



Appendix A

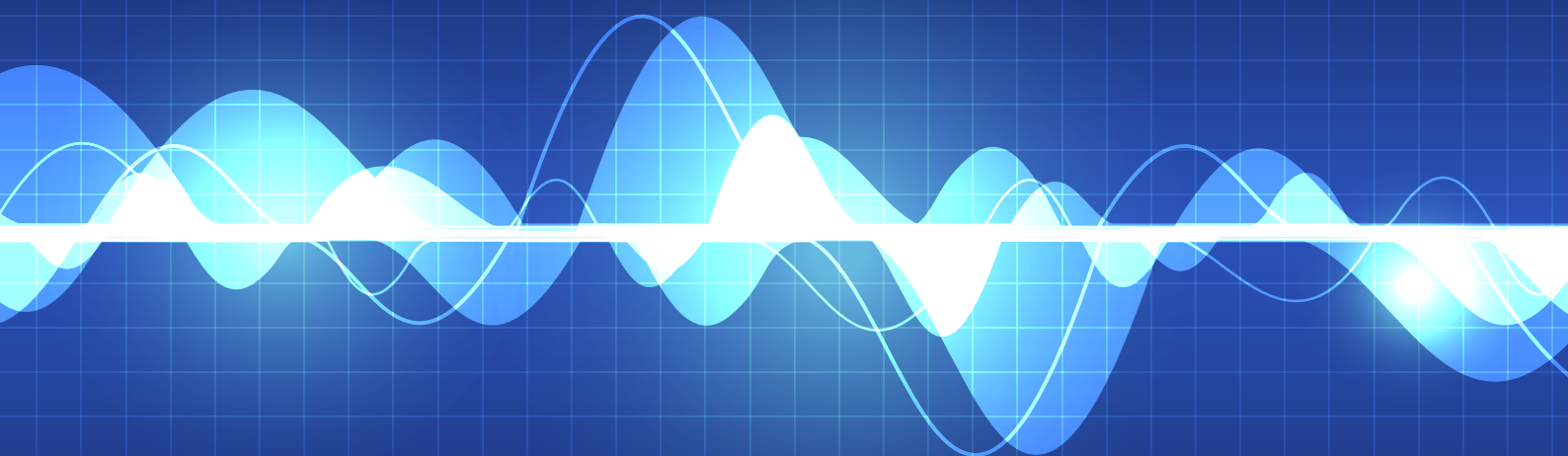
Clarence Colliery - Noise and vibration impact assessment



Clarence Colliery - Modification 6

Noise and vibration impact assessment

Prepared for Centennial Coal Company Limited
August 2020





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Clarence Colliery - Modification 6

Noise and vibration impact assessment

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24 August 2020

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Executive Summary

Clarence Colliery (Clarence) is an underground coal mining operation within the Western Coalfield of New South Wales (NSW) approximately 10 kilometres (km) east of Lithgow in the Lithgow local government area (LGA). Clarence extracts coal from the Katoomba Seam and has the facilities on-site to wash run-of-mine (ROM) coal in order to maximise coal quality. A by-product of the washing process is coarse coal reject (CCR), which is approved to be emplaced in six reject emplacement areas (REAs) at Clarence's pit top.

Centennial has identified an opportunity to use CCR material from Clarence Colliery to enhance rehabilitation at Charbon Colliery (Charbon). Charbon is an underground and open cut coal mine owned and operated by Charbon Coal Pty Limited (Charbon Coal). In 2015, mining operations at Charbon ceased following the depletion of the mine's approved coal reserves. Since the cessation of mining, Charbon Coal has been progressively rehabilitating the site.

To facilitate the transfer of CCR from Clarence to Charbon, Centennial is seeking to modify DA 504-00 to allow for the exportation of CCR from Clarence to Charbon by rail. If approved, the proposed modification would authorise:

- extraction of CCR from REA6;
- transfer of CCR from REA6 and Clarence's production stream to the existing train load out (TLO);
- loading of CCR into train-based containers via the existing TLO; and
- export of CCR off-site to Charbon via rail.

This noise and vibration impact assessment (NVIA) has been prepared to accompany the modification report and assesses the noise and vibration impacts of the proposed modification on existing noise-sensitive receptors in the surrounding area. Project noise trigger levels (PNTLs) were established based on the results of ambient noise monitoring undertaken by EMM in December 2018 to enable an assessment of operational noise emissions in accordance with the *Noise Policy for Industry* (NPfI) (EPA 2017).

Operational noise emissions from existing and proposed activities are predicted to be above the PNTLs at seven of the nine assessment locations. Three assessment locations do not currently have dwellings on the property. An assessment of feasible and reasonable noise mitigation options concluded that negotiated agreements will be pursued with potentially affected residents.

Predicted maximum noise levels excluding a train on the rail loop are below the maximum sleep disturbance screening criteria. When a train is on or exiting the rail loop, the predicted maximum noise levels are above the maximum screening criteria. L_{Amax} noise is expected to be unchanged from existing activities at Clarence as a result of the proposed modification. Consultation with residences where maximum noise levels are predicted to be above the relevant screening criteria will continue.

Centennial will continue to implement existing noise mitigation and management measures as provided in the *Western Region - Noise Management Plan* (NMP) including specific measures to minimise noise associated with rail loading and rail operations on the Clarence rail loop.

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1 Introduction

1.1 Overview

Clarence Colliery (Clarence) is an underground coal mining operation within the Western Coalfield of New South Wales (NSW) approximately 10 kilometres (km) east of Lithgow in the Lithgow local government area (LGA) (Figure 1.1). Clarence has been in operation since the 1980s and is currently owned by Centennial Coal Company Limited (Centennial) and SK Networks Resources Australia Pty Ltd as participants in the Clarence Colliery Joint Venture. Centennial has been appointed as the management entity for the Clarence Colliery Joint Venture.

Clarence operates under three separate development consents:

- an interim development consent issued in 1976 by Blaxland Shire Council (now Lithgow City Council) for the construction of surface facilities (IRM.GE.76);
- a development consent issued in 1994 by Lithgow City Council for the extension of underground coal mining, surface reject emplacement areas (REAs) and water management and ancillary structures (174/93); and
- development consent issued in 2005 (DA 504-00) by the NSW Department of Infrastructure, Planning and Natural Resources (now the NSW Department of Planning, Industry and Environment (DPIE)) to expand site operations into Mining Lease (ML) 1583.

Clarence extracts coal from the Katoomba Seam and has the facilities on-site to wash run-of-mine (ROM) coal in order to maximise coal quality. A by-product of the washing process is coarse coal reject (CCR), which is approved under the aforementioned development consents to be emplaced in six REAs at Clarence's pit top, including:

- REA1, REA2 and REA4, which are rehabilitated but not closed;
- REA3, which is in care and maintenance;
- REA5, which is currently being constructed within the rail loop; and
- REA6, which is operational.

Centennial has identified an opportunity to use CCR material from Clarence Colliery to enhance rehabilitation at Charbon Colliery (Charbon) (Figure 1.1). Charbon is an underground and open cut coal mine owned and operated by Charbon Coal Pty Limited (Charbon Coal). In 2015, mining operations at Charbon ceased following the depletion of the mine's approved coal reserves. Since the cessation of mining, Charbon Coal has been progressively rehabilitating the site. Charbon Coal undertakes rehabilitation and mine closure activities at the site pursuant to SSD 08_0211.

Centennial is seeking to modify DA 504-00 pursuant to Section 4.55(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to allow for the transportation of CCR from REA6 and Clarence's production stream to Charbon via rail. If approved, the modification will authorise:

- extraction of CCR from REA6;
- transfer of CCR from REA6 and Clarence's production stream to the existing train load out (TLO);
- loading of CCR into train-based containers via the existing TLO; and
- export of CCR off-site to Charbon via rail.

At the same time that Centennial is seeking to modify DA 504-00, Charbon Coal will submit a modification application for SSD 08_0211 to allow for the importation of CCR from Clarence by rail and its use in ongoing rehabilitation activities at Charbon.

1.2 Site description

Clarence Colliery's holding boundary (Figure 1.2) is the existing development consent boundary applicable to DA 504-00. Surface facilities at Clarence are on Crown and free-hold land north of Chifley Road (a continuation of Bells Line of Road) and the Main Western Rail Line. A spur rail line also connects the surface facilities to the Main Western Rail Line (Figure 1.2). Road access to Clarence is directly from Clarence Colliery Road.

Clarence is bordered by the Blue Mountains National Park to the east and Newnes State Forest to the north and west. The residential areas of Newnes Junction and Clarence Village are 900 metres (m) south-east and 1.5 km south-west of Clarence, respectively (refer Figure 1.2). A number of extractive industries are in close proximity, including Hanson Quarry to the west and the disused Rocla Quarry to the south-east (refer Figure 1.2). The proposed Newnes Kaolin Project is also to the south (refer Figure 1.2).

There are six sensitive receivers within 1 km of Clarence Colliery's surface facilities (refer Figure 1.2).

1.3 Assessment guidelines and requirements

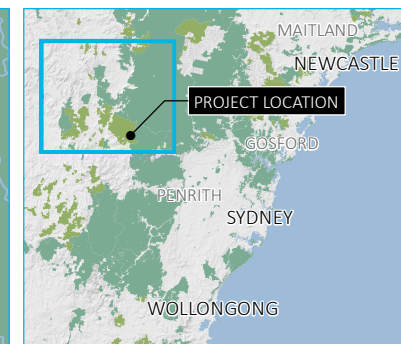
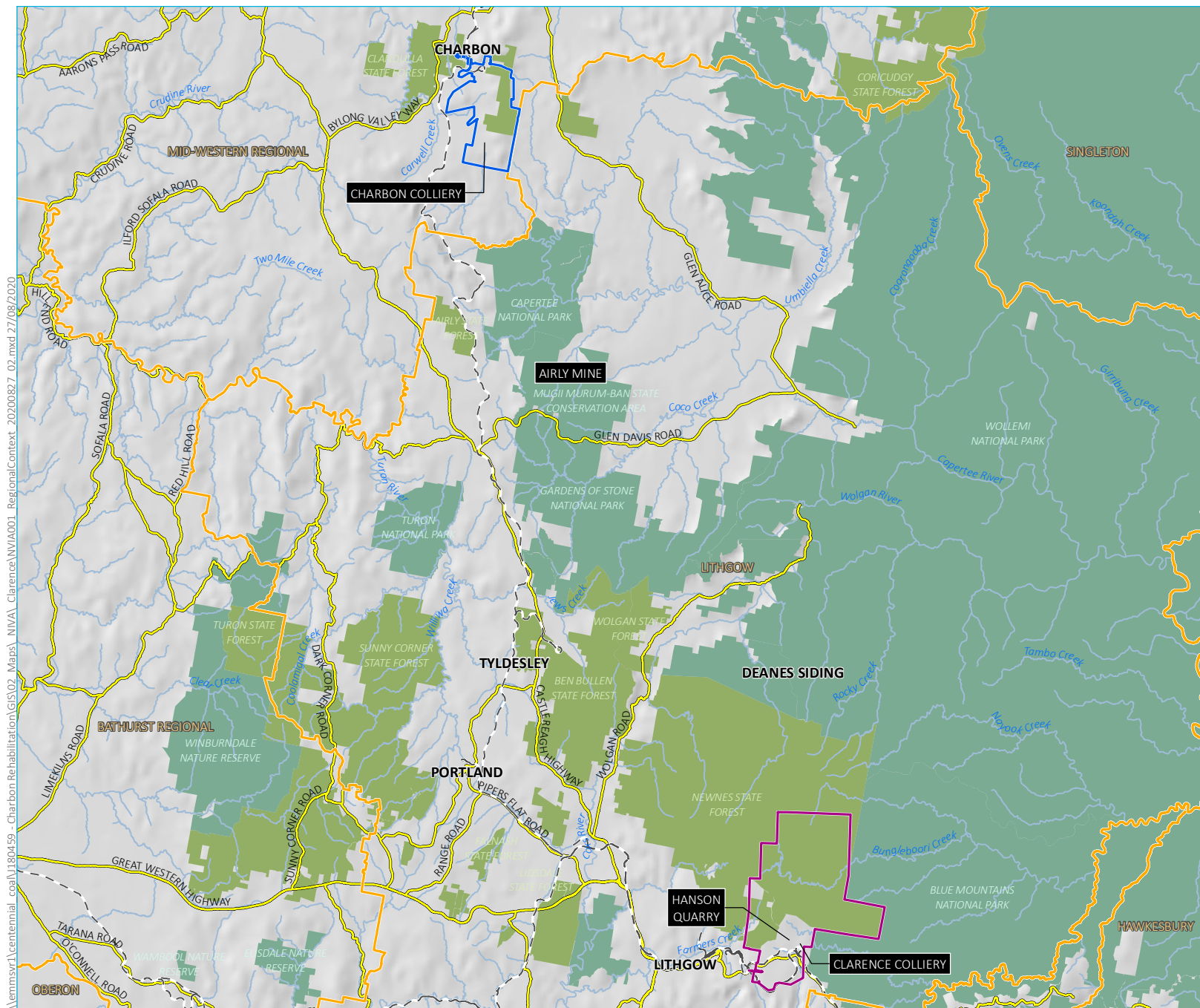
This noise and vibration impact assessment (NVIA) has been prepared to accompany the modification report and assesses the noise and vibration impacts of the proposed modification on existing noise-sensitive receptors in the surrounding area.

This NVIA has been completed with reference to the following guidelines and policies:

- NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry* (NPfI); and
- NSW Government 2018, *Voluntary Land Acquisition and Mitigation Policy* (VLAMP).

A number of technical terms have been utilised throughout this report for the discussion of noise and vibration. These are explained in the Glossary.

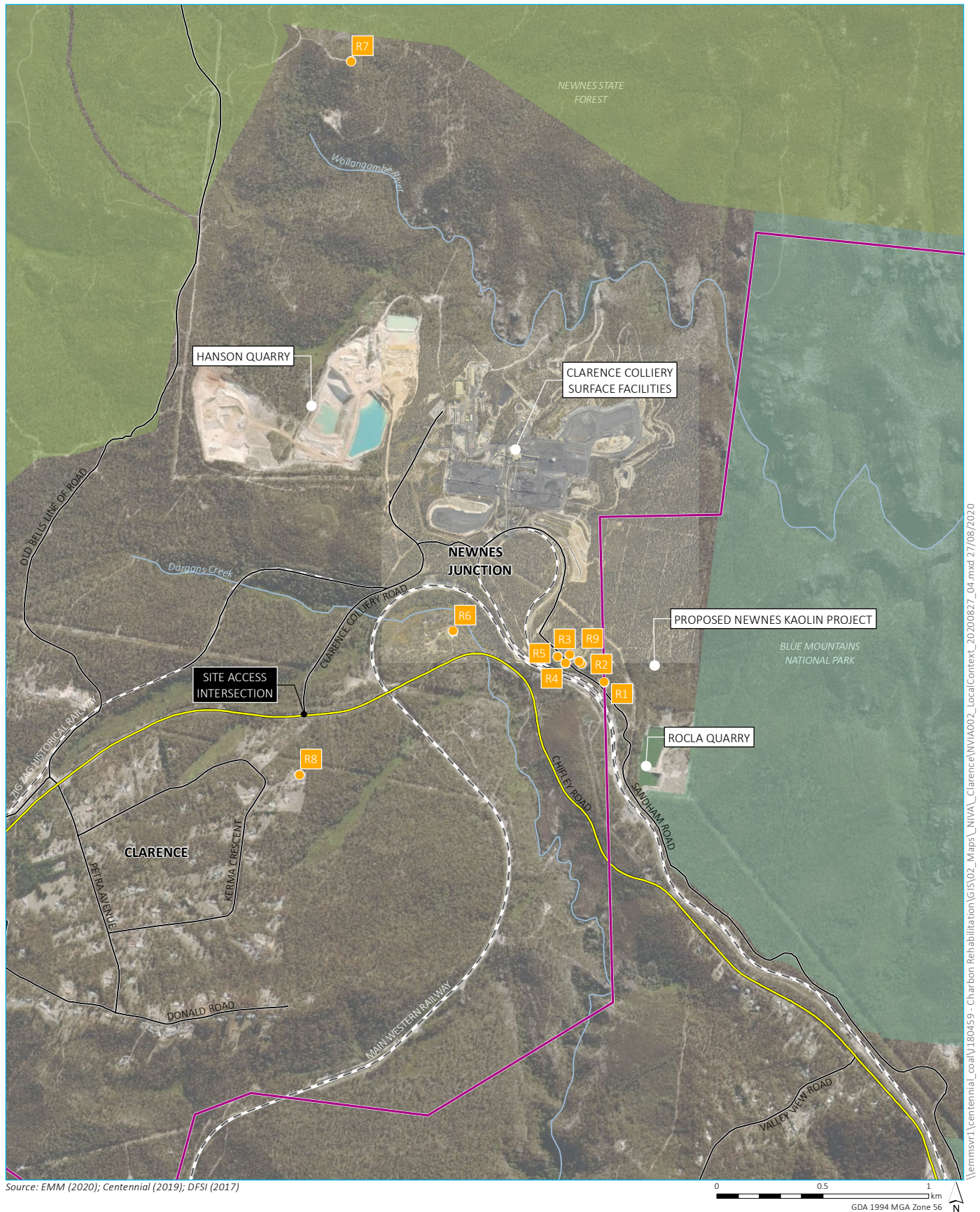
A separate NVIA will assess the noise and vibration impacts associated with the proposed modifications to existing operations at Charbon.



- KEY**
- Clarence Colliery holding boundary
 - Charbon Colliery project site boundary
 - Rail line
 - Main road
 - Watercourse
 - NPWS reserve
 - State forest
 - LGA boundary

Regional context

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Noise and vibration impact assessment
Figure 1.1



KEY

- Clarence Colliery holding boundary
- Assessment location
- Rail line
- Main road
- Local road
- Watercourse
- NPWS reserve
- State forest

Local context

Clarence Colliery – Modification 6
Noise and vibration impact assessment
Figure 1.2

2 Proposed modification

2.1 Overview

Centennial is seeking to modify DA 504-00 pursuant to Section 4.55(2) of the EP&A Act to allow for the transportation of CCR from REA6 and Clarence's production stream to Charbon via rail. The transfer of CCR from Clarence to Charbon will help Charbon Coal develop a final landform that is representative of existing landforms within and adjacent to the site at Charbon. The proposed modification includes:

- extraction of CCR from REA6;
- transfer of CCR from REA6 and Clarence's production stream to the existing TLO;
- loading of CCR into train-based containers via the existing TLO; and
- export of CCR off-site to Charbon via rail.

There will be no change to currently approved extraction limits, coal handling and preparation or dispatch via rail or road as part of the proposed modification.

2.1.1 Construction activities

No construction activities are required on-site at Clarence to facilitate the proposed modification. No additional plant, equipment or fixed infrastructure is required.

2.1.2 Material handling

An excavator currently operating on-site at the REA3 complex will be used (as required) to excavate CCR from REA6. Excavated material will be loaded into trucks that will be used to transfer this material to Clarence's product stockpile area. From the stockpile, CCR will be transferred via Clarence's existing reclaim system and TLO to containers on trains. The containers will not have a roof allowing them to be loaded directly from the TLO and will have a rear opening to assist with the discharge of material on-site at Charbon.

CCR from Clarence's production stream will also be transferred from the CHPP to the product stockpile area before it is transferred via the existing reclaim system and TLO onto containers on trains.

Excavation and stockpiling of CCR will occur between 7 am and 6 pm. Train loading activities will occur 24 hours, 7 days per week, as for coal loading currently approved under DA 504-00.

No changes to the approved status of REAs 1, 2, 3, 4 or 5 are proposed as part of this modification (Figure 2.1).

2.1.3 Proposed rail movements

A spur rail line connects Clarence's surface facilities to the Main Western Rail Line. Centennial has approval to transport up to 3 million tonnes per annum (Mtpa) of coal via rail, which can take place 24 hours per day, seven days per week.

As part of the proposed modification, one CCR-laden train will be used per day (ie two rail movements) to transport CCR from Clarence to Charbon. It is anticipated that trains will consist of 2 locomotives and approximately 30 wagons. Each train will carry 2 containers per wagon, providing a total of 60 containers per train. Containers are able to hold 25 t of CCR. Therefore, each train will have the ability to transport up to approximately 1,500 t of CCR.

Over a period of five years, it is anticipated that up to 1.5 Mt of CCR will be transported from Clarence to Charbon with an average annual transfer of between 300,000 t and 350,000 t.

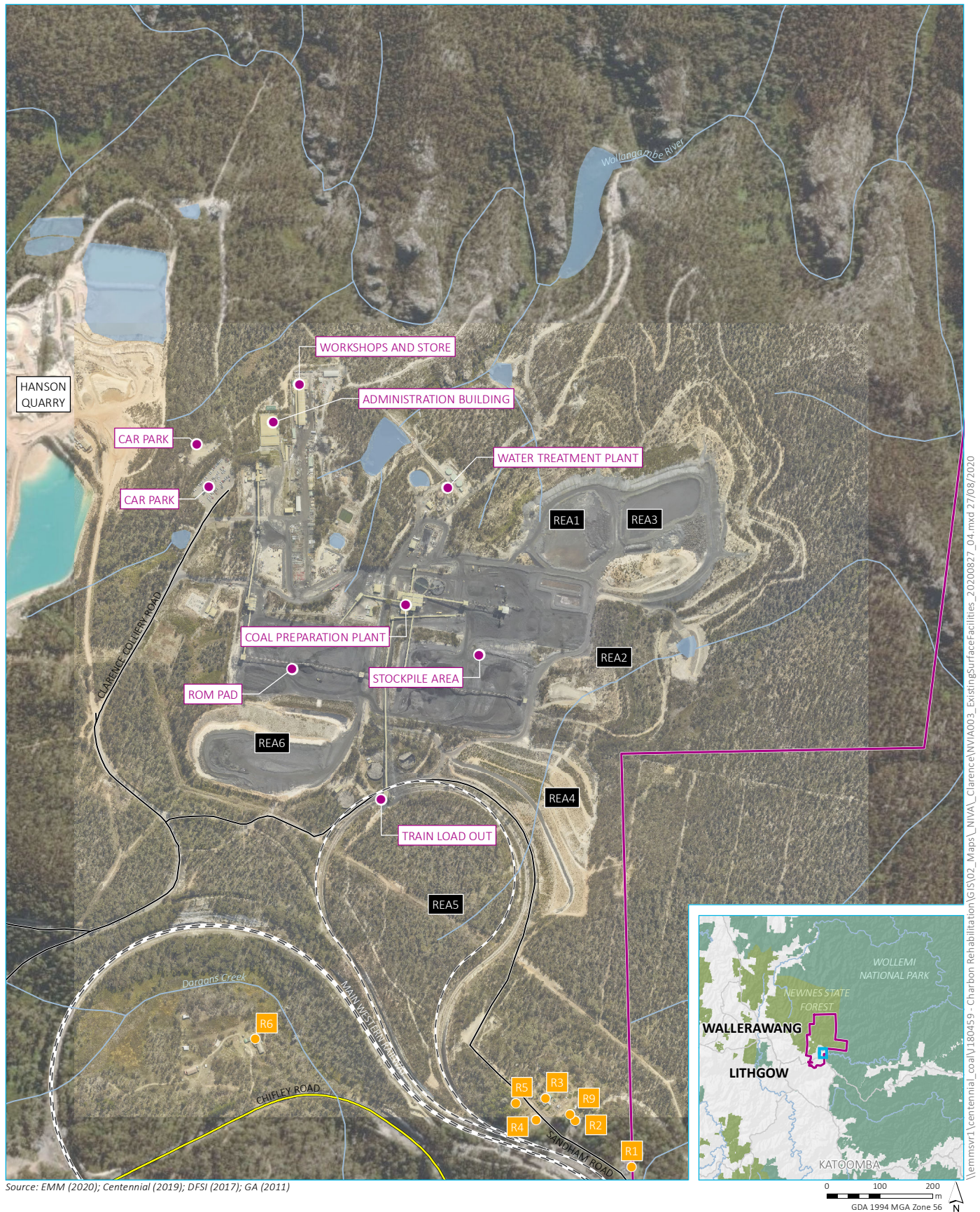
2.2 Assessment locations

The nearest noise and vibration sensitive receptors (herein referred to as assessment locations) are shown in Figure 2.1 and described in Table 2.1. The numbering of these assessment locations is consistent with that utilised in DA 504-00 except for the addition of:

- R8, which is representative of the nearest residences within Clarence village; and
- R9, which is an existing dwelling near R2 that has not been assessed previously.

Table 2.1 **Assessment locations**

Assessment location	Address	Type
R1	12 Sandham Road, Dargan	Residential (no current dwelling)
R2	576 Sandham Road, Dargan	Residential
R3	588-602 Sandham Road, Dargan	Residential
R4	Sandham Road, Clarence	Residential
R5	Sandham Road, Clarence	Residential (no current dwelling)
R6	590 Chiefly Road, Dargan	Residential (no current dwelling)
R7	Newnes State Forest	Passive recreation area
R8	122 Kerma Crescent, Clarence	Residential
R9	Sandham Road, Clarence	Residential



KEY

- Clarence Colliery holding boundary
- Assessment location
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Waterbody

Existing surface facilities

Clarence Colliery – Modification 6
Noise and vibration impact assessment
Figure 2.1

3 Assessment methodology

3.1 Applying the NPfI to existing sites

The NPfI provides a methodology for the assessment of noise from existing industrial sites. The NPfI acknowledges that some industrial sites were designed for higher allowable noise emissions than those outlined in current NSW noise policy and may have been in existence before neighbouring noise-sensitive developments. The range of mitigation options available for such sites can be limited or costly.

Section 6.1 of the NPfI states that:

The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where noise emissions from the existing site exceed the project noise trigger levels (PNTLs) as defined in the NPfI, the relevant regulatory authorities and proponent will determine achievable noise limits for the site through negotiation and discussion with relevant stakeholders as required.

The process for applying the NPfI to existing sites is outlined in Section 6.1.1 of the NPfI and is summarised as follows as applicable to the amended project:

1. Undertake an initial evaluation, including whether approvals/licences include noise limits and whether they are being met.
2. Establish relevant PNTLs, in accordance with the NPfI, to establish a benchmark level to assess the need to consider noise mitigation.
3. Measure/predict the noise levels produced by the source in question, having regard to meteorological effects such as wind and temperature inversions.
4. Compare the measured/predicted noise level with the PNTLs.
5. Where the PNTLs are exceeded, assess feasible and reasonable noise mitigation strategies.
6. Develop and refine achievable noise limits that will become long-term noise goals for the site. This may involve interaction between the regulator and proponent as well as consultation with the community. Regulators and operators need to consider the technical practicalities and cost of noise reduction measures, and how long it will take to implement these measures, along with the environmental consequences of exceeding the PNTLs.
7. Monitor compliance with the agreed noise limits, and review and amend the noise performance of the site as required.

3.2 Operational noise limits - NPfI

Noise from industrial sites or processes in NSW is regulated by the local council, DPIE and/or the EPA and usually have a licence and/or development consent conditions stipulating noise limits. These limits are normally derived from operational noise levels applied at assessment locations. They are based on EPA guidelines (ie NPfI) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation measures.

The reaction to noise is highly subjective. Hence, it is not possible to adopt noise levels that will guarantee that no one will experience an impact. Adherence with the PNTLs should not be interpreted to mean that industrial noise will be inaudible, or that all members of the community will find the noise acceptable. The PNTLs for industry provide a benchmark for assessing a proposed or existing industrial development.

Both the increase in noise level above background levels (ie the intrusiveness of a source) as well as the absolute level of noise are important factors in how a community will respond to noise from industrial sources. To ensure both of these factors are considered, the EPA provides two separate noise trigger levels: intrusiveness and amenity. The fundamental difference being intrusiveness noise levels apply over 15 minutes in any period (day, evening or night), whereas the amenity noise levels apply to the entire assessment period (day, evening or night).

3.2.1 Assessing intrusiveness

The intrusive noise trigger levels require that $L_{Aeq,15\text{ minute}}$ noise levels from the site during the relevant operational periods (ie day, evening and night) do not exceed the rating background level (RBL) by more than 5 dB. The NPfI recommends that the intrusive noise trigger level for evening be set at no greater than the intrusive noise level for daytime and that the intrusive noise level for night-time should be no greater than the intrusive noise level for day or evening. Intrusive noise trigger levels are applicable at residential assessment locations only.

A long-term, unattended ambient noise survey was undertaken during December 2018 to establish background noise levels at neighbouring noise sensitive receptors.

3.2.2 Assessing amenity

The amenity assessment is based on noise targets specific to land use and associated activities. The targets relate only to industrial-type noise and do not include road, rail and/or community noise. Where the measured existing industrial noise approaches the recommended amenity noise level, it needs to be demonstrated that noise levels from new industry will not contribute to existing industrial noise such that amenity noise levels are exceeded.

To ensure that total industrial noise levels remain within the recommended amenity noise levels for an area, the project amenity noise level for the subject development is the recommended amenity noise level (outlined in Table 2.2 of the NPfI) minus 5 dB.

Residences have been categorised in the NPfI rural amenity category as per the definition provided in the NPfI:

An area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.

Newnes State Forest (R7) has been assessed as a passive recreation area.

An extract from the NPfI that relates to the amenity noise levels relevant to the proposed modification is given in Table 3.1.

Table 3.1 **Amenity noise levels - Recommended L_{Aeq} noise levels from all industrial noise sources**

Type of receptor	Noise amenity area	Time of day ¹	Recommended $L_{Aeq(Period)}$ noise level (dB) ²
Residence	Rural	Day	50
		Evening	45
		Night	40
Area specifically reserved for passive recreation	All	When in use	48

¹ Daytime: 7 am to 6 pm; Evening: 6 pm to 10 pm; Night-time: 10 pm to 7 am. On Sundays and Public Holidays, Daytime: 8 am to 6 pm; Evening: 6 pm to 10 pm; Night-time: 10 pm to 8 am.

² The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

3.2.3 Project noise trigger levels

PNTLs are the lower of the derived intrusiveness and amenity levels.

It is commonly acknowledged and accepted amongst regulators and industry that average noise levels are typically 3 dB higher over a 15-minute worst case assessment period when compared to an entire day (11 hour), evening (4 hour) and night (9 hour) assessment period. This is outlined in the NPfI and has been used in this assessment to standardise the time periods for the intrusive and amenity noise levels.

3.2.4 Low frequency noise

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 **One-third octave low-frequency noise thresholds ($L_{Zeq,15\text{ minute}}$)**

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the daytime period.

3.2.5 Sleep disturbance

The difficulty in establishing an absolute noise level criterion that would correlate to an acceptable level of sleep disturbance is acknowledged by relevant governing authorities.

The NPfI suggests that a detailed maximum noise level event assessment should be undertaken where night-time noise levels at a residential location exceed:

- $L_{Aeq,15\text{ minute}}$ 40 dB or the prevailing RBL plus 5 dB (whichever is the greater); and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB (whichever is the greater).

The NPfI also references guidance regarding potential for sleep disturbance provided in the *Road Noise Policy* (RNP) (DECCW 2011). The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels (L_{Amax}) below 50 to 55 dB are unlikely to awaken people from sleep; and
- one or two noise events per night, with maximum internal noise levels (L_{Amax}) of 65 to 70 dB, are not likely to affect health and wellbeing significantly.

It is commonly accepted by acoustic practitioners and regulatory bodies that a facade including a partially open window will reduce external noise levels by 10 dB. Therefore, external noise levels in the order of 60–65 dB calculated at the facade of a residence is unlikely to awaken people according to the RNP.

If noise levels over the NPfI screening levels are identified, then additional analysis would consider factors such as the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the extent of impacts on sleep include:

- how often high noise events will occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development;
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods); and
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

3.3 Voluntary Land Acquisition and Mitigation Policy

Consent authorities are required to consider the *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments* (VLAMP) (DPE 2018) when assessing and determining development applications and modification applications for SSD mining developments. Page 17 of the VLAMP states the following regarding the application of voluntary mitigation and voluntary land acquisition:

A consent authority can apply voluntary mitigation and voluntary land acquisition rights to reduce:

- operational noise impacts of a development on privately owned land; and
- rail noise impacts of a development on privately owned land near a non-network rail line (private rail line), that is on, or exclusively servicing and industrial site (see Appendix 3 of the RING);

But not:

- construction noise impacts, as these impacts are shorter term and can be controlled;
- noise impacts on the public road or rail network; or
- modifications of existing developments with legacy noise issues, where the modification would have beneficial or negligible noise impacts¹³.

¹³Noise issues for existing premises may be addressed through site-specific pollution reduction programs under the Protection of the Environment Operations Act 1997.

Of most interest is the last point above relating to the relative noise impact of the proposed operation compared to the existing development. As this report shows, the noise emissions from the proposed modification are predicted to be the same compared to existing operational noise emissions at all assessment locations.

3.4 Operational vibration

Vibration from operational activity is not expected to change as a result of the proposed modification when compared to that currently approved. Thus, a detailed assessment of vibration impacts has not been included in this NVIA.

3.5 Rail noise

A spur rail line connects Clarence's surface facilities to the Main Western rail line. Clarence has approval to transport coal via rail, which can take place 24 hours per day, seven days per week.

As part of the proposed modification, one CCR-laden train will be used per day (ie two rail movements) to transport CCR from Clarence to Charbon. The number of trains between Clarence and Charbon will be within the existing capacity of the rail network and no additional rail paths are required.

A detailed assessment of off-site rail noise impacts has not been included as part of this assessment.

4 Existing noise

4.1 Existing noise criteria

Noise criteria for Clarence are provided in Schedule 3 Condition 15 of DA 504-00 and Condition L5 of EPL 726. Noise limits are consistent between these two documents and are summarised in Table 4.1. These limits apply to noise generated from Clarence excluding train loading and rail operations.

Table 4.1 Clarence noise criteria

Location	Day	Evening	Night
	L _{Aeq,15min} (dB)	L _{Aeq,15min} (dB)	L _{Aeq,15min} (dB)
Any residence on privately owned land	38	36	35

4.2 Existing noise emissions

Noise compliance monitoring occurs during day, evening and night-time periods on an annual basis adopting a location at the end of Sandham Road north of the residences and south of the rail loop (M1 on Figure 5.1).

A summary of the annual noise monitoring results, as provided in noise compliance reports and Clarence's Annual Reviews, for the period between 2013 and 2019 is shown in Table 4.2 together with the noise limit that has been applied for this location.

