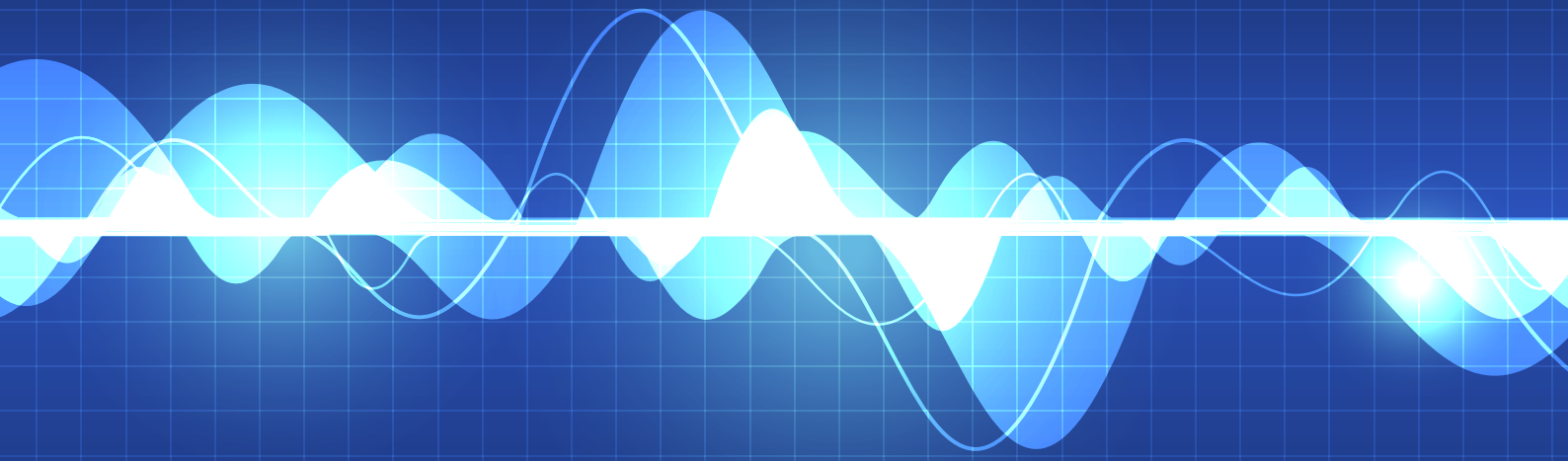
Kings Hill Release Area

Road traffic noise assessment

Prepared for APP Pty Ltd and King & Campbell Pty Ltd
December 2019



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Adelaide SA 5000
T 08 8232 2253

PERTH
PO Box 8155
Fremantle WA 6160

CANBERRA
PO Box 9148
Deakin ACT 2600

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EMM Newcastle
Level 3, 175 Scott Street
Newcastle NSW 2300

T 02 4907 4800
E info@emmconsulting.com.au

www.emmconsulting.com.au

Kings Hill Release Area

Road Traffic Noise Assessment

Report Number

H190502 RP#1

Client

APP Pty Ltd and King & Campbell Pty Ltd

Date

9 December 2019

Version

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Prepared by

Lucas Adamson
Acoustic Consultant
9 December 2019

Approved by

Katie Teyhan
Associate
9 December 2019

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1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by APP Corporation Pty Limited (APP) and King & Campbell Pty Ltd (King & Campbell) to conduct a noise impact assessment relevant to the proposed Kings Hill Development (KHD) and Gwynvill land holdings located at Raymond Terrace (the 'project').

This noise impact assessment addresses three key aspects pertaining to the project including:

- quantify, via noise modelling, the existing road traffic noise levels within the project land;
- compare the predicted noise levels against relevant guidelines; and
- provide noise control or management recommendations to reduce noise impacts, where appropriate.

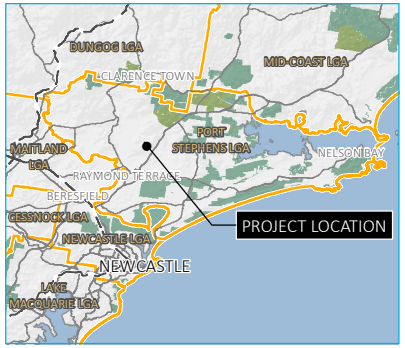
The acoustic assessment has been guided by the following relevant guidelines, policies, and standards:

- NSW Environment Protection Authority (EPA) 2011 *Road Noise Policy (RNP)*;
- NSW Department of Planning 2007 *State Environmental Planning Policy (SEPP) (Infrastructure)*;
- Australian Standard AS 1055-2018 *Acoustics – Description and measurement of environmental noise*;
- Australian Standard AS/NZS 2107-2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors*;
- NSW Department of Planning 2008 *Development Near Rail Corridors and Busy Roads - Interim Guidelines*;
- NSW Environmental Protection Authority (EPA) 2017, *Noise Policy for Industry* (NPfI); and
- Port Stephens Council Development Control Plan (2013).

