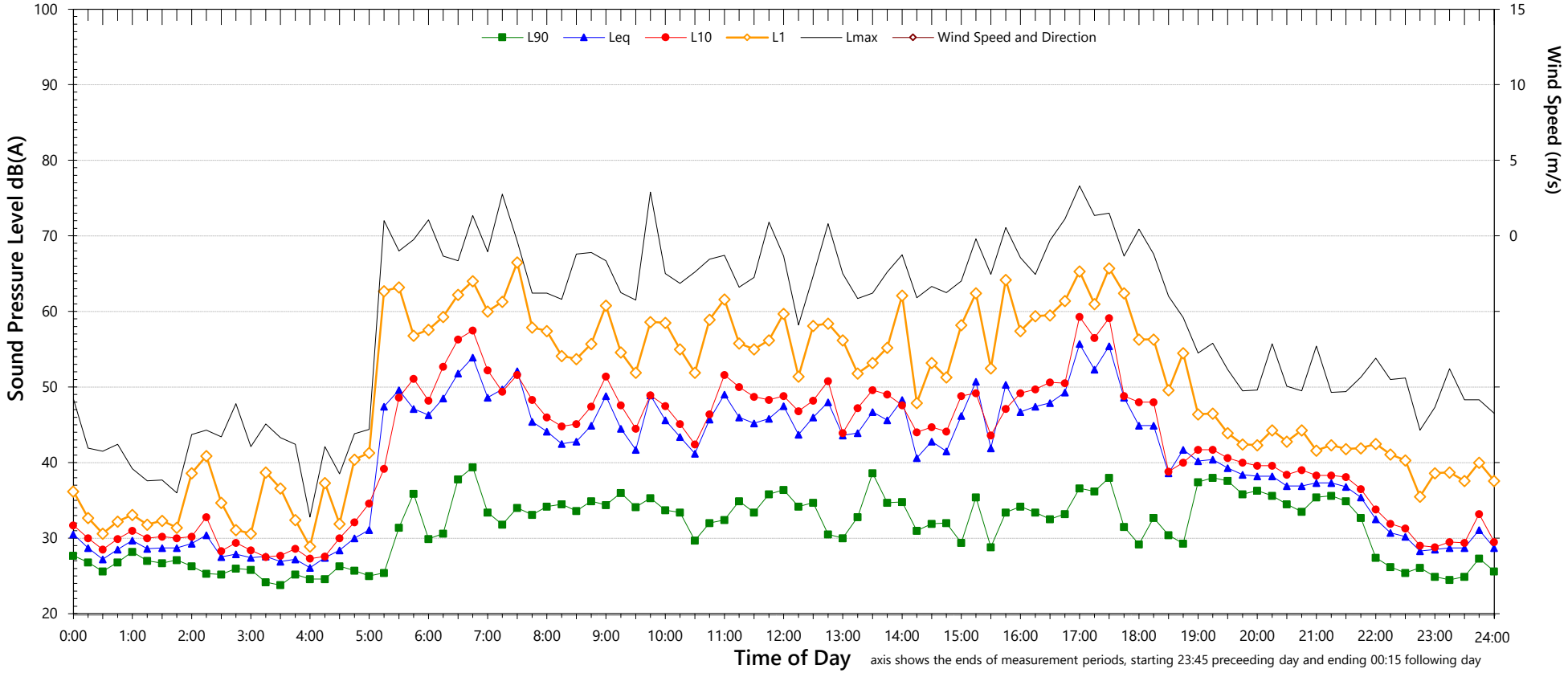
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Monday, 23 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	67	54	50
L_1	57	45	41
L_{10}	48	40	34
L_{90}	32	32	25
Leq	48	39	43

Notes:

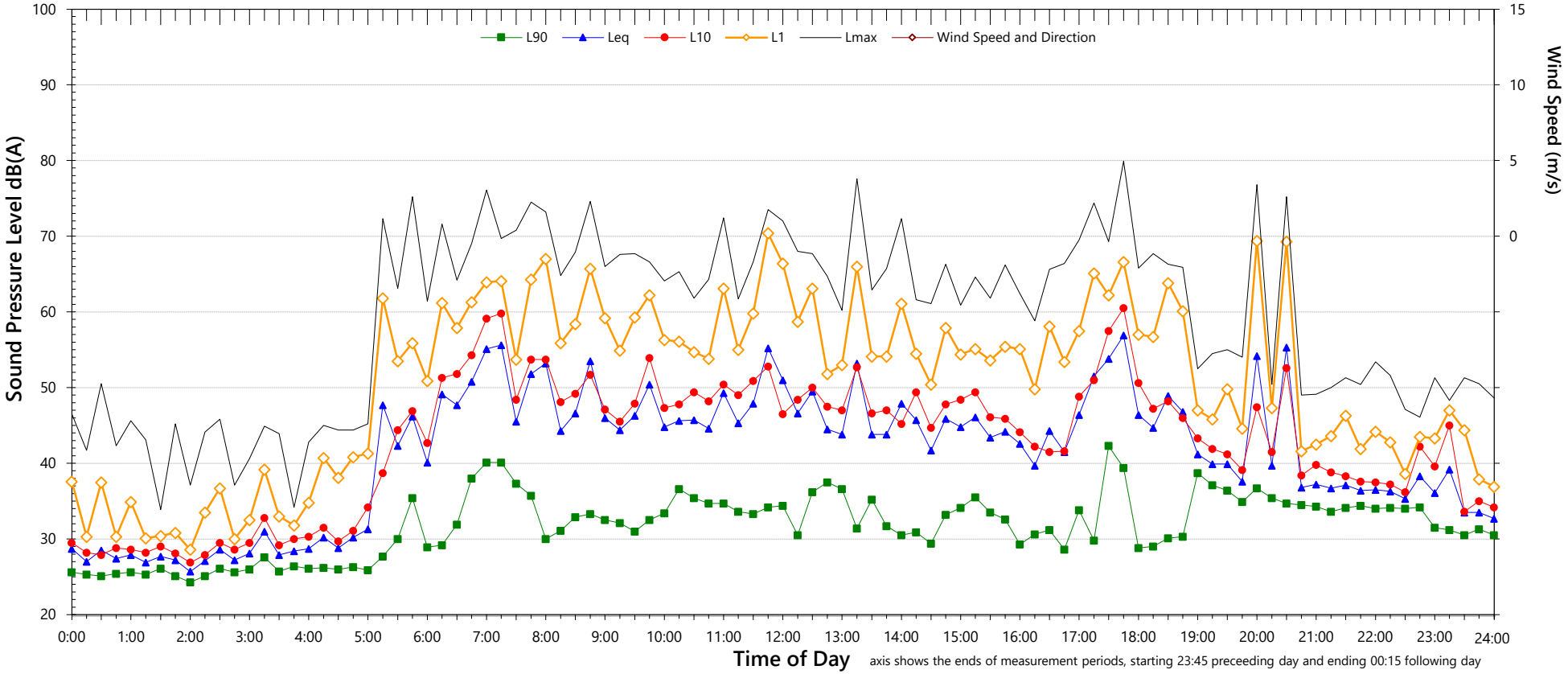
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Tuesday, 24 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	67	58	47
L_1	58	51	38
L_{10}	49	42	35
L_{90}	31	32	29
Leq	49	47	34

Notes:

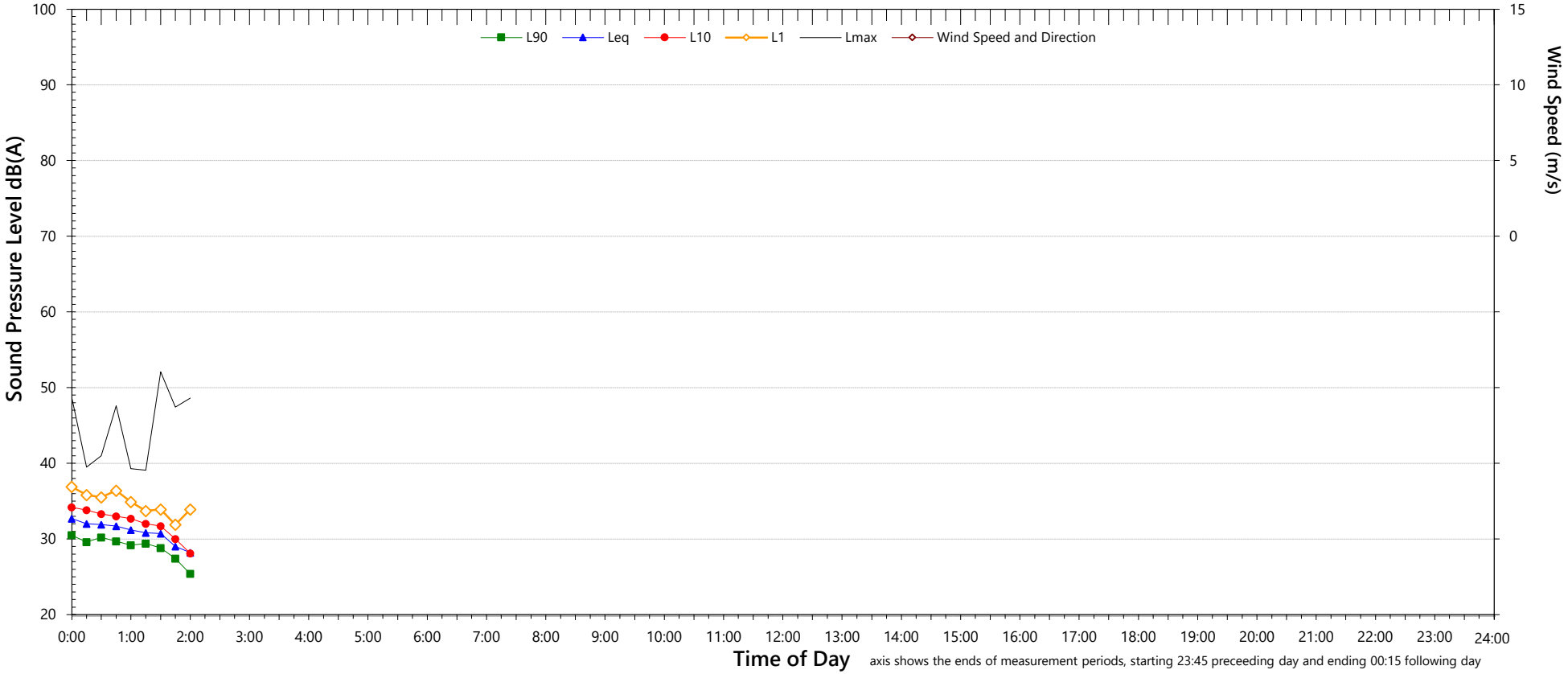
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L1

Wednesday, 25 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	-	-	-
L_1	-	-	-
L_{10}	-	-	-
L_{90}	-	-	-
Leq	-	-	-

Notes:

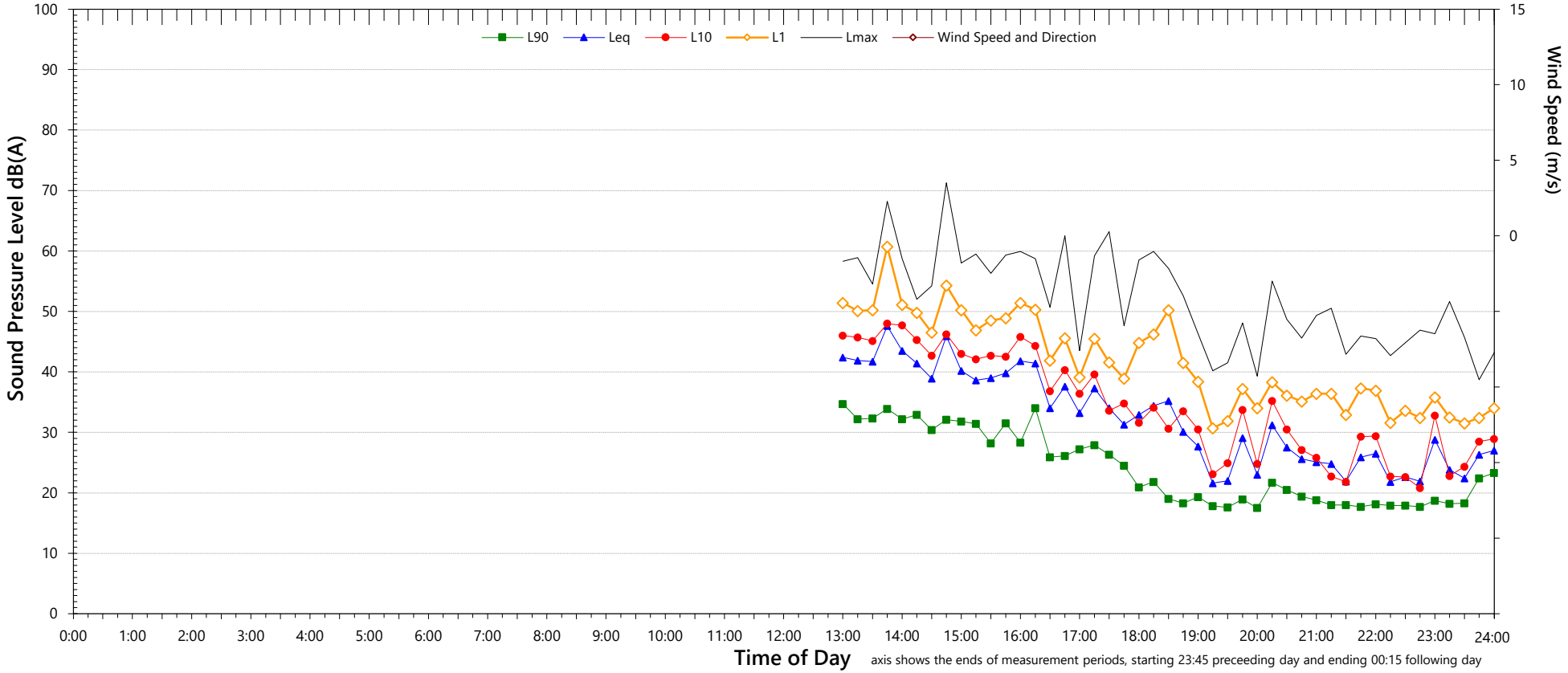
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Tuesday, 10 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	58	48	48
L_1	48	37	37
L_{10}	42	29	31
L_{90}	27	18	19
Leq	41	29	34