Table 4.2 Summary of annual compliance and additional noise monitoring results – Location M1

Period	Estimated Clarence noise level, L _{Aeq,15min} (dB)							Highest	Log average	Existing criteria
	2013	2014	2015	2016	2017	2018	2019			
Day	38	37	36	33	IA	35	IA	38	36	38
Evening	34	34	45	33	30	30	IA	45	38	36
Night	35	34	45	35	42	IA	35	45	40	35

IA = inaudible

Results of annual noise monitoring surveys indicate that evening and night time noise emissions from Clarence have, at times, been above the noise criteria applied at M1.

The major contributor to the elevated noise levels measured during the evening and night-time 2015 surveys was identified to be tonal reversing alarms on mobile equipment operating on the stockpiles.

The major contributor to the elevated noise levels measured during the 2017 night-time survey was identified to be general mining noise from conveyors and the rotary breaker.

The applicability of modifying factors has been determined during the 2017 and 2018 surveys in accordance with the methodology provided in the NPfI. Modifying factors due to low frequency noise were found to be not applicable during these surveys. Hence, low frequency noise modifying factors have not been applied to predicted noise emissions from Clarence for the purpose of this NVIA.

4.3 Noise and vibration complaints history

EMM understands that within the last five years there has only been one complaint received in relation to noise emissions from Clarence. In March 2017, a complaint was received regarding 'a low hum' from site.

5 Existing acoustic environment

To establish ambient and background noise levels, unattended noise monitoring was completed by EMM at four locations surrounding Clarence (refer Figure 5.1) in accordance with the NPfI.

The noise loggers were in place from 13 December 2018 and were programmed to record statistical noise level indices continuously in 15-minute intervals. Calibration of each noise logger was checked prior to and following unattended noise monitoring. The equipment carried appropriate and current NATA calibration certificates. Weather data for the unattended noise monitoring period was obtained from the on-site automatic weather station. The wind speed and rainfall data were used to exclude noise data during periods of any rainfall and/or wind speeds in excess of 5 m/s (approximately 9 knots) in accordance with the methodology provided in the NPfI.

The locations of the noise loggers are shown on Figure 5.1. A summary of the background and ambient noise monitoring results is provided in Table 5.1. Detailed graphs of the data obtained by EMM are provided in Appendix A.

Table 5.1 Summary of existing measured background and ambient noise levels (March 2020)

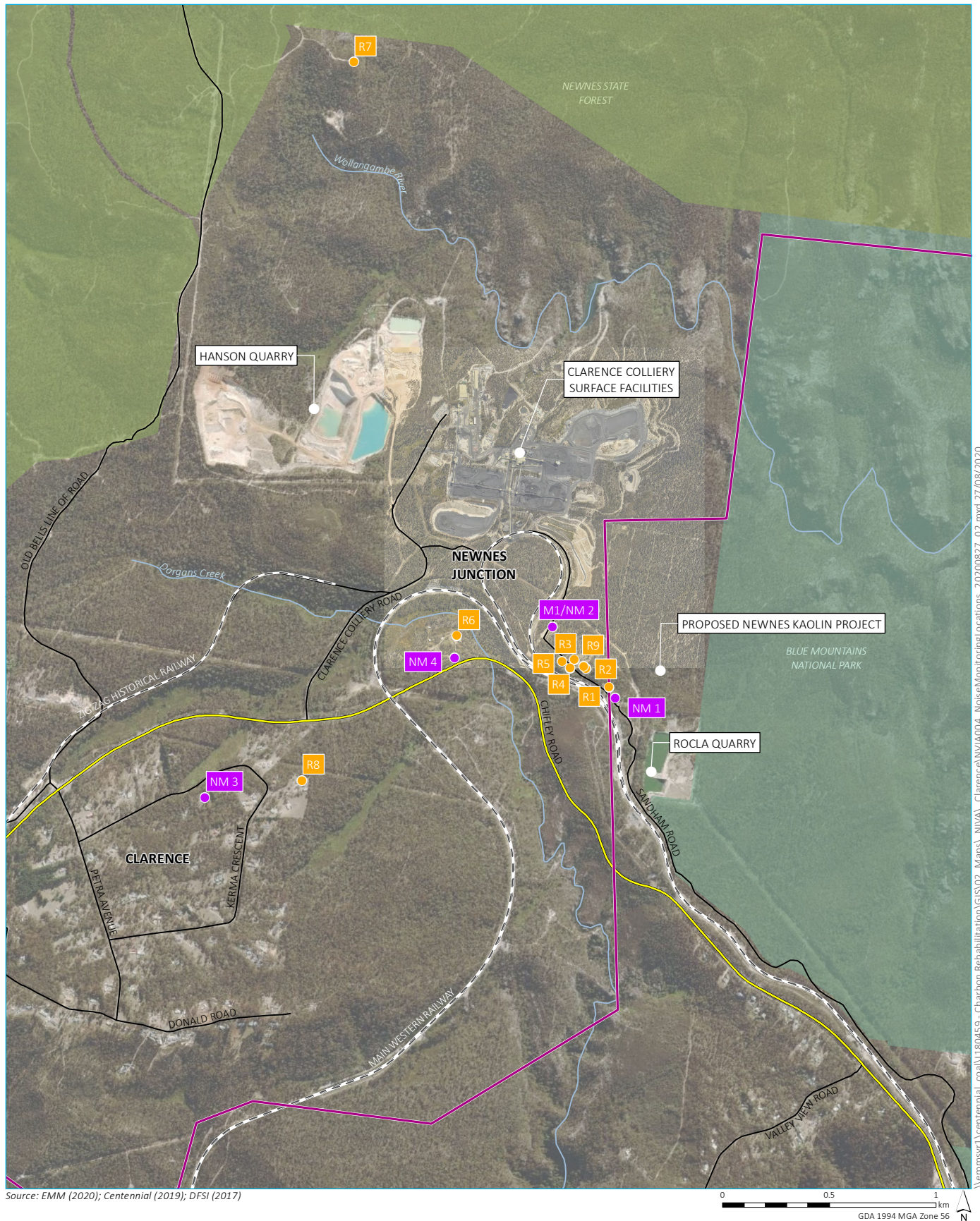
Monitoring location	Period ¹	RBL ² , dB	L _{Aeq, period} noise level ³ , dB
NM1 – 12 Sandham Road, Clarence	Day	<35	46
	Evening	<30	52
	Night	<30	53
NM2 – Clarence Colliery rail loop	Day	<35	45
	Evening	30	54
	Night	30	57
NM3 – 171 Kerma Crescent, Clarence	Day	<35	50
	Evening	34	52
	Night	32	53
NM4 – 590 Chifley Road, Dargan	Day	<35	51
	Evening	<30	50
	Night	<30	51

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: 10 pm to 7 am.
 2. The RBL is an NPfI term and is used represent the background noise level.
 3. The energy averaged noise level over the measurement period and representative of general ambient noise.

Based on observations whilst on-site, the main contributors to overall ambient noise levels are as follows:

- NM1 – natural sounds, train on the main line and local road activity, hum from Clarence.
- NM2 – Clarence mine noise, distant traffic and natural sounds.
- NM3 – natural sounds, local and distant traffic noise, residential activity.
- NM4 – natural sounds, traffic on Chiefly Road, Clarence just audible at times.

Where Clarence was audible at monitoring locations, the resulting RBLs were the NPfI minimum applicable levels and hence site contributions do not influence the assessment.



KEY

- Clarence Colliery holding boundary
- Noise monitoring location
- Assessment location
- Rail line
- Main road
- Local road
- Watercourse
- NPWS reserve
- State forest

Noise monitoring locations

Clarence Colliery – Modification 6
Noise and vibration impact assessment
Figure 5.1

6 Operational noise targets

6.1 Project noise trigger levels

6.1.1 Intrusiveness

The intrusiveness targets require that $L_{Aeq,15min}$ noise levels from sites during the relevant operational periods (ie day, evening and night) do not exceed the relevant RBL by more than 5 dB.

The RBLs utilised for determination of the intrusiveness target are based on either the background noise monitoring results presented in Chapter 5 or on the minimum RBLs as provided in the NPfI. The project intrusive noise levels are presented in Table 6.1.

Table 6.1 Intrusive noise levels

Assessment location (representative noise monitoring location)	Adopted RBL (dB)			Project intrusive noise level, $L_{Aeq,15min}$ (dB)		
	Day ¹	Evening ¹	Night ¹	Day	Evening	Night
R1 (NM1)	35	30	30	40	35	35
R2 (NM2)	35	30	30	40	35	35
R3 (NM2)	35	30	30	40	35	35
R4 (NM2)	35	30	30	40	35	35
R5 (NM2)	35	30	30	40	35	35
R6 (NM4)	35	30	30	40	35	35
R7 (N/A)	Intrusive noise levels not applicable at passive recreation areas.					
R8 (NM3)	35	34	32	40	39	37
R9 (NM2)	35	30	30	40	35	35

1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: all remaining periods.

N/A: Not applicable.

6.1.2 Amenity

The assessment of amenity is based on noise targets specific to the land use. It is possible, due to the proximity of the existing industrial facilities, that the assessment locations could be classified as “suburban” in accordance with the NPfI definition (ie an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry). Given the relatively low background levels measured in the area, a conservative approach has been taken and assessment locations have been categorised in the NPfI (EPA 2017) rural amenity category (ie an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels). This will have negligible impact on the PNTLs determined for the Clarence since intrusiveness noise levels will set the limiting criteria.

So that total industrial noise levels remain within the recommended amenity noise levels for an area, the project amenity noise levels for Clarence are the recommended amenity noise level (outlined in Table 2.2 of the NPfI) minus 5 dB. This accounts for the potential cumulative industrial noise levels in the area.

As described earlier, a 3 dB adjustment is adopted for 15-minute worst case period noise levels from Clarence for the entire day (11 hour), evening (4 hour) and night (9 hour) assessment periods. This assumption is outlined in the NPfI and has been used in this assessment to standardise the time periods for the intrusive and amenity noise levels.

The corresponding recommended amenity noise levels for all assessment locations are given in Table 6.2.

Table 6.2 Project amenity noise levels

Assessment location	Indicative area	Project amenity noise level ($L_{Aeq,15min}$) (dB)		
		Day ¹	Evening ¹	Night ¹
All	Rural	48	43	38

1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night: all remaining periods.

6.1.3 Project noise trigger levels

The PNTLs are the more stringent of either the project intrusive or amenity noise levels and are shown in Table 6.3.

Table 6.3 Project noise trigger levels, $L_{Aeq,15min}$

Assessment location	Intrusive noise level, $L_{Aeq,15min}$, dB			Amenity noise level, $L_{Aeq,15min}$, dB			PNTL, $L_{Aeq,15min}$, dB		
	Day ¹	Evening ¹	Night ¹	Day ¹	Evening ¹	Night ¹	Day ¹	Evening ¹	Night ¹
R1	40	35	35	48	43	38	40	35	35
R2	40	35	35	48	43	38	40	35	35
R3	40	35	35	48	43	38	40	35	35
R4	40	35	35	48	43	38	40	35	35
R5	40	35	35	48	43	38	40	35	35
R6	40	35	35	48	43	38	40	35	35
R7 (passive recreation)	N/A	N/A	N/A	48	48	48	48	48	48
R8	40	39	37	48	43	38	40	39	37
R9	40	35	35	48	43	38	40	35	35

1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: all remaining periods.
N/A: Not applicable.

6.2 Sleep disturbance

Based on the guidance in the NPfI, Table 6.4 provides the sleep disturbance screening levels for the residential assessment locations.

Table 6.4 Sleep disturbance screening levels for residential assessment locations

Assessment location	Adopted RBL (dB)	Sleep disturbance screening levels (dB)	
		L _{Aeq,15min}	L _{Amax}
R1	30	40	52
R2	30	40	52
R3	30	40	52
R4	30	40	52
R5	30	40	52
R6	30	40	52
R7	Sleep disturbance not applicable at passive recreation area		
R8	32	40	52
R9	30	40	52

Reference has also been made to the conclusions presented in the RNP regarding assessment of the potential for sleep disturbance.

7 Operational noise assessment

7.1 Overview

This section presents the methods and base parameters used to model noise emissions from Clarence's existing operations including the effects of noise-enhancing meteorological conditions. It is noted that the proposed modification will not introduce new types of noise sources to the site but will involve the activation of REA6 and transportation of rejects from REA6 to the ROM pad.

Noise modelling was based on three-dimensional digitised ground contours of Clarence, surrounding land and surface infrastructure. The operational noise model represents a snapshot of typical operations, with equipment placed at various locations and heights, representing a realistic operational scenario.

Noise predictions were carried out using the iNoise software, created by the same developers responsible for B&K's Predictor software. iNoise calculates total noise levels at assessment locations from concurrent operation of multiple noise sources. The model considers factors such as the lateral and vertical location of plant, source-to-receptor distances, ground effects, atmospheric absorption, topography of the surface facilities area and surrounds and applicable meteorological conditions.

7.2 Meteorology

During certain weather conditions, noise may increase or decrease compared with noise during calm conditions. This is due to refraction caused by the varying speed of sound with increasing height above the ground that occurs during winds or where air temperature changes with height.

A simple yet conservative approach has been selected for the consideration of potentially noise-enhancing weather conditions with reference to Fact Sheet D of the NPfI. Noise emissions from Clarence have been predicted for noise-enhancing conditions. This provides a conservative approach since the noise emissions predicted under noise-enhancing conditions are expected to represent the upper range of noise emissions from Clarence.

7.3 Plant and equipment

The operational noise model considered a representative snapshot of surface operations at Clarence with equipment placed at locations representing a realistic operational scenario. Adopted locations of plant and equipment are shown in Appendix B for both existing and proposed operations.

Acoustically significant fixed and mobile equipment items considered in the noise model are provided for expected day, evening and night operations in Table 7.1. Most of the sound power data were obtained from noise measurements of existing activities at Clarence. Where this was not possible, sound power data has been obtained from previous noise studies undertaken at Clarence or an EMM database of similar plant and equipment.

Table 7.1 Acoustically significant plant and equipment for noise modelling

Item (quantity/location)	Sound power level per item (dBA)	Operating during this period		
		Day	Evening	Night
Existing operations at Clarence				
ROM coal conveyor transfer house ²	106	✓	✓	✓
Conveyor drift drive house ²	104	✓	✓	✓
Banana screen ¹	107	✓	✓	✓
CHPP ¹	110	✓	✓	✓
Screen/conveyor transfer house ¹	106	✓	✓	✓
Bradford breaker ¹	110	✓	✓	✓
TLO ¹	99	✓	✓	✓
Conveyor ³	69/m	✓	✓	✓
Road truck (domestic coal haulage route) ³	103	✓	✓	✗
Haul truck (REA3 to washed coal stockpile) ²	105	✓	✗	✗
Dozer (REA5, ROM coal and washed coal stockpiles) ³	110	✓	✗	✗
Front end loader (secondary product coal stockpile) ²	114	✓	✓	✓
Excavator (REA3) ²	105	✓	✗	✗
Water cart (all haulage routes) ²	106	✓	✓	✗
Vent fans ²	111	✓	✓	✓
Water treatment plant ³	98	✓	✓	✓
Locomotive (rail loop) ³	105	✓	✓	✓
Train wagons (rail loop) ²	78/m	✓	✓	✓
Additional operations at Clarence (proposed modification)				
Excavator (REA6) ²	105	✓	✗	✗
Haul truck (REA6 to ROM pad) ²	105	✓	✗	✗

1. Measured at Clarence by EMM in December 2018.

2. Sourced from previous study measurements at Clarence.

3. Sourced from EMM database.

7.4 Noise model validation

Noise from existing operations at Clarence was modelled and compared to the results of historical operator-attended noise surveys as reported in the annual monitoring reports. This comparison is summarised in Table 7.2.

Table 7.2 Predicted $L_{Aeq,15min}$ night-time noise levels compared to results of historic noise monitoring

Location	Measured range of noise emissions (dB)	Log average of measured noise emissions (dB)	Predicted (including noise enhancing weather conditions) (dB)
M1	30–45	40	44

The predicted noise levels, with the adoption of noise-enhancing weather conditions, are approximately at the top end of the measured range and within 1 dB of the highest measured level over the last seven years monitored. The operational noise model is therefore considered appropriate for the purpose of determining noise impacts from Clarence.

The results of historical operator-attended noise compliance surveys have identified that modifying factors are typically not applicable to noise emissions from Clarence. Hence, modifying factors have not been applied here to noise predictions.

7.5 Operational noise assessment

Predicted noise levels for the existing operation of Clarence and those inclusive of the proposed modification are presented in Table 7.3 and Table 7.4 for all assessment locations (those predicted to be above the PNTLs are shown in **bold** text). Noise-enhancing weather conditions have been considered and the highest predicted noise level is presented for each period. Cells are shaded within Table 7.4 to indicate the predicted level compared to PNTLs as follows:

- green cells: Clarence noise levels predicted to be less than or equal to 2 dB above PNTL;
- yellow cells: Clarence noise levels predicted to be 3–5 dB above PNTL; and
- red cells: Clarence noise levels predicted to be more than 5 dB above PNTL.

Indicative night-time noise contours for the proposed modification under noise-enhancing weather conditions are provided in Appendix C.

Table 7.3 Predicted $L_{Aeq,15min}$ operational noise levels – existing operations

Assessment location	Period ¹	Predicted noise level (excluding train) (dB)	Predicted noise level (including train) (dB)	PNTL $L_{Aeq,15min}$ (dB)
		Noise-enhancing conditions	Noise-enhancing conditions	
R1	Day	39	40	40
	Evening	38	40	35
	Night	38	40	35
R2	Day	40	44	40
	Evening	39	44	35
	Night	39	44	35
R3	Day	41	43	40
	Evening	40	43	35
	Night	40	43	35
R4	Day	34	46	40
	Evening	33	46	35
	Night	33	46	35
R5	Day	38	49	40
	Evening	37	49	35
	Night	37	49	35
R6	Day	37	42	40
	Evening	36	42	35
	Night	36	42	35
R7	Day	35	35	48
	Evening	36	36	48
	Night	36	36	48
R8	Day	35	36	40
	Evening	35	36	39
	Night	35	36	37
R9	Day	40	44	40
	Evening	39	44	35
	Night	39	44	35

1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night: all remaining periods.

Table 7.4 presents predicted noise levels for the proposed modification with changes to existing noise shown in brackets.

Table 7.4 Predicted $L_{Aeq,15min}$ operational noise levels – proposed modification

Assessment location	Period ¹	Predicted noise level (excluding train) (dB)	Predicted noise level (including train) (dB)	PNTL $L_{Aeq,15min}$ (dB)
		Noise-enhancing conditions	Noise-enhancing conditions	
R1	Day	39	40	40
	Evening	38	40	35
	Night	38	40	35
R2	Day	40	45 (+1)	40
	Evening	39	44	35
	Night	39	44	35
R3	Day	41	43	40
	Evening	40	43	35
	Night	40	43	35
R4	Day	35 (+1)	46	40
	Evening	33	46	35
	Night	33	46	35
R5	Day	38	49	40
	Evening	37	49	35
	Night	37	49	35
R6	Day	38 (+1)	42	40
	Evening	36	42	35
	Night	36	42	35
R7	Day	36 (+1)	36 (+1)	48
	Evening	36	36	48
	Night	36	36	48
R8	Day	36 (+1)	36	40
	Evening	35	36	39
	Night	35	36	37
R9	Day	40	45 (+1)	40
	Evening	39	44	35
	Night	39	44	35

1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night: all remaining periods.

Results of noise predictions demonstrate negligible difference in noise emissions between Clarence's existing operations and the proposed modification.

PNTLs are predicted to be met during the daytime period when there are no train or rail loading activities occurring at Clarence with the exception of a negligible exceedance (+1dB) at R3.

Since PNTLs are predicted to be exceeded at most assessment locations when rail activity is occurring (with the exception of R7 and R8), an assessment of reasonable and feasible mitigation has been undertaken (Chapter 8).

Centennial will continue to implement existing noise mitigation and management measures as provided in the *Western Region - Noise Management Plan (NMP)* (Centennial 2019).

7.6 Sleep disturbance

Consideration has been given to likely maximum noise level events at the nearest residential assessment locations. It is noted that Clarence's operations will not significantly change as a result of the proposed modification when compared to existing operations and, hence, maximum noise levels are expected to remain the same as those currently experienced.

It is noted that DA 504-00 and EPL 726 do not currently contain maximum noise limits relevant to Clarence and, as such, existing maximum noise emission levels have not been measured as part of annual noise compliance surveys.

Maximum noise level events at Clarence are typically associated with trains or dozer operations. A typical maximum sound power level of L_{Amax} 125 dB has been adopted for all such events and is based on EMM's measurements of similar activities. These events represent the likely highest maximum noise level events from Clarence.

Predicted maximum noise levels for operation of Clarence, both with and without a train, are presented in Table 7.5 for all assessment locations.

Table 7.5 Predicted L_{Amax} noise levels and sleep disturbance assessment (noise enhancing)

Assessment location	Night predicted Clarence noise level (excluding train)		Night predicted Clarence noise level (including train)		Sleep disturbance screening levels	
	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
R1	40	43	40	54	40	52
R2	44	44	44	65	40	52
R3	43	43	43	61	40	52
R4	46	46	46	69	40	52
R5	49	49	49	71	40	52
R6	42	42	42	58	40	52
R7	Not a residential receptor					
R8	36	41	36	44	40	52
R9	44	44	44	65	40	52

Predicted maximum noise levels (Table 7.5) excluding a train on the rail loop are below the relevant L_{Amax} sleep disturbance screening level. When a train is on or exiting the loop the predicted maximum noise levels are above the relevant L_{Amax} sleep disturbance screening level. However, the proposed modification is not expected to result in a change to this level when compared with existing activities at Clarence. Additional information is provided in Chapter 8 with regard to consideration of feasible and reasonable noise mitigation options for these residences.

8 Noise mitigation, management and monitoring

8.1 Existing noise mitigation and management measures

Noise emissions from Clarence will continue to be managed in accordance with the existing NMP.

The NMP outlines the noise mitigation and management measures common to all of Centennial's operations within the western region, where applicable, as well as those specific to Clarence. Relevant measures include:

- modifying the location of trains idling while being loaded or waiting to enter the network to minimise off-site noise impacts at sensitive receptors, where feasible;
- use of a combination of partial and fully enclosed conveyors and conveyor drives;
- regular inspection of conveyor idlers and prompt replacement of damaged or highly worn idlers during maintenance;
- regular maintenance of mobile plant and equipment in accordance with the manufacturer's specifications to ensure optimal operating conditions;
- installation of frequency modulated reversing alarms or 'quackers' on mobile plant;
- switching off vehicles and plant when not in use;
- operating mobile plant in a quiet, efficient manner and regular training of operators;
- selecting low noise plant for operation on-site;
- install acoustic enclosures around processing plants and seal all unnecessary openings;
- regular inspections and maintenance of haul road surfaces; and
- limiting truck speeds on private haul roads.

A number of measures are implemented to proactively plan and manage noise emissions from Centennial's western region operations. Measures implemented by Centennial include:

- a region-wide monitoring rationalisation to make more use of real-time noise monitoring to provide more informative data and enable more timely response to elevated noise levels off-site;
- procurement of quieter equipment whenever new items or maintenance work are required;
- regular (annual) reviews of monitoring and management measures; and
- impact assessments of future changes/expansions.

In addition to the management of noise from mining operations, DA 504-00 has previously required a specific plan for the: "management and minimisation of noise emissions associated with train-loading and rail operations, including consideration of all feasible and reasonable noise mitigation measures".

Clarence has consulted with Pacific National regarding practically feasible measures to reduce noise while rail loading. This consultation and the options investigated are summarised in the feasible and reasonable assessment in Section 8.2.

Further options to minimise noise associated with rail loading and rail operations on the Clarence rail loop that have previously been considered/implemented include:

- scheduling coal train movements within daytime hours, where practical;
- scheduling coal train movements within evening hours in preference to night hours, where practical;
- instructing coal train operators to decelerate and accelerate slowly and smoothly when approaching rounding and departing the rail loop;
- filling the train loading bin during daylight hours and maintaining the bin at greater than 60% during train loading operations (so as not to create excess noise from filling the bin), where practical; and
- maintaining the train loading infrastructure to include regular inspections to detect wearing and noisy rollers, early detection of failing parts, and structural inspections on the belt gantry and associated infrastructure to detect and repair loose components potentially leading to noise. Corrective action required as a result of these inspections is managed through the mine planning corrective action system.

8.2 Feasible and reasonable assessment of additional mitigation

Section 3.1 of the NPfI describes the approach to be adopted in determining feasible and reasonable mitigation measures:

A noise mitigation measure is feasible if it can be engineered and is practical to build and implement, given project constraints such as safety and maintenance requirements.

Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure.

Consideration of the feasibility and reasonableness of additional noise mitigation measures has been undertaken with reference to the guidance provided in Section 3.4 of the NPfI. The NPfI also provides the following guidance on the application of noise mitigation to existing premises:

The range of noise reduction strategies for existing situations is generally more limited than those available for new development at the planning stage. For example, spatial separation between the source and receiver is not an option for existing situations. The initial focus for existing sites should be operational procedures and prioritising noise-control measures that provide the greatest benefits to residents at least cost.

The main operational noise sources at Clarence contributing to off-site noise levels are trains on the rail loop, rail loading activities and dozers. Mitigation options targeting these noise sources have been considered.

A summary of the mitigation options considered is provided in Table 8.1.

Mitigation strategies have been considered in the following hierarchical approach:

1. Control of noise at the source.
2. Once feasible and reasonable controls at the source are exhausted, controlling transmission of noise.
3. Once source and transmission feasible and reasonable controls are exhausted, considering mitigation measures at the noise sensitive receivers.

Table 8.1 Mitigation decision-making matrix

Mitigation option	Feasible?	Reasonable?	Justification for adopting / disregarding and expected noise benefit
At-source controls			
Reduce locomotive engine noise	No	No	Locomotives currently meet noise emissions guidelines, no further engineering mitigation options feasible.
Use of horn	No	No	Use of horn not identified as an issue by residents.
Review the location of relief points and signals on the departure side as well as idling location of the rail loop to minimise idling noise near residences	Yes	Yes	This measure has been previously implemented (as provided in the NMP).
Control transmission of noise			
Noise barrier near rail loop	No	No	Due to topography in the area and the relative location of the rail line to the nearest residences, installation of a noise barrier would have limited acoustic benefit. Further, the cost-benefit of such a measure is very low given the limited number of receivers that would benefit.
Mitigation at the receptor			
Receptor mitigation/negotiated agreements.	Yes	Yes	There has only been one complaint regarding noise from Clarence within the last five years. The proposed modification will result in negligible changes to noise emissions compared to existing emissions for approved operations at all assessment locations. Centennial will consult with those receptors identified as experiencing mine noise emissions above PNTLs. Residences will be invited to meet with Centennial representatives to discuss the scope of the proposed modification and provide the findings of this NVIA. The type of mitigation measures that could be implemented at the residences and/or the nature of any agreement between Centennial and the landowner will depend on the outcomes of relevant negotiations. Once finalised, a copy of any negotiated agreement will be provided to DPIE (where required).

Based on the information in Table 8.1, it is understood that Centennial has commenced and will continue to pursue consultation and negotiated agreements with landowners identified as experiencing mine noise emissions above PNTLs namely R1, R2, R3, R4, R5, R6 and R9.

9 Conclusion

EMM has prepared this NVIA to accompany a modification report for a proposed modification to DA 504-00. A quantitative assessment of noise emissions associated with the operation of Clarence has been undertaken. The assessment included ambient noise monitoring, establishment of PNTLs and computer noise modelling which has shown that the proposed modification is predicted to result in negligible changes to existing operational noise emissions.

Operational noise emissions from existing and proposed activities are predicted to be above the PNTLs at seven of the nine assessment locations. Three assessment locations do not currently have dwellings on the property.

An assessment of feasible and reasonable noise mitigation options concluded that negotiated agreements will be pursued with potentially affected residents.

Predicted maximum noise levels excluding a train on the rail loop are below the relevant L_{Amax} sleep disturbance screening level. When a train is on or exiting the rail loop the predicted maximum noise levels are above the relevant L_{Amax} sleep disturbance screening level. However, L_{Amax} noise is expected to be unchanged from existing activities at Clarence as a result of the proposed modification. Residences where maximum noise levels are predicted to be above the relevant screening levels are the subject of ongoing consultation regarding negotiated agreements.

Noise emissions from Clarence will continue to be managed in accordance with the existing NMP. All feasible and reasonable mitigation measures will be considered. The NMP will be updated following determination of the proposed modification (as required).

Glossary

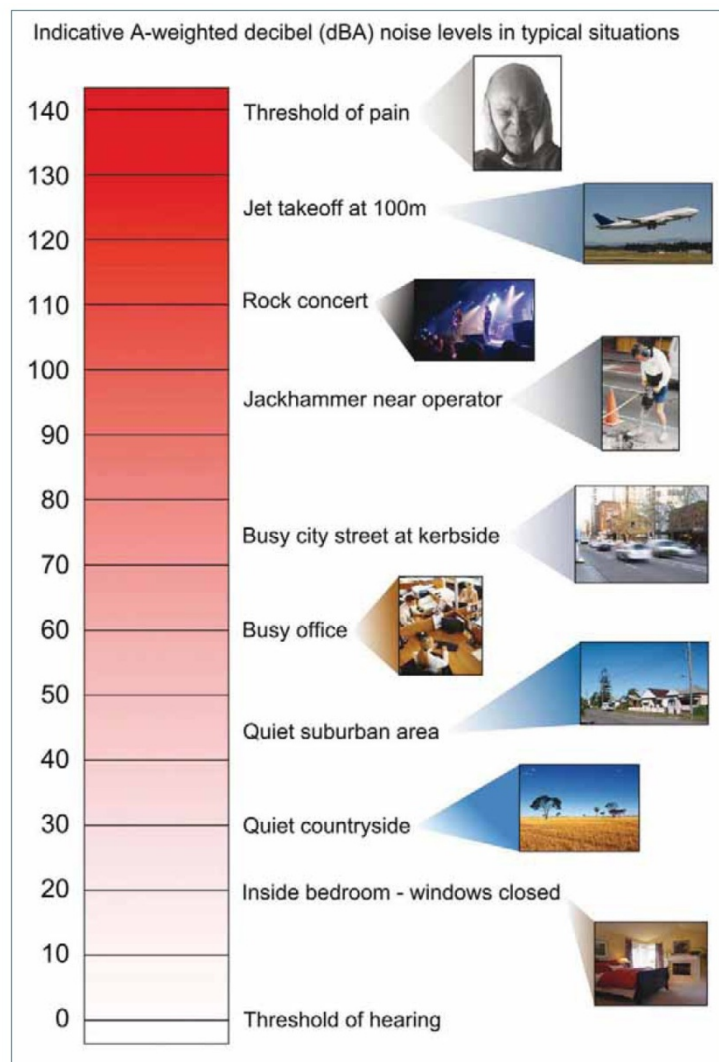
Table G.9.1 **Glossary of acoustic terms and abbreviations**

Abbreviation or term	Definition
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L_{A90} statistical noise levels.
Amenity noise level	The amenity noise levels relate to the overall level of industrial noise subject to land zoning or use
A-weighting	There are several different weightings utilised for describing noise, the most common being the 'A-weighting'. This attempts to closely approximate the frequency response of the human ear.
Day period	Monday–Saturday: 7.00 am to 6.00 pm, on Sundays and public holidays: 8.00 am to 6.00 pm.
dB	Noise is measured in units called decibels (dB).
DPIE	NSW Department of Planning, Industry and Environment
EMM	EMM Consulting Pty Limited
EP&A Act	NSW <i>Environmental and Planning Assessment Act 1979</i> (NSW)
EPA	NSW Environment Protection Authority (formerly the Department of Environment, Climate Change and Water).
Evening period	Monday–Saturday: 6.00 pm to 10.00 pm, on Sundays and public holidays
ICNG	Interim Construction Noise Guideline
Intrusive noise level	The intrusive noise level refers to noise that intrudes above the background level by more than 5 dB.
L_{A1}	The A-weighted noise level exceeded for 1% of the time.
L_{A10}	The A-weighted noise level which is exceeded 10% of the time. It is roughly equivalent to the average of maximum noise level.
L_{A90}	The A-weighted noise level that is exceeded 90% of the time. Commonly referred to as the background noise level.
L_{Aeq}	The A-weighted energy average noise level. This is the equivalent continuous sound pressure level over a given period. The $L_{Aeq(15\text{-minute})}$ descriptor refers to an L_{Aeq} noise level measured over a 15 minute period.
L_{Zeq}	The unweighted energy average noise level. This is the equivalent continuous sound pressure level over a given period without any frequency weighting applied.
L_{Amax}	The maximum A-weighted sound pressure level received during a measurement interval.
Night period	Monday–Saturday: 10.00 pm to 7.00 am, on Sundays and public holidays: 10.00 pm to 8.00 am.
NMP	Noise management plan
PNTL	The project noise trigger levels are targets for a particular industrial noise source or industry. The PNTLs are the lower of either the project intrusive noise level or project amenity noise level.
POEO Act	NSW <i>Protection of the Environment Operations Act 1997</i> (NSW)
RBL	The rating background level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the average background levels.
RNP	Road Noise Policy
Sound power level (L_w)	A measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table G.9.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure G.9.1.