2 Project description

The site is located in the mid-north coast region of NSW in Kings Hill, approximately 5 km north of Raymond Terrace on the Pacific Highway. It comprises Lot 41/DP 1037411 (KHD), Lot 4821/DP 852073 (KHD), Lot 481/DP 804971 (GWY) and Lot 4822/DP 852073 (GWY) and varies from relatively flat area in the east to undulating areas in the west.

The site is bound by Six Mile Road to the north, the Pacific Highway to the east, currently undeveloped rural allotments to the south and Newline Road to the west. The subdivision will be exposed to road traffic noise from the Pacific Highway, located immediately east of the site. The proposed lot layout has been provided and is shown in Figure 2.1.



KEY

- Noise Monitoring Locations
- Project layout
- Main road
- Local road
- Watercourse/drainage line
- NPWS reserve (see inset)
- State forest (see inset)
- Local government area (see inset)

Source: EMM (2019); DFSI (2017); APP (2019)

\\emmsvr1\EMM\Jobs\2019\H190502 - Kings Hill Road Traffic Noise Assessment\8 GIS\02 Maps\N001 MonitoringLocations 20191022 01.mxd 24/10/2019

Noise monitoring locations

Kings Hill release area
Road traffic noise assessment
Figure 2.1

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3 Existing environment

3.1 Unattended noise monitoring

EMM completed 14 days of unattended noise monitoring to establish existing road traffic noise levels on the Pacific Highway. The noise loggers were placed adjacent to the Pacific Highway, with two noise loggers located approximately 1.4 km south of the intersection of the Pacific Highway and Six Mile Road and two noise loggers located approximately 3 km south of the intersection of the Pacific Highway and Six Mile Road. The logger microphones were positioned approximately 50 m and 100 m from the Pacific Highway, respectively. The road traffic noise monitoring locations are indicated on Figure 2.1. The monitoring locations were chosen after inspection of the site and giving due consideration to ease and safety of site access, other noise sources which may influence the ambient noise environment and the safety of the logging devices.

The unattended noise monitoring was carried out using Rion NL-42EX noise loggers (S/N 00873125, 00345934, 00885459 and 01173759). The noise loggers were in place from 6 to 19 September 2019 and were programmed to record statistical noise level indices continuously in 15-minute intervals. Calibration of the noise loggers was checked prior to and immediately following completion of the noise monitoring. Drift in calibration did not exceed ±0.5 dB. The equipment carried appropriate and current NATA calibration certificates.

Weather data for the unattended noise monitoring period was obtained from the Bureau of Meteorology (BoM) Williamtown RAAF Automatic Weather Station (ID 061087) located approximately 10 km south east of the site. 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 methodology provided in the Noise Policy for Industry (NPfI) (EPA 2017).

A summary of the unattended noise monitoring results is provided in Table 3.1 . Detailed noise monitoring results are provided in Appendix A.

Table 3.1 Unattended road traffic noise monitoring results

Location	Road section	Assessment period[1]	Measured noise level, dB
L1 – Pacific Highway South (50 m from Pacific Highway)	Between Six Mile Road and Rangers Road	Day	63 $L_{Aeq,15\ hour}$
		Night	60 $L_{Aeq,9\ hour}$
L2 – Pacific Highway South (100 m from Pacific Highway)	Between Six Mile Road and Rangers Road	Day	See Note 2
		Night	See Note 2
L3 – Pacific Highway North (50 m from Pacific Highway)	Between Six Mile Road and Rangers Road	Day	66 $L_{Aeq,15\ hour}$
		Night	63 $L_{Aeq,9\ hour}$
L4 – Pacific Highway North (100 m from Pacific Highway)	Between Six Mile Road and Rangers Road	Day	63 $L_{Aeq,15\ hour}$
		Night	60 $L_{Aeq,9\ hour}$

Notes: 1. As per the RNP the day period is from 7:00 am to 10:00 pm and the night period is from 10:00 pm to 7:00 am.
2. The noise logger at location L2 failed to collect any valid data due to a battery failure.

3.2 Attended noise monitoring

Operator-attended noise monitoring was conducted during deployment of the loggers on 6 September 2019. The attended noise measurement was conducted using a Brüel and Kjær Type 2250 one-third octave hand-held analyser (S/N 2759405). Field calibration of the instrument was completed using a Brüel and Kjær type 4230 calibrator (S/N 1276091). Attended measurements were undertaken in accordance with AS 1055-1997 *Description and Measurement of Environmental Noise, Parts 1, 2 and 3*. Meteorological conditions throughout the survey period were calm and clear with no winds above 5 m/s or rain.

The results of the operator-attended noise measurements are summarised in Table 3.2.