Notes:

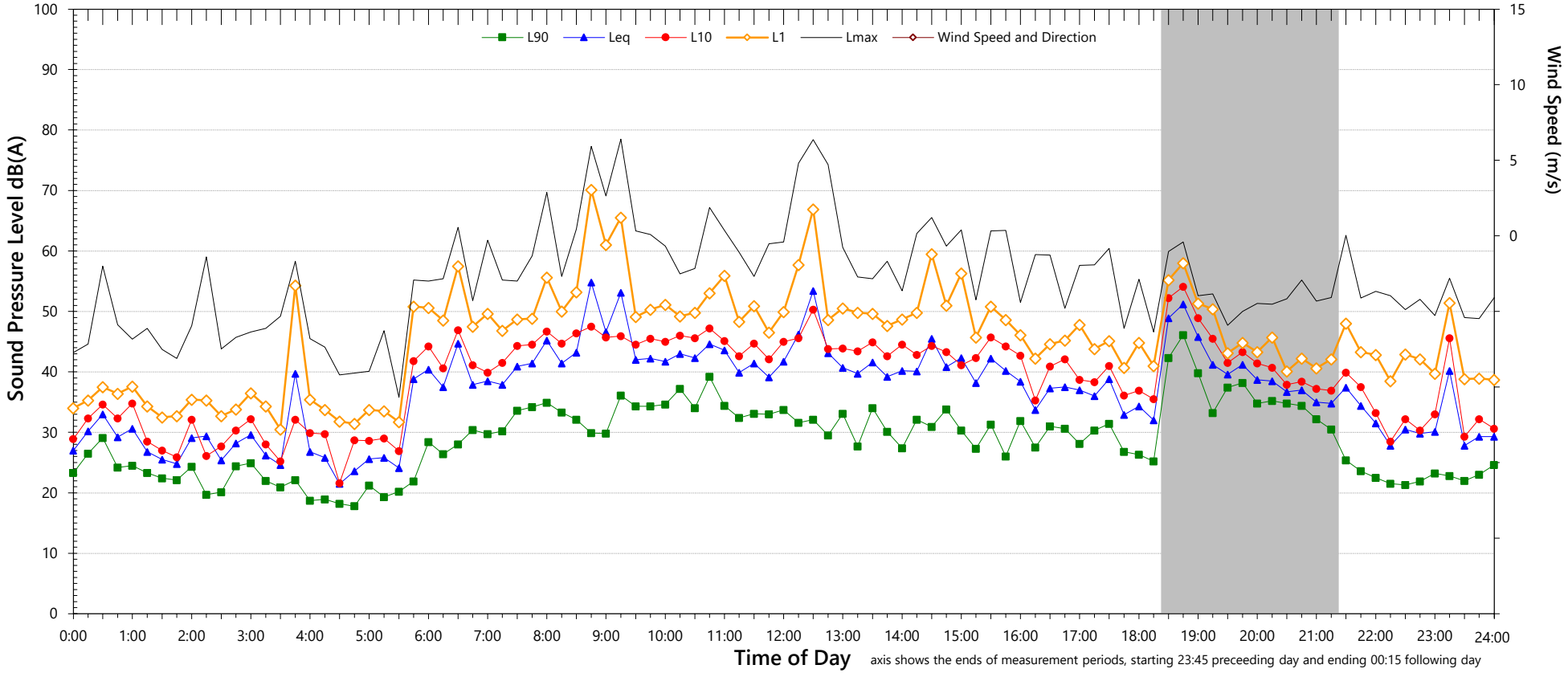
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Wednesday, 11 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	61	54	51
L_1	51	44	41
L_{10}	44	37	35
L_{90}	29	23	23
Leq	45	34	38

Notes:

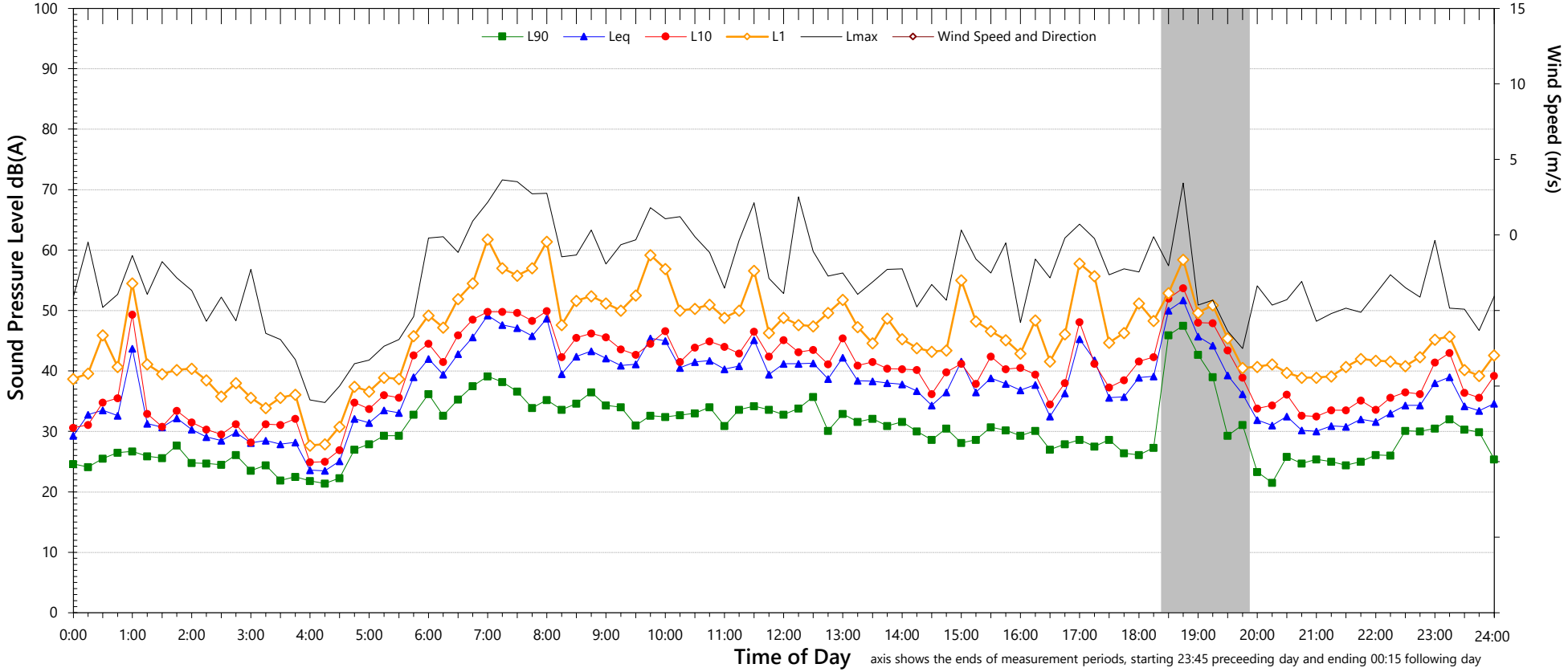
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Thursday, 12 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	60	52	52
L_1	50	41	42
L_{10}	43	35	38
L_{90}	29	23	27
Leq	42	33	39

Notes:

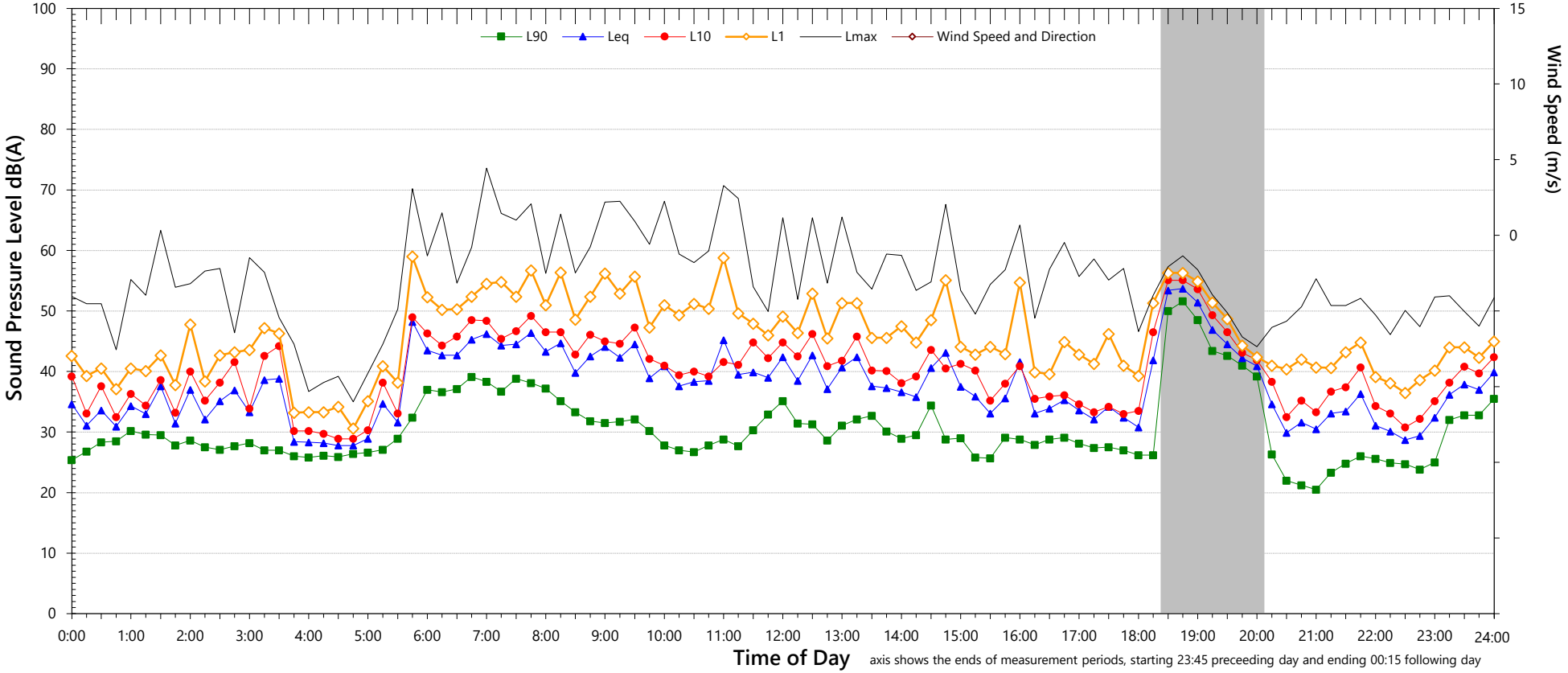
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Friday, 13 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	59	51	51
L_1	49	43	43
L_{10}	41	37	39
L_{90}	28	22	27
Leq	41	35	40

Notes:

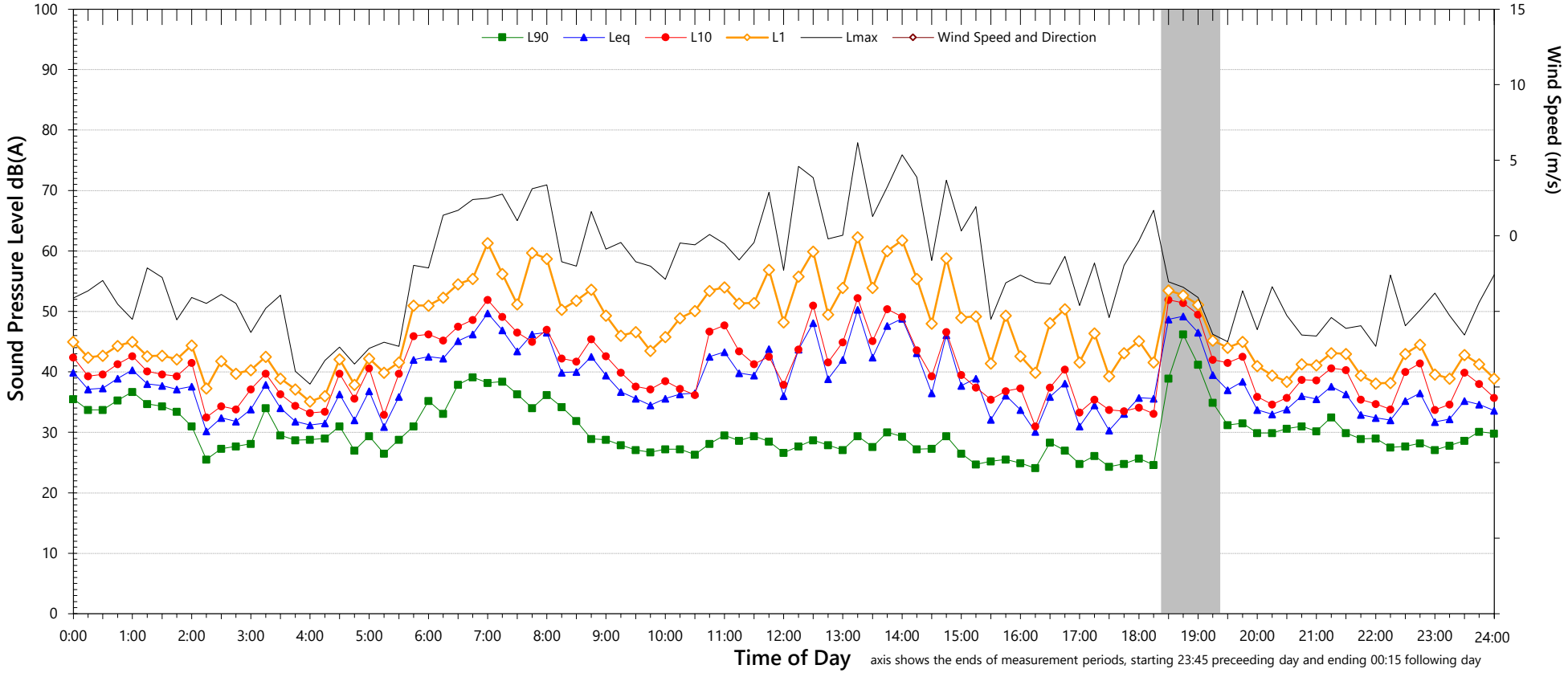
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Saturday, 14 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	62	50	51
L_1	51	41	43
L_{10}	41	38	39
L_{90}	26	29	29
Leq	43	36	39