Table G.9.2 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure G.9.1 Common noise levels

References

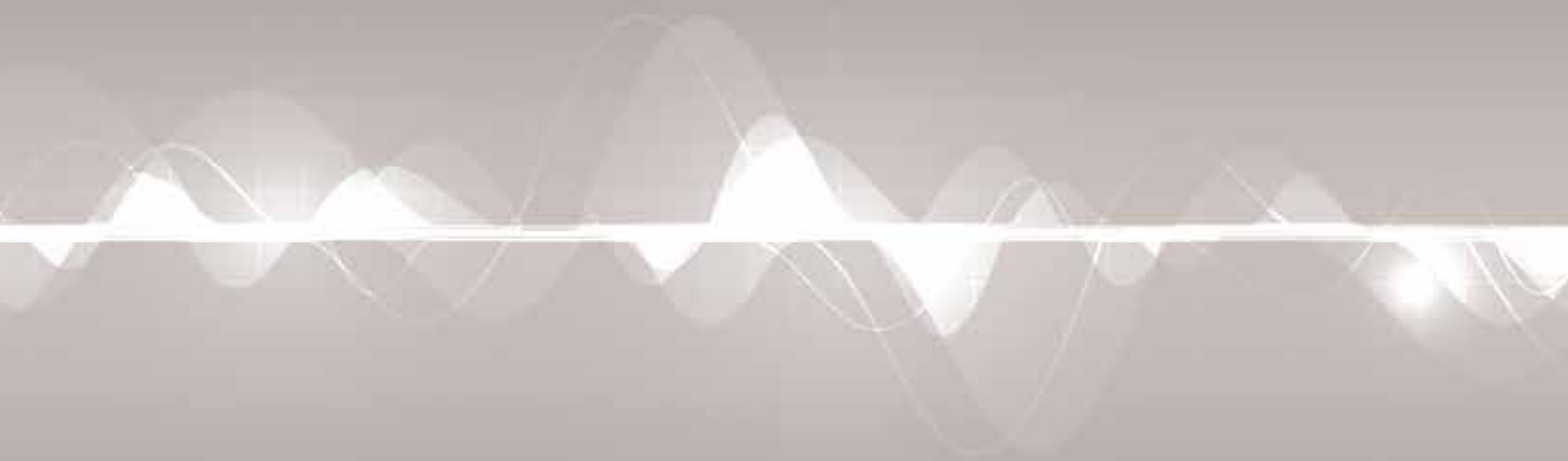
NSW Department of Environment, Climate Change and Water (DECCW) 2011, *Road Noise Policy*.

NSW Environment Protection Authority (EPA) 2017, *Noise Policy for Industry*.

NSW Government 2018, *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments*.

Appendix A

Measured existing ambient noise levels

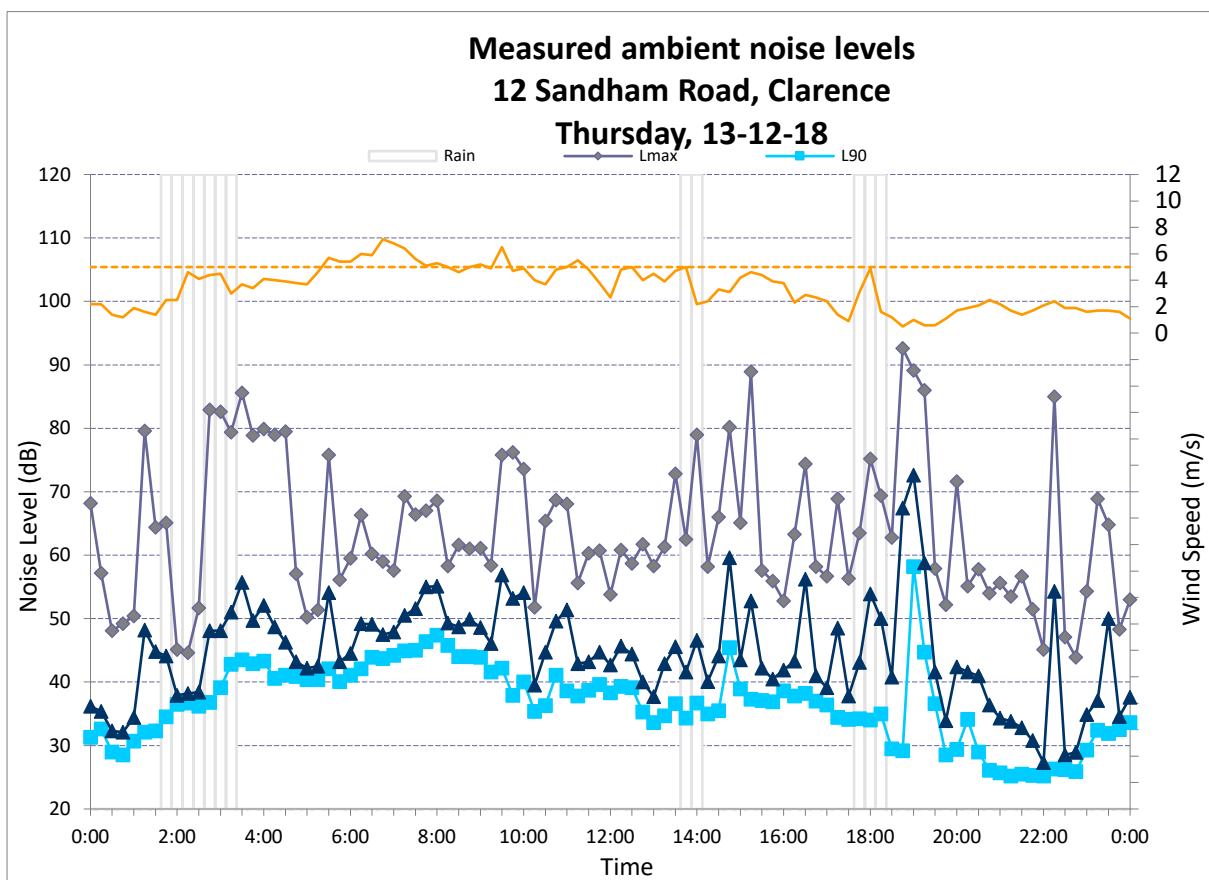
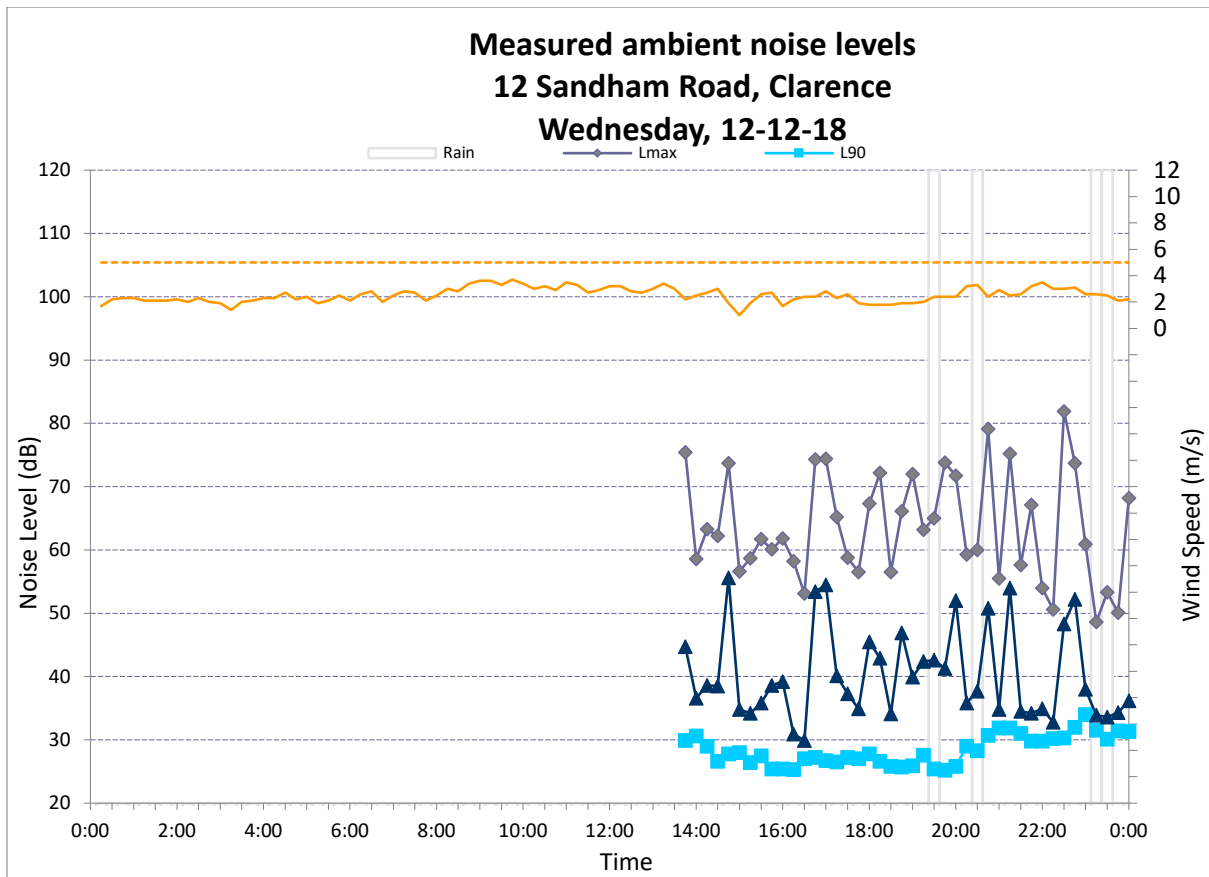


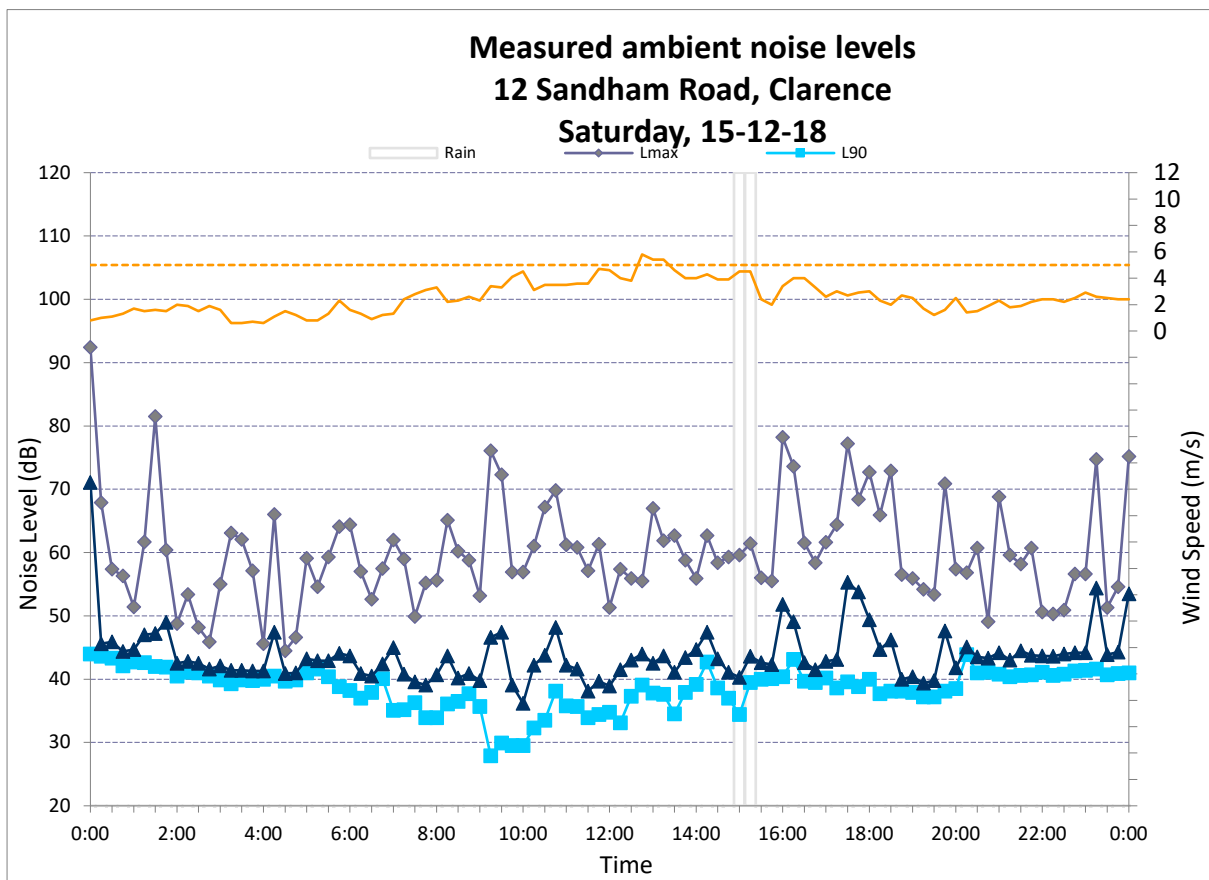
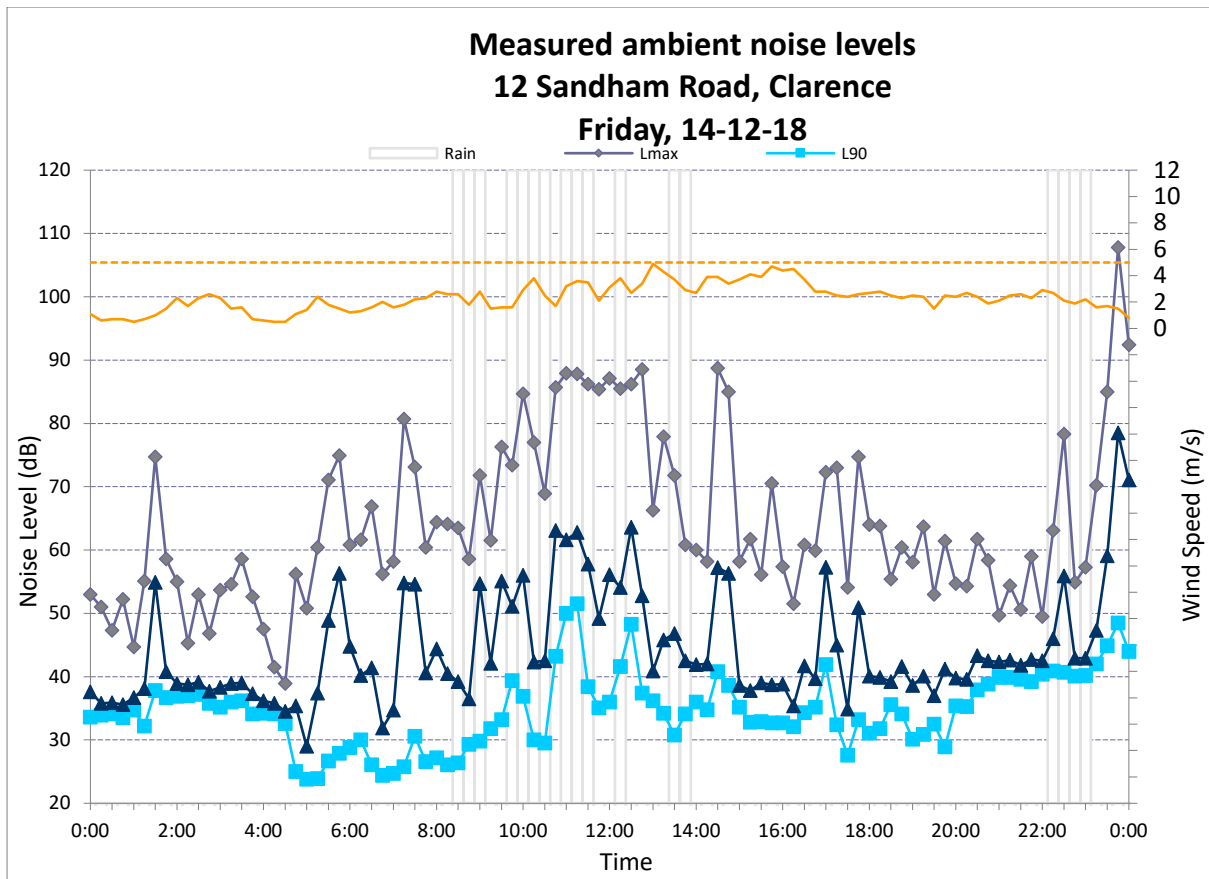
Date	ABL Day	ABL Evening	ABL Night	L _{Aeq,11 hour} Day	L _{Aeq,4 hour} Evening	L _{Aeq,9 hour} Night	L _{Aeq,15 hour} Day	L _{Aeq,24 hour} Day	L _{Aeq,8 hour} Night
Wednesday, 12-12-18	0	26	0	0	47	0	0	0	0
Thursday, 13-12-18	0	25	25	0	62	46	0	55	46
Friday, 14-12-18	0	30	38	0	41	64	0	0	65
Saturday, 15-12-18	30	37	30	46	44	45	46	45	46
Sunday, 16-12-18	31	27	25	44	47	46	45	45	46
Monday, 17-12-18	28	25	23	46	48	47	46	47	46
Tuesday, 18-12-18	28	27	0	45	48	0	46	46	0
Wednesday, 19-12-18	26	0	29	46	0	49	0	53	49
Thursday, 20-12-18	0	44	35	0	47	45	0	55	45
Friday, 21-12-18	29	39	34	50	47	47	49	49	48
Saturday, 22-12-18	28	31	25	46	51	44	48	47	44
Sunday, 23-12-18	27	24	23	47	48	44	48	47	44
Monday, 24-12-18	27	24	24	43	42	43	43	43	43
Tuesday, 25-12-18	27	25	24	40	40	41	40	40	41
Wednesday, 26-12-18	28	25	26	45	44	42	45	44	42
Thursday, 27-12-18	27	25	26	41	44	45	42	43	44
Friday, 28-12-18	28	24	24	42	41	42	42	42	42
Saturday, 29-12-18	0	0	0	0	0	0	0	0	0
Summary Values	28	26	25	46	52	53	46	49	54

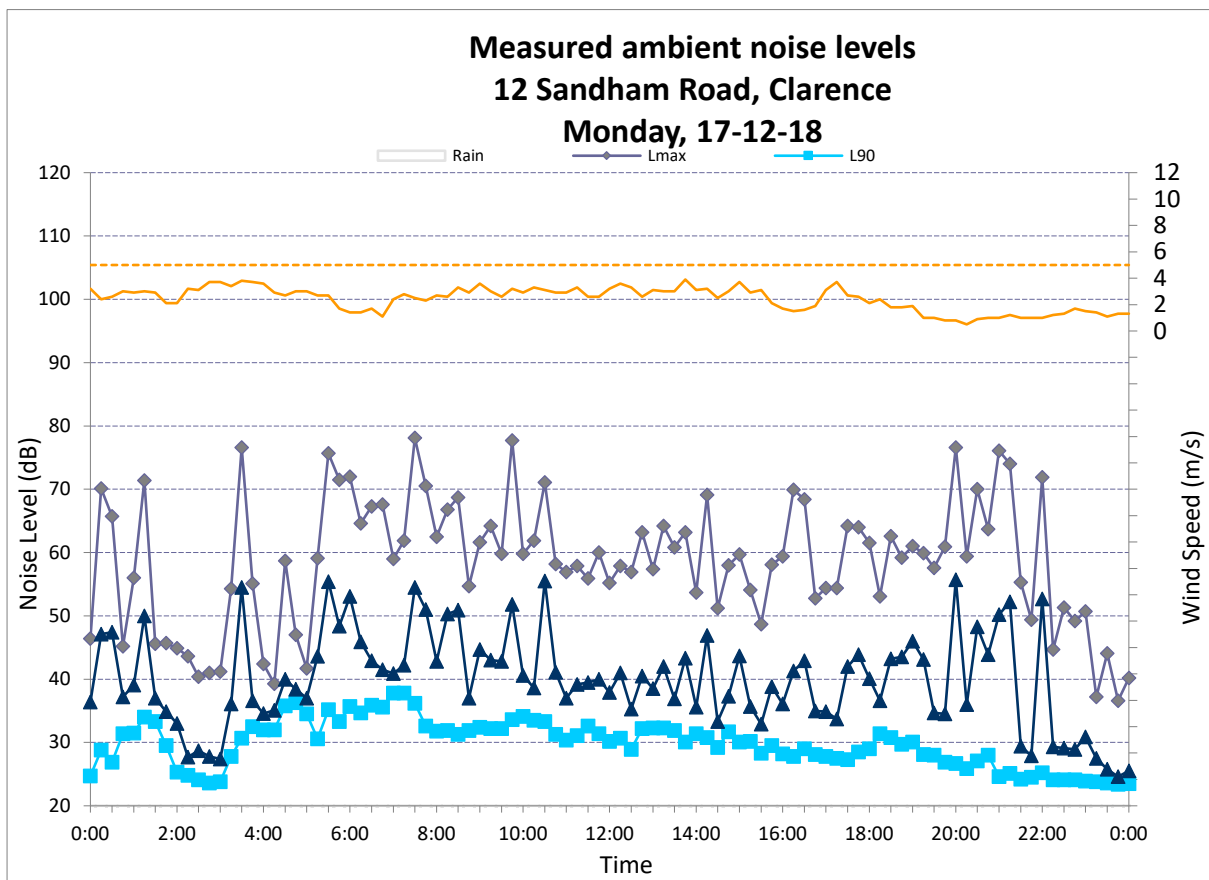
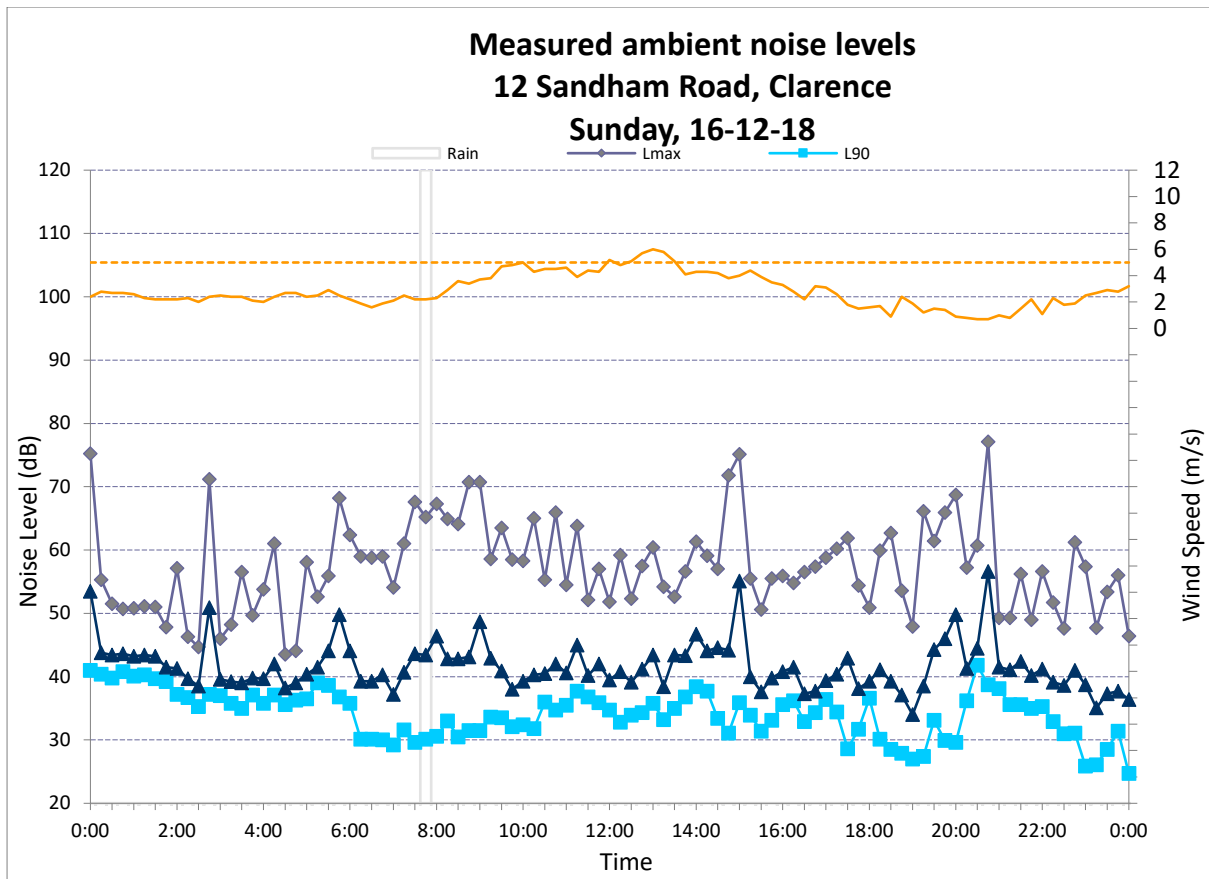
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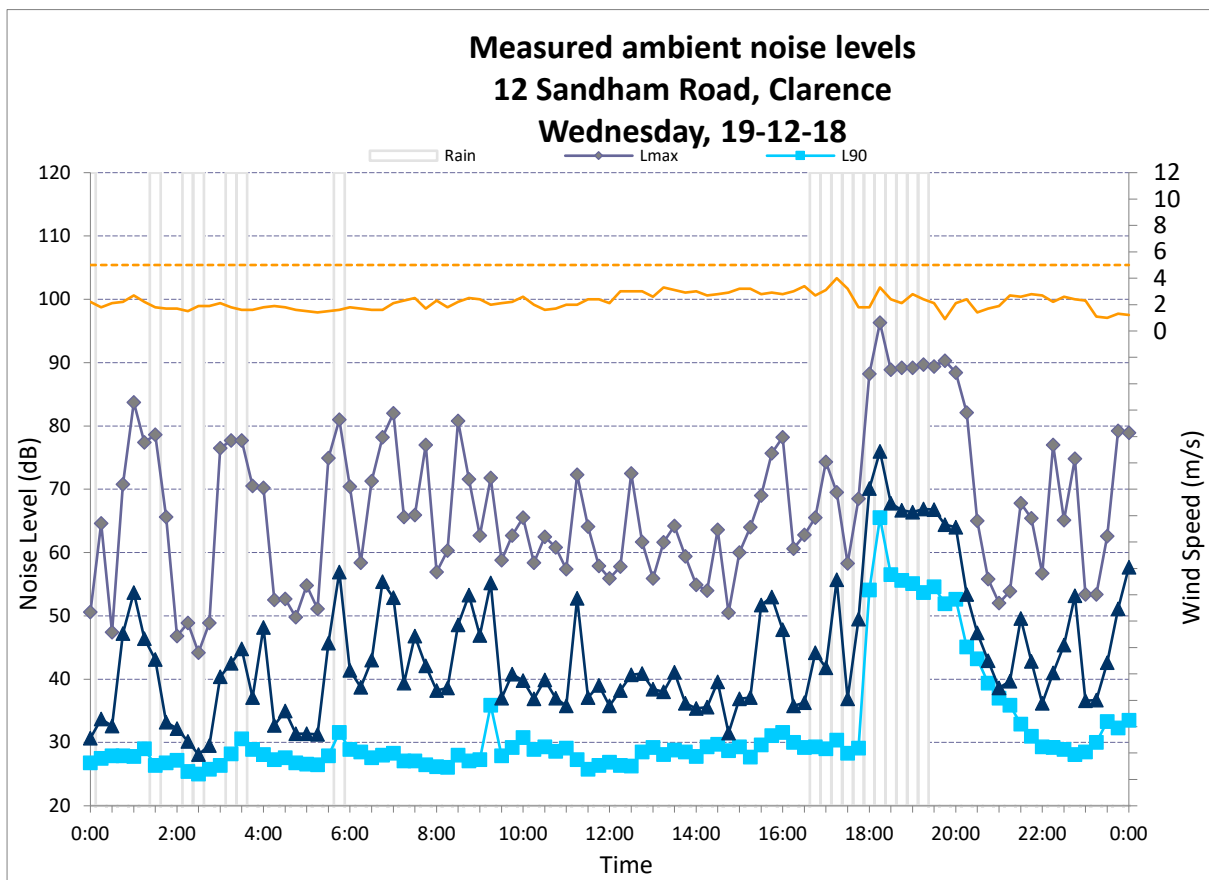
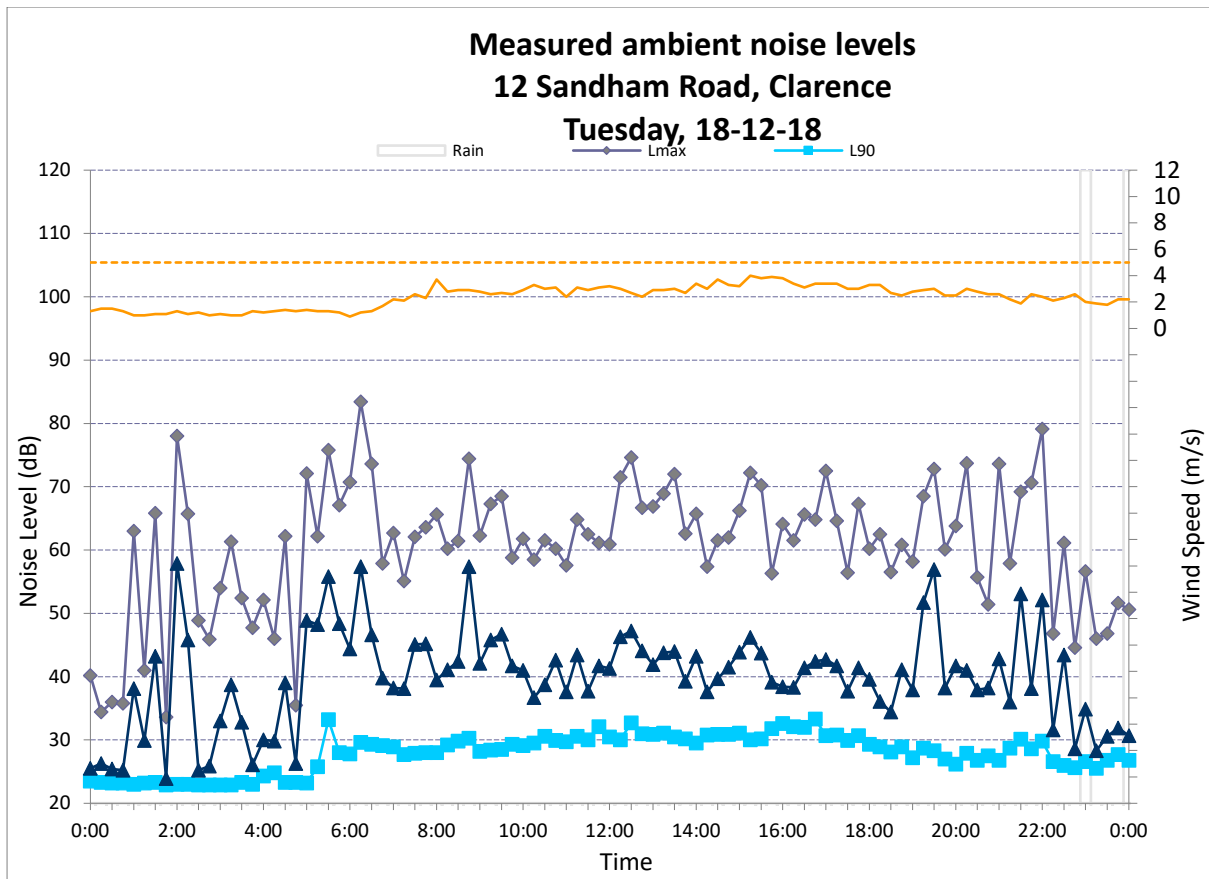
0 indicates periods with too few valid samples due to weather or logger operation