Table 3.2 Summary of 15-minute attended noise measurements

Location	Coordinates, MGA 56H	Start time	Measured noise level dB			Comments
			L_{A90}	L_{Aeq}	L_{Amax}	
L1 – Pacific Highway South (50 m from Pacific Highway)	386207 E, 6378515 S	11:27	58	63	75	Consistent traffic on Pacific Highway. Frequent bird noise and insects. Occasional aircraft noise.
L2 – Pacific Highway South (100 m from Pacific Highway)	386182 E, 6378539 S	11:44	57	63	73	Consistent traffic on Pacific Highway. Frequent bird noise and insects. Occasional tractor noise.
L3 – Pacific Highway North (50 m from Pacific Highway)	387062 E, 6379981 S	12:22	61	65	77	Consistent traffic on Pacific Highway Consistent insects. Frequent bird noise
L4 – Pacific Highway North (100 m from Pacific Highway)	387030 E, 6380006 S	13:19	57	60	67	Consistent traffic on Pacific Highway Consistent insects. Frequent bird noise

Results of the operator-attended noise survey indicate that road traffic noise is the main contributor to ambient noise levels with some contribution from natural sounds and aircraft noise.

4 Road Traffic noise assessment criteria

4.1 NSW Road Noise Policy

The table note of Table 3 in the NSW Government Department of Environment, Climate Change and Water's (DECCW) NSW Road Noise Policy (RNP) (DECCW 2011) states:

> Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see Appendix C10).

Appendix C10 of the RNP states:

> While application of the Infrastructure SEPP requirements is mandatory only for residential developments near specific highly trafficked roads as listed in the guidelines, the design advice offered in the SEPP may be useful when designing such a development near other high traffic roads.

4.2 SEPP (Infrastructure) 2007

The SEPP (Infrastructure) 2007 relates to roads having an annual average daily traffic volume of 40,000 vehicles, although it can also be applied to roads with 20,000 to 40,000 vehicles daily. Clause 102 of the SEPP (Infrastructure) 2007 addresses the impact of road noise or vibration on non-road development and states:

> **Sub-clause 3:** "If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:
>
> (a) in any bedroom in the building-35 dB(A) at any time between 10 pm and 7 am,
>
> (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)-40 dB(A) at any time."

Although not mandatory for this development (as mentioned in Section 4.1), the criteria provided in the SEPP (Infrastructure) 2007 are consistent with other relevant guidelines (i.e. AS 2107) and have been applied for the purpose of this assessment.

4.3 Development near Rail Corridors and Busy Roads – Interim Guideline

NSW Government Department of Planning *Development near Rail Corridors and Busy Roads – Interim Guideline* (2008) (the Guideline) adopts the same internal noise target prescribed by the SEPP (Infrastructure) 2007 and provides additional guidance on things like ventilation requirements. Section 3.6 of the Guideline states that:

> If internal noise levels with windows or doors open exceed the criteria by more than 10 dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.

4.4 Australian Standards

Australian Standard AS 3671-1989 *Acoustics - Road traffic noise intrusion - Building siting and construction* is concerned with the reduction of road traffic noise intrusion in buildings in areas near major roads. This standard provides guidelines for determining the type of building construction necessary to achieve acceptable internal noise levels. Table 1 summarises the recommended building construction categories outlined in AS 3671-1989.

Table 4.1 Definition of construction categories (AS 3671-1989)

Category Type	Definition	Approximate traffic noise reduction
Category 1	Standard construction; openings, including open windows and doors may comprise of up to 10% of the exposed facade.	≤ 10 dB
Category 2	Standard construction, except for light-weight elements such as fibrous cement, metal cladding or all-glass facades. Windows, doors and other openings must be closed.	10 dB – 25 dB
Category 3	Special construction. Windows, doors and other openings must be closed.	25 dB – 35 dB
Category 4	Specialist acoustic advice must be sought.	>35 dB

5 Noise assessment

5.1 Road traffic noise modelling

Quantitative modelling of road traffic noise was completed using the Calculation of Road Traffic Noise (CoRTN) algorithms within the Brüel & Kjær Predictor noise prediction software. The model incorporates factors such as:

- the lateral and vertical location of noise sources;
- source-to- receptor distances;
- ground effects;
- atmospheric absorption;
- topography; and
- meteorological conditions.

The noise model was calibrated using the measured noise data assuming that the total ambient noise level at each noise logger was from traffic. This provides a conservative approach to the road traffic noise assessment since other sources (natural sounds, aircraft noise and residential activity) also contributed to ambient noise levels.

After the model was validated hypothetical residential dwelling envelopes were included at each proposed lot as per the plans provided by APP and King & Campbell (refer Figure 2.1). The model was then used to predict and assess road traffic noise levels across the subject site, and noise contours were created to enable determination of areas of potential road traffic noise affectation. Road traffic noise was predicted at a height of 1.5 m above ground level representative of single storey dwellings.