Notes:

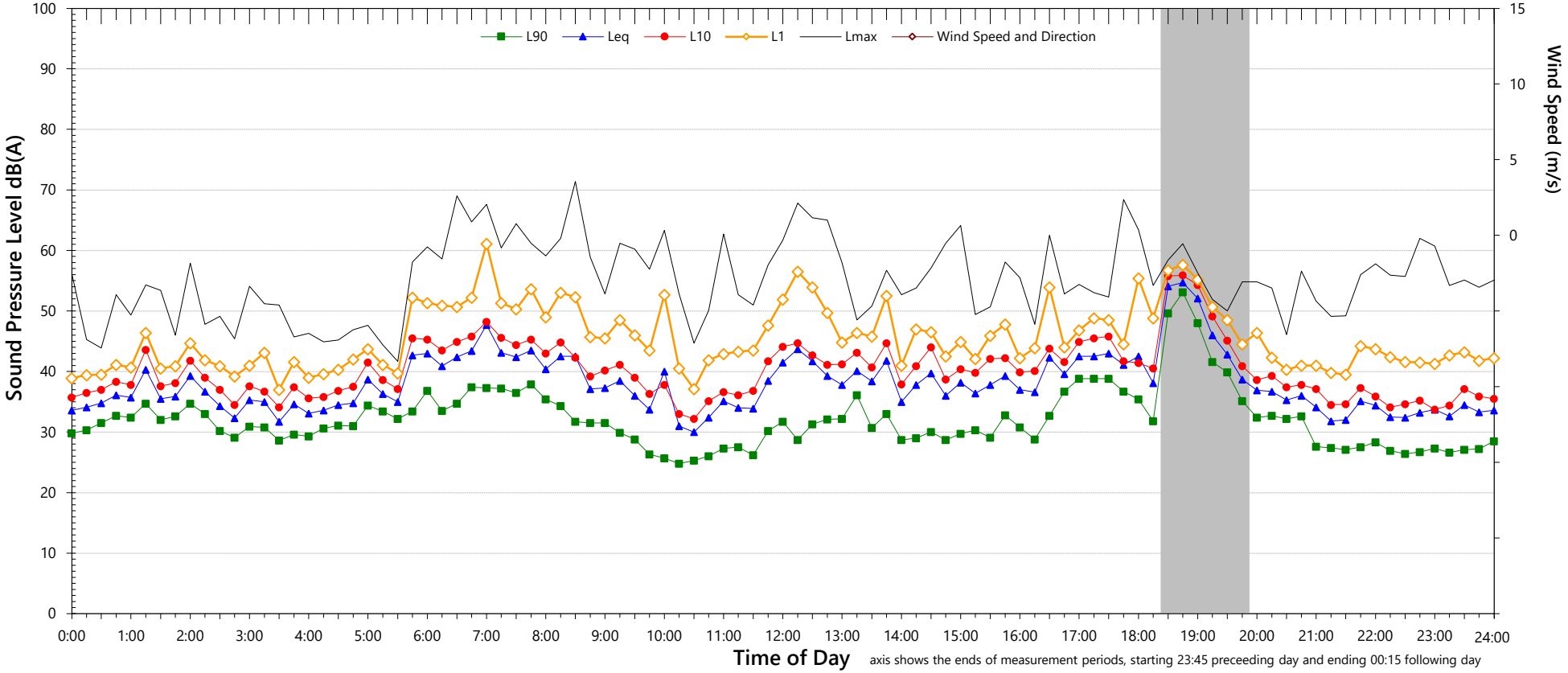
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Sunday, 15 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	58	53	55
L_1	47	43	43
L_{10}	41	37	36
L_{90}	28	28	27
Leq	40	35	40

Notes:

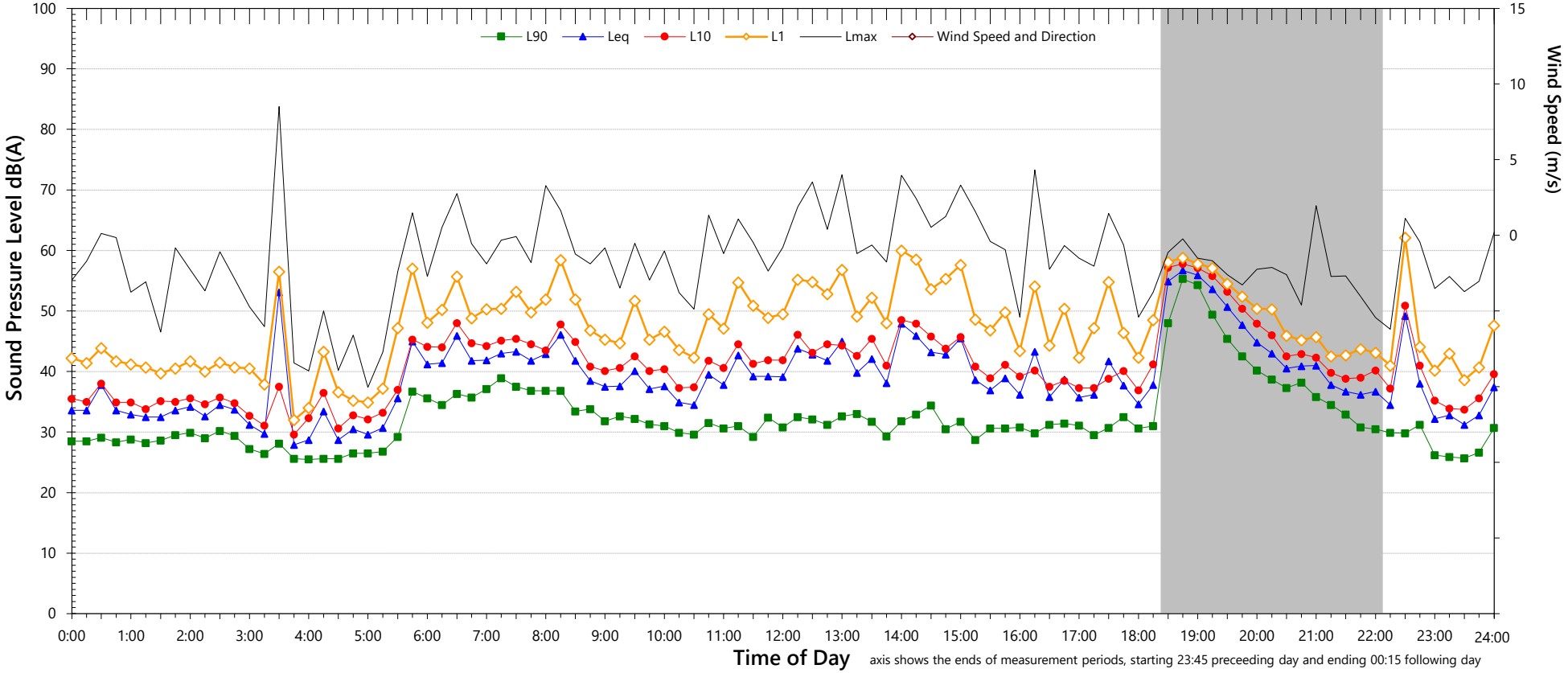
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Monday, 16 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	62	53	54
L_1	50	49	44
L_{10}	42	41	39
L_{90}	30	-	28
Leq	42	38	39

Notes:

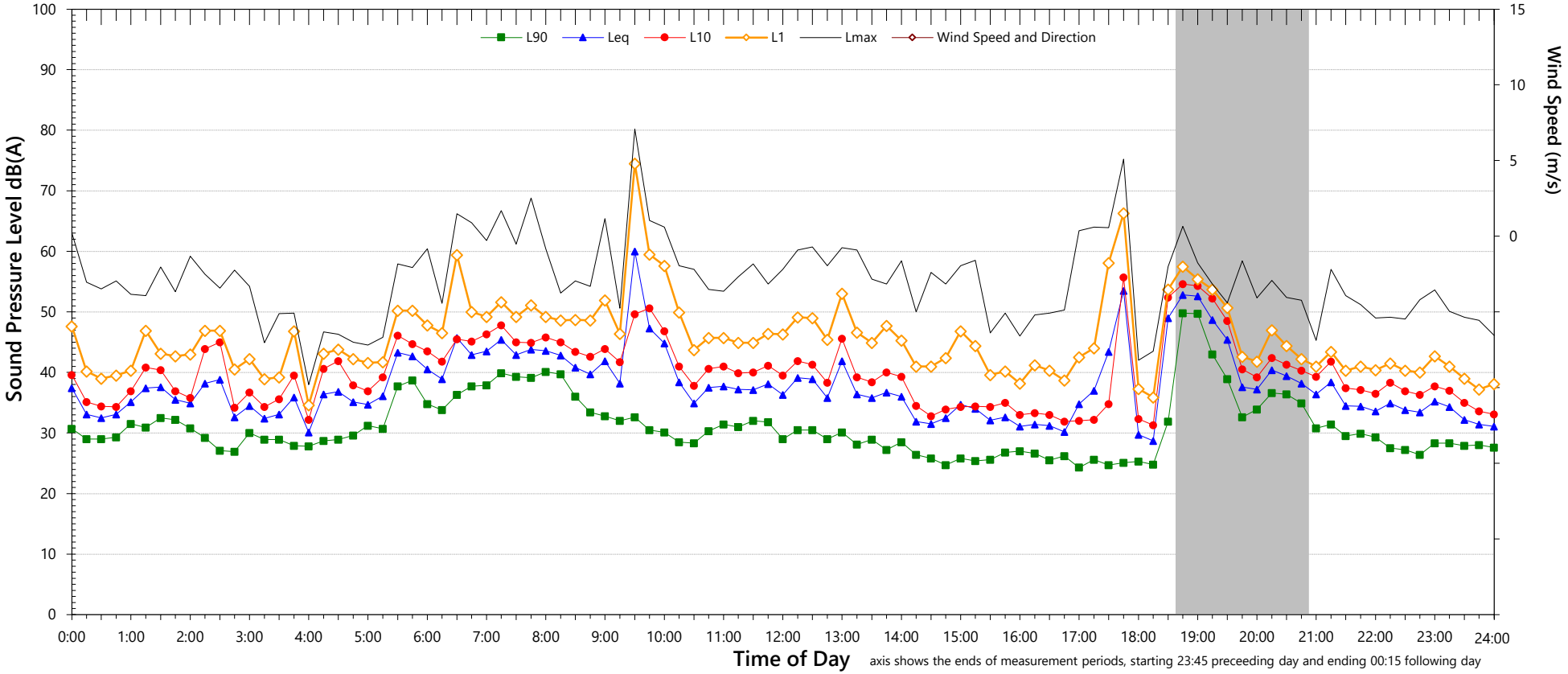
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Tuesday, 17 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	58	51	51
L_1	47	42	42
L_{10}	40	39	38
L_{90}	26	28	28
Leq	46	42	37

Notes:

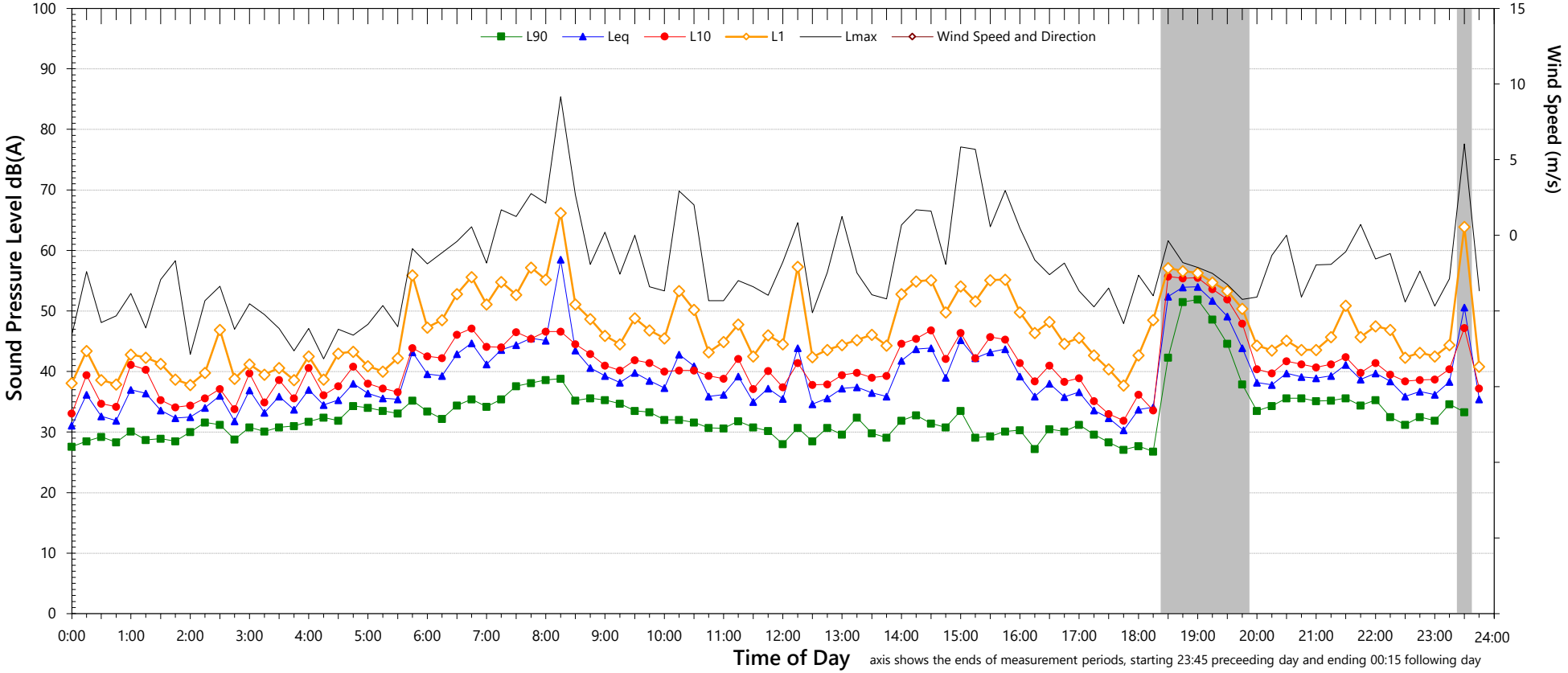
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Wednesday, 18 September 2019