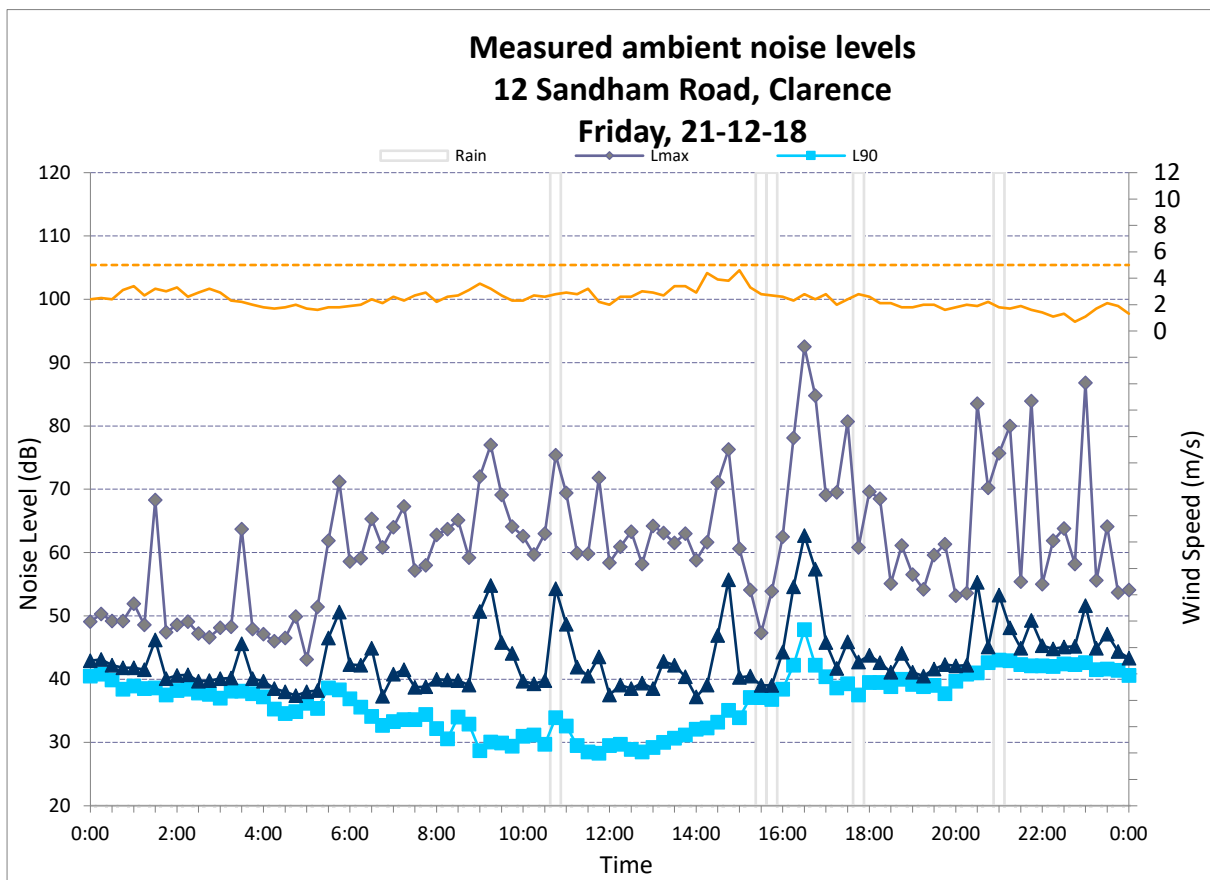
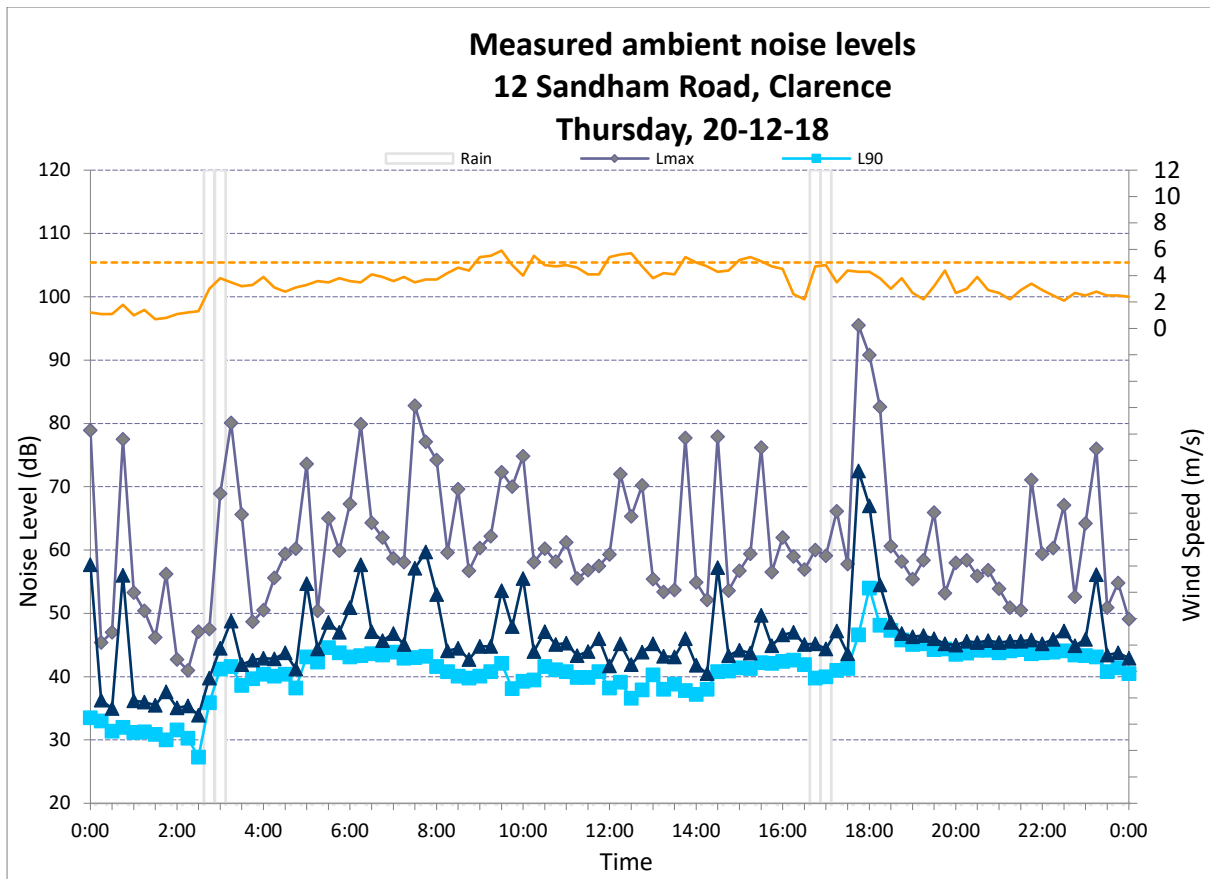
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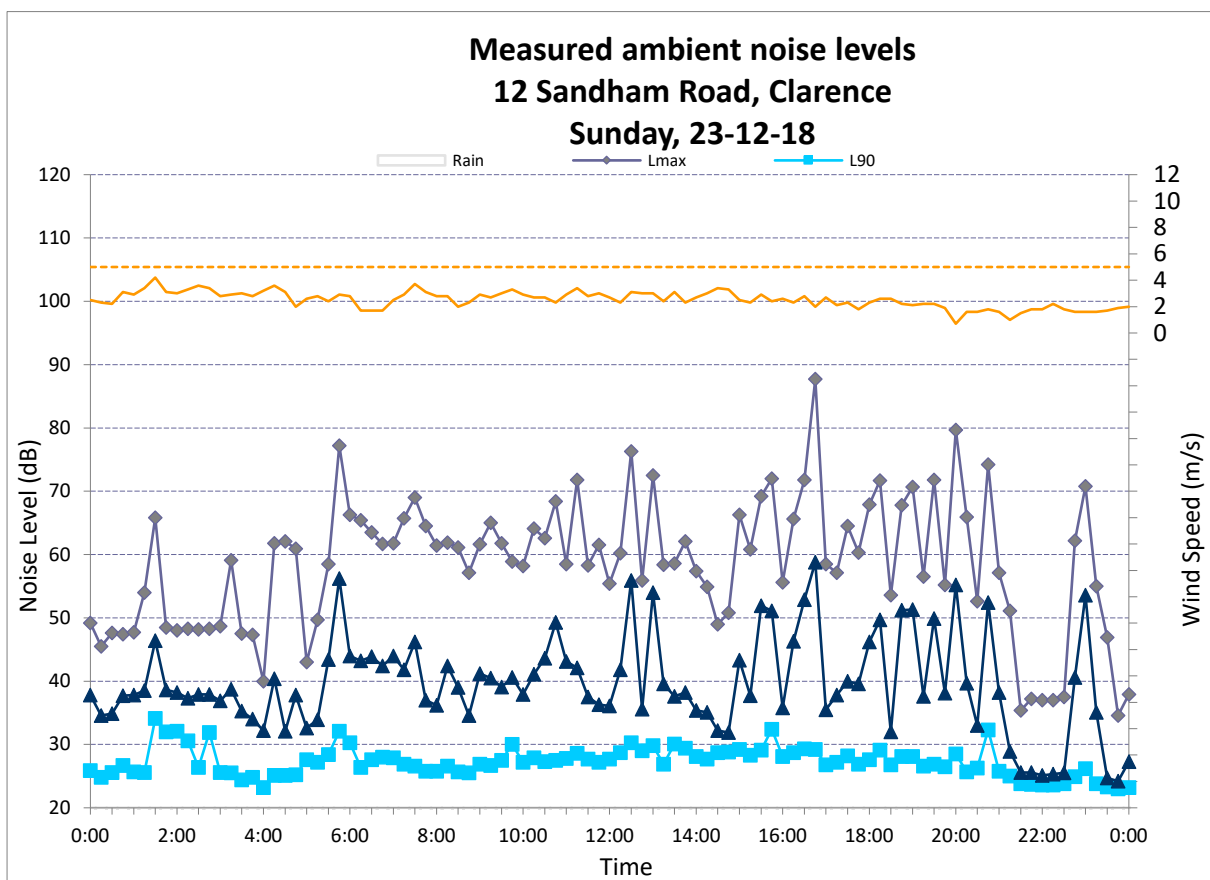
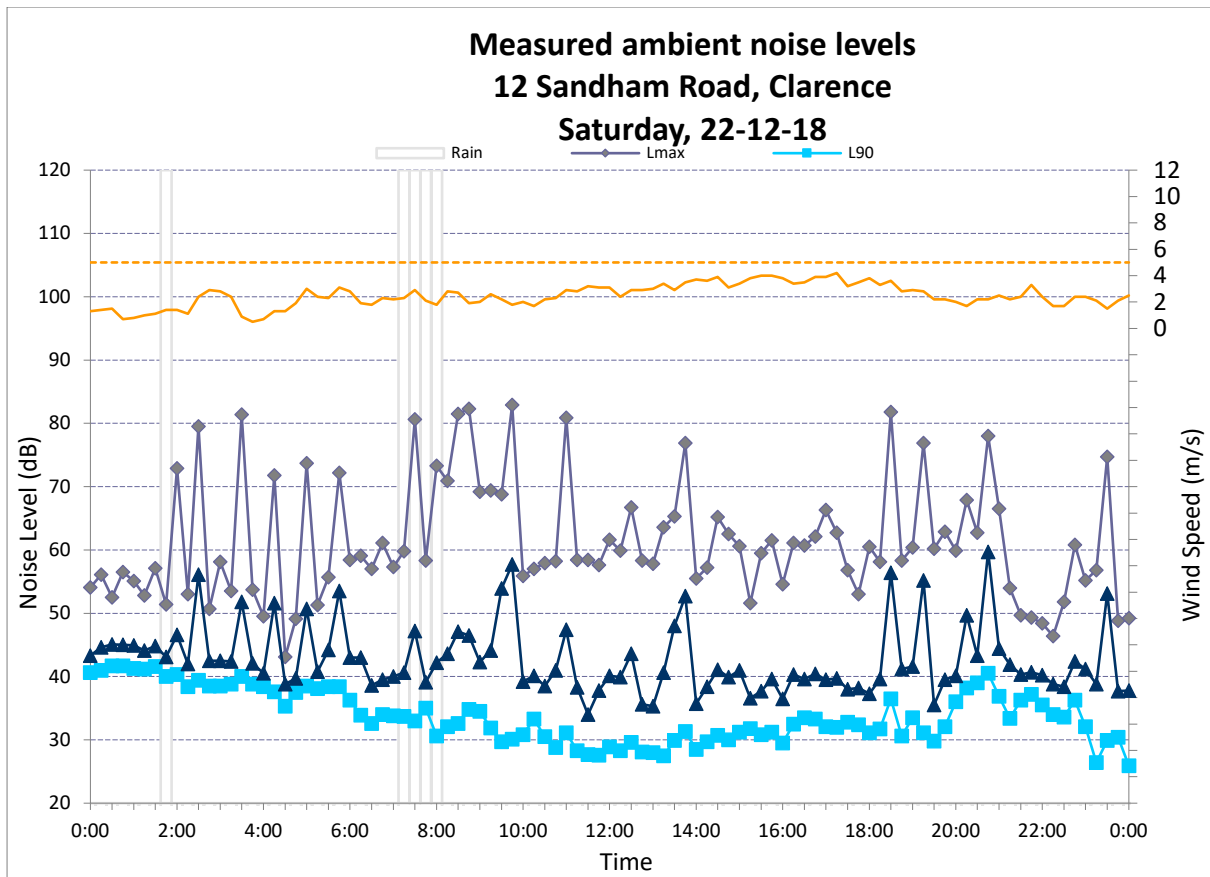


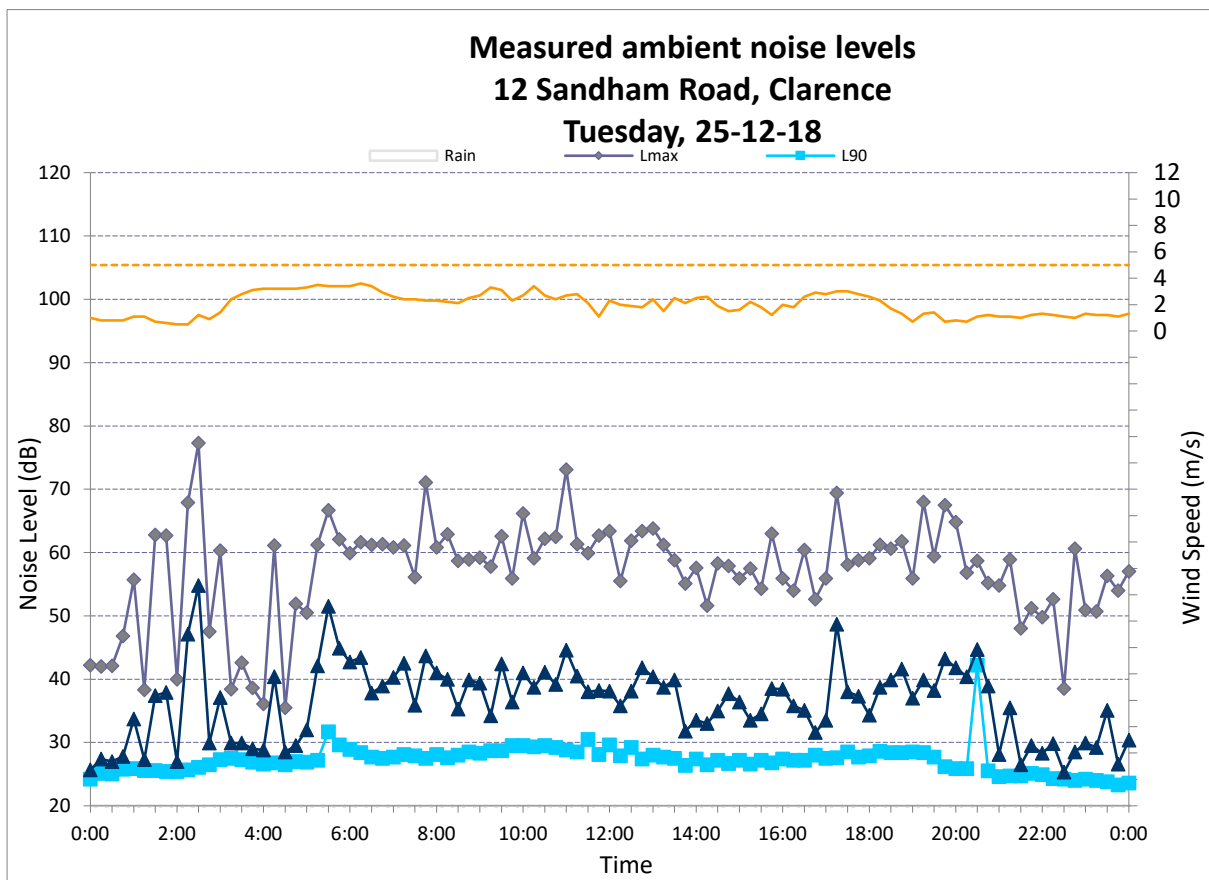
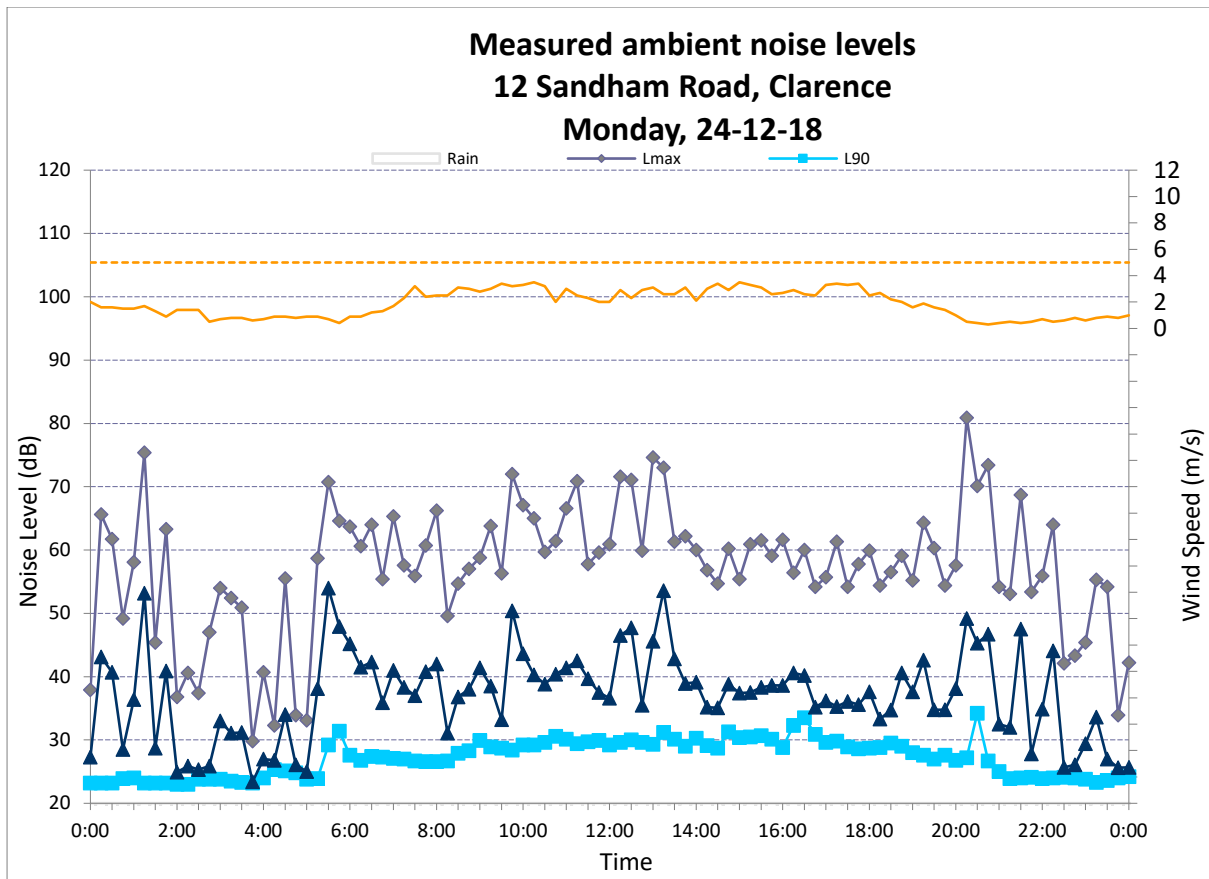


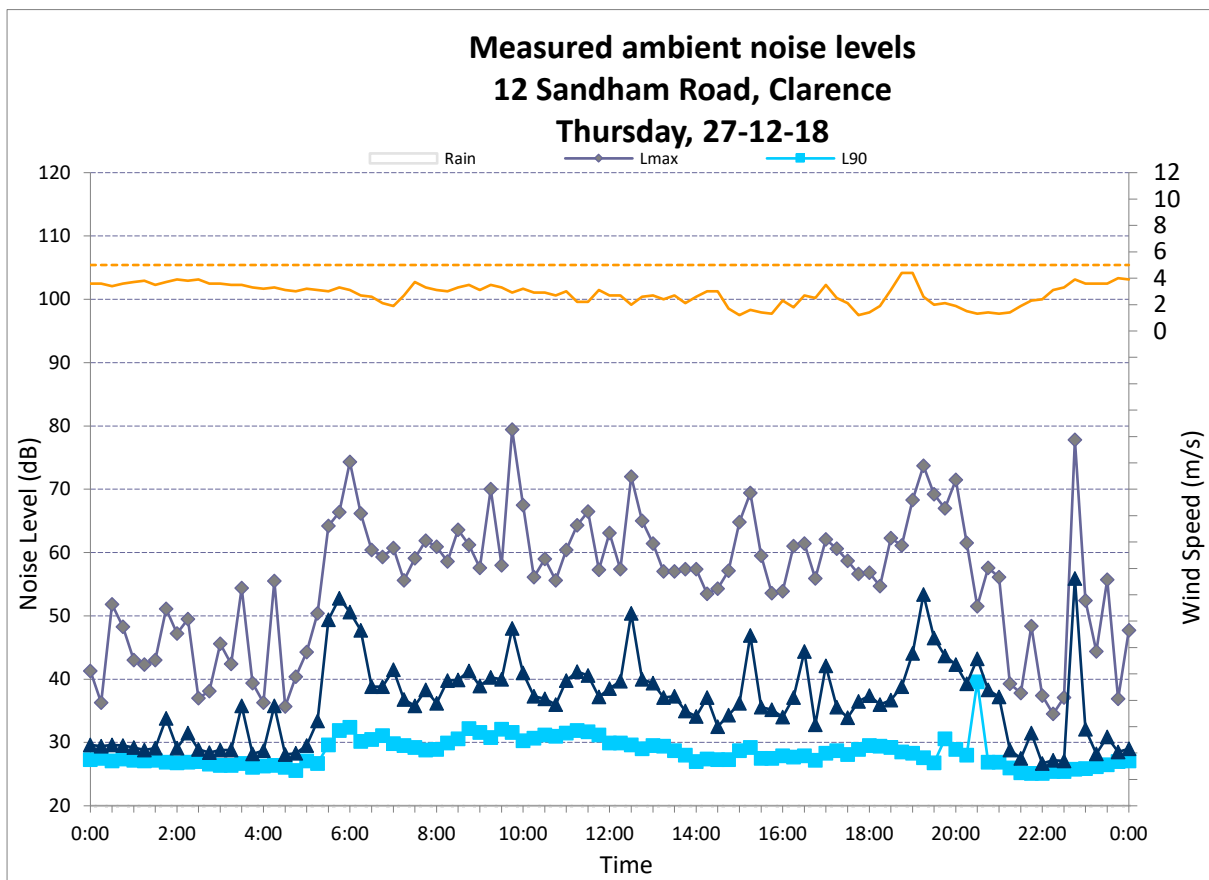
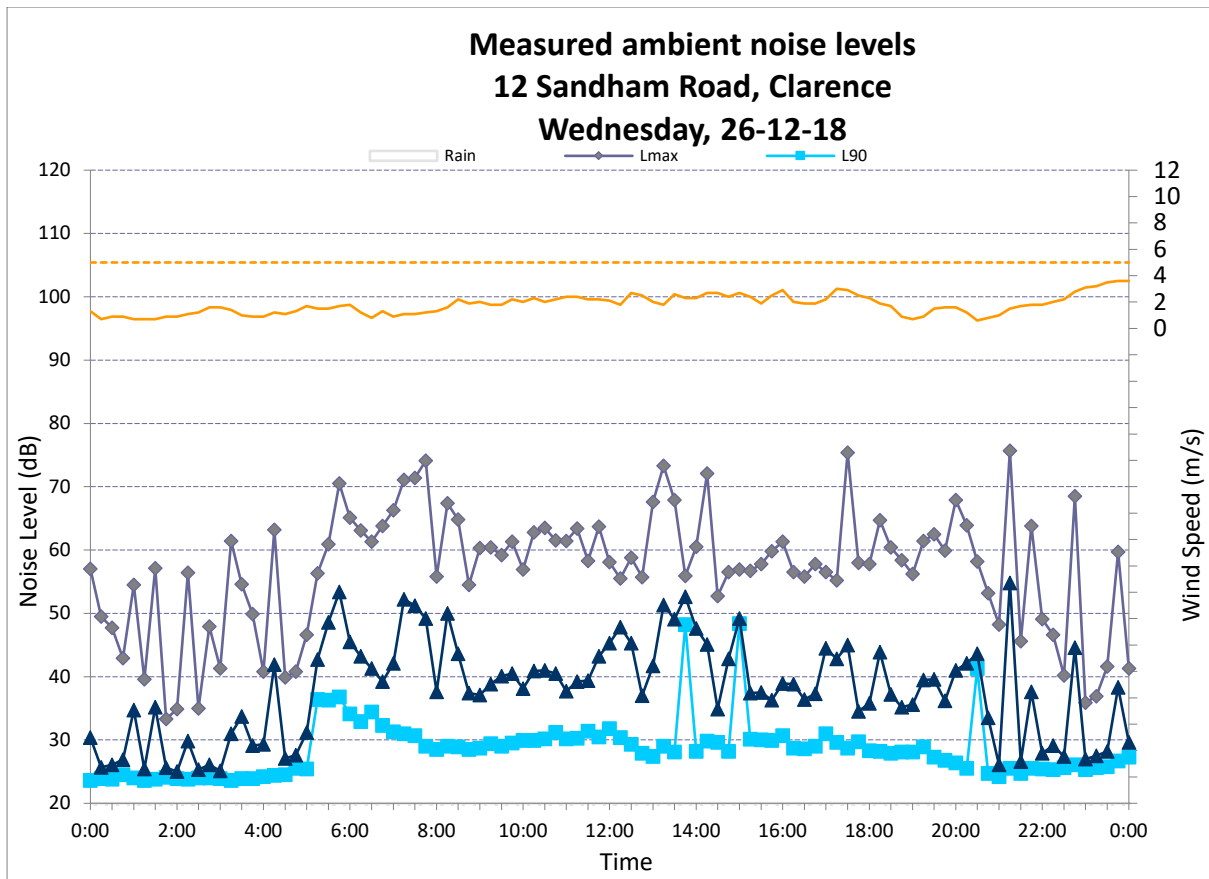


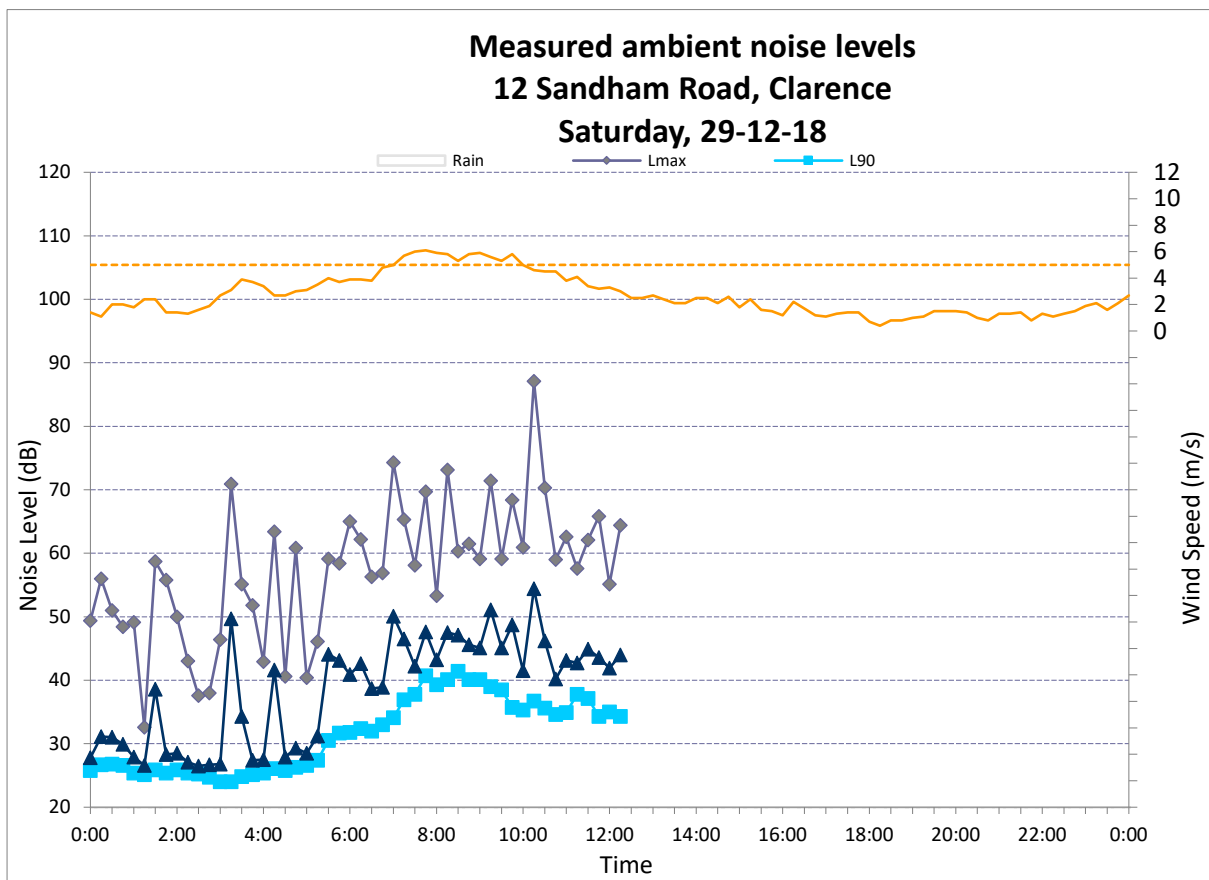
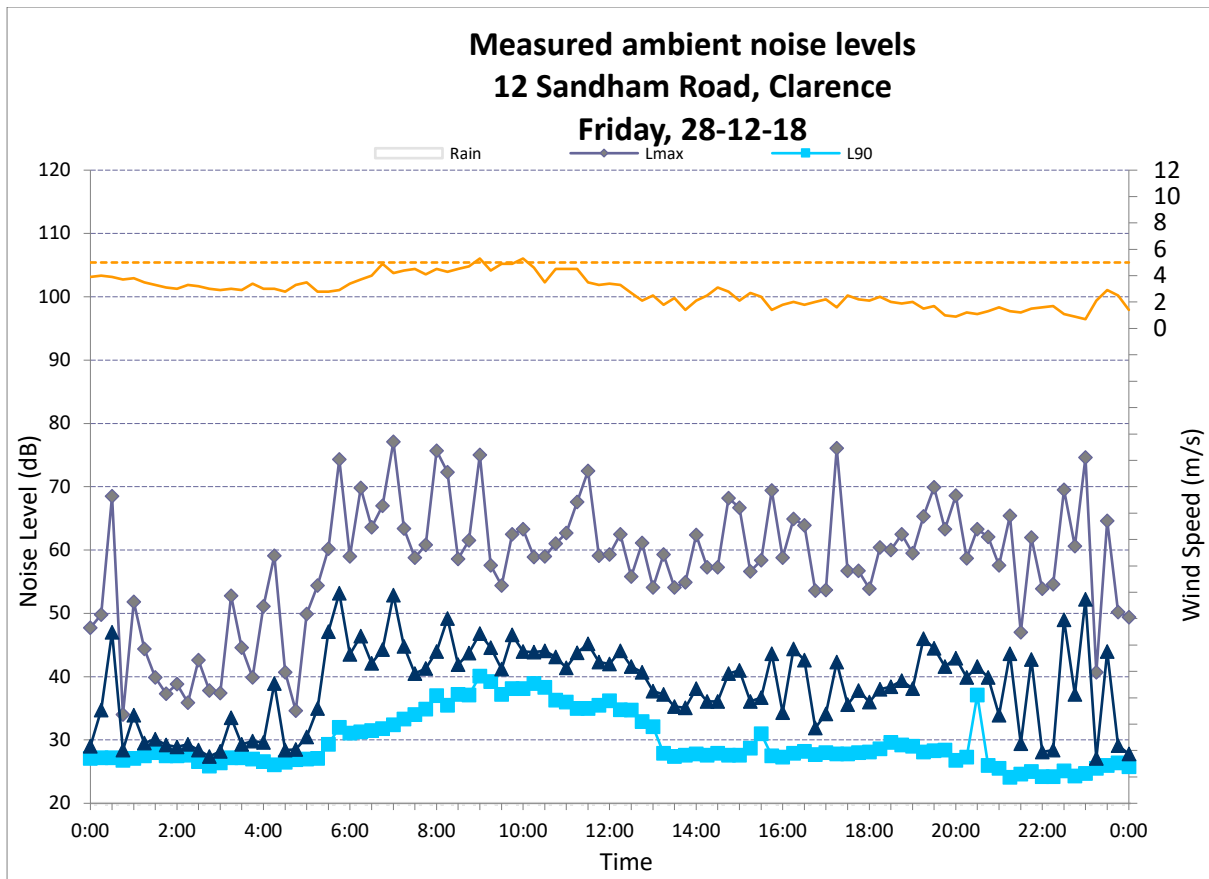










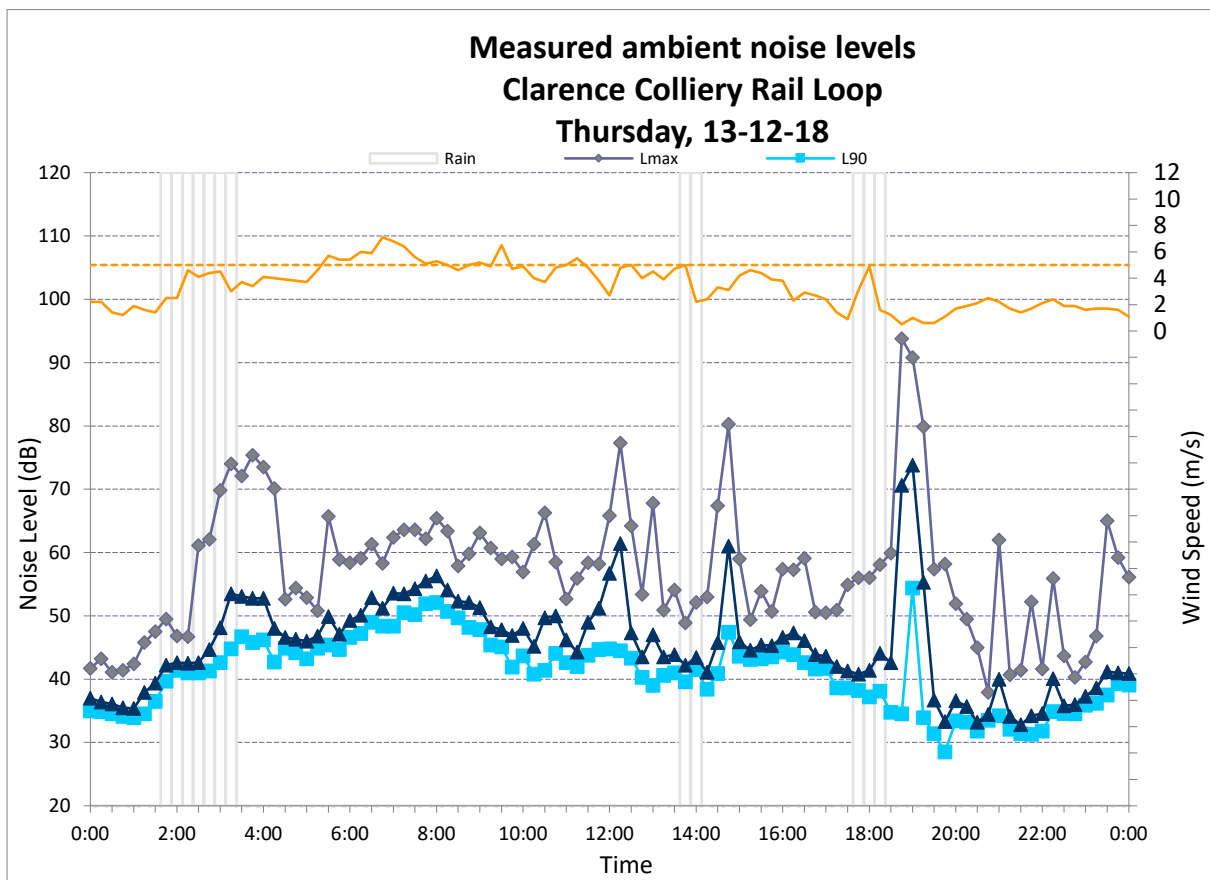
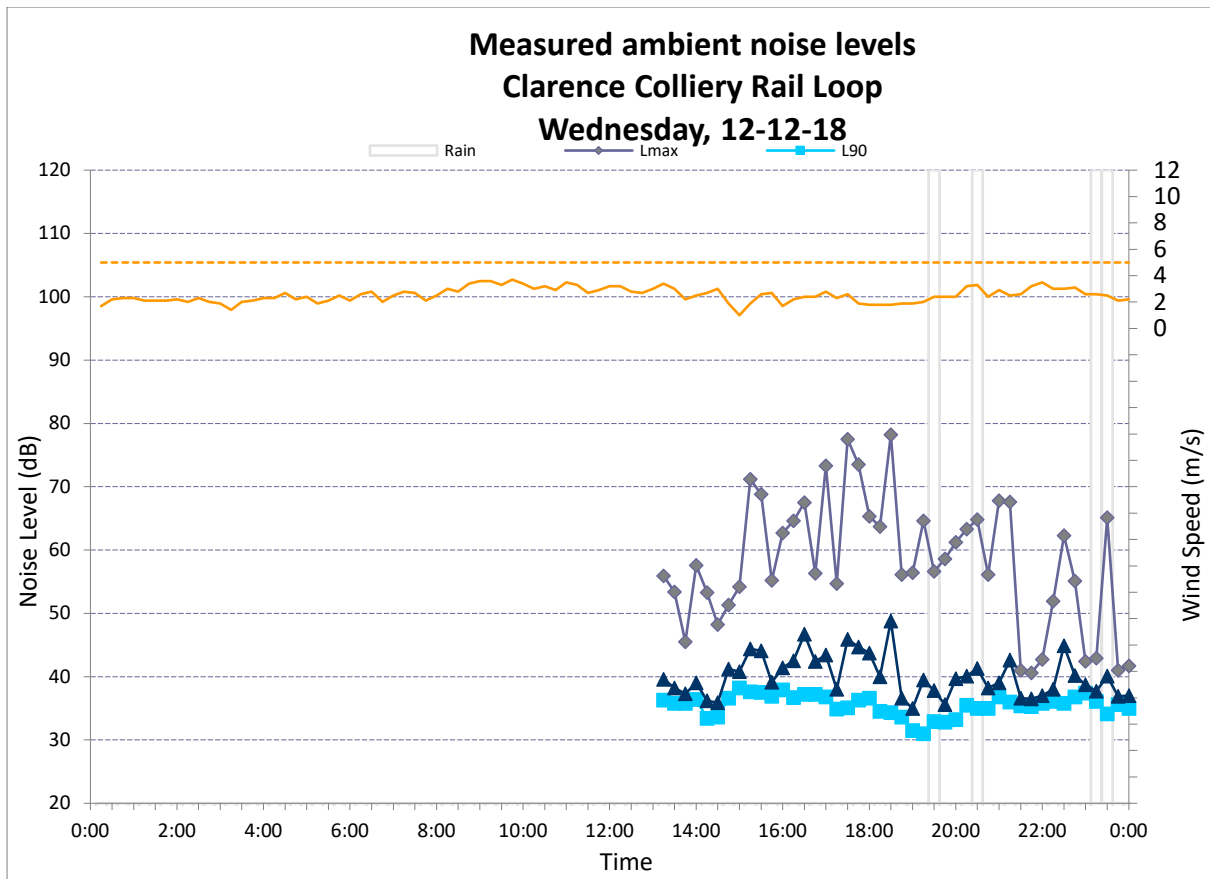