5.2 Road traffic volumes

The traffic volumes for the Pacific Highway were obtained from 7-day tube traffic counts taken immediately south of the Six Mile Road intersection, while the road traffic volumes for the proposed interchange were taken from *Kings Hill Interchange & Drainage Channel - Traffic & Construction Noise Assessment* prepared by Wilkinson Murray dated 13 October 2017. The road traffic volumes used in the noise modelling are shown in Table 5.1.

Table 5.1 Existing road traffic volumes

Roadway	Direction	Lane	Day (7am to 10pm)			Night (10pm to 7am)			% Heavy vehicles	
			Light	Heavy	Total	Light	Heavy	Total	Day	Night
Pacific Highway	Northbound	Kerb	5069	1678	6747	620	450	1070	25	42
		Middle	1653	503	2156	86	33	119	23	28
	Southbound	Kerb	4952	1873	6825	610	565	1175	27	48
		Middle	1698	203	1901	96	17	113	11	15
	All	All	13372	4258	17630	1412	1066	2478	24	43
Interchange on-ramp	Northbound	-	116	6	122	22	1	23	5	4
	Southbound	-	1715	90	1805	327	17	344	5	5
Interchange off-ramp	Northbound	-	1691	89	1780	323	17	340	5	5
	Southbound	-	108	6	114	21	1	22	5	5

5.3 Noise modelling results

Results of preliminary noise modelling indicated that road traffic noise levels at the nearest residences in both Gwynvill land holdings and the northern and central KHD land holdings were above the relevant internal noise goals. External road traffic noise predictions before the application of mitigation are presented for the daytime and night-time periods in Figures B.1 and B.2.

A barrier spanning the eastern boundary of these sites was considered in order to reduce road traffic noise levels in these areas. The barrier is recommended to extend from the north eastern corner of the northern KHD land holding, spanning the eastern boundary to the south eastern corner of the southern Gwynvill land holding. It is noted that the acoustic performance of the barrier would be most effective if the barrier was located on the eastern boundary of the site, as close to the road reserve as possible.

The barrier is assumed to be continuous and contain no gaps, constructed from an appropriate material, such as packed earth, concrete, lapped and capped timber or a combination of these, and be a minimum height of 2.4 m. Consideration should also be given to the durability of the barrier material.

The southern KHD land holding was found to be afforded acoustic shielding from the proposed interchange topography, along with greater separation distances from the road to the nearest residences. Further, extending the proposed barrier to this area was found to be ineffective due to the site topography. As such, it was concluded that a barrier was not required in this area.

External road traffic noise predictions after the inclusion of a 2.4 m high barrier are presented for the daytime and night-time periods in Figures B.3 and B.4.

Where the required external noise reduction is less than 10 dB, standard (i.e. Category 1) construction techniques are expected to reduce internal noise levels to recommended values. In cases where a noise reduction in the range of 10-25 dB is required, Category 2 construction techniques are expected to provide adequate attenuation to reduce road traffic noise levels to at, or below, relevant internal goals. Similarly, if the required noise reduction is in the range of 25-35 dB, Category 3 construction techniques would be expected to reduce internal noise to an acceptable level. Results of this analysis are described in Table 5.2. In all instances where windows are required to be closed (i.e. construction categories 2 or 3) to achieve internal noise levels, alternative means of achieving the requirement for “comfort ventilation” will need to be considered to enable openings in the external facade (i.e. windows and doors) to remain fully closed during noisy periods.

Table 5.2 Noise reduction required to achieve internal noise goals

Time period/Type of occupancy	Required noise reduction	Relevant lots	Architectural treatment
Daytime (Living Areas)	Up to 10dBA	Lots in the green zone (<50dBA)	Construction category 1 (i.e. standard construction)
	10 dBA – 25 dBA	Lots in the yellow zone (50-65dBA)	Construction category 2 (i.e. standard construction with windows/doors closed)
	25 dBA – 35 dBA	Lots in the red zone (>65dBA)	Further consideration or Construction category 3 (i.e. special construction)
Night-time (Bedrooms)	Up to 10dBA	Lots in the green zone (<45dBA)	Construction category 1 (i.e. standard construction)
	10 dBA – 25 dBA	Lots in the yellow zone (45-60dBA)	Construction category 2 (i.e. standard construction with windows/doors closed)
	25 dBA – 35 dBA	Lots in the red zone (>60dBA)	Further consideration or Construction category 3 (i.e. special construction)

Mitigation recommendations apply to single storey dwellings. The upper floors of double storey (or higher) dwellings will need further consideration and possibly additional mitigation. Multiple storey dwellings should be assessed on a case by case basis.