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	61	58	55
L_1	49	46	43
L_{10}	41	40	39
L_{90}	29	33	32
Leq	44	39	37

Notes:

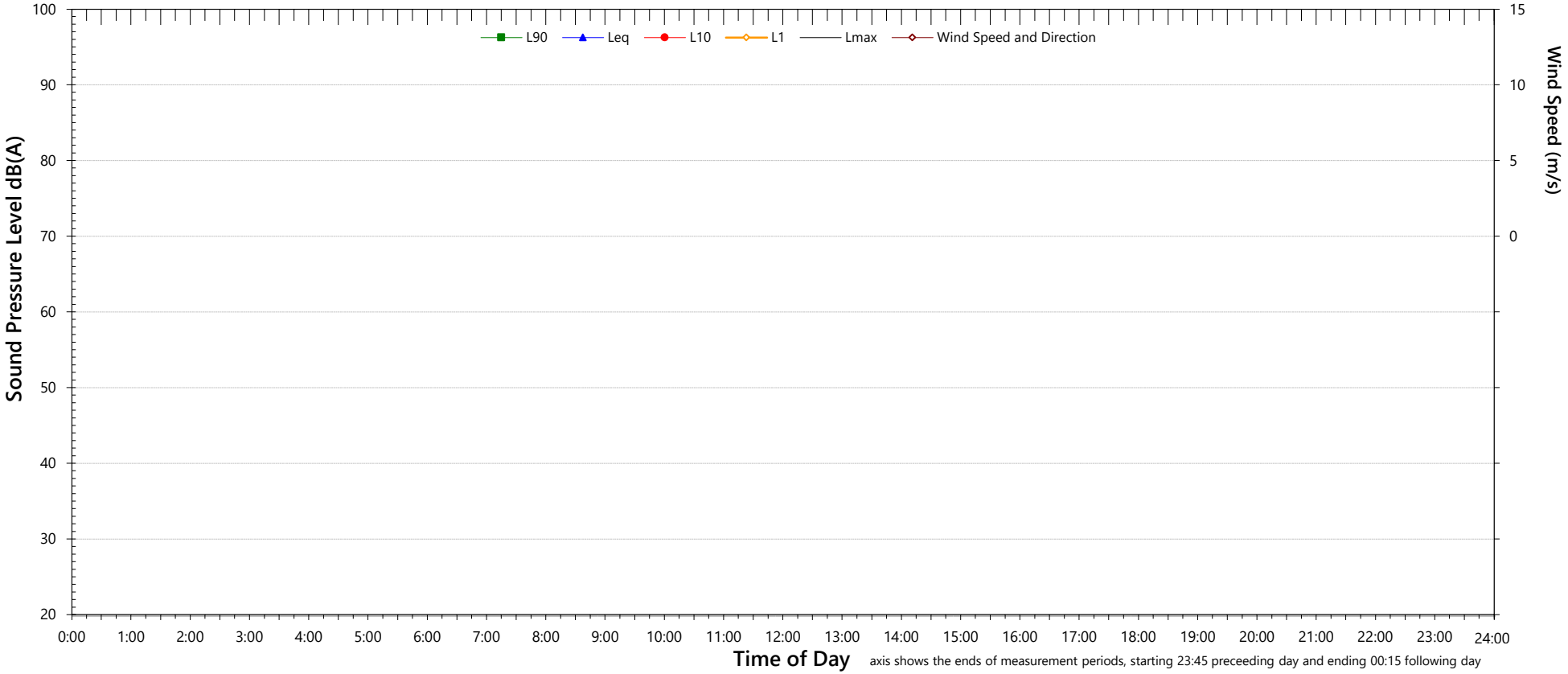
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L2

Thursday, 19 September 2019



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	-	-	-
L_1	-	-	-
L_{10}	-	-	-
L_{90}	-	-	-
Leq	-	-	-

DTMR Summary						
Descriptor	L_{max}	L_{eq}	L_{eq} 1h	L_{10}	Max L_{10} 1h	L_{90}
Day	-	-	-	-	-	-
Night	-	-	-	-	-	-
8 Hour	-	-	-	-	-	-
12 Hour	-	-	-	-	-	-
18 Hour	-	-	-	-	-	-
24 Hour	-	-	-	-	-	-

Notes:

1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

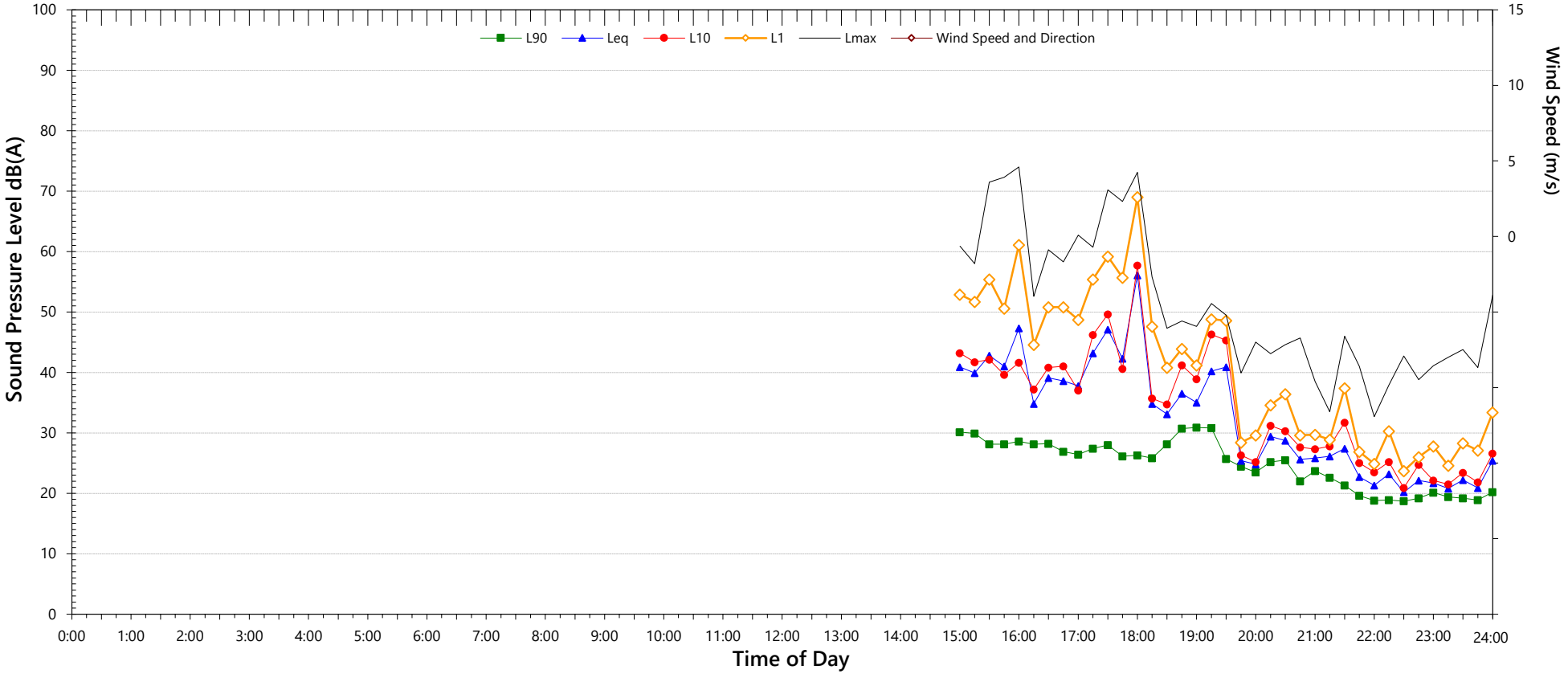
2. Graphed & tabulated data measured in free-field

3. Night period is taken from 10pm in the first day to 7am the next day

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Tuesday, 8 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	65	44	44
L_1	54	36	32
L_{10}	43	32	28
L_{90}	27	22	19
Leq	47	34	39

Notes:

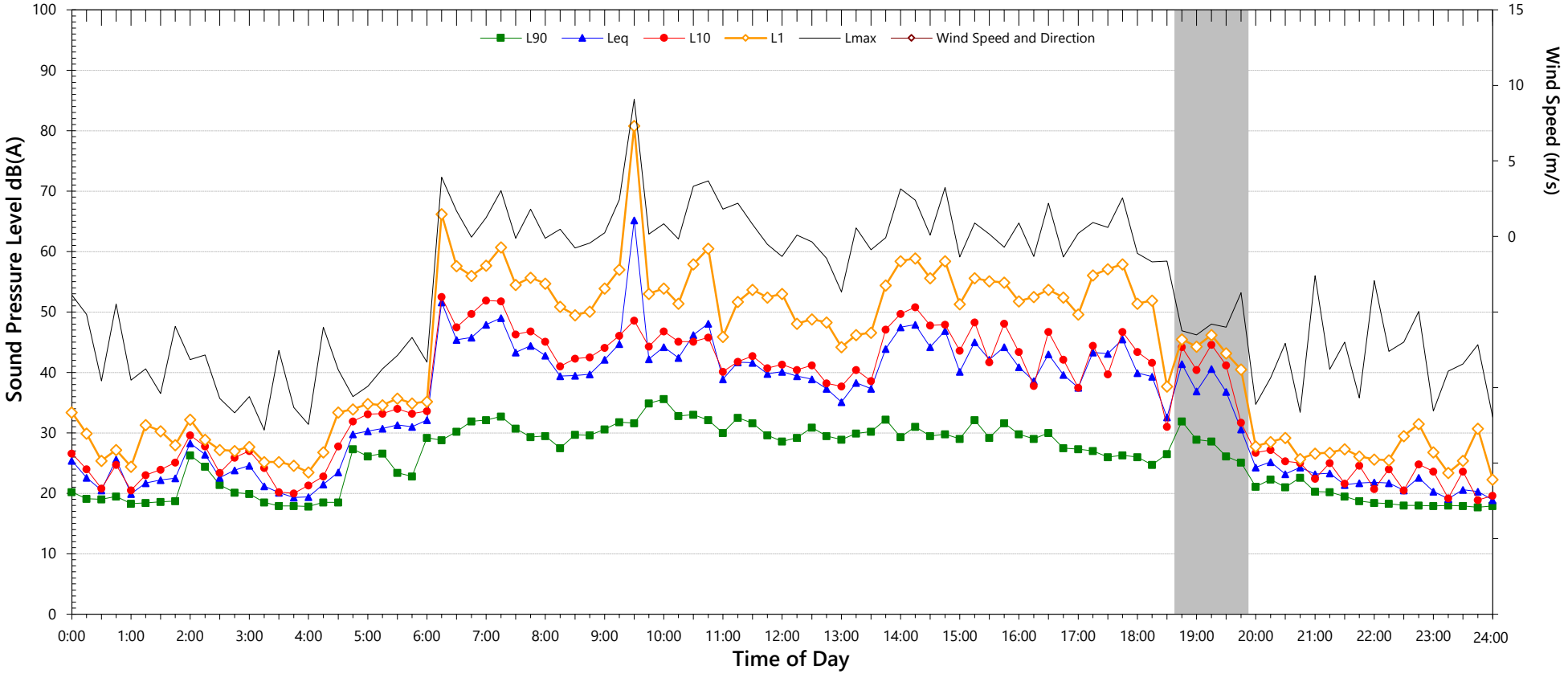
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Wednesday, 9 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	64	46	45
L_1	54	30	32
L_{10}	44	26	26
L_{90}	28	19	18
Leq	50	30	42

Notes:

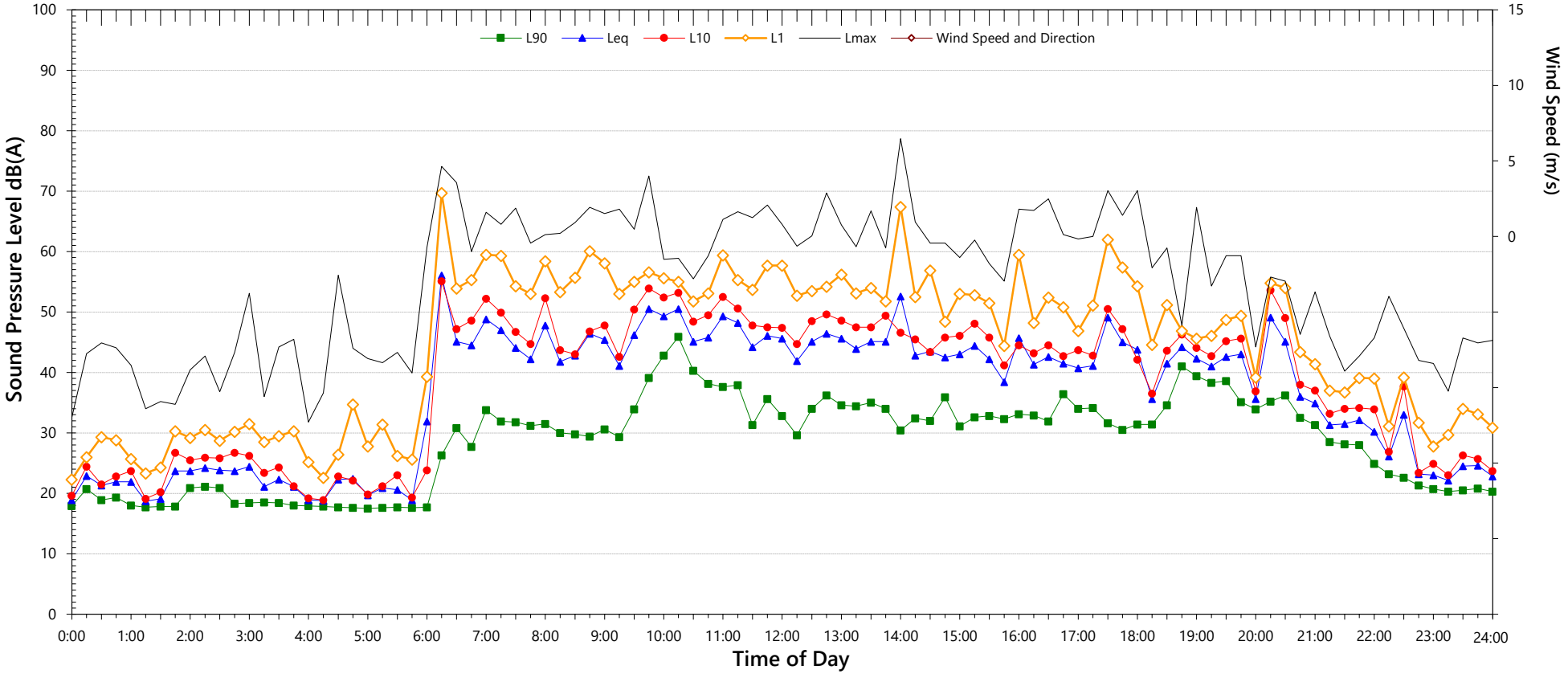
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Thursday, 10 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	64	52	46
L_1	55	45	34
L_{10}	47	41	28
L_{90}	31	30	20
Leq	46	42	44