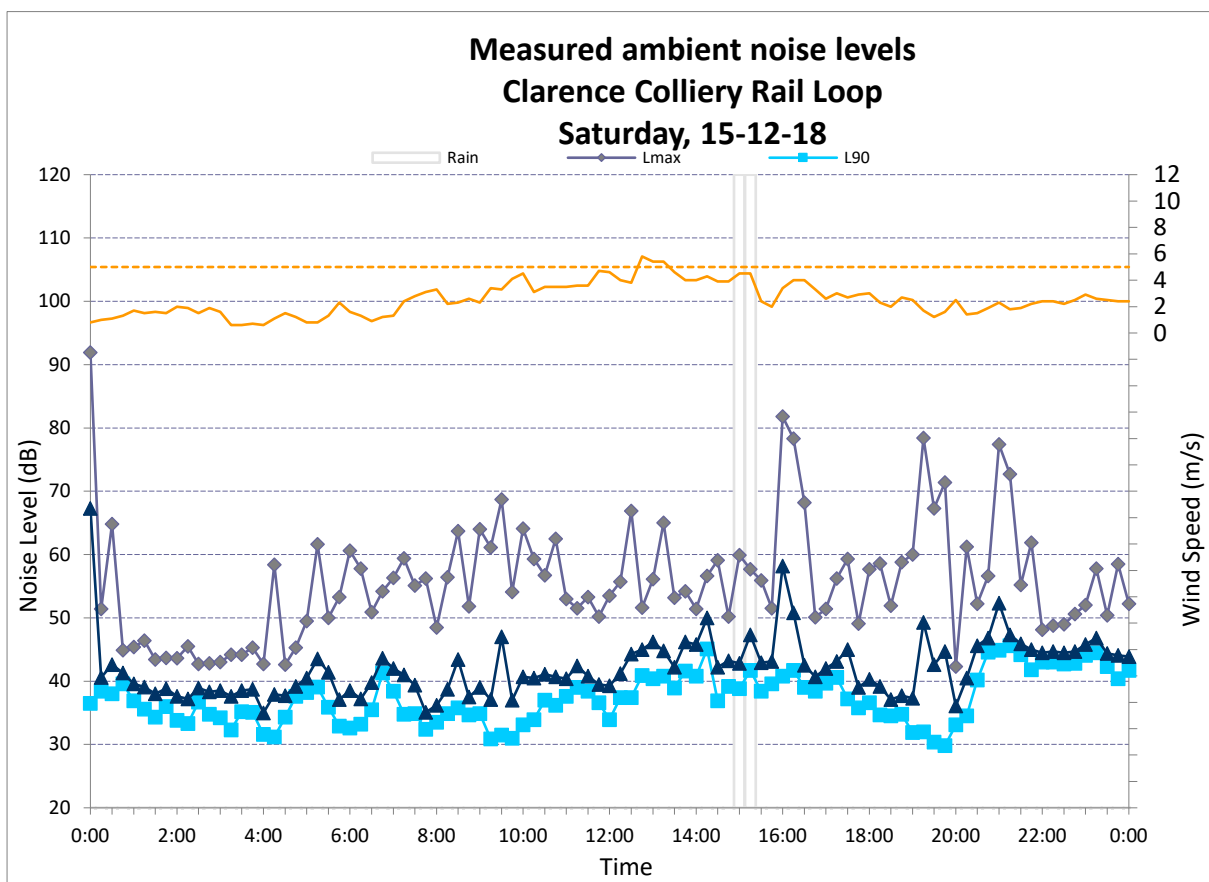
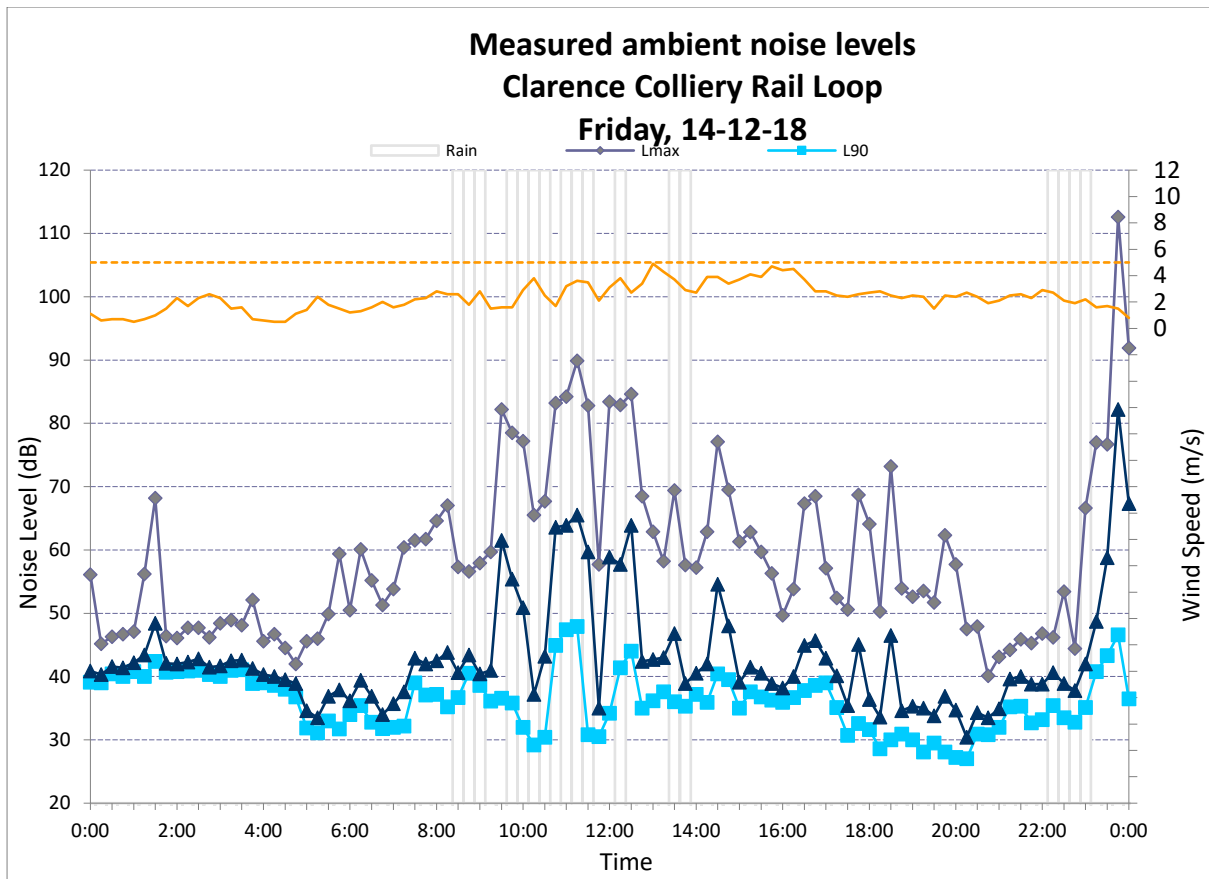
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Wednesday, 12-12-18	0	32	0	0	41	0	0	0	0
Thursday, 13-12-18	0	31	32	0	64	41	0	57	41
Friday, 14-12-18	0	27	33	0	38	67	0	0	68
Saturday, 15-12-18	32	30	31	46	46	41	46	44	42
Sunday, 16-12-18	34	28	27	44	39	41	43	42	40
Monday, 17-12-18	32	25	25	42	37	37	41	40	37
Tuesday, 18-12-18	32	30	0	39	38	0	39	38	0
Wednesday, 19-12-18	32	0	35	40	0	46	0	50	46
Thursday, 20-12-18	0	42	33	0	48	45	0	58	46
Friday, 21-12-18	31	32	28	53	45	44	52	50	44
Saturday, 22-12-18	31	34	24	39	42	37	40	39	36
Sunday, 23-12-18	27	28	23	42	37	35	41	40	33
Monday, 24-12-18	29	0	0	39	0	0	39	0	0
Summary Values	32	30	30	45	54	57	45	51	58

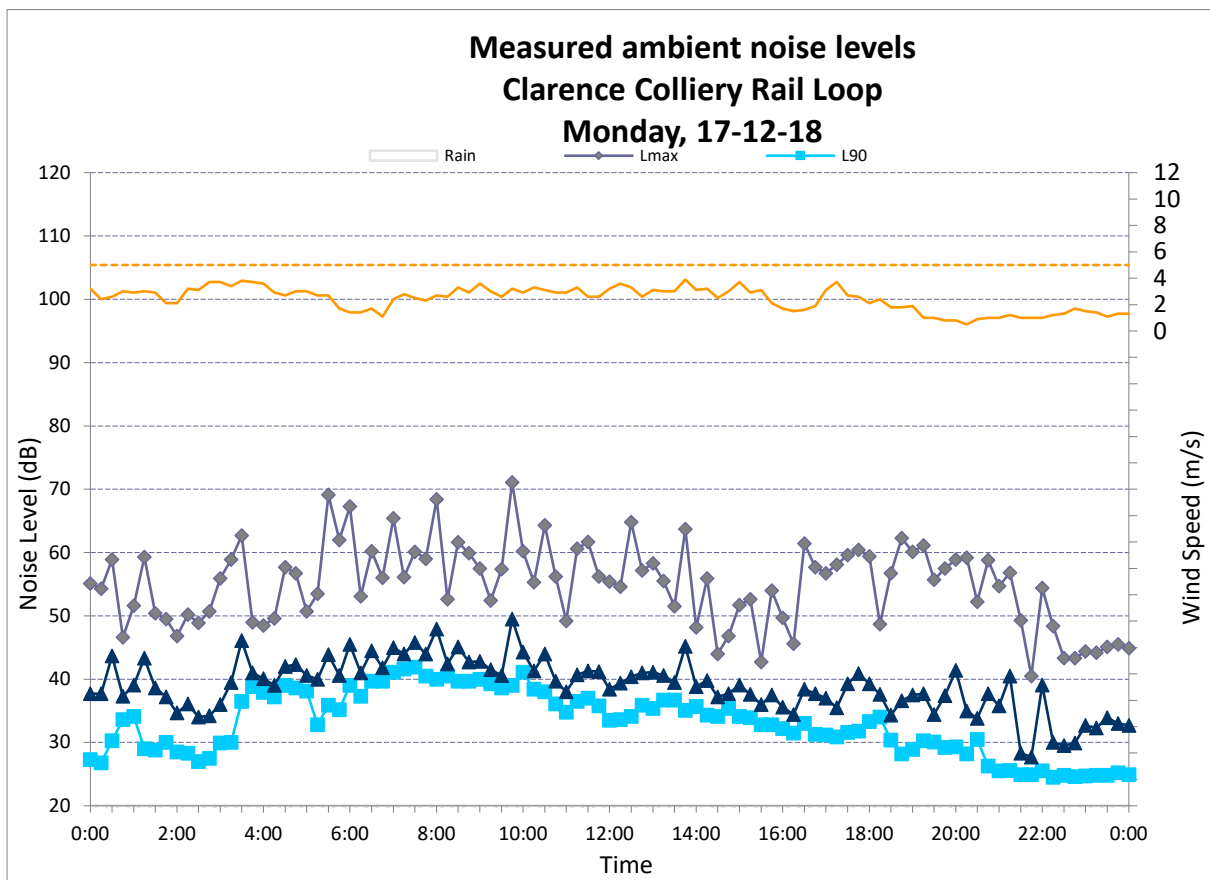
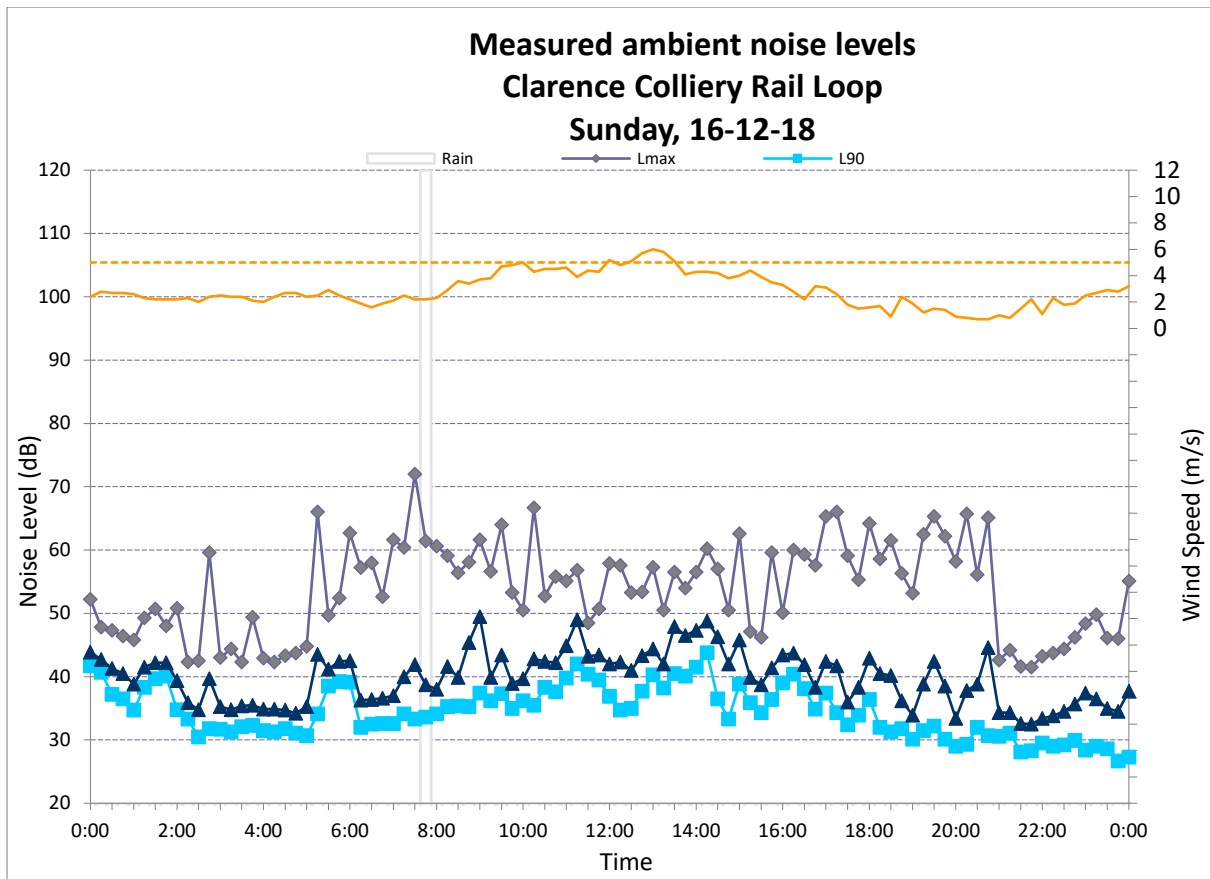
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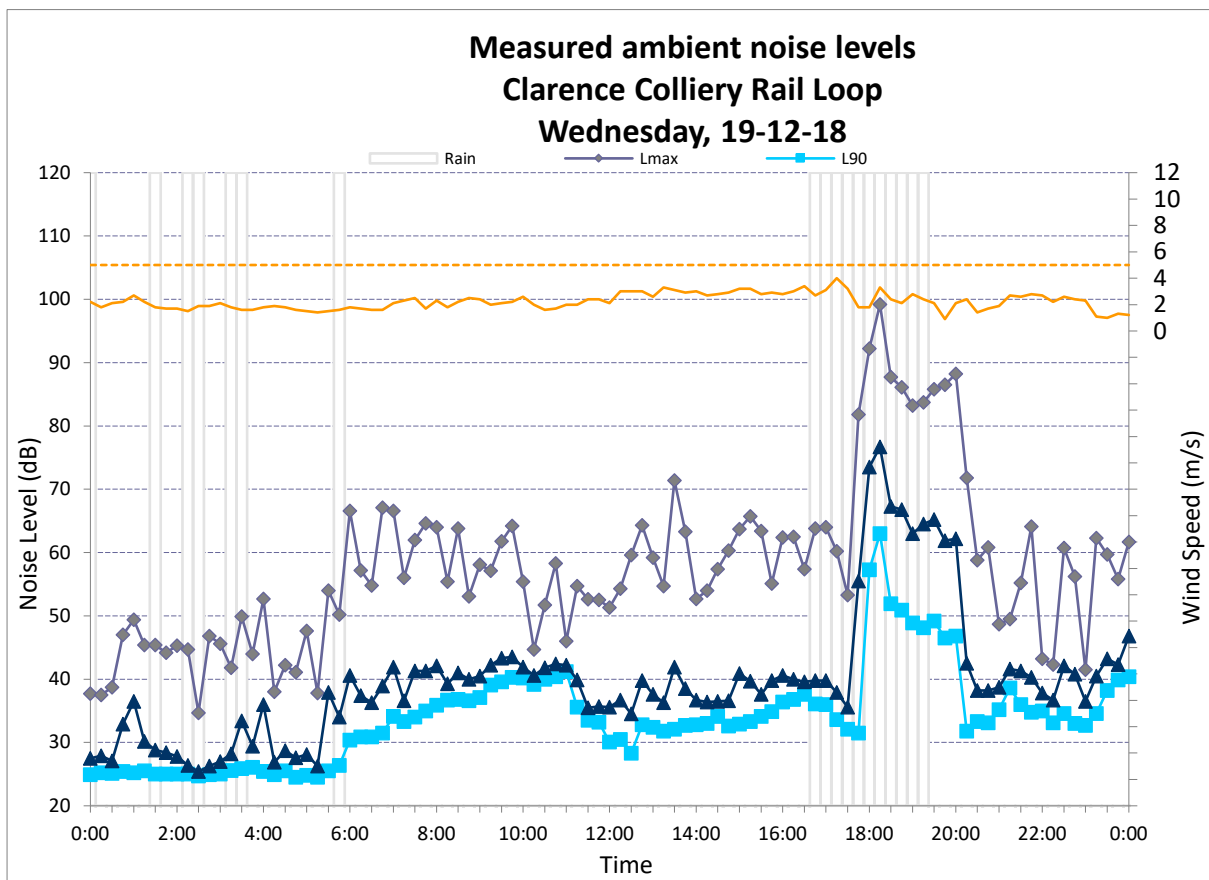
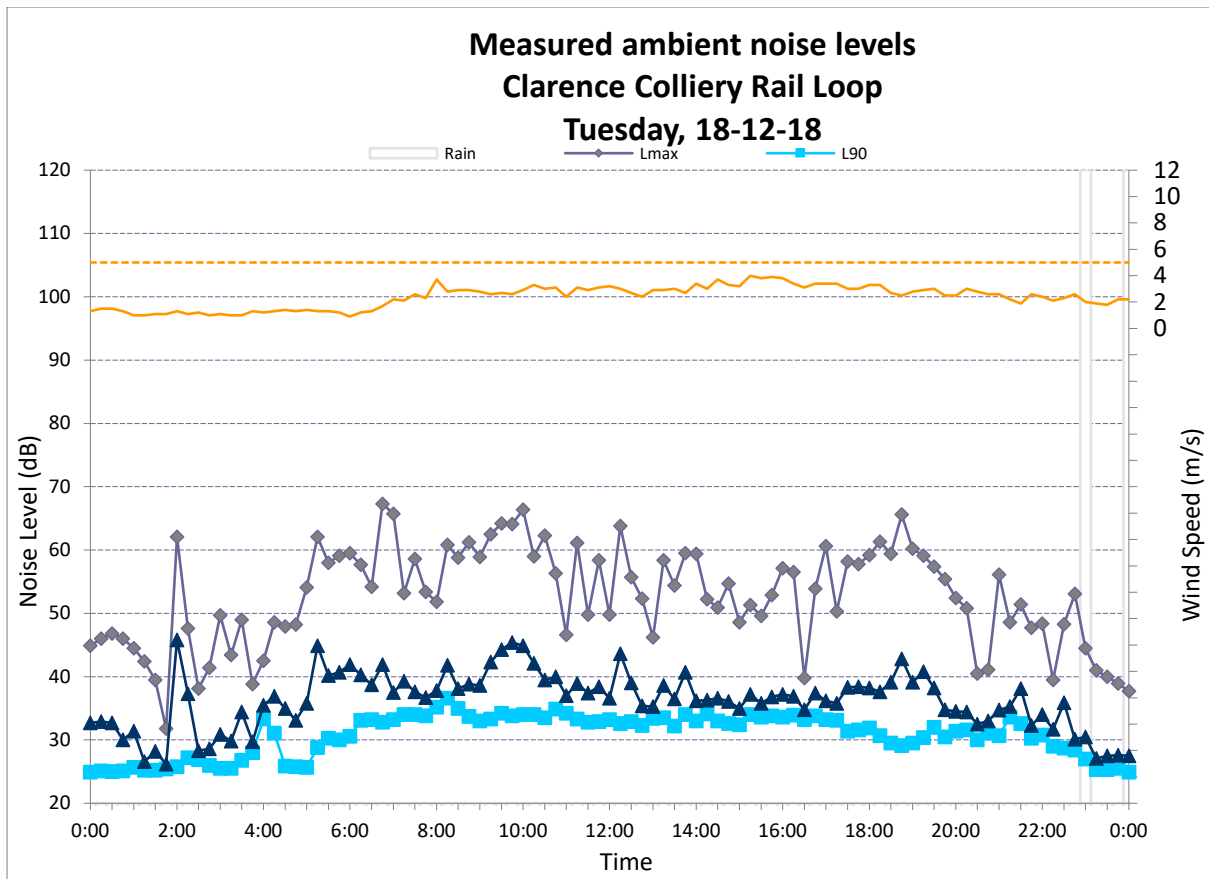
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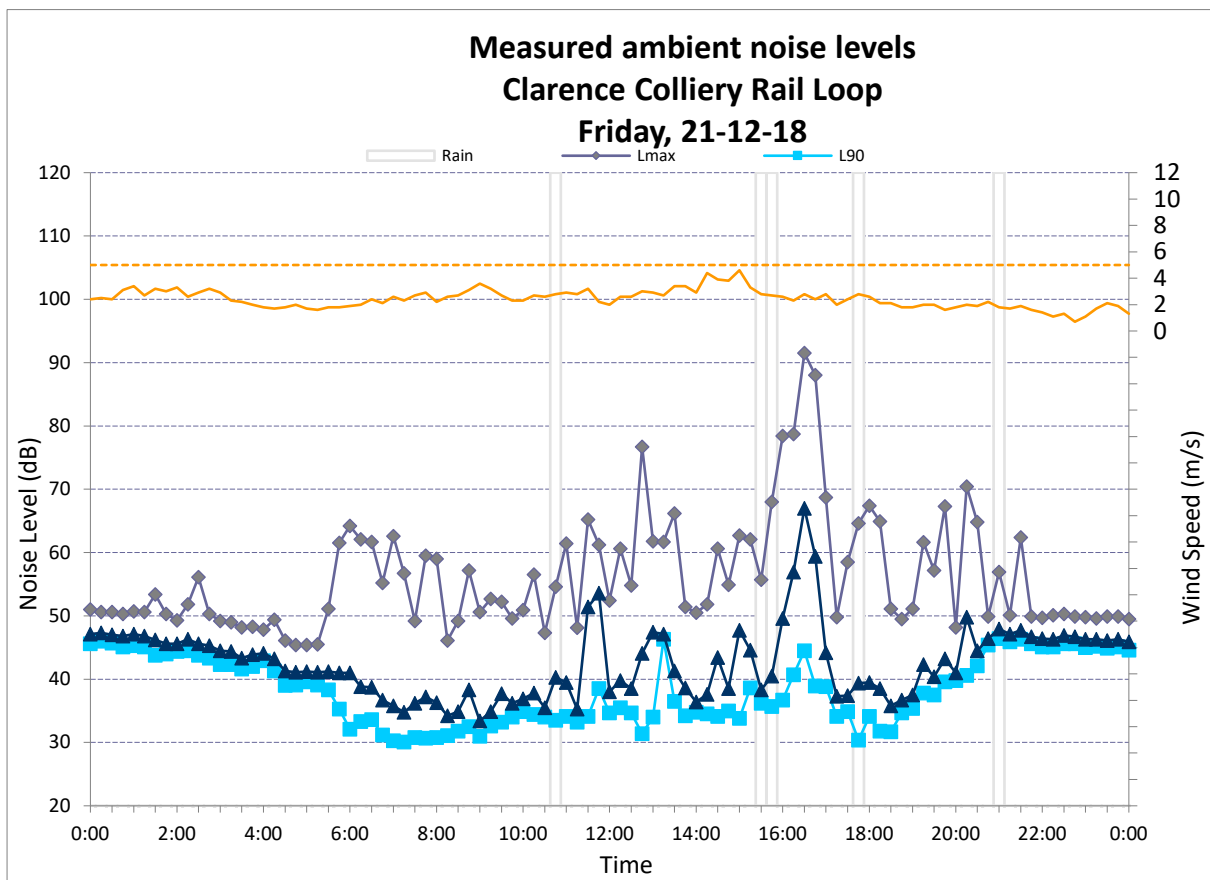
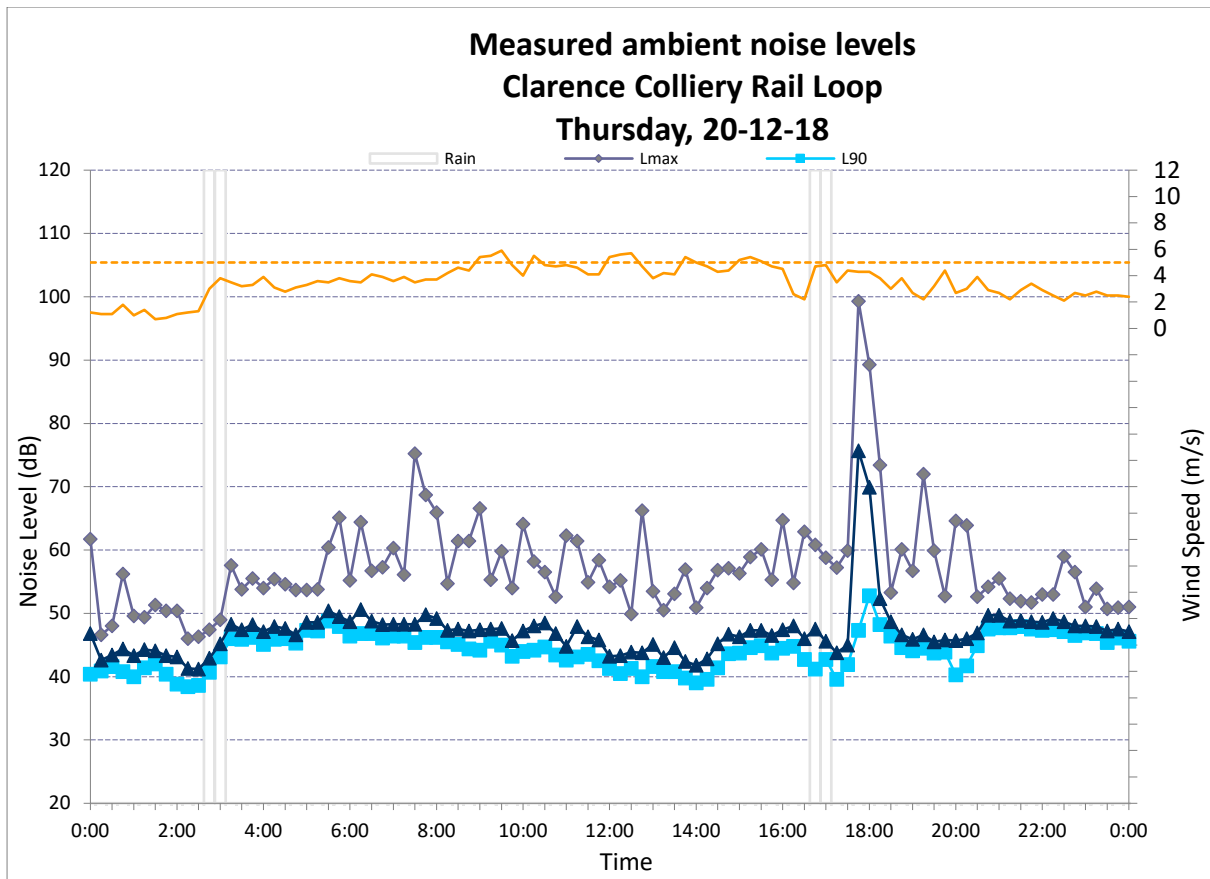
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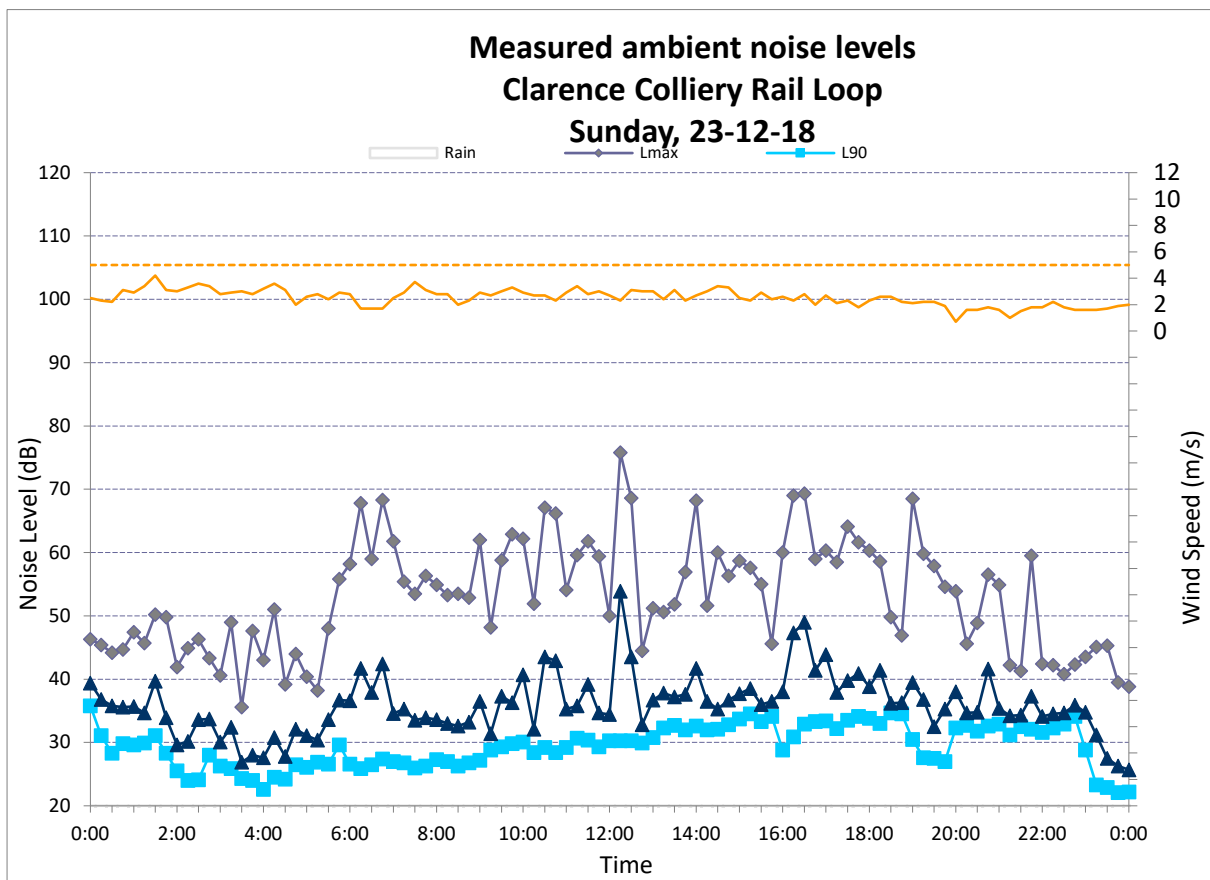
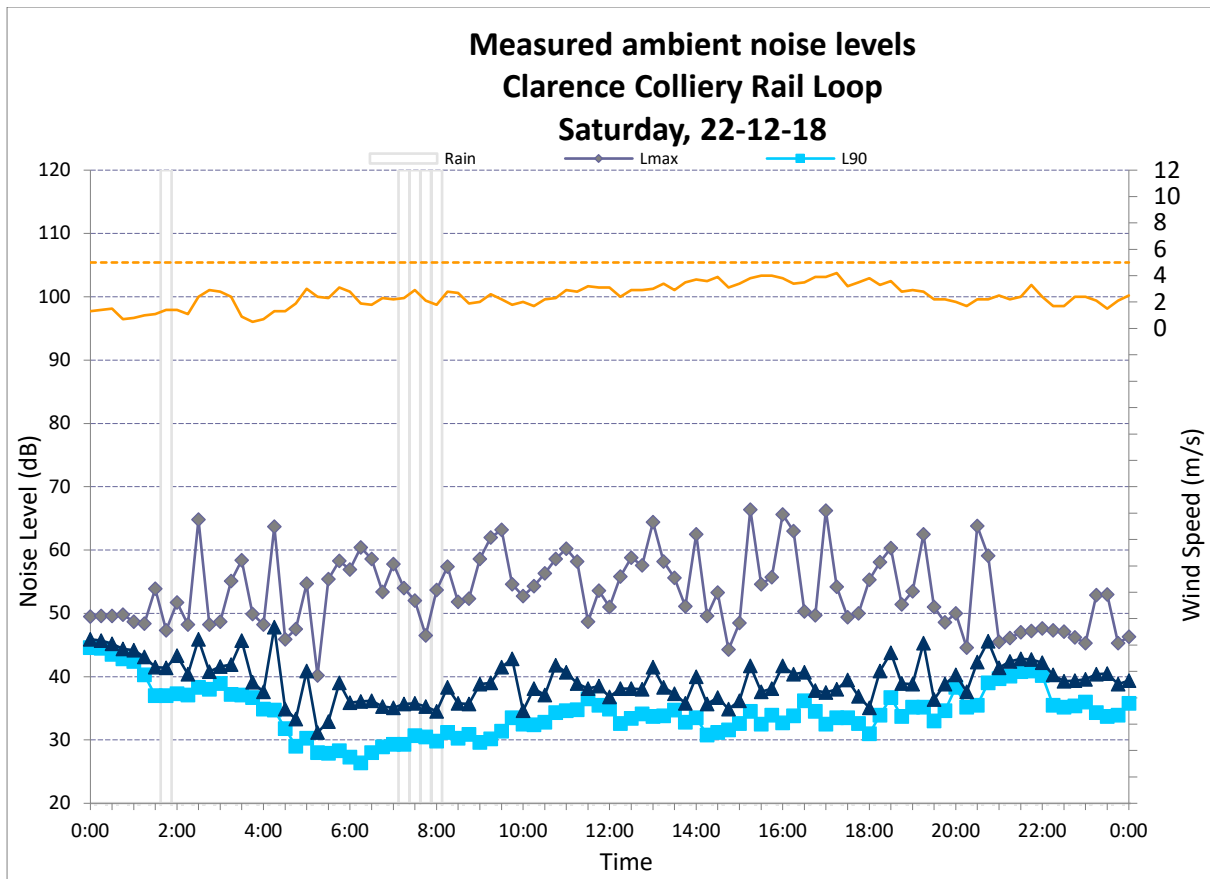