Figure B.4 shows that there are a number of residences fronting the Pacific Highway that may potentially require further consideration given that the 60 dB noise contour marginally encroaches into their respective allotments. Notwithstanding, this does not necessitate the need for category three construction on these allotments. Applying one or more of the following recommendations can ensure that category two construction on these allotments can satisfy the relevant internal noise goals outlined in DPIE's "*Development near Rail Corridors and Busy Roads – Interim Guidelines*". These recommendations include, but are not limited to, the following:

- Locate dwellings on each allotment as far as possible from the Pacific Highway.
- Minimise the size and number of windows facing the Pacific Highway.
- Locate noise insensitive areas such as the kitchen, storage areas and laundry toward the Pacific Highway.
- Use construction techniques that focus on sealing gaps around windows, doors, ceiling spaces, etc.
- Use thicker glass or double glazing on windows susceptible to excessive noise intrusion from the Pacific Highway.
- Use solid core doors and appropriate door seals on doors susceptible to excessive noise intrusion from the Pacific Highway.

Appropriately applying one or more of the recommendations can ensure that category two construction can satisfy the relevant internal noise goals at these locations. As previously mentioned, extending the proposed barrier to the southern KHD land holding was found to be ineffective due to the topography of the area.

6 Conclusion

EMM has completed a noise impact assessment for the proposed Kings Hill Development and Gwynvill land holdings located on the Pacific .

Long-term attended noise monitoring was completed to establish existing ambient noise levels and road traffic noise exposure across the subject site. Measured noise levels were assessed with reference to Clause 102 of the infrastructure SEPP (2007) and DPIE's *"Development near Rail Corridors and Busy Roads – Interim Guidelines"* (2008).

Road traffic noise levels, including a 2.4m high barrier spanning the majority of the eastern boundary of the site, were predicted across the site at hypothetical dwellings, as shown in Appendix B. Results of noise modelling indicated that the relevant requirements regarding road traffic noise intrusion will be achieved for the large majority of dwellings by adopting standard, complying development construction techniques and including an alternate means of ventilation as per the DPIE's "*Development near Rail Corridors and Busy Roads – Interim Guidelines"* (2008).

A small number of residences fronting the Pacific Highway that may potentially require further consideration given that the 60 dB noise contour marginally encroaches into their respective allotments. Appropriately applying the recommendations herein, pertaining to dwelling siting, floor plan and construction type, can ensure that category two construction can satisfy the relevant internal noise goals at these locations.