Notes:

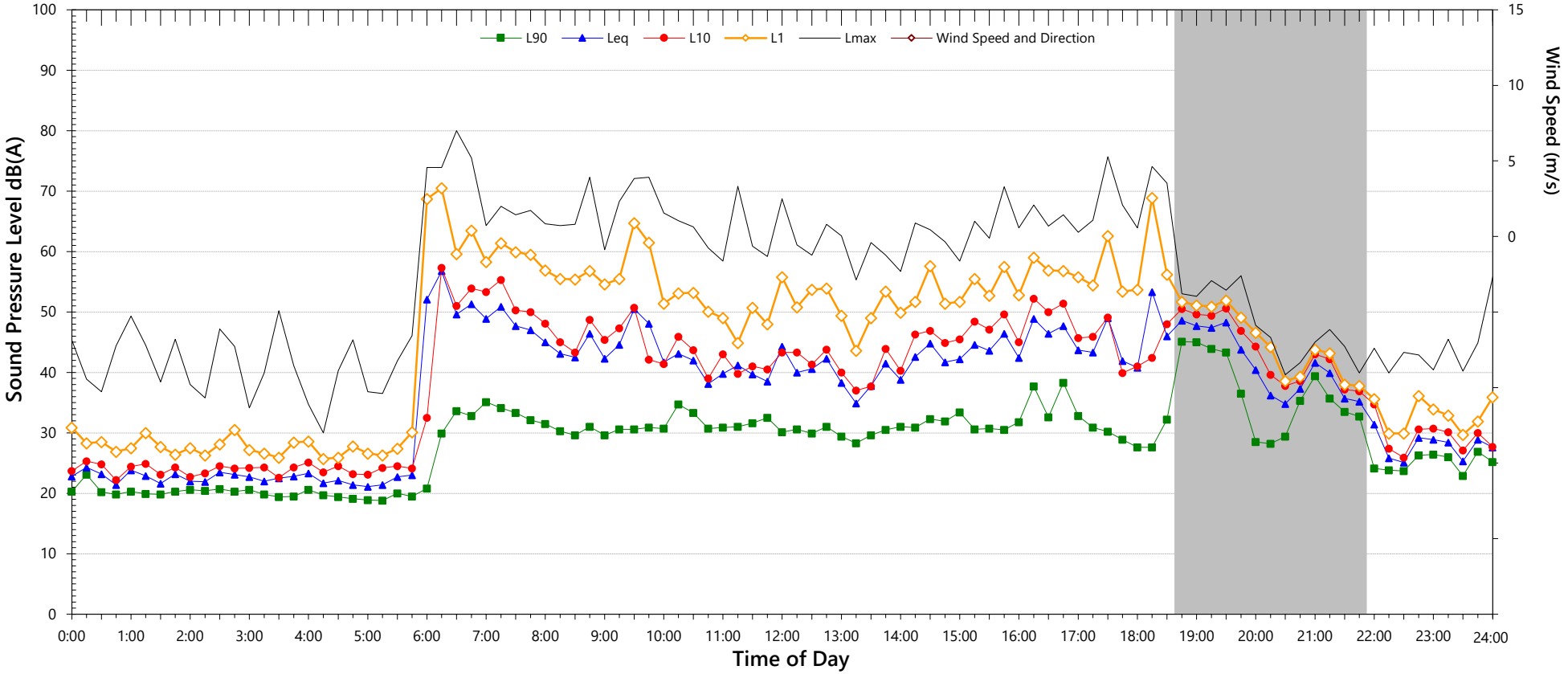
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Friday, 11 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	64	63	47
L_1	54	54	37
L_{10}	45	42	32
L_{90}	30	24	23
Leq	45	49	42

Notes:

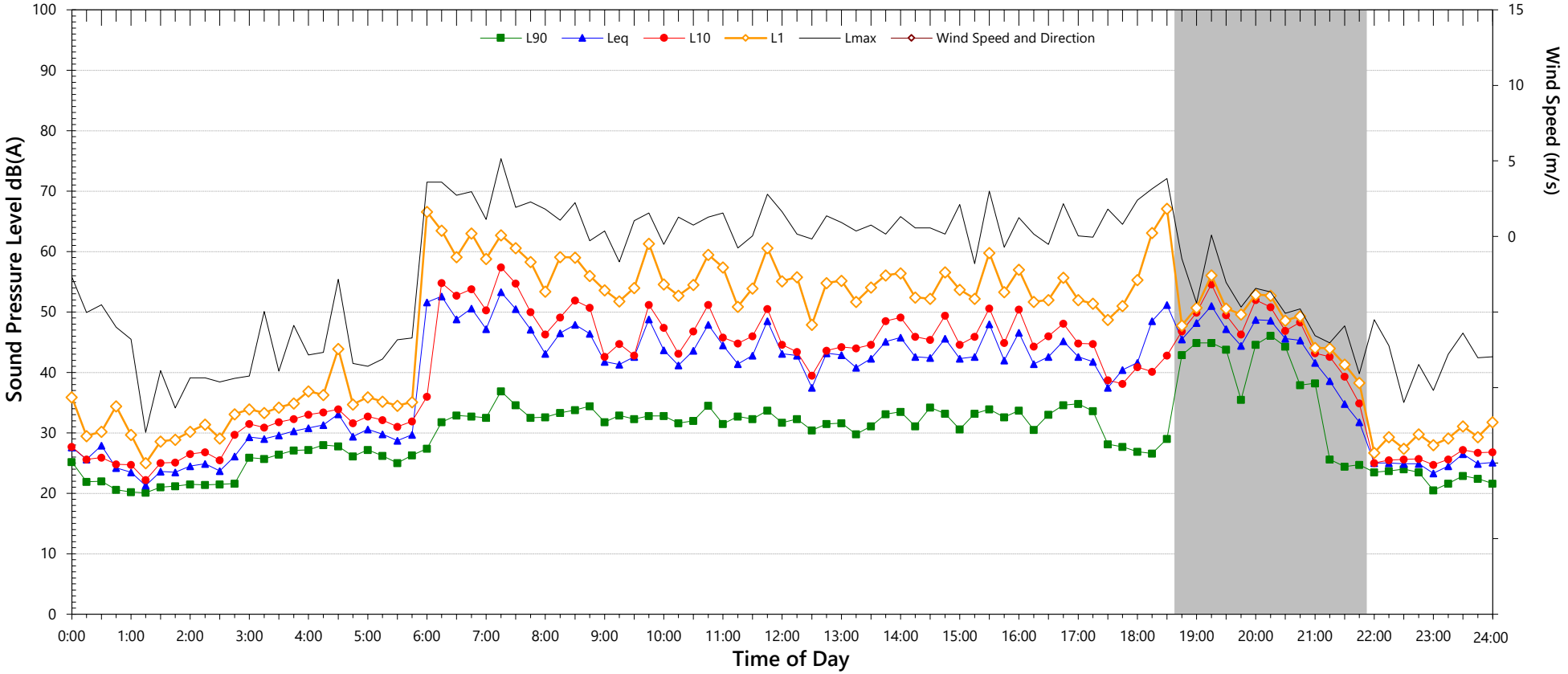
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Saturday, 12 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	65	64	47
L_1	55	52	34
L_{10}	46	36	28
L_{90}	31	24	18
Leq	45	48	44

Notes:

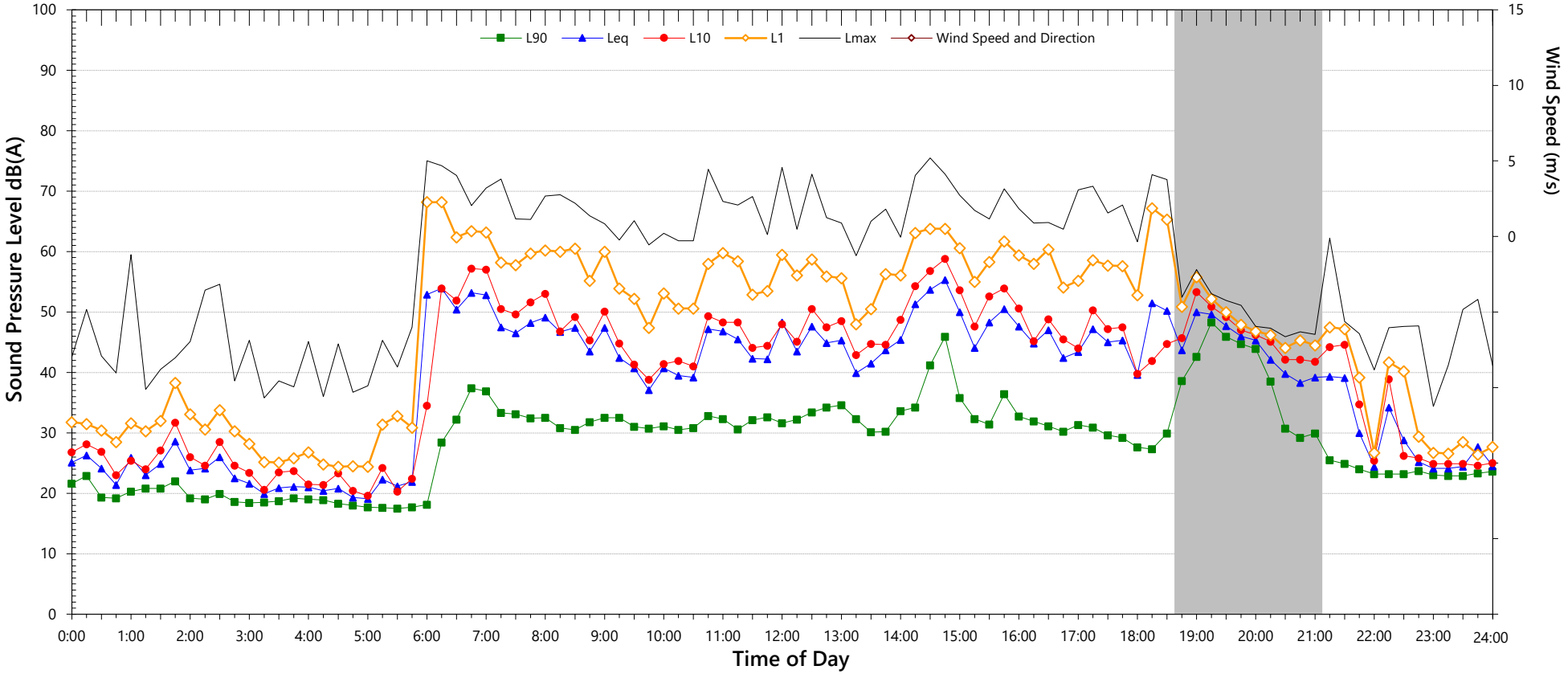
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Sunday, 13 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	67	57	46
L_1	57	49	33
L_{10}	48	39	28
L_{90}	31	24	19
Leq	47	46	44

Notes:

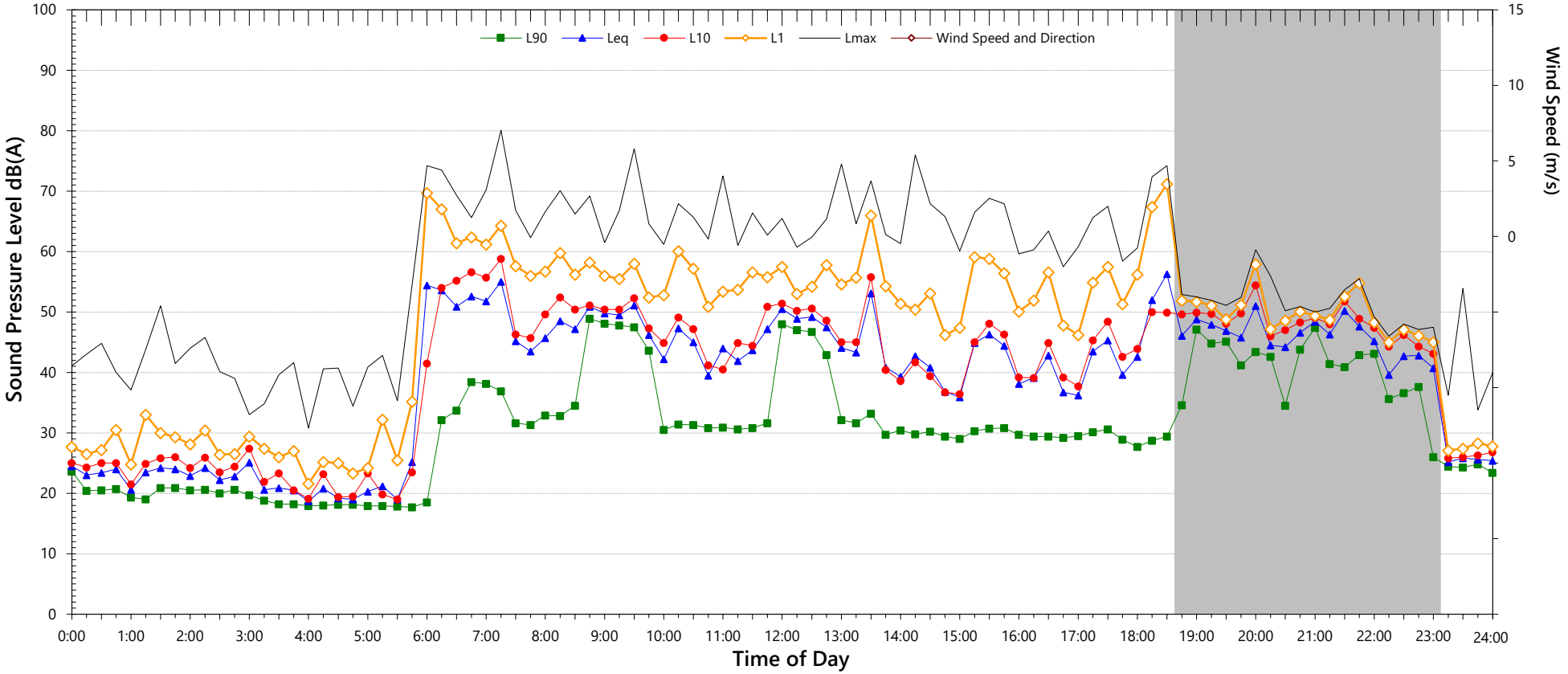
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Monday, 14 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	66	73	45
L_1	55	69	33
L_{10}	46	50	29
L_{90}	30	29	20
Leq	47	55	45

Notes:

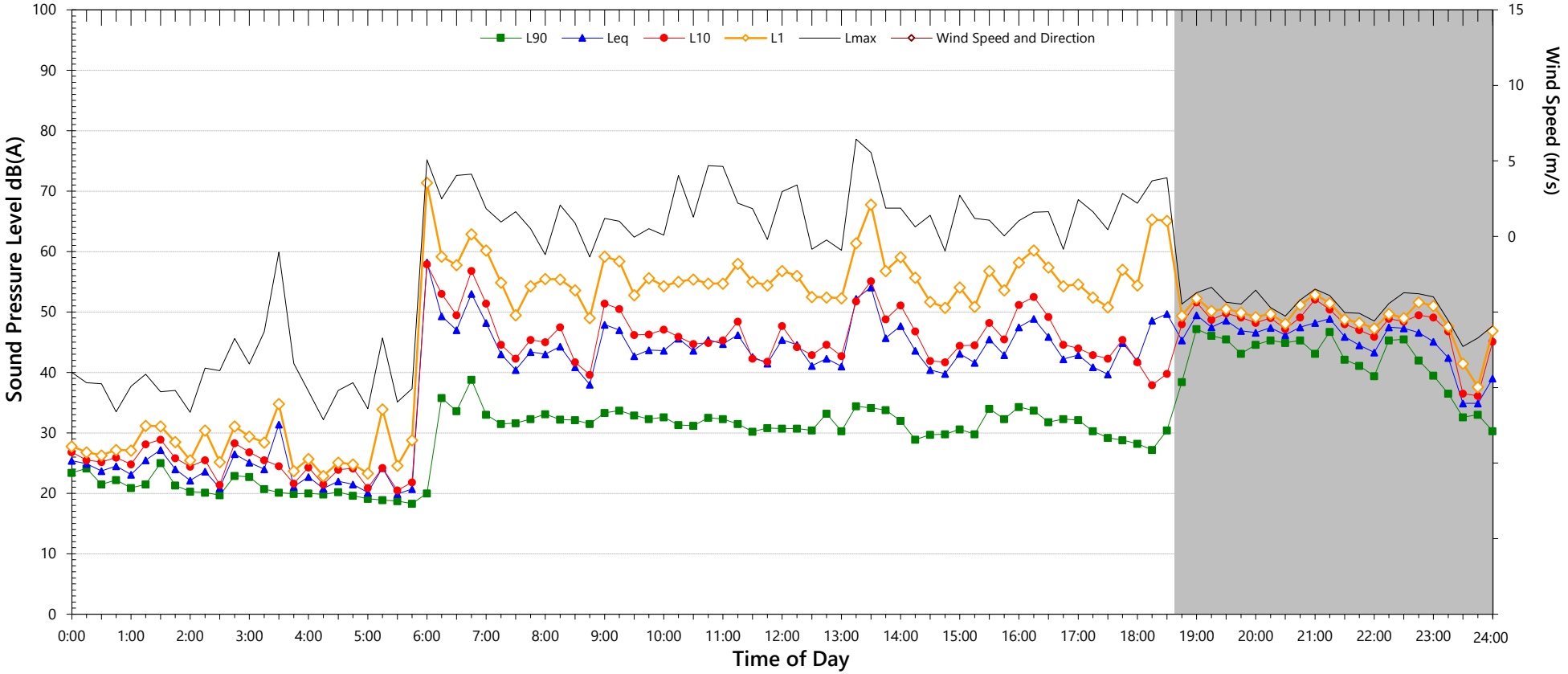
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Tuesday, 15 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	66	72	47
L_1	55	65	37
L_{10}	46	39	32
L_{90}	30	27	19
Leq	45	49	46

Notes:

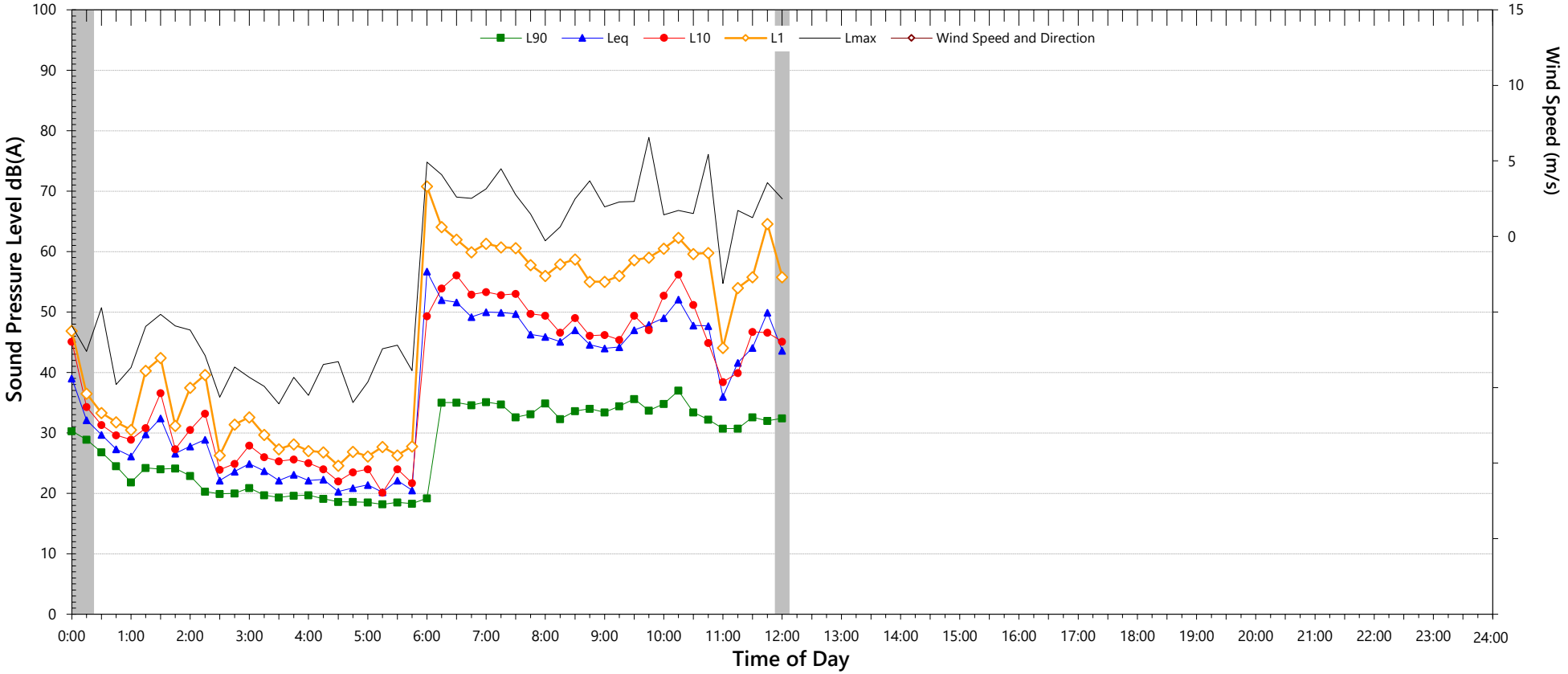
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Mine - Logger L3

Wednesday, 16 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	68	-	-
L_1	58	-	-
L_{10}	48	-	-
L_{90}	32	-	-
Leq	47	-	-

Notes:

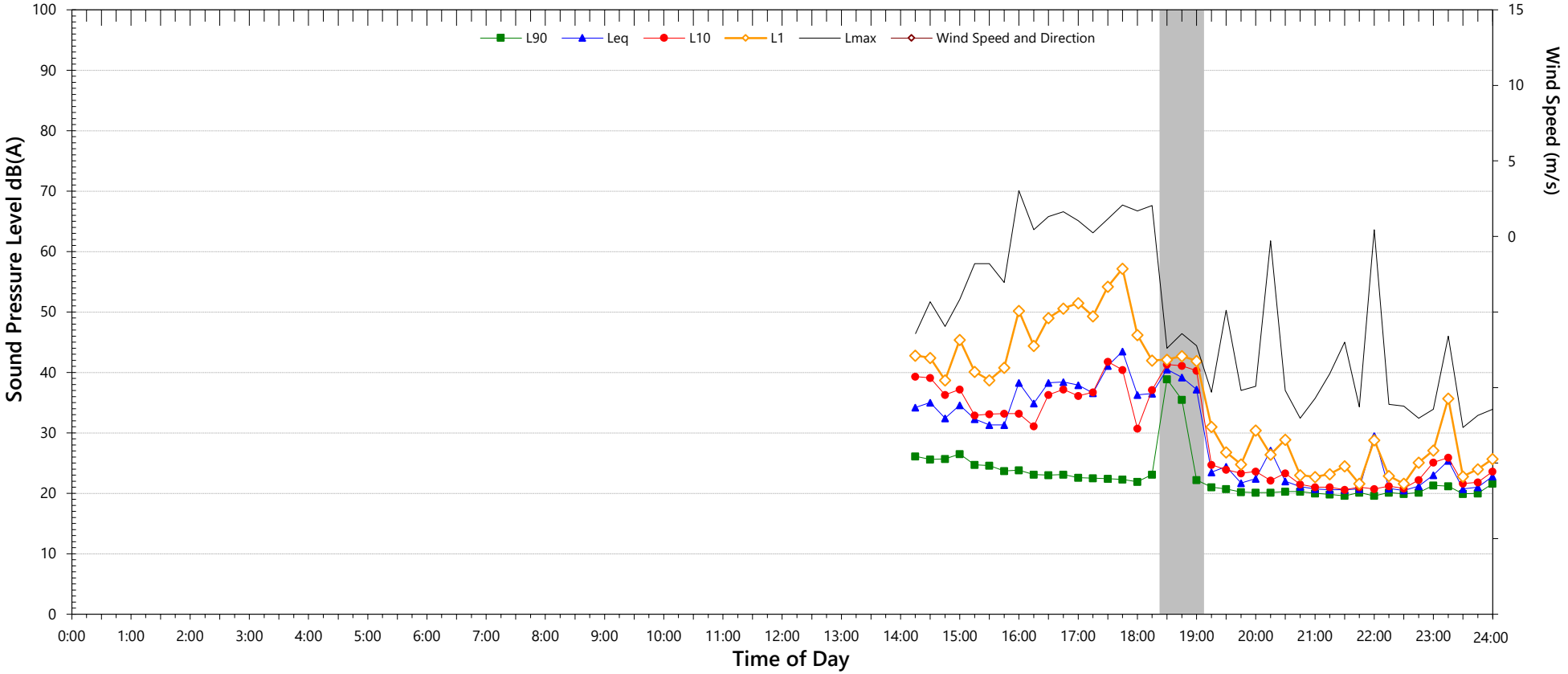
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Tuesday, 8 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	60.2	44.5	41.4
L_1	46.3	27.2	30.6
L_{10}	35.9	23.4	25.1
L_{90}	22.6	19.8	19.6
Leq	37.4	27.6	37.3

Notes:

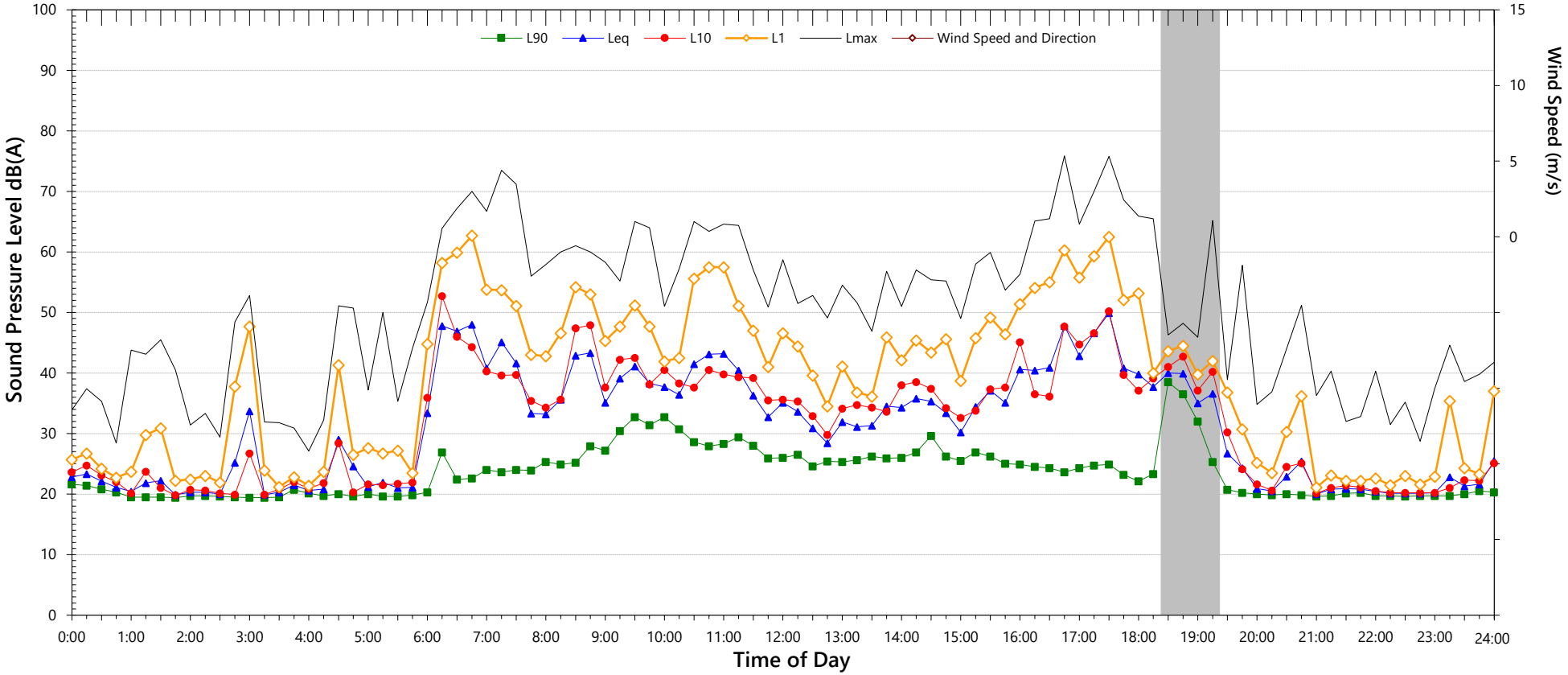
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Wednesday, 9 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	59.6	42.6	41.6
L_1	48.1	27.8	30.3
L_{10}	38.5	24.1	24.3
L_{90}	24.5	19.7	19.6
Leq	40.8	28.2	36.6

Notes:

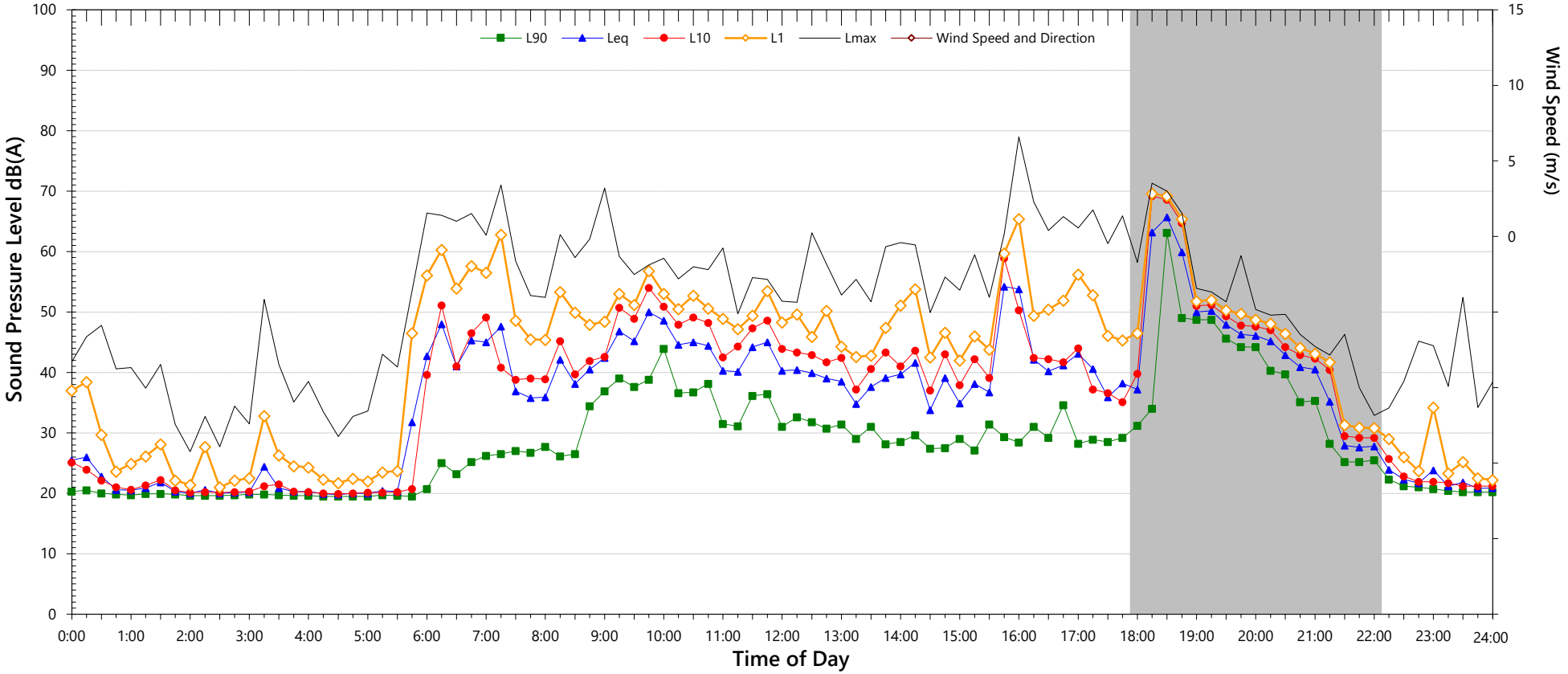
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Thursday, 10 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	59.3	-	44.4
L_1	49.8	-	31.9
L_{10}	43.4	-	25.9
L_{90}	28.0	-	19.8
Leq	44.6	-	38.8

Notes:

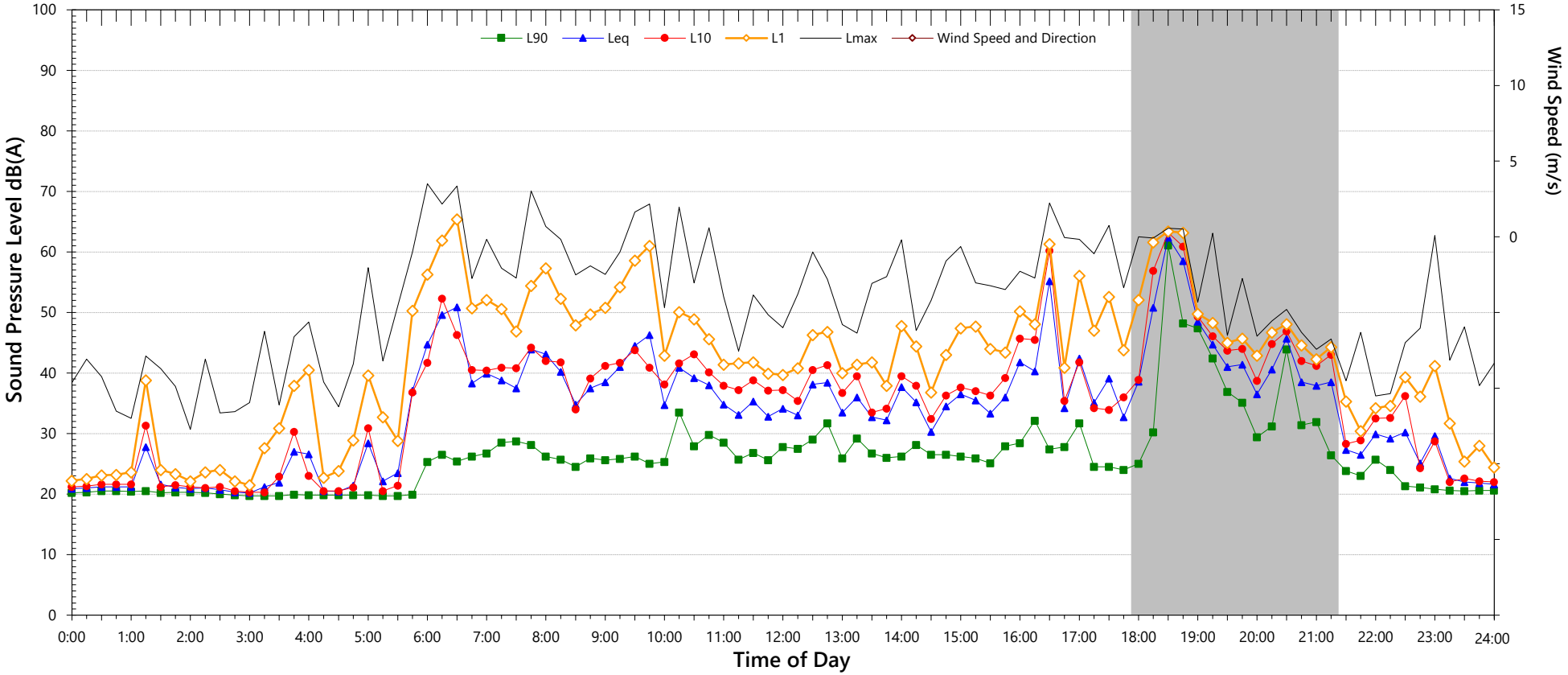
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Friday, 11 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	57.2	40.5	44.9
L_1	47.1	33.3	32.6
L_{10}	39.3	29.9	26.7
L_{90}	25.5	23.0	20.4
Leq	41.8	28.2	38.9

Notes:

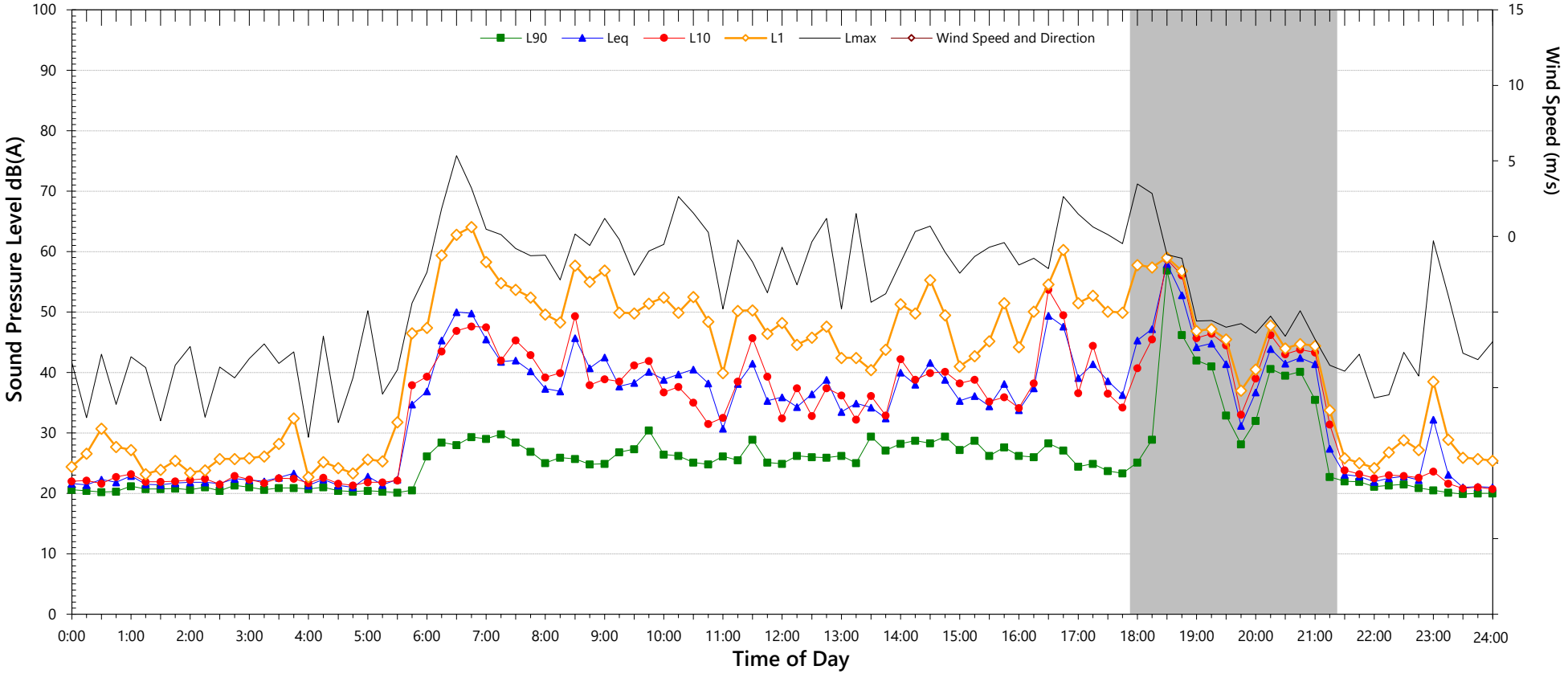
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Saturday, 12 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	60.3	39.7	46.6
L_1	49.4	25.0	32.2
L_{10}	38.8	23.2	24.9
L_{90}	25.1	21.1	19.6
Leq	40.4	22.6	41.4

Notes:

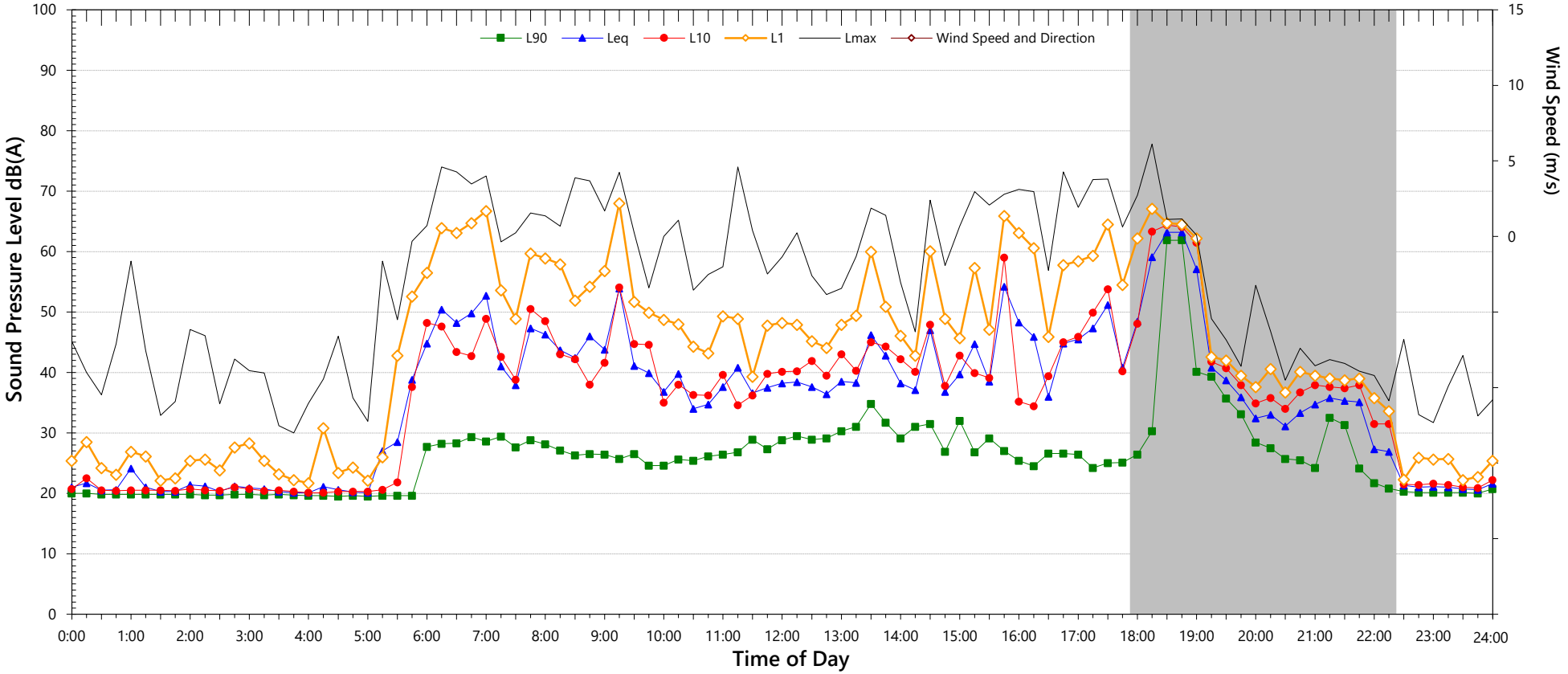
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Sunday, 13 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	63.6	-	44.4
L_1	52.4	-	30.1
L_{10}	42.1	-	24.8
L_{90}	25.8	-	19.9
Leq	45.1	-	42.1

Notes:

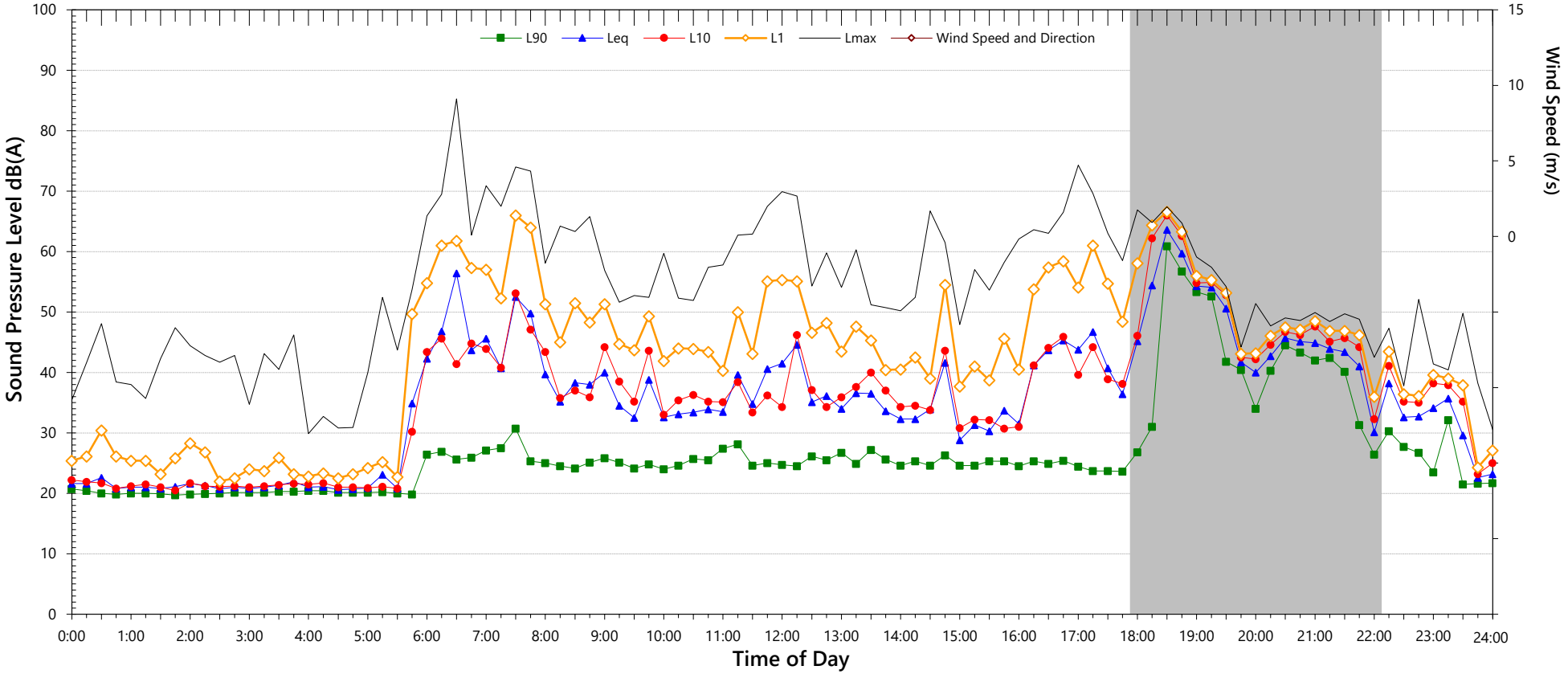
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Monday, 14 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	60.2	-	44.8
L_1	48.3	-	33.4
L_{10}	38.0	-	28.4
L_{90}	24.4	-	20.1
Leq	41.6	-	40.1

Notes:

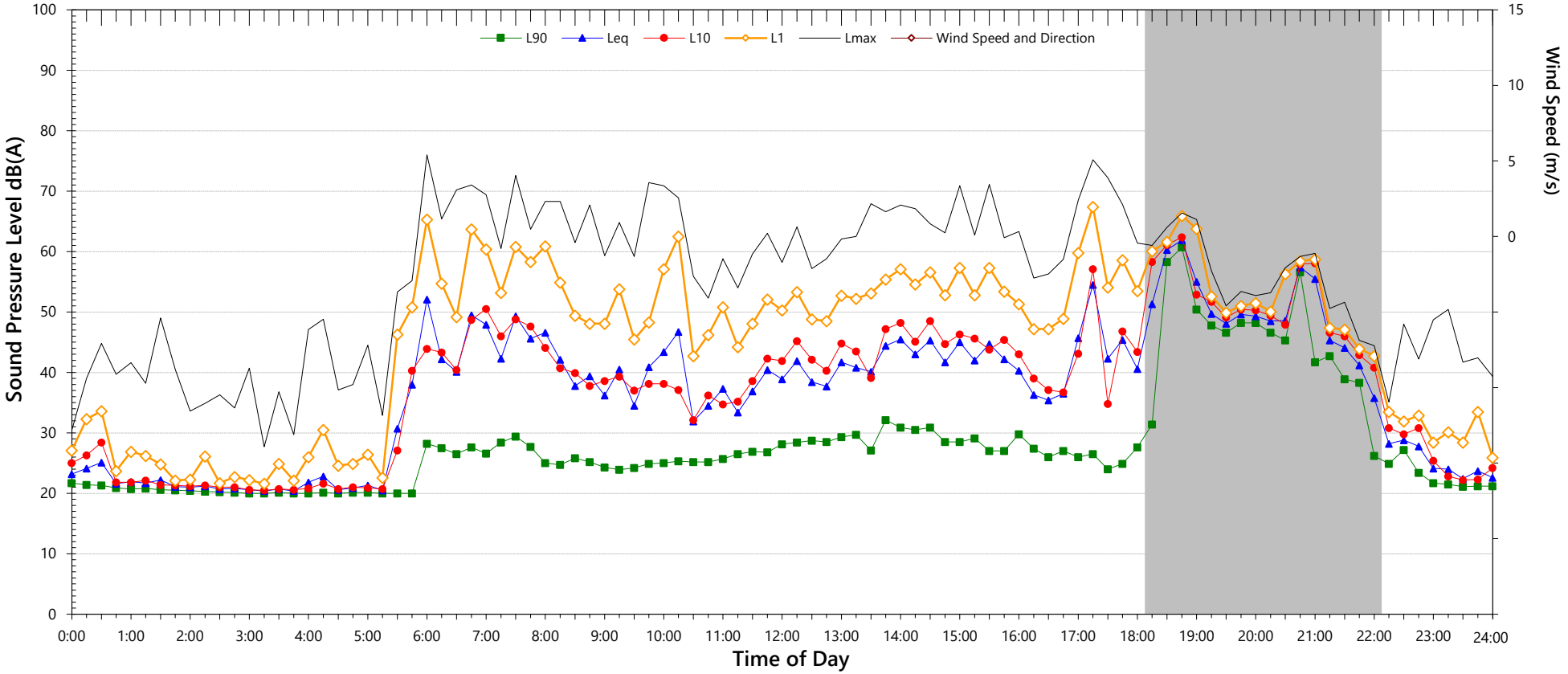
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Tuesday, 15 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	63.8	-	45.7
L_1	52.9	-	31.7
L_{10}	41.9	-	25.9
L_{90}	25.3	-	20.1
Leq	43.8	-	36.1

Notes:

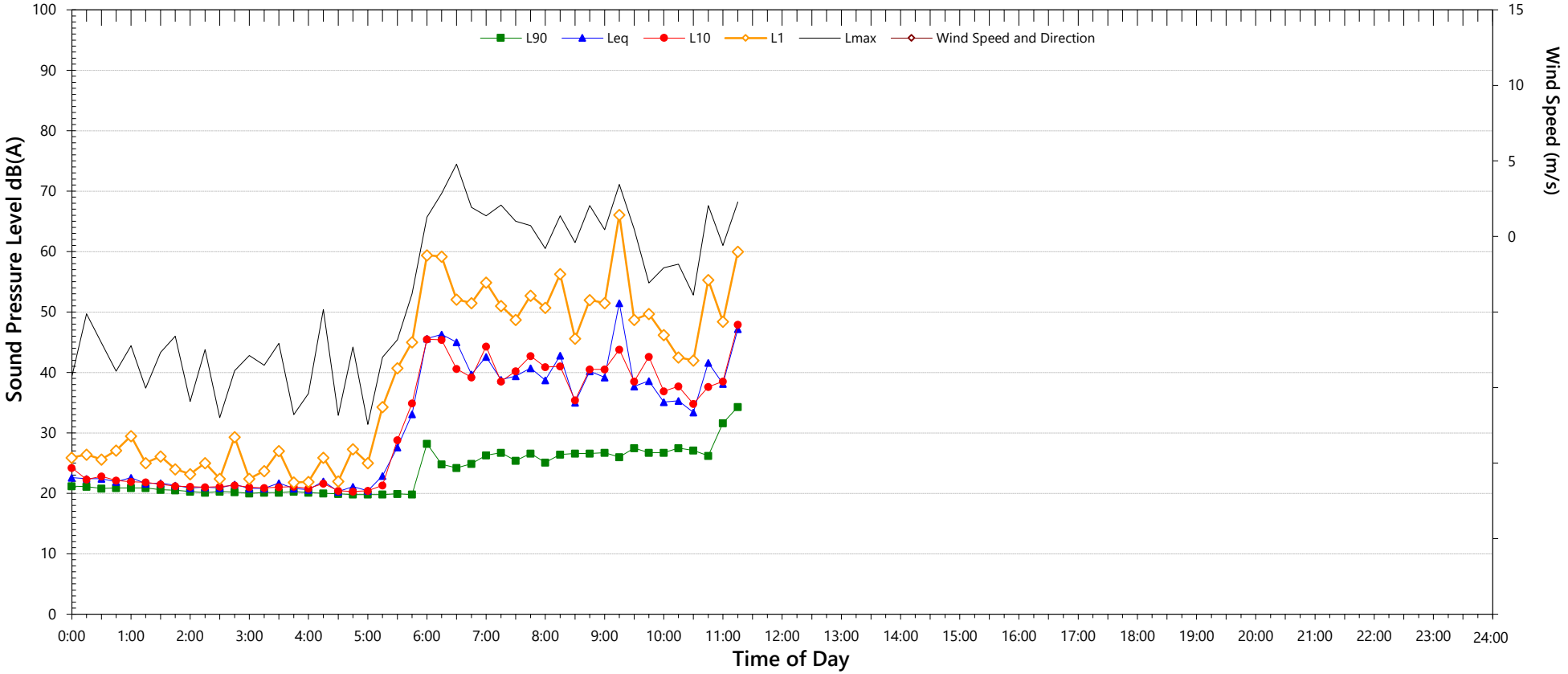
1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

Unattended Noise Monitoring Results

Winchester South Project - Deverill

Wednesday, 16 August 2017



Representative Noise Levels			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
Lmax	63.0	-	-
L_1	51.0	-	-
L_{10}	39.9	-	-
L_{90}	26.1	-	-
Leq	42.7	-	-

Notes:

1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field