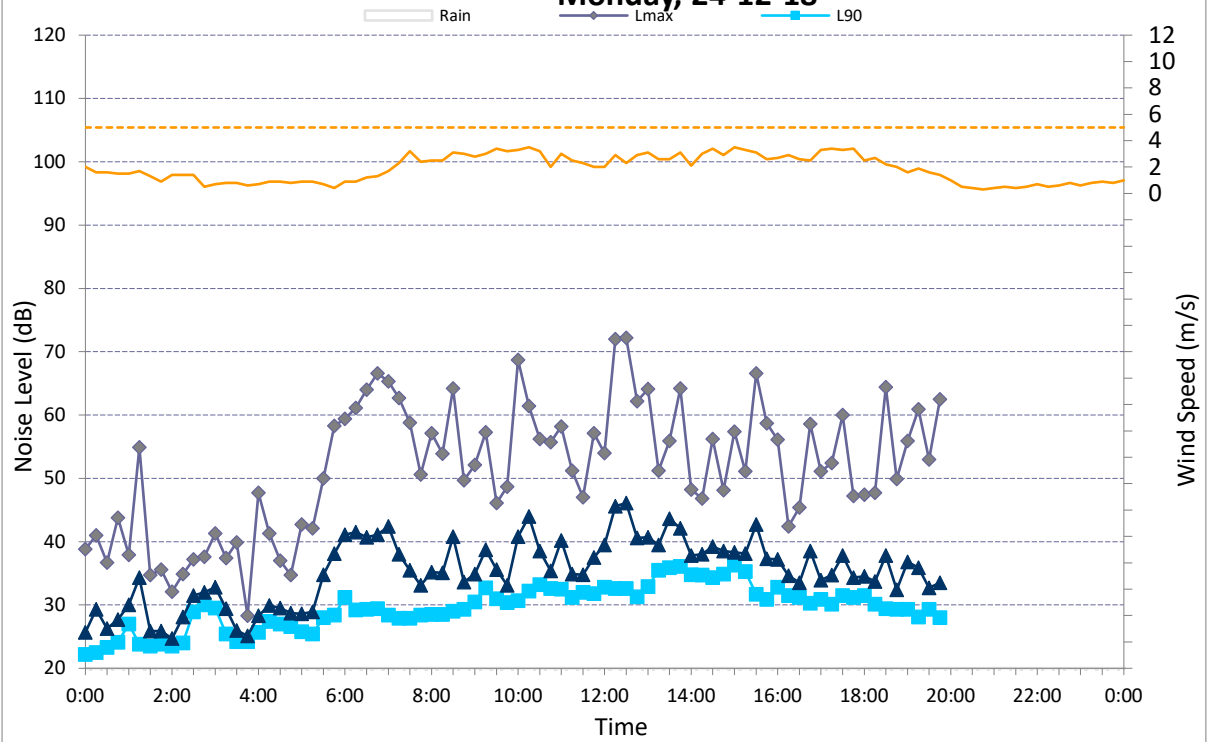






Measured ambient noise levels Clarence Colliery Rail Loop

Monday, 24-12-18



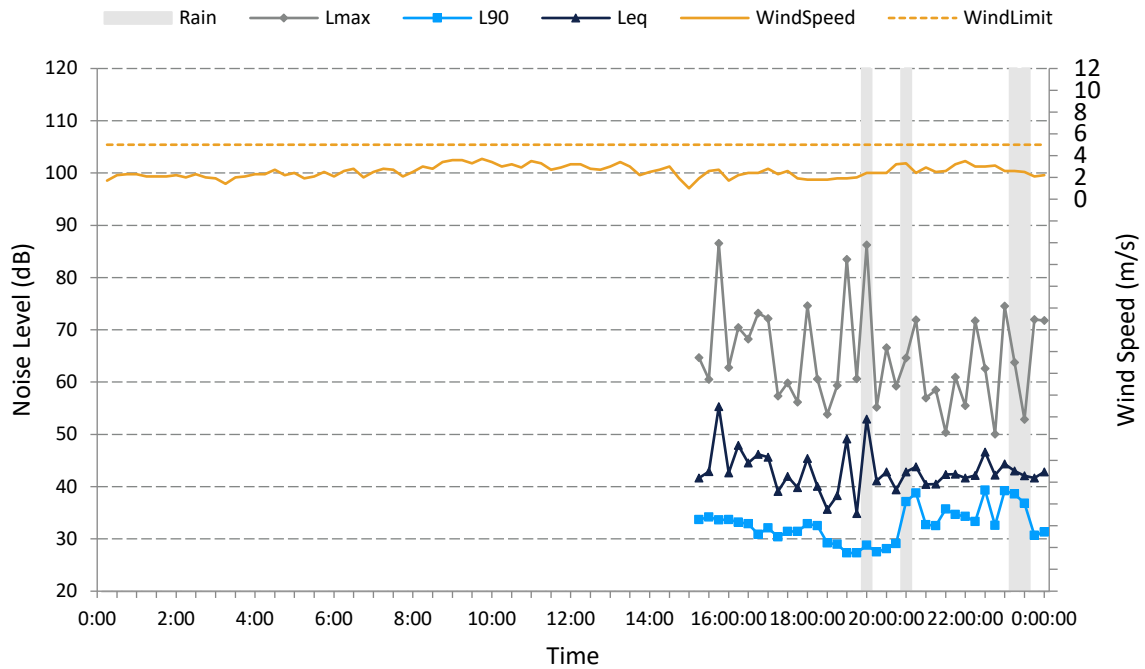
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Wednesday, 12-12-18	0	27	0	0	42	0	0	0	0
Thursday, 13-12-18	0	32	29	0	58	45	0	52	43
Friday, 14-12-18	0	32	36	0	46	61	0	0	61
Saturday, 15-12-18	35	47	32	49	54	48	51	50	48
Sunday, 16-12-18	33	39	27	47	51	48	49	48	47
Monday, 17-12-18	31	35	24	47	47	47	47	47	46
Tuesday, 18-12-18	30	29	0	48	44	0	47	46	0
Wednesday, 19-12-18	31	0	32	53	0	46	0	52	46
Thursday, 20-12-18	0	44	33	0	48	46	0	58	46
Friday, 21-12-18	0	0	0	0	0	0	0	0	0
Summary Values	31	34	32	50	52	53	49	53	54

Notes:

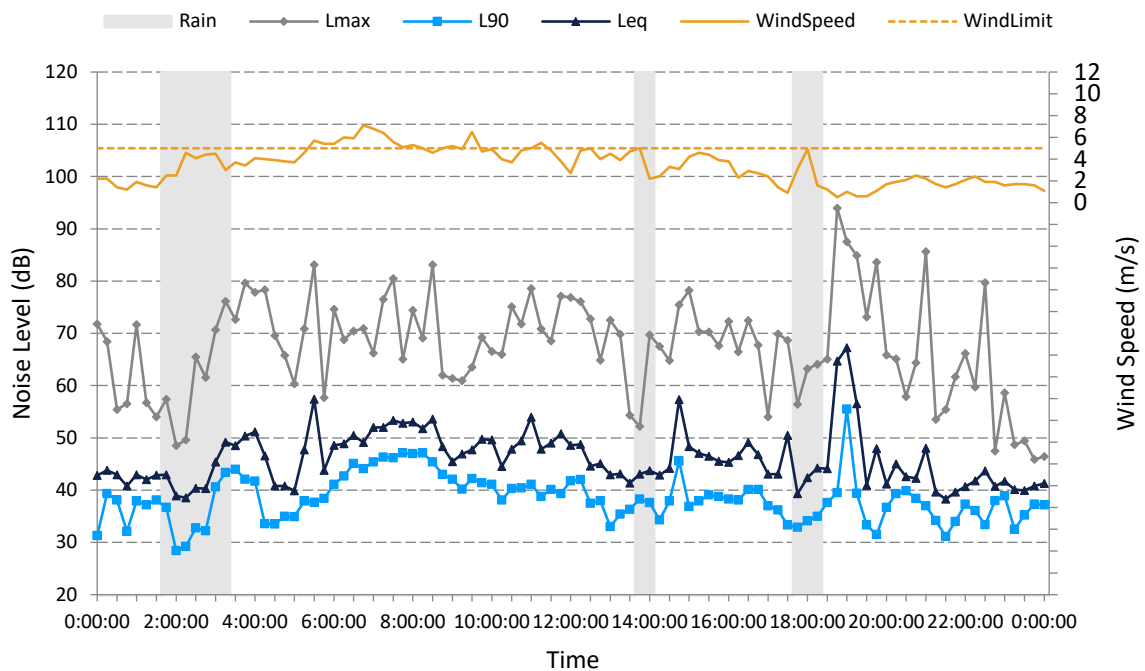
0 indicates periods with too few valid samples due to weather or logger operation

Leq24hr encompasses the period 7am to 7am

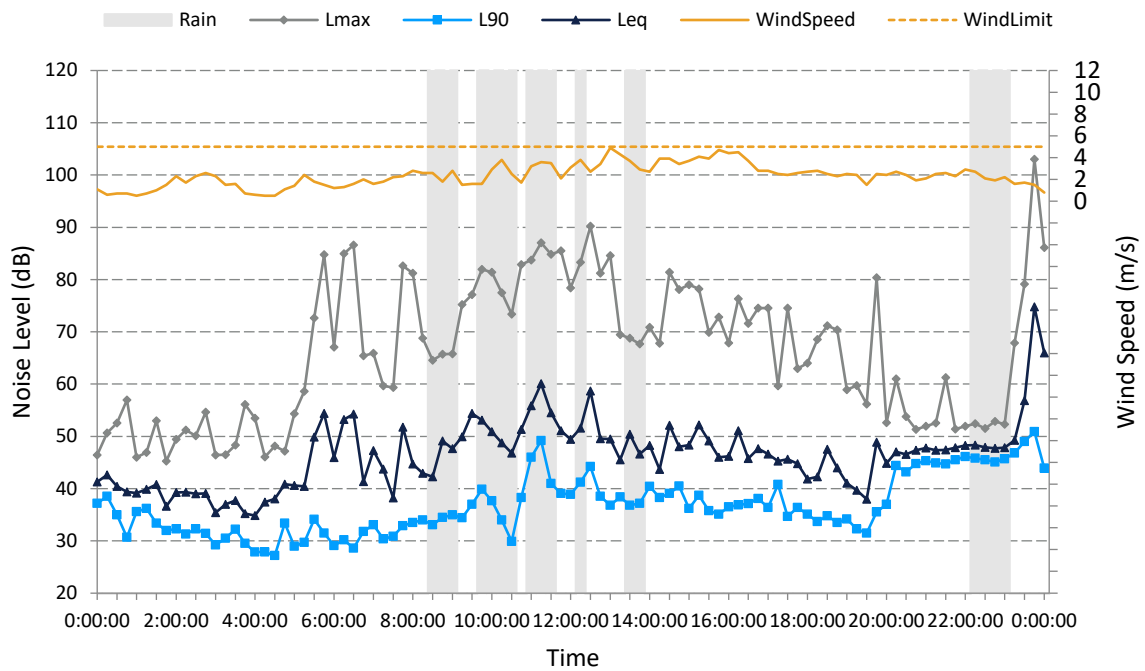
Measured ambient noise levels
171 Kerma Crescent, Clarence
Wednesday, 12-12-18



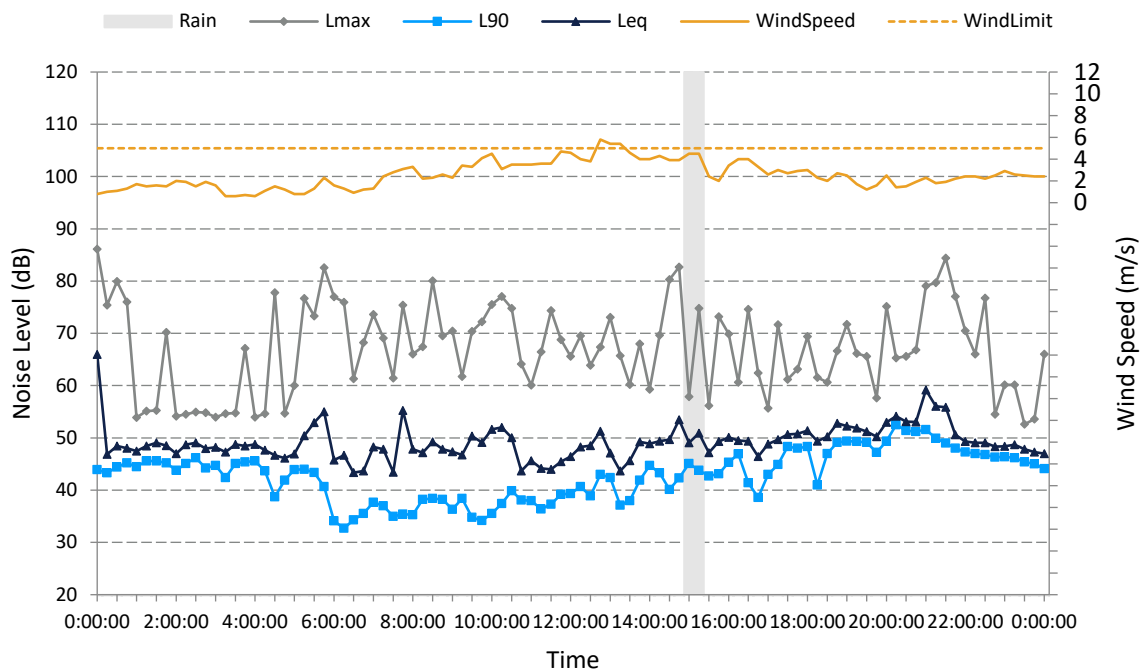
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171 Kerma Crescent, Clarence
Thursday, 13-12-18



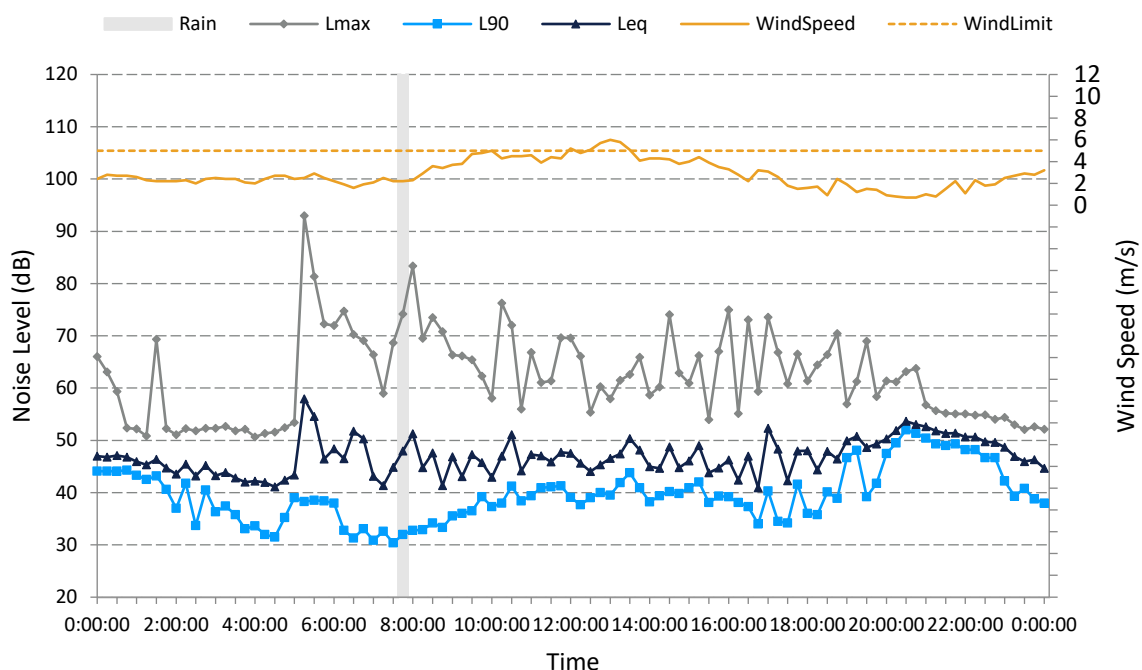
**Measured ambient noise levels
171 Kerma Crescent, Clarence
Friday, 14-12-18**



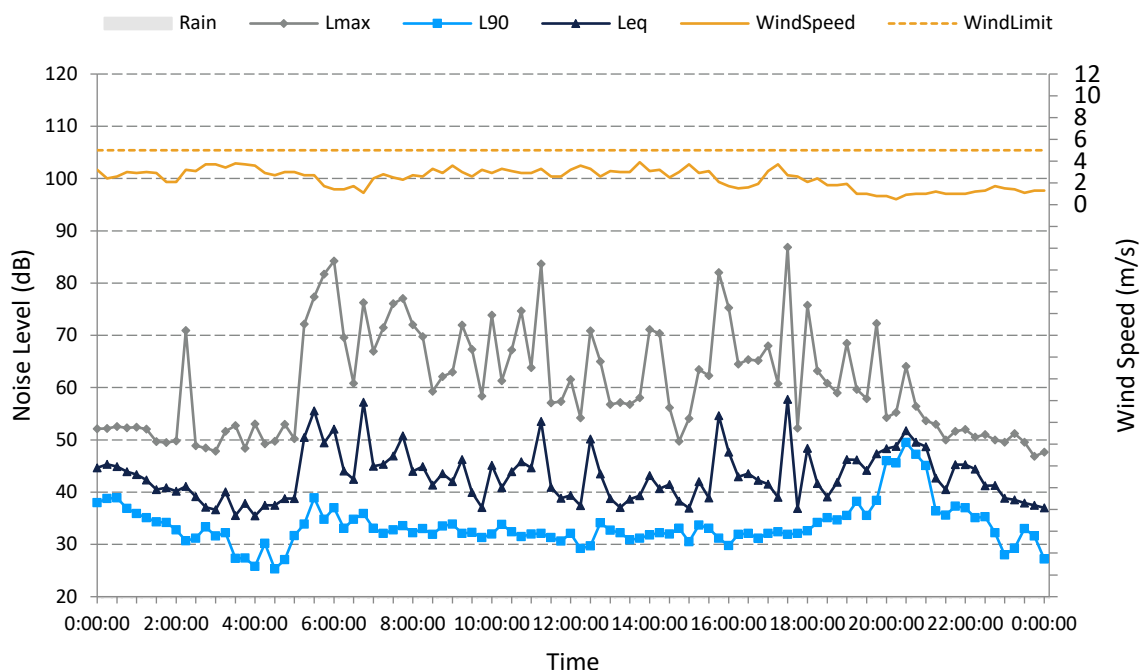
**Measured ambient noise levels
171 Kerma Crescent, Clarence
Saturday, 15-12-18**



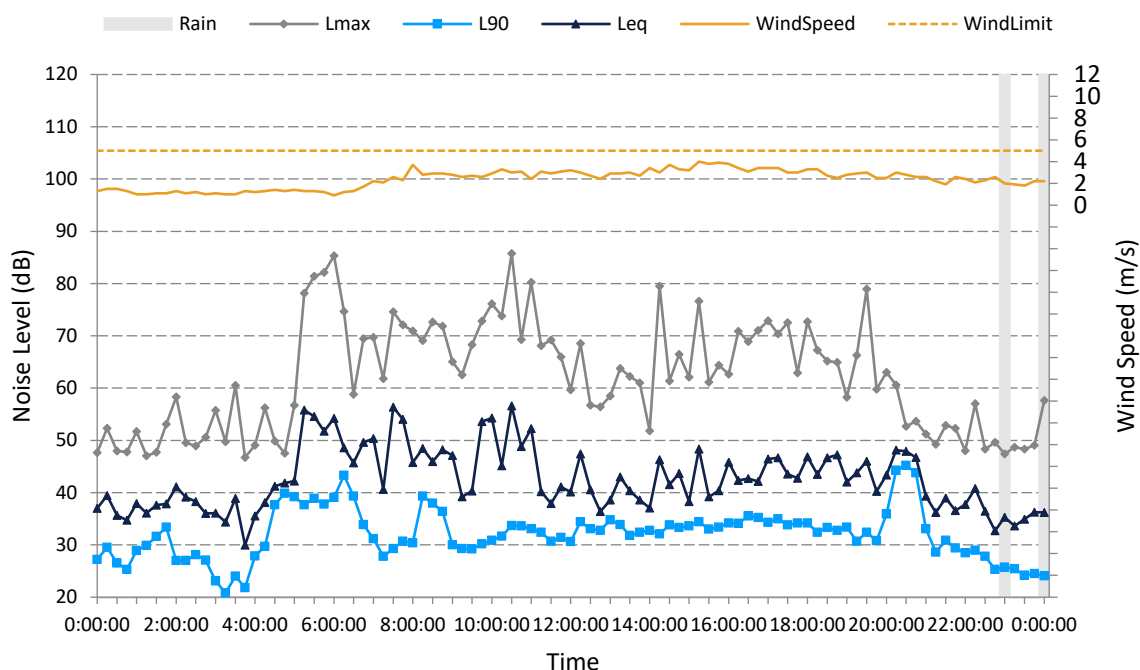
Measured ambient noise levels
171 Kerma Crescent, Clarence
Sunday, 16-12-18



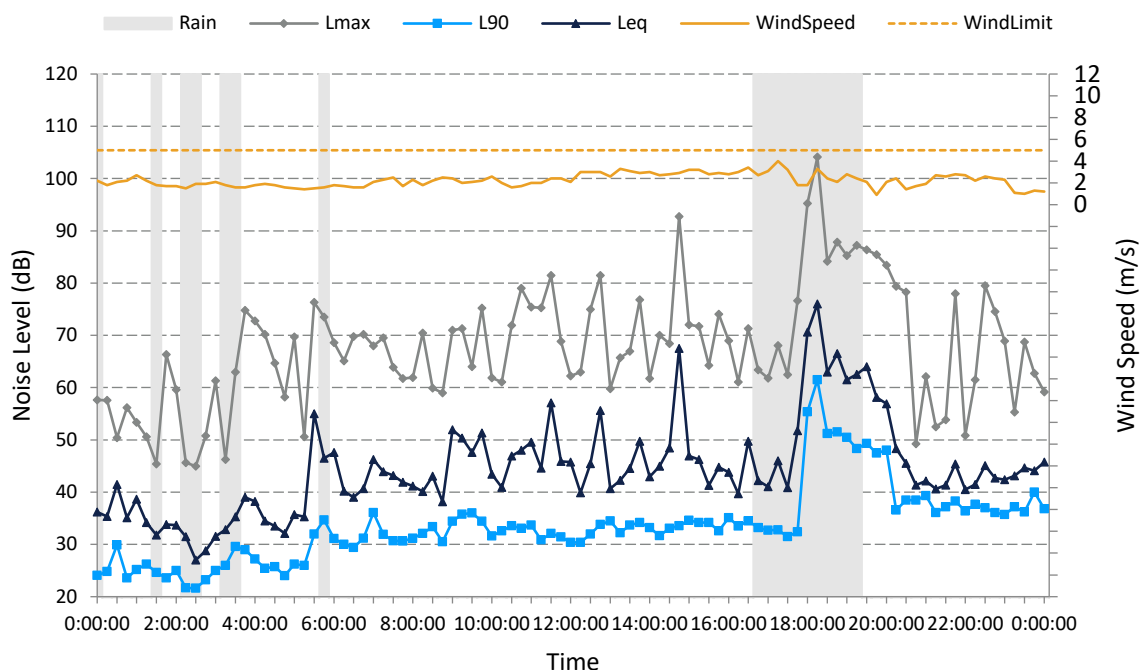
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171 Kerma Crescent, Clarence
Monday, 17-12-18



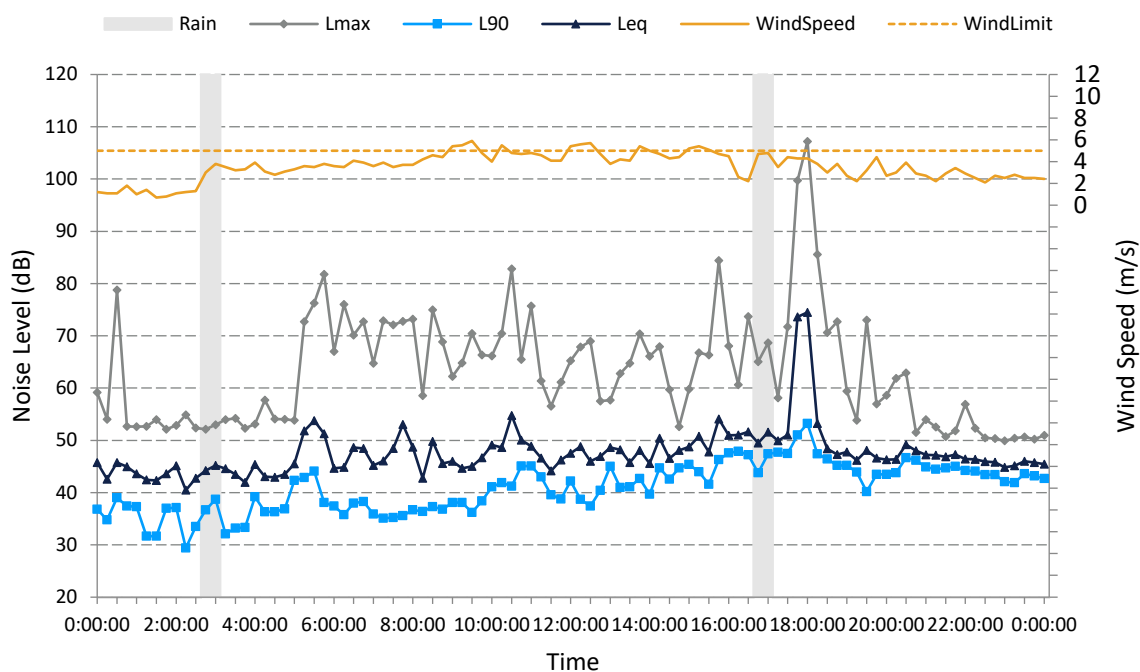
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171 Kerma Crescent, Clarence
Tuesday, 18-12-18



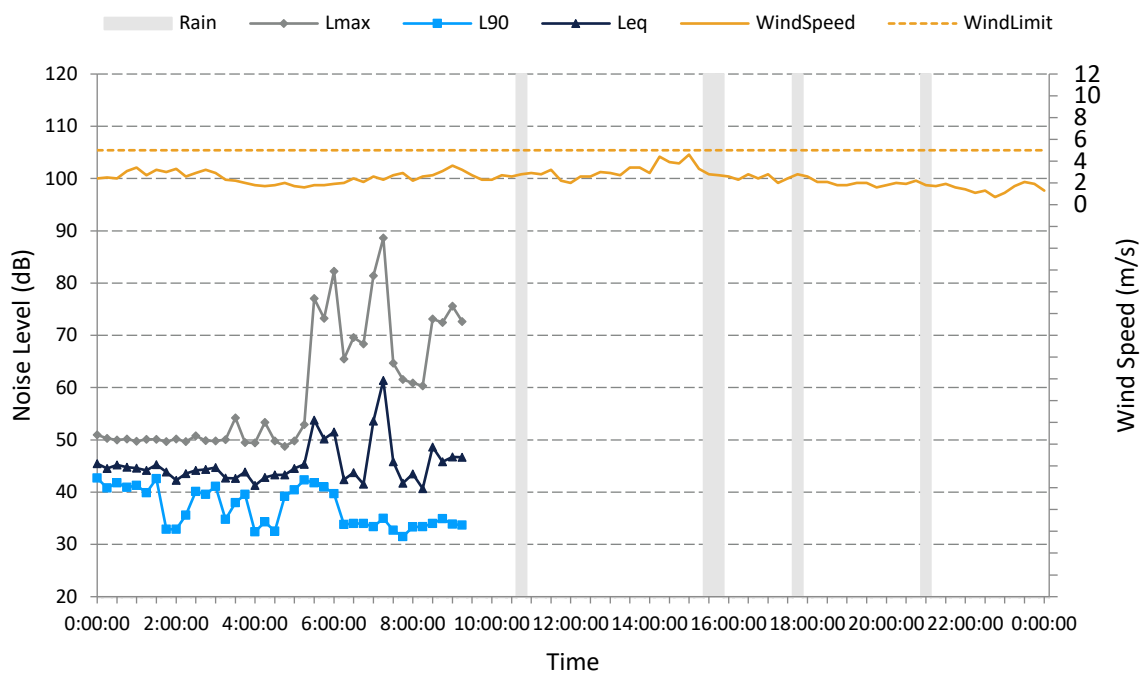
Measured ambient noise levels
171 Kerma Crescent, Clarence
Wednesday, 19-12-18