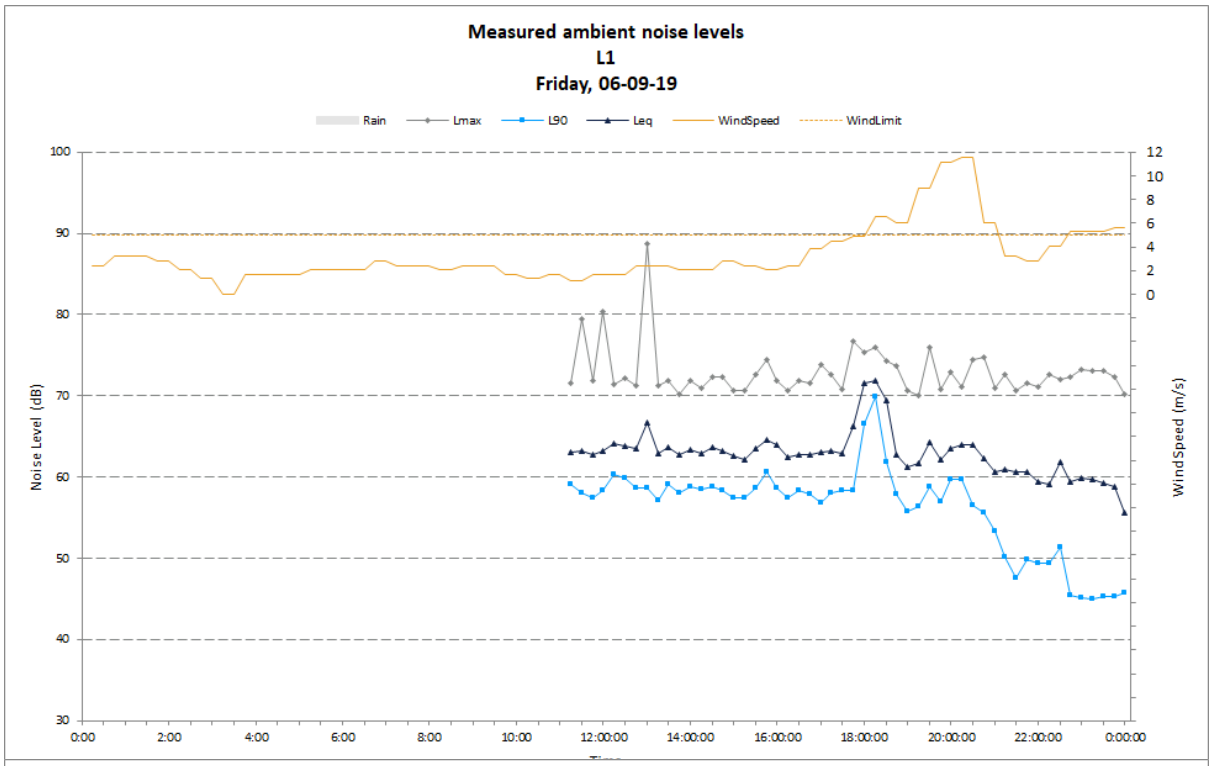
Appendix A

Unattended noise monitoring results and charts

Table A.1 Summary of daily noise logging results – L1

Date	RBL (Day)	RBL (Evening)	RBL (Night)	$L_{Aeq,15\ hour}$, dB (Day)	$L_{Aeq,9\ hour}$, dB (Night)
Thursday, 06-09-18	0	0	45	0	60
Friday, 07-09-18	0	46	36	0	55
Saturday, 08-09-18	56	48	37	62	58
Sunday, 09-09-18	57	50	39	63	60
Monday, 10-09-18	58	0	40	65	60
Tuesday, 11-09-18	55	51	42	64	61
Wednesday, 12-09-18	55	52	43	63	61
Thursday, 13-09-18	59	54	35	64	58
Friday, 14-09-18	56	49	29	62	55
Saturday, 15-09-18	52	51	36	61	60
Sunday, 16-09-18	55	49	0	63	0
Monday, 17-09-18	0	0	0	0	0
Tuesday, 18-09-18	0	63	0	0	0
Wednesday, 19-09-18	0	0	0	0	0
Overall	56	51	38	63	59

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


Measured ambient noise levels
L1
Friday, 06-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
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12:00:00
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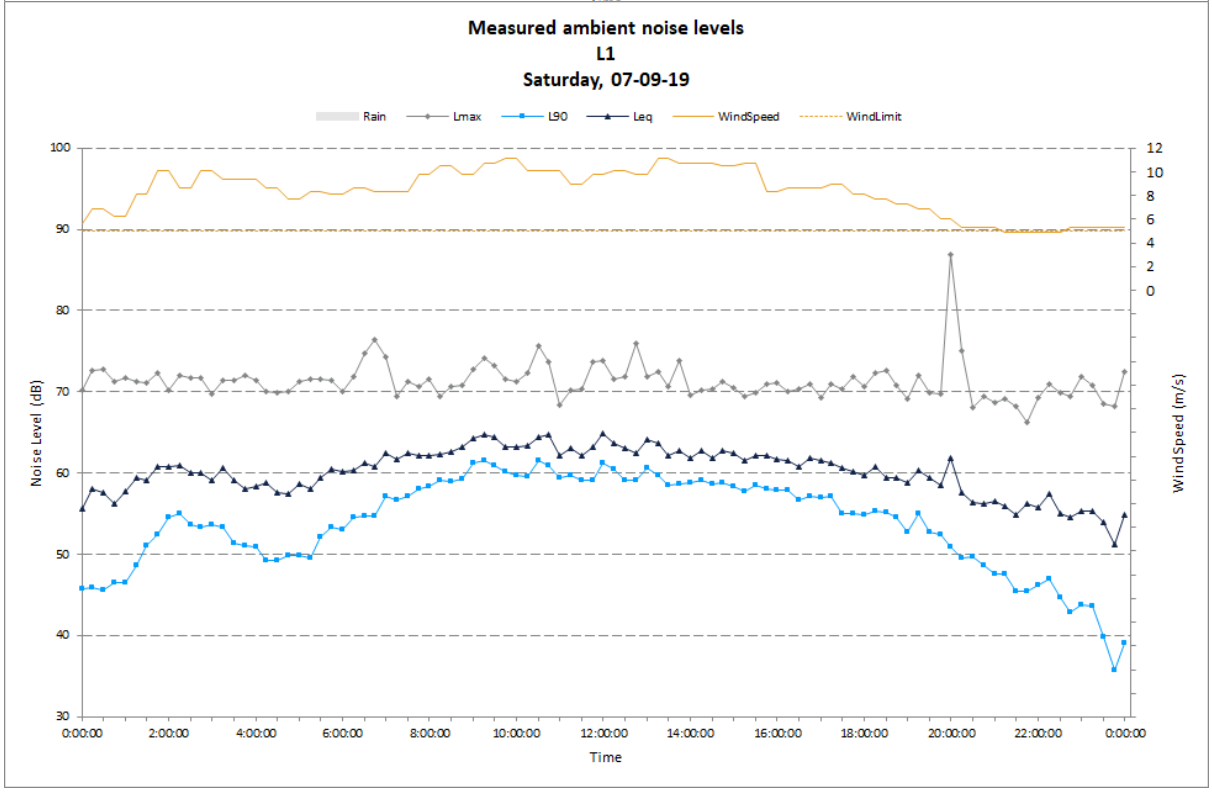
Measured ambient noise levels
L1
Saturday, 07-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
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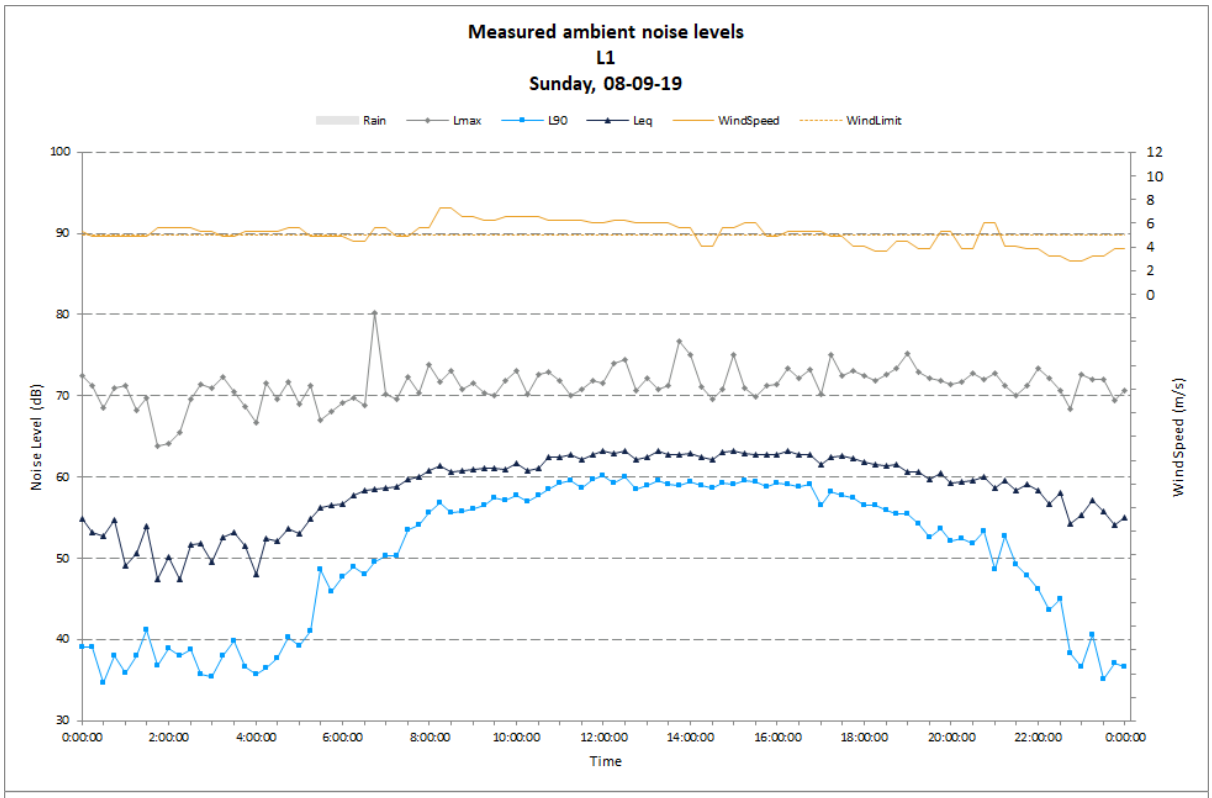
Time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Sunday, 08-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