Measured ambient noise levels
171 Kerma Crescent, Clarence
Thursday, 20-12-18



Measured ambient noise levels
171 Kerma Crescent, Clarence
Friday, 21-12-18



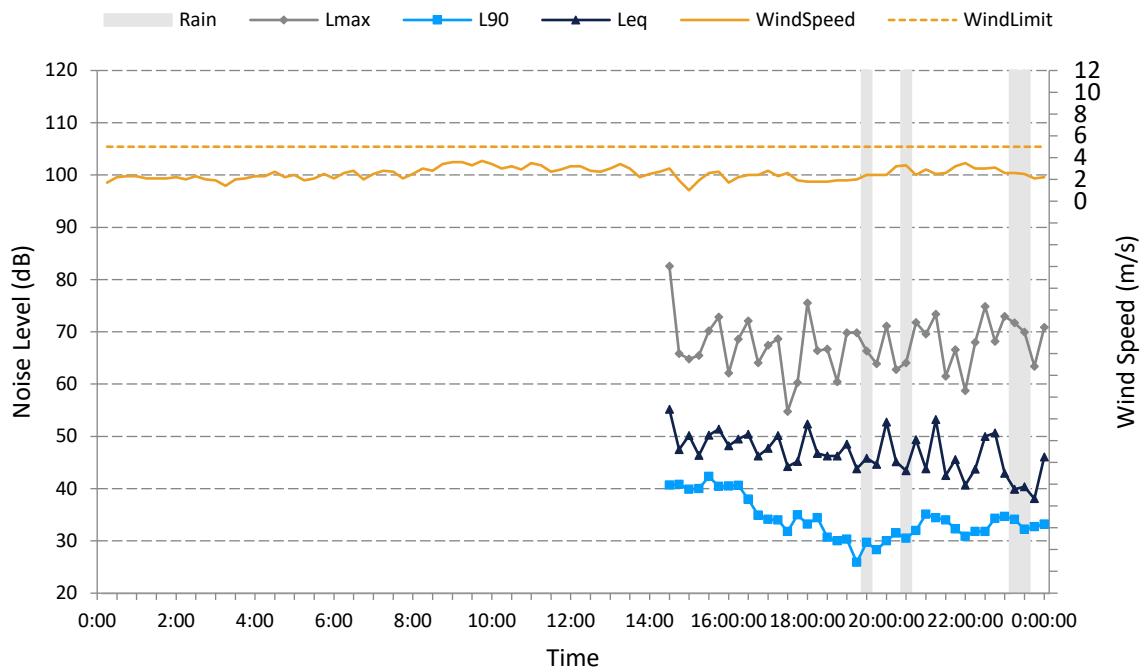
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Wednesday, 12-12-18	0	28	0	0	48	0	0	0	0
Thursday, 13-12-18	0	26	28	0	59	46	0	55	46
Friday, 14-12-18	0	27	24	0	49	63	0	0	63
Saturday, 15-12-18	33	26	26	49	45	45	48	47	45
Sunday, 16-12-18	33	23	21	47	49	50	48	49	49
Monday, 17-12-18	33	28	22	51	48	48	50	50	48
Tuesday, 18-12-18	34	32	0	50	48	0	49	49	0
Wednesday, 19-12-18	31	0	28	48	0	49	0	51	49
Thursday, 20-12-18	0	36	32	0	48	48	0	60	47
Friday, 21-12-18	36	32	30	52	49	48	51	50	48
Saturday, 22-12-18	37	31	26	49	48	41	49	47	41
Sunday, 23-12-18	33	31	21	49	47	45	49	48	44
Monday, 24-12-18	30	23	22	47	44	45	46	46	45
Tuesday, 25-12-18	30	24	23	44	44	42	44	43	41
Wednesday, 26-12-18	34	28	26	47	48	44	47	46	43
Thursday, 27-12-18	34	26	27	47	49	46	48	47	46
Friday, 28-12-18	34	22	24	49	47	47	49	48	47
Saturday, 29-12-18	0	23	21	0	43	42	0	45	42
Sunday, 30-12-18	35	22	21	47	45	41	47	45	40
Monday, 31-12-18	36	0	22	46	0	39	46	44	38
Tuesday, 01-01-19	34	26	23	45	46	46	46	46	45
Wednesday, 02-01-19	35	25	20	60	47	46	58	57	46
Thursday, 03-01-19	35	27	21	53	48	43	52	50	42
Friday, 04-01-19	35	32	0	48	51	0	49	0	0
Summary Values	34	27	23	51	50	51	50	51	51

Notes:

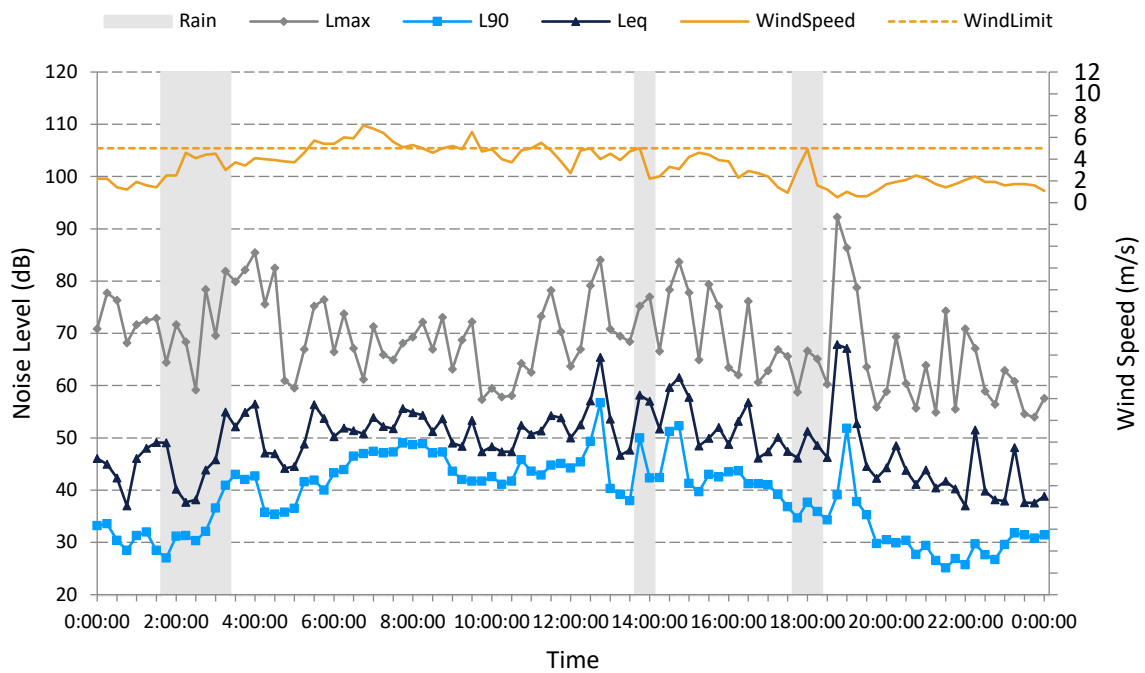
0 indicates periods with too few valid samples due to weather or logger operation

Leq24hr encompasses the period 7am to 7am

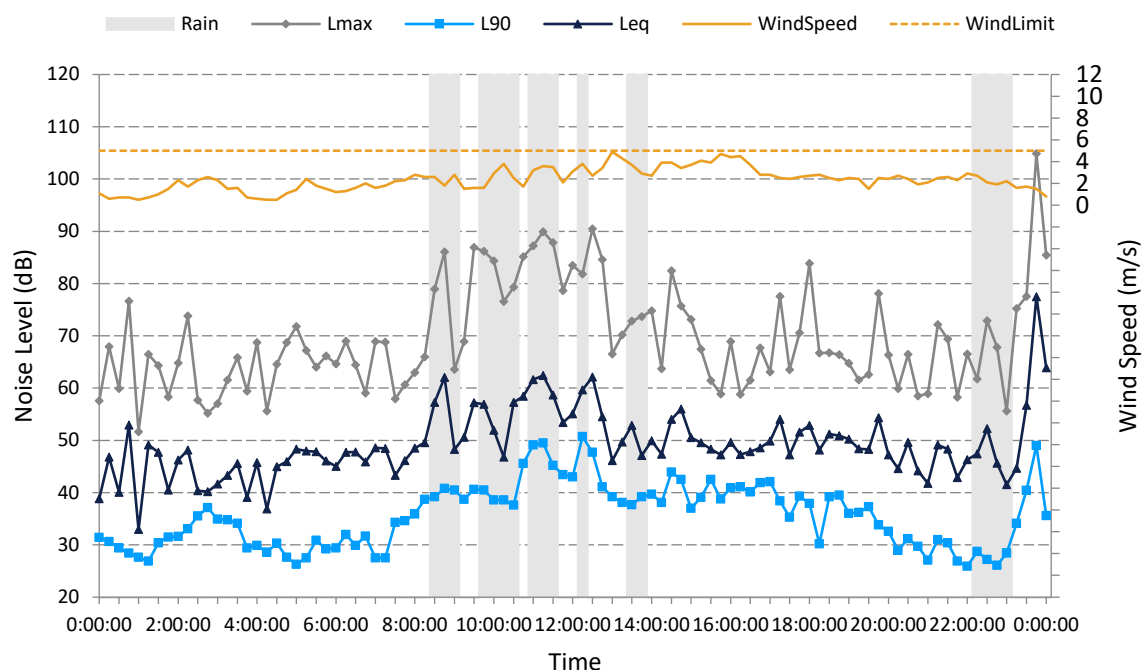
Measured ambient noise levels
590 Chiefly Road, Dargan
Wednesday, 12-12-18



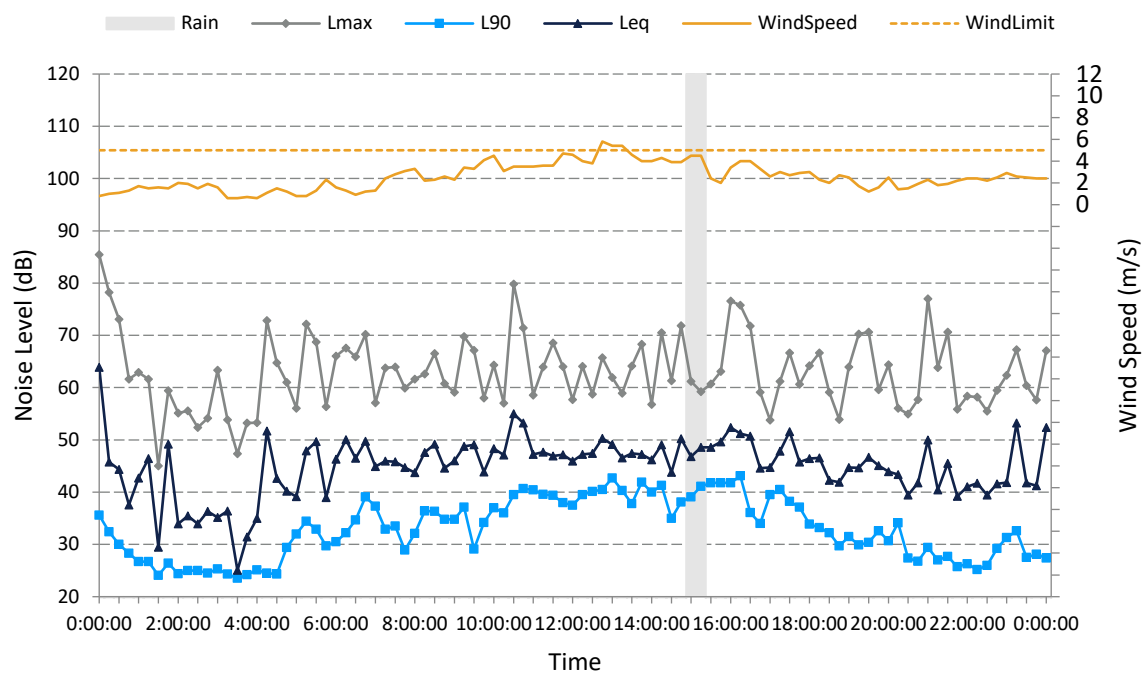
Measured ambient noise levels
590 Chiefly Road, Dargan
Thursday, 13-12-18



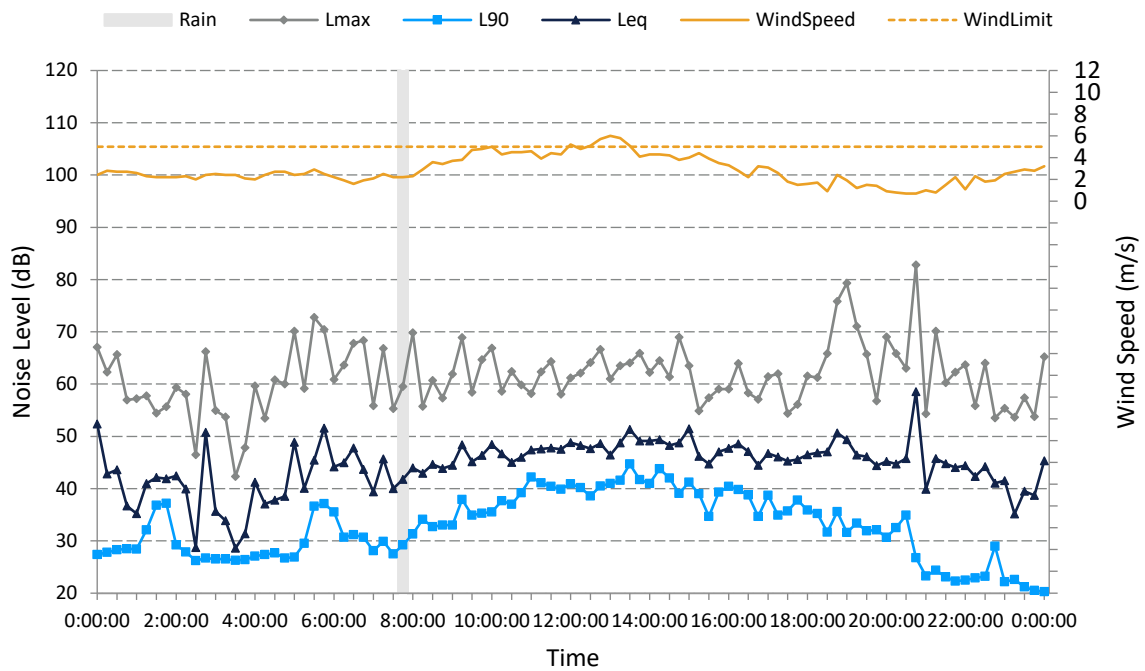
Measured ambient noise levels
590 Chiefly Road, Dargan
Friday, 14-12-18



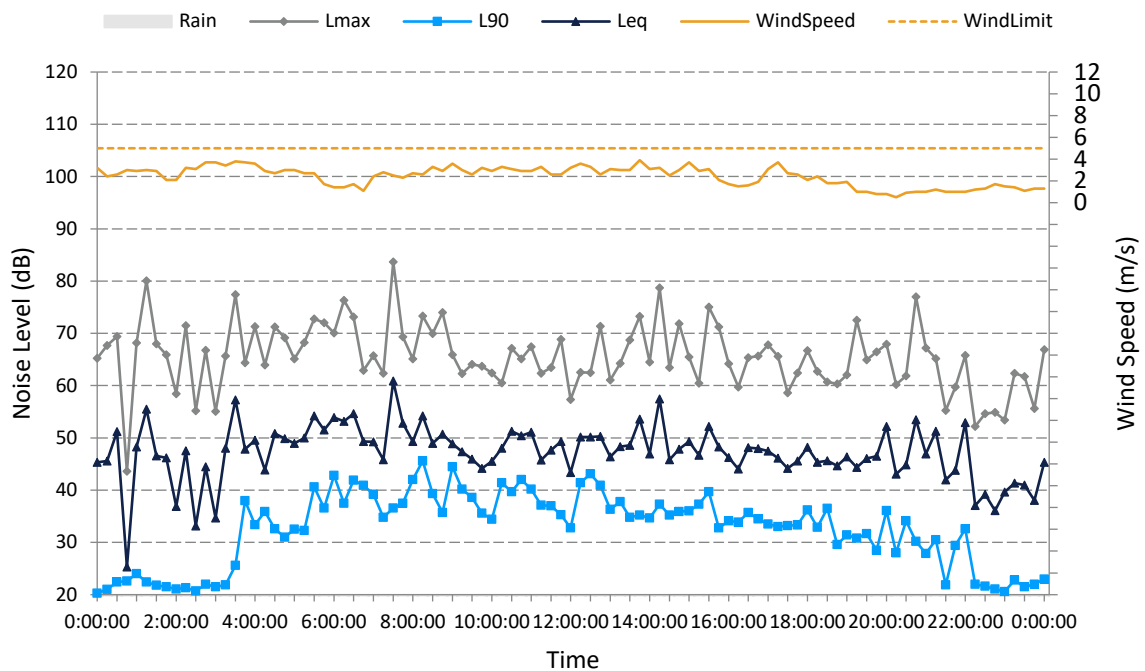
Measured ambient noise levels
590 Chiefly Road, Dargan
Saturday, 15-12-18



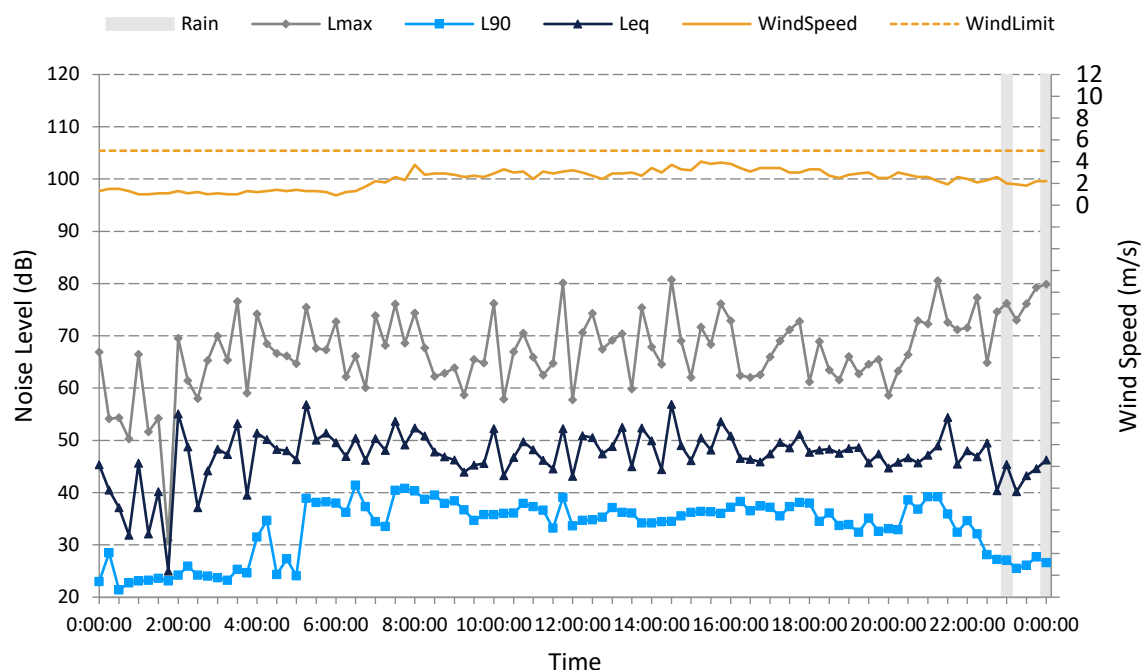
**Measured ambient noise levels
590 Chiefly Road, Dargan
Sunday, 16-12-18**



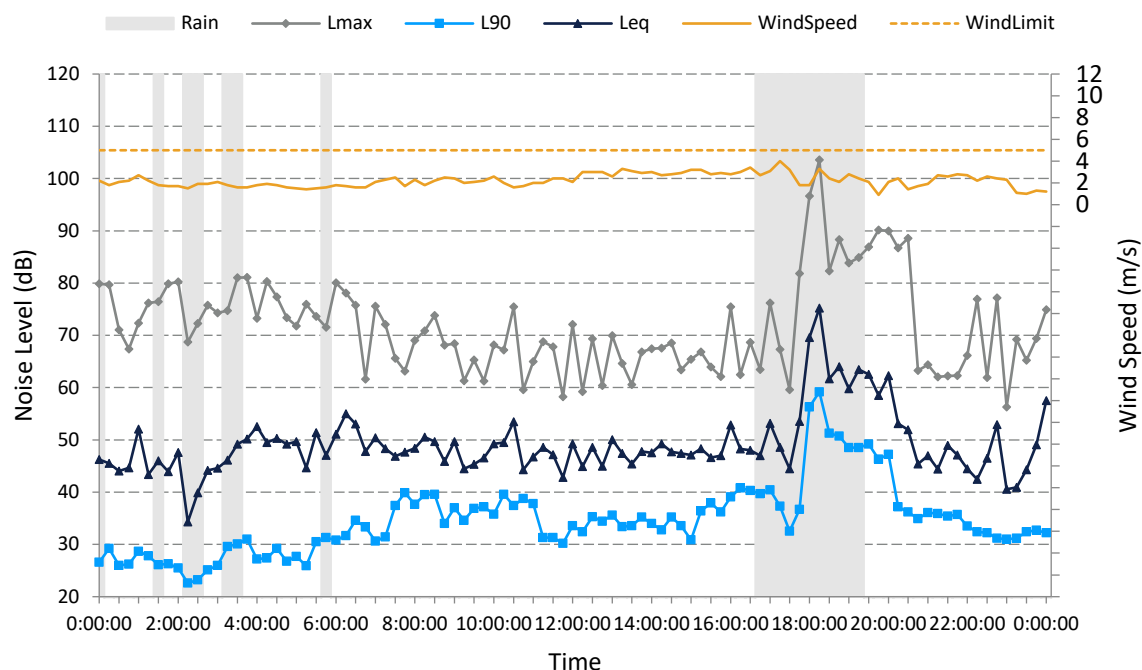
**Measured ambient noise levels
590 Chiefly Road, Dargan
Monday, 17-12-18**



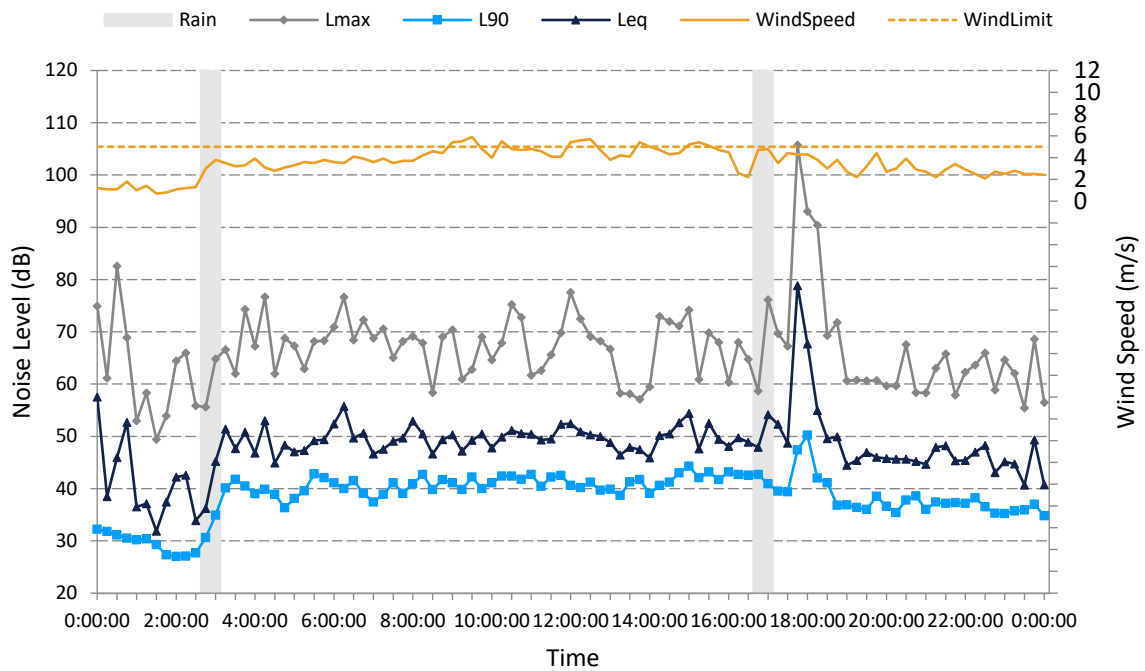
Measured ambient noise levels
590 Chiefly Road, Dargan
Tuesday, 18-12-18



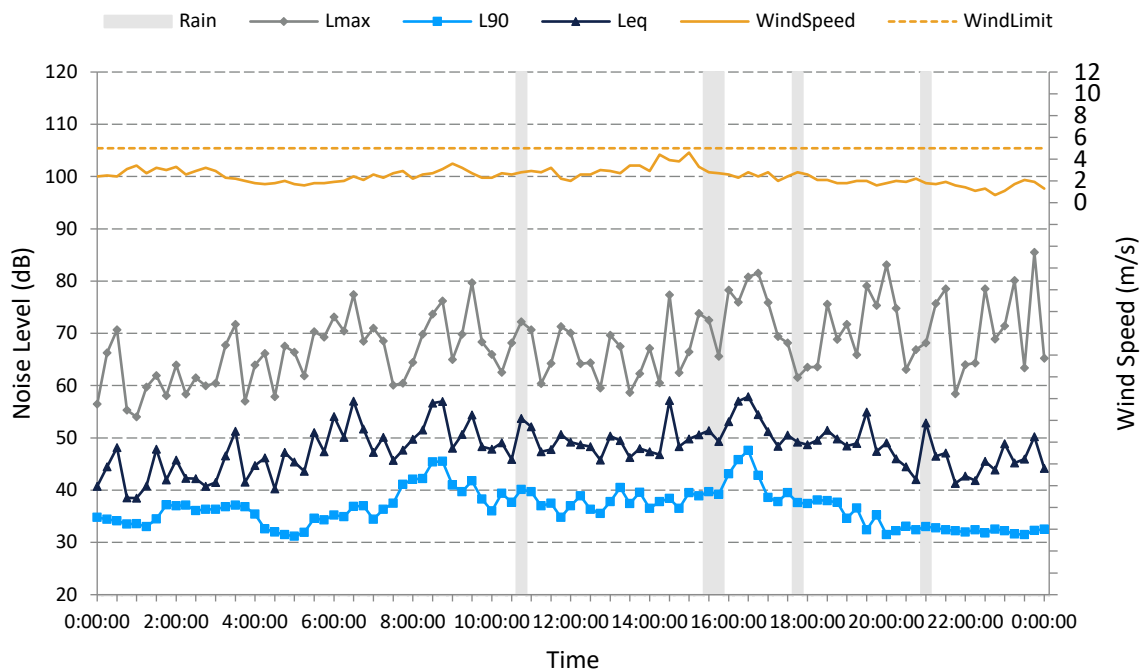
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590 Chiefly Road, Dargan
Wednesday, 19-12-18



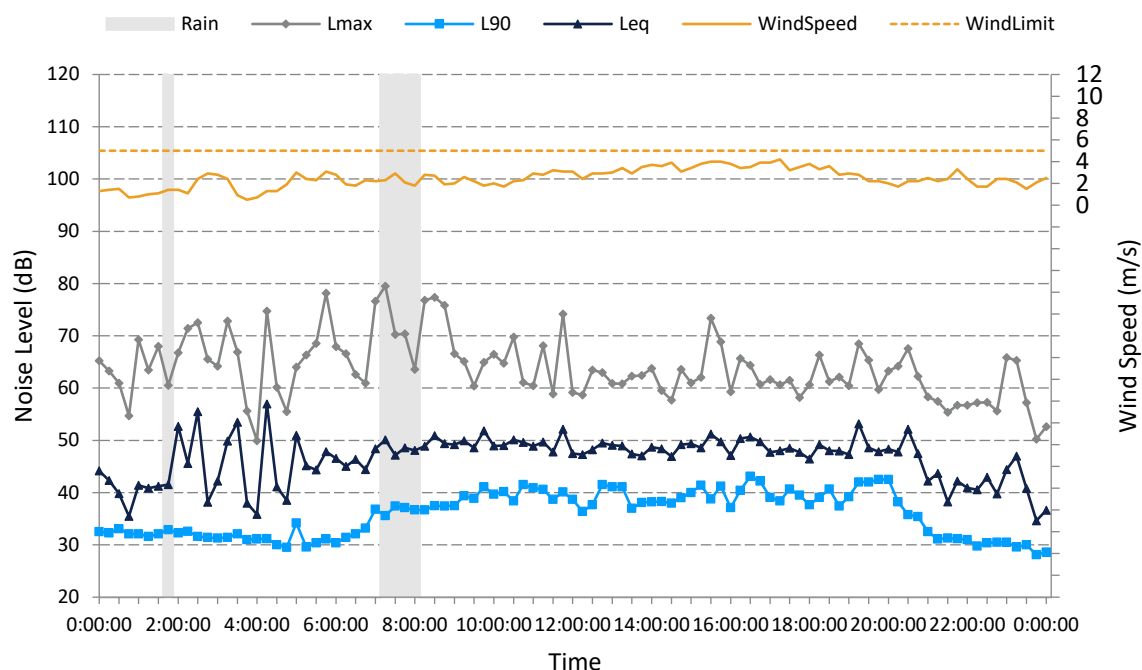
Measured ambient noise levels
590 Chiefly Road, Dargan
Thursday, 20-12-18



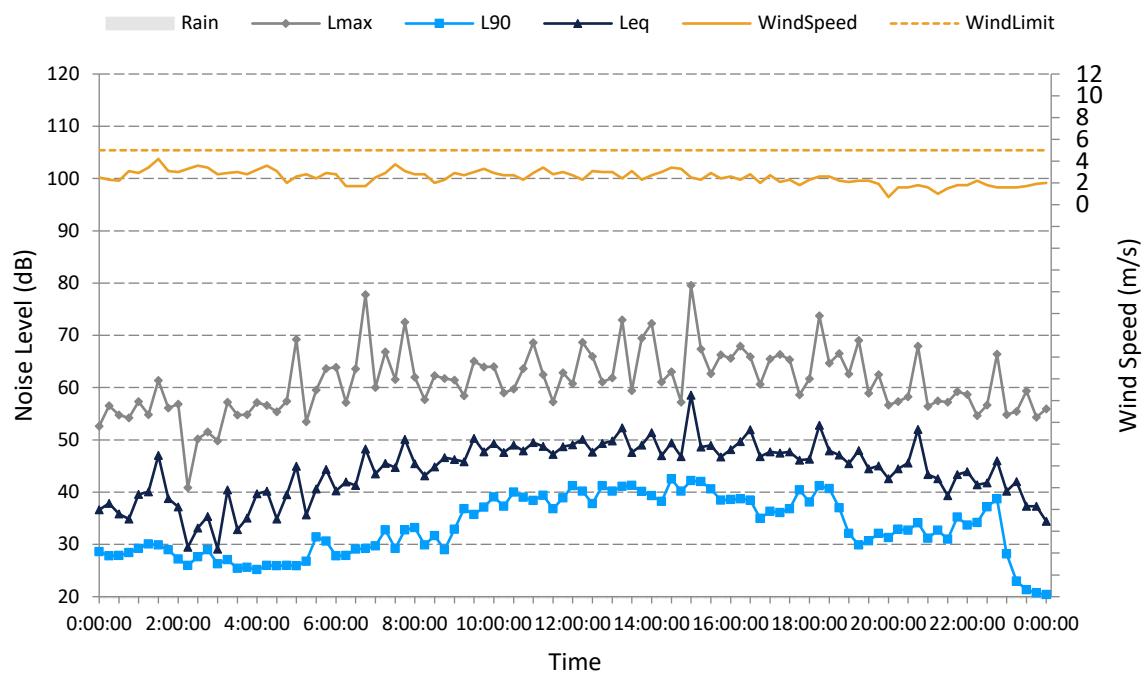
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Friday, 21-12-18



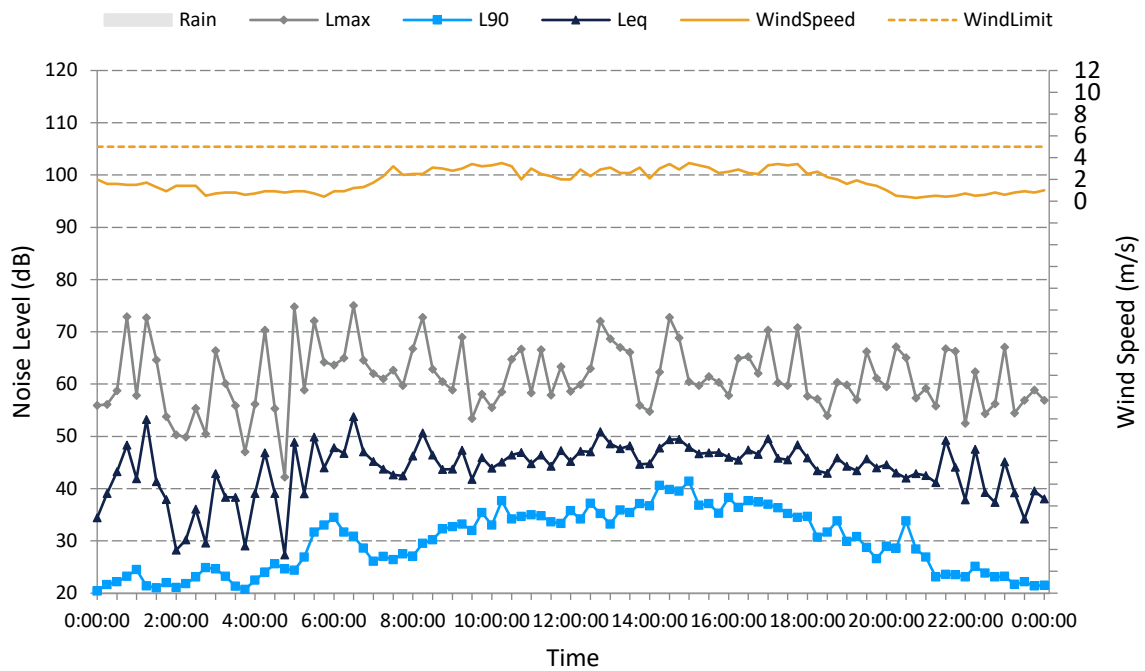
Measured ambient noise levels
590 Chiefly Road, Dargan
Saturday, 22-12-18



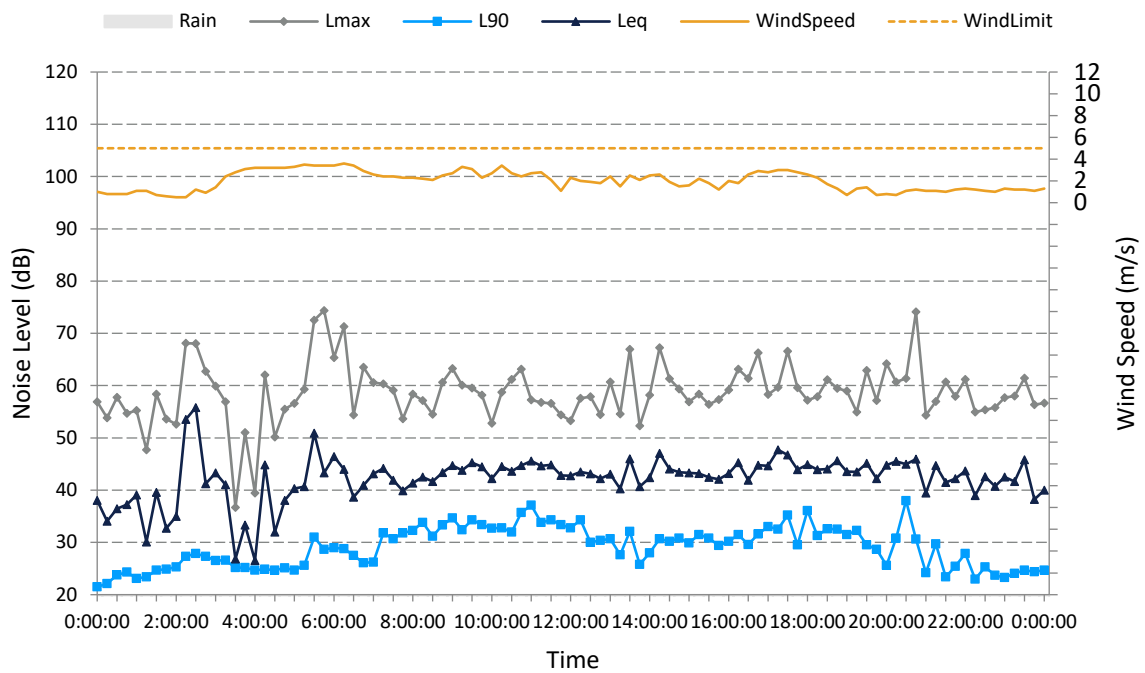
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590 Chiefly Road, Dargan
Sunday, 23-12-18



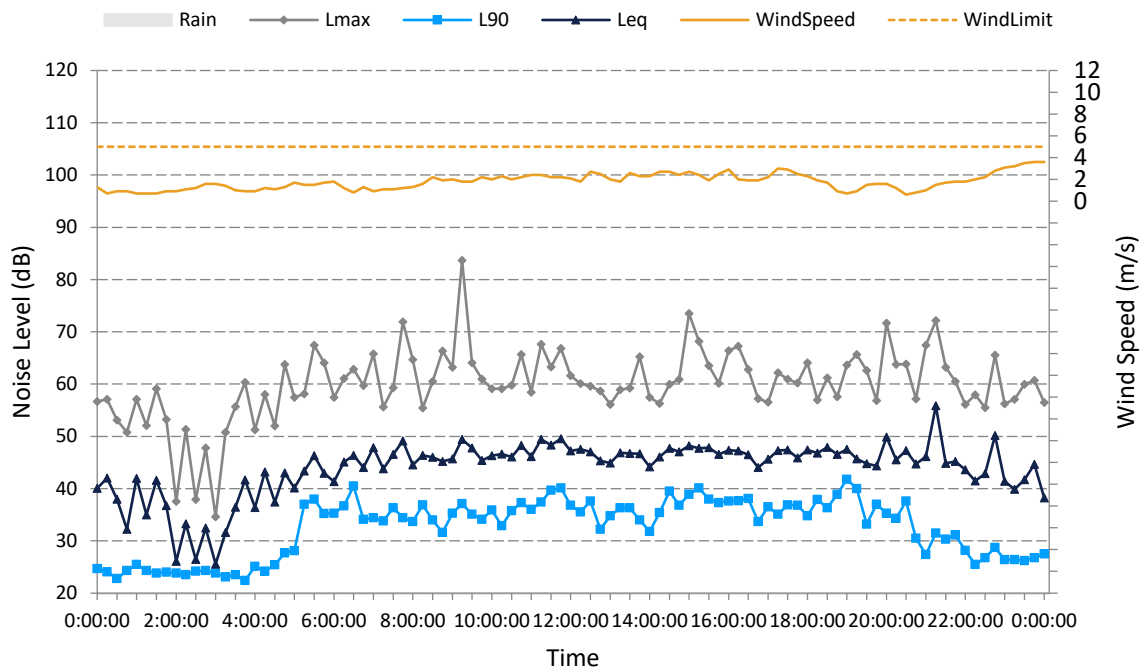
Measured ambient noise levels
590 Chiefly Road, Dargan
Monday, 24-12-18



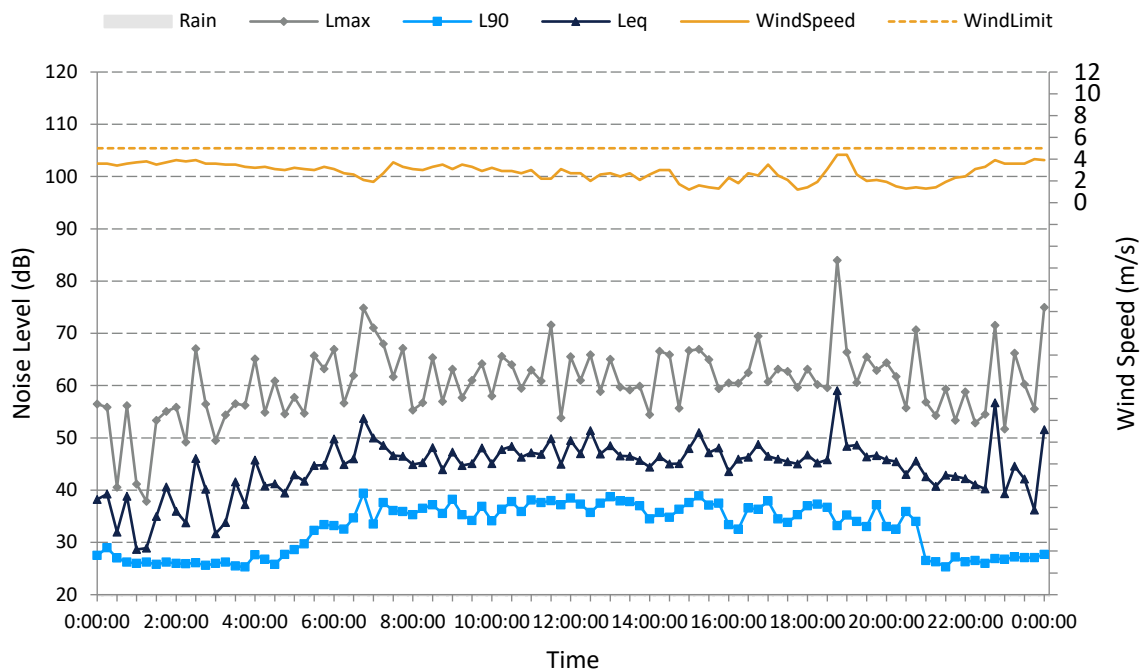
Measured ambient noise levels
590 Chiefly Road, Dargan
Tuesday, 25-12-18



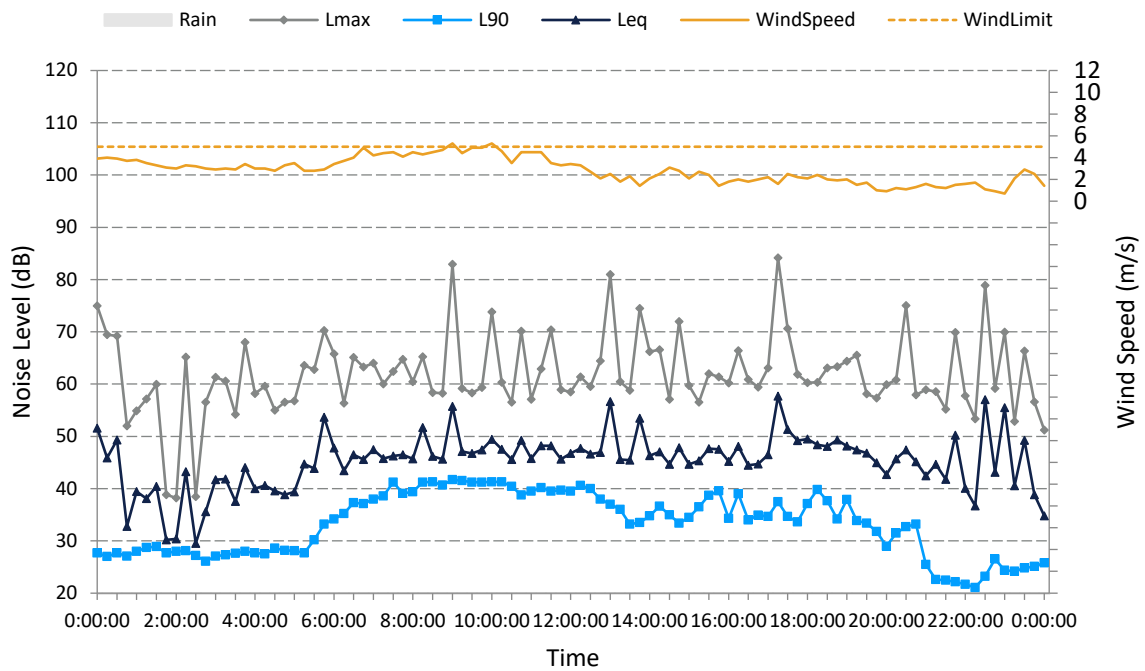
**Measured ambient noise levels
590 Chiefly Road, Dargan
Wednesday, 26-12-18**



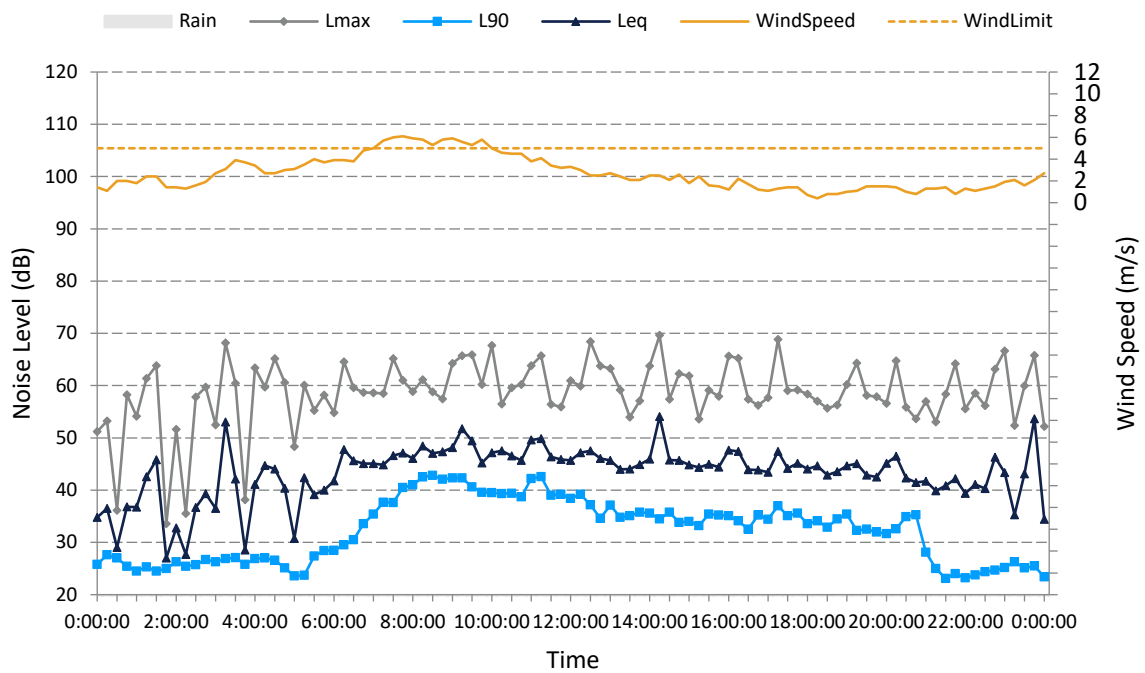
**Measured ambient noise levels
590 Chiefly Road, Dargan
Thursday, 27-12-18**



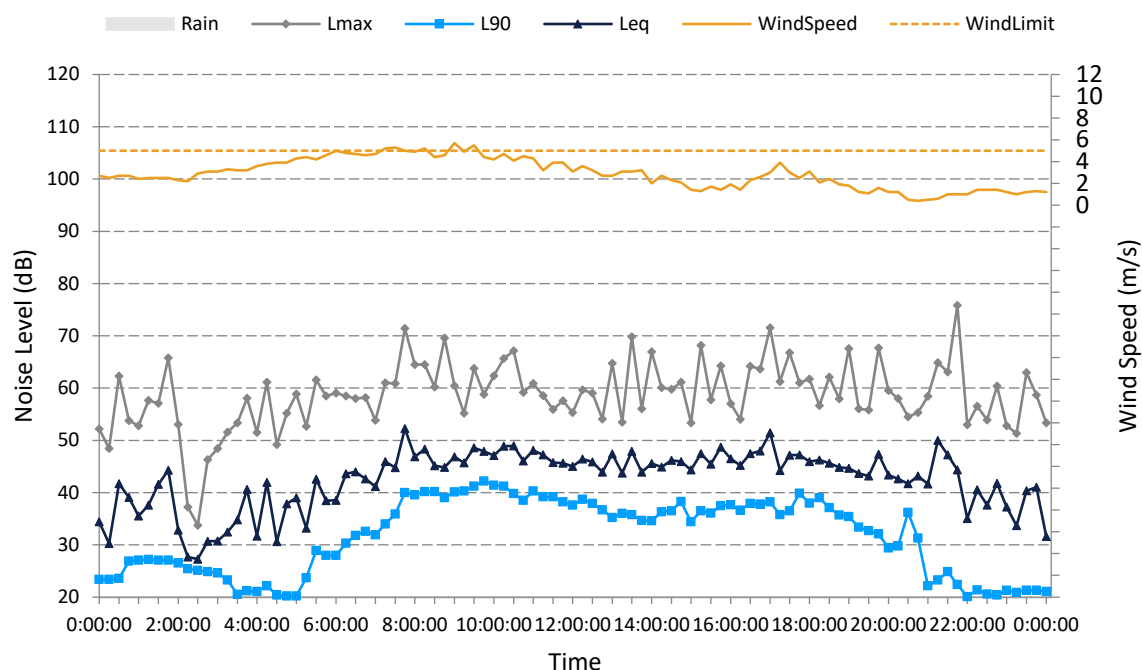
Measured ambient noise levels
590 Chiefly Road, Dargan
Friday, 28-12-18



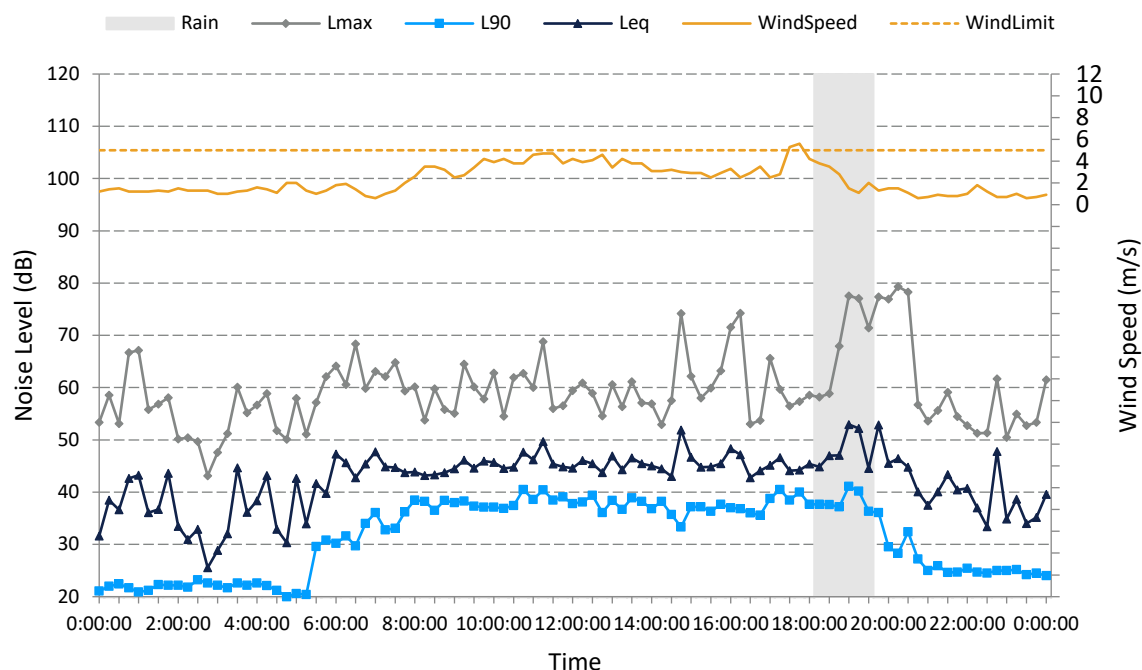
Measured ambient noise levels
590 Chiefly Road, Dargan
Saturday, 29-12-18



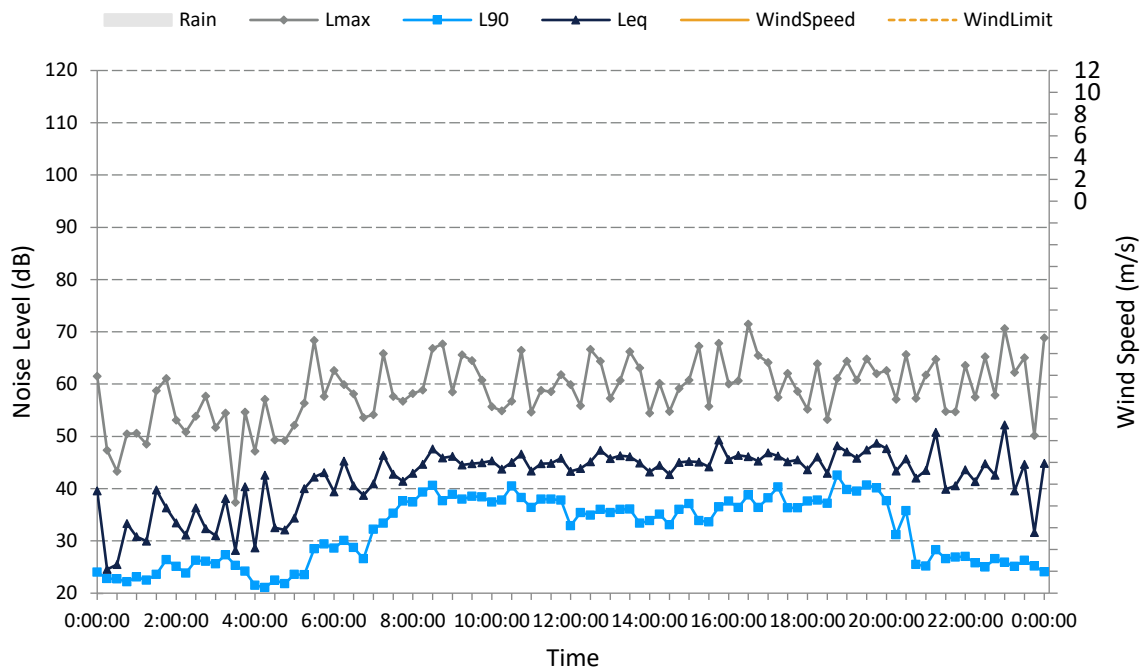
Measured ambient noise levels 590 Chiefly Road, Dargan Sunday, 30-12-18



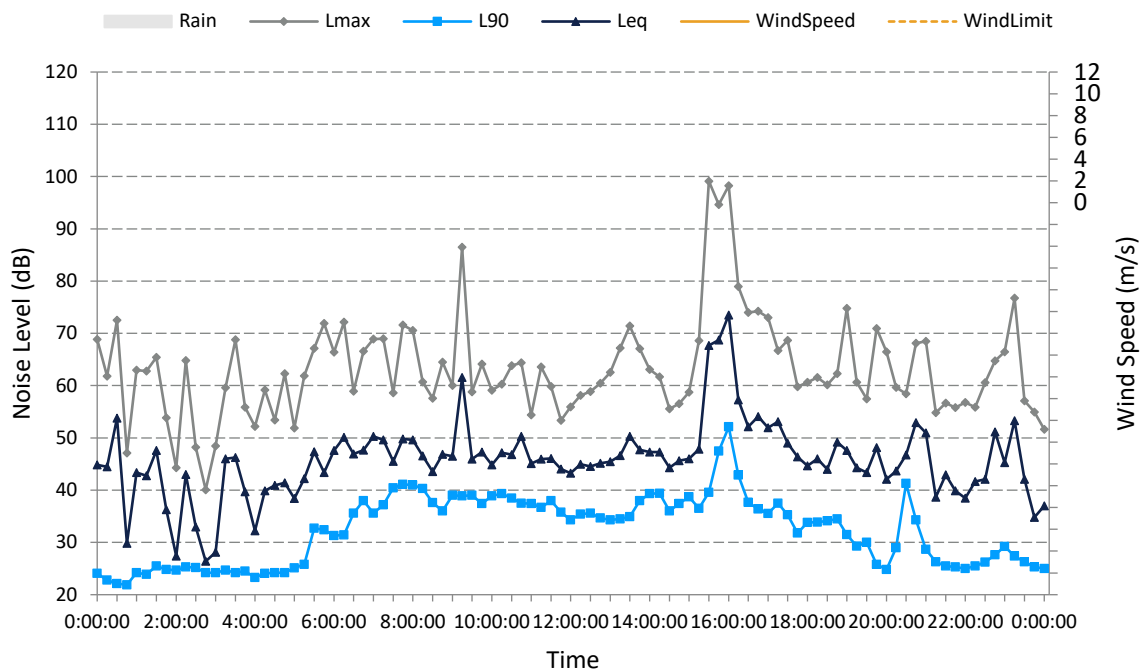
Measured ambient noise levels 590 Chiefly Road, Dargan Monday, 31-12-18



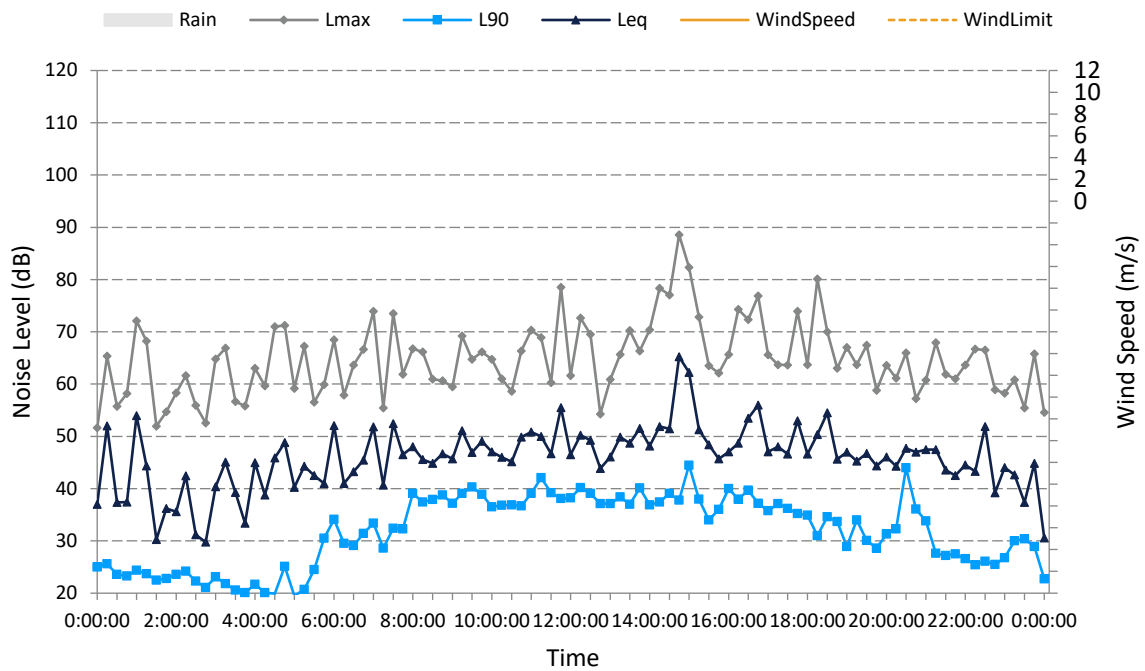
Measured ambient noise levels
590 Chiefly Road, Dargan
Tuesday, 01-01-19



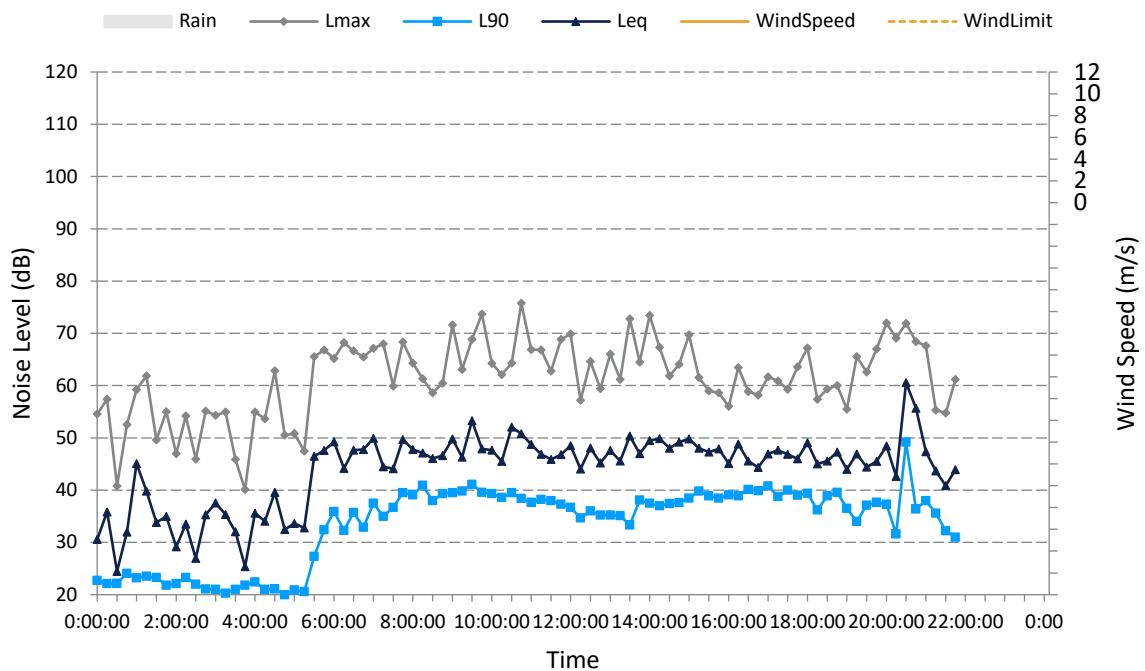
Measured ambient noise levels
590 Chiefly Road, Dargan
Wednesday, 02-01-19



Measured ambient noise levels
590 Chiefly Road, Dargan
Thursday, 03-01-19

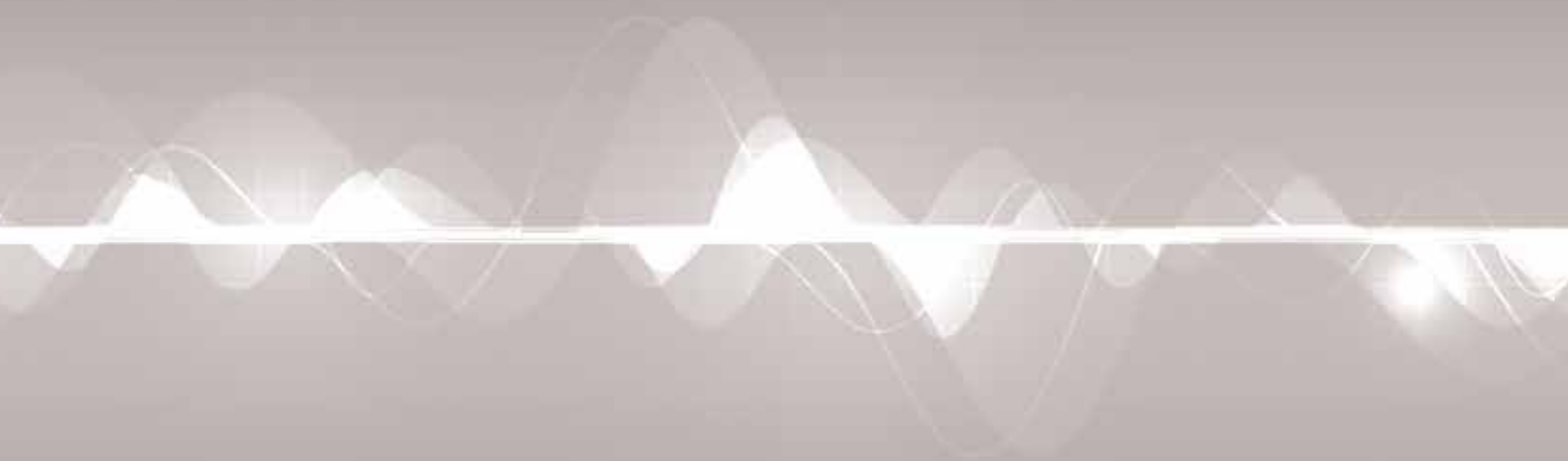


Measured ambient noise levels
590 Chiefly Road, Dargan
Friday, 04-01-19



Appendix B

Modelled noise source locations

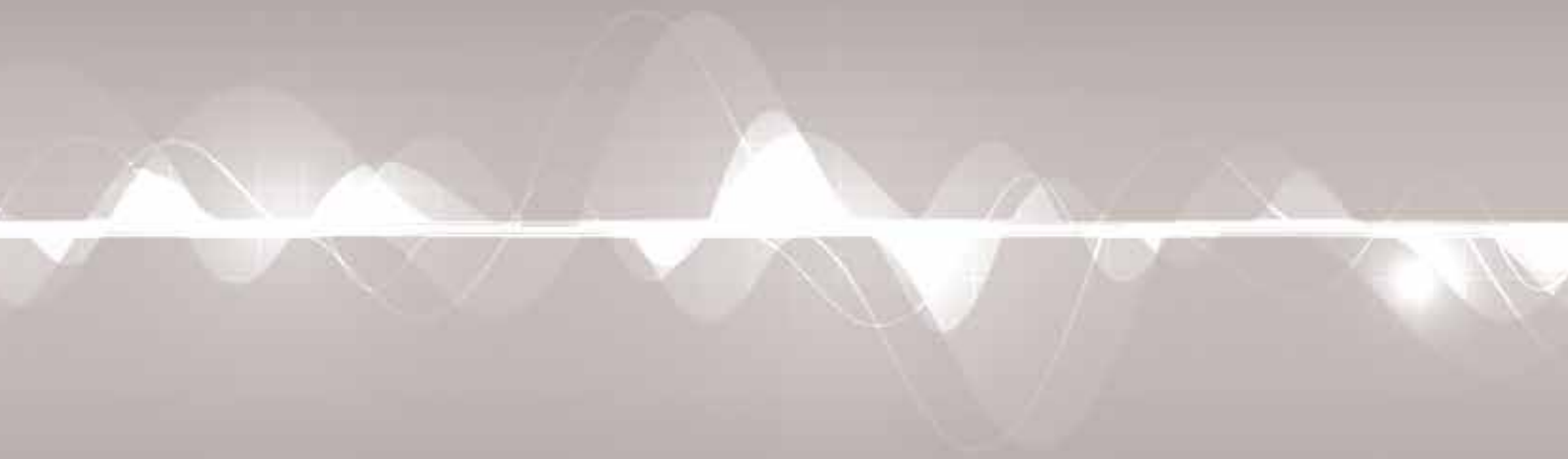


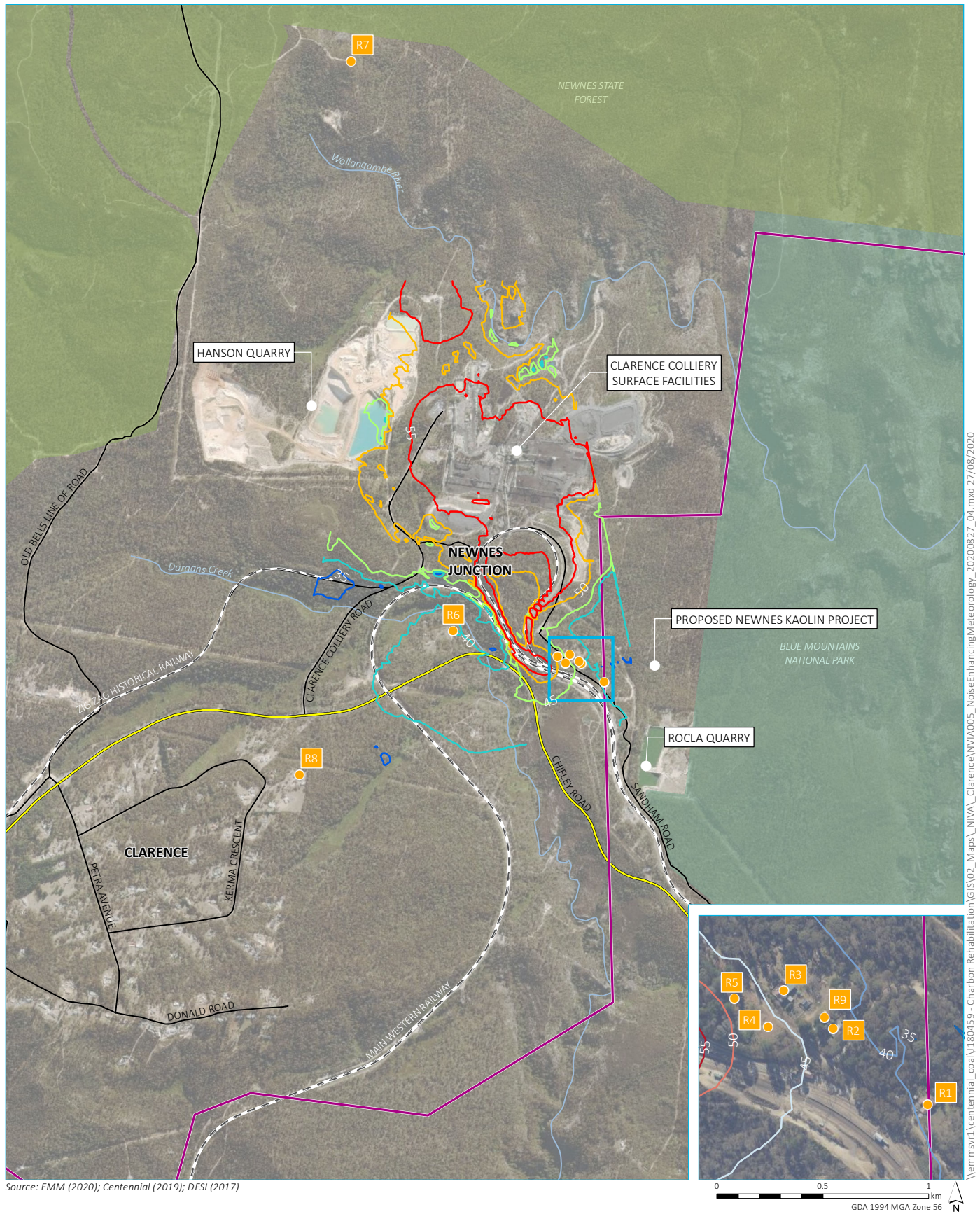




Appendix C

Proposed modification - operational noise contours





KEY

 Clarence Colliery holding boundary	Predicted LAeq (15min) noise level
● Assessment location	— 35 dB
— — Rail line	— 40 dB
— Main road	— 45 dB
— Local road	— 50 dB
— Watercourse	— 55 dB
 NPWS reserve	
 State forest	

Operational noise contours - noise enhancing meteorology - including train and rail loading

Clarence Colliery – Modification 6
Noise and vibration impact assessment
Figure C.1