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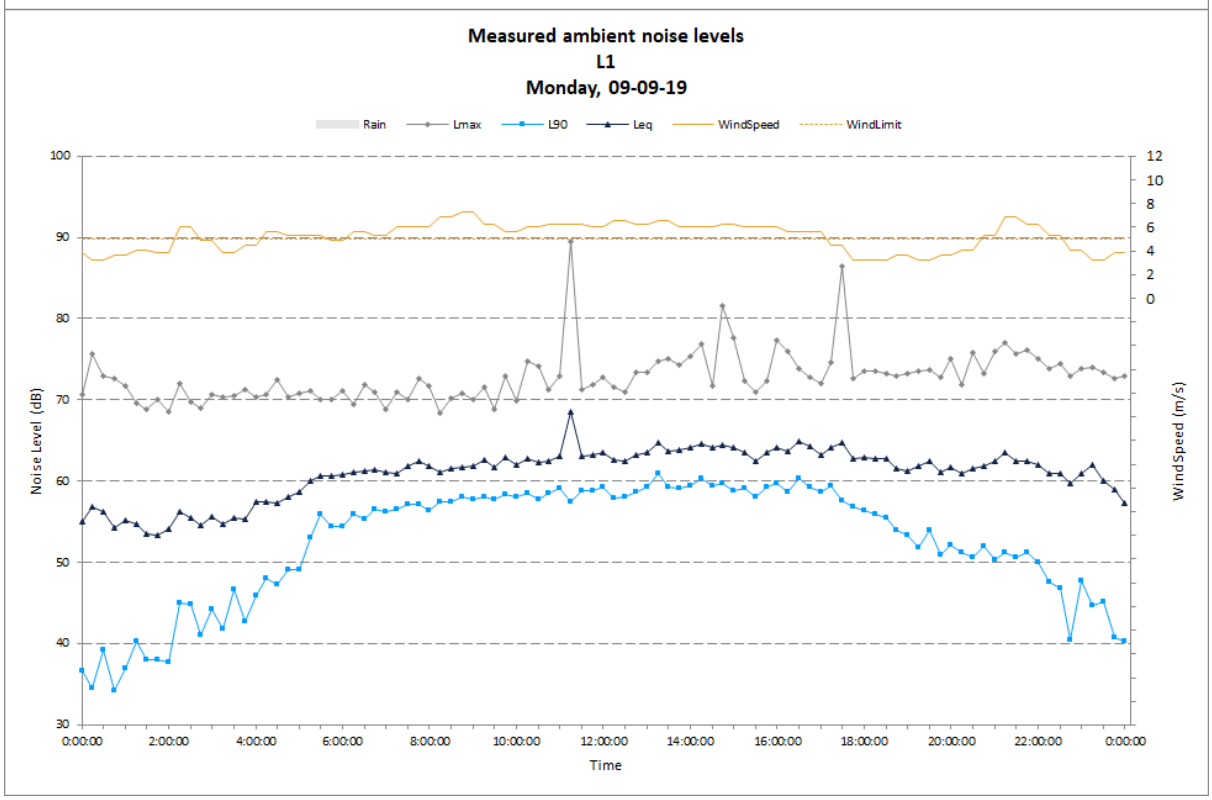
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Monday, 09-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
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WindSpeed (m/s)
Time
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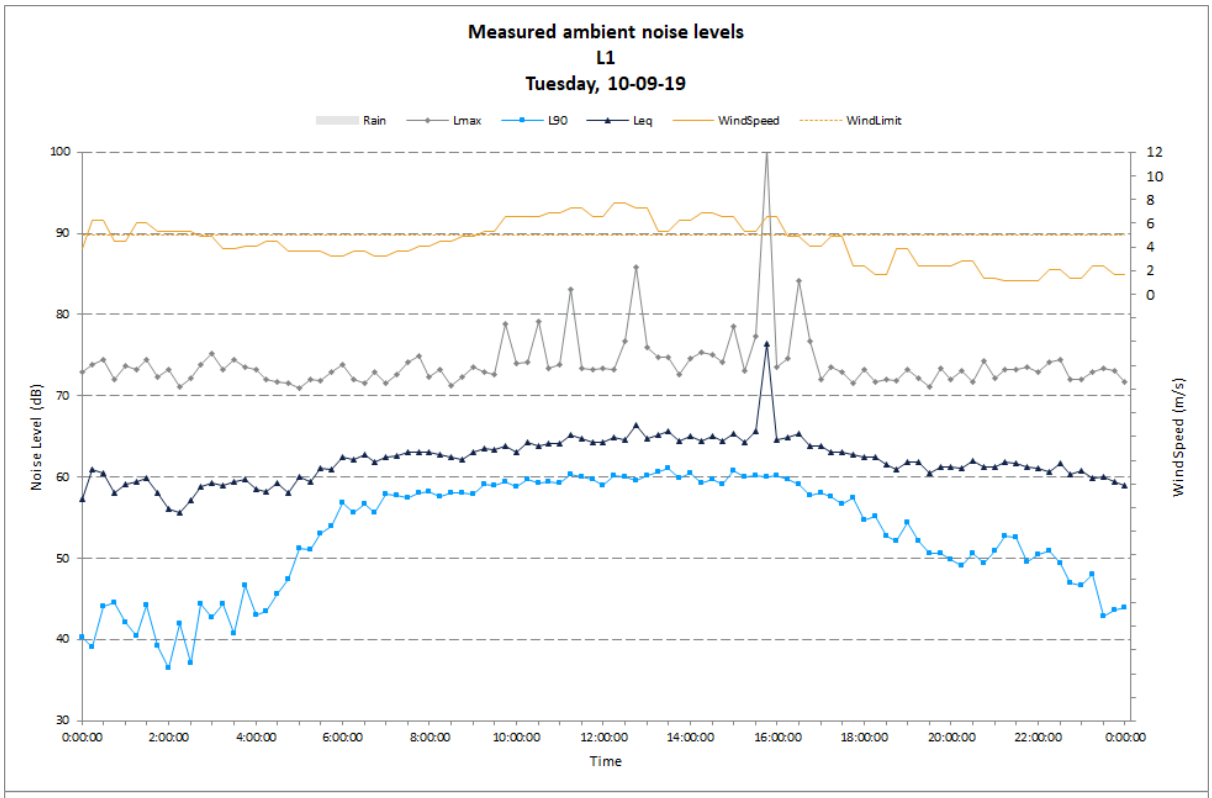
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Tuesday, 10-09-19
Rain
Lmax
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WindSpeed
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Noise Level (dB)
WindSpeed (m/s)
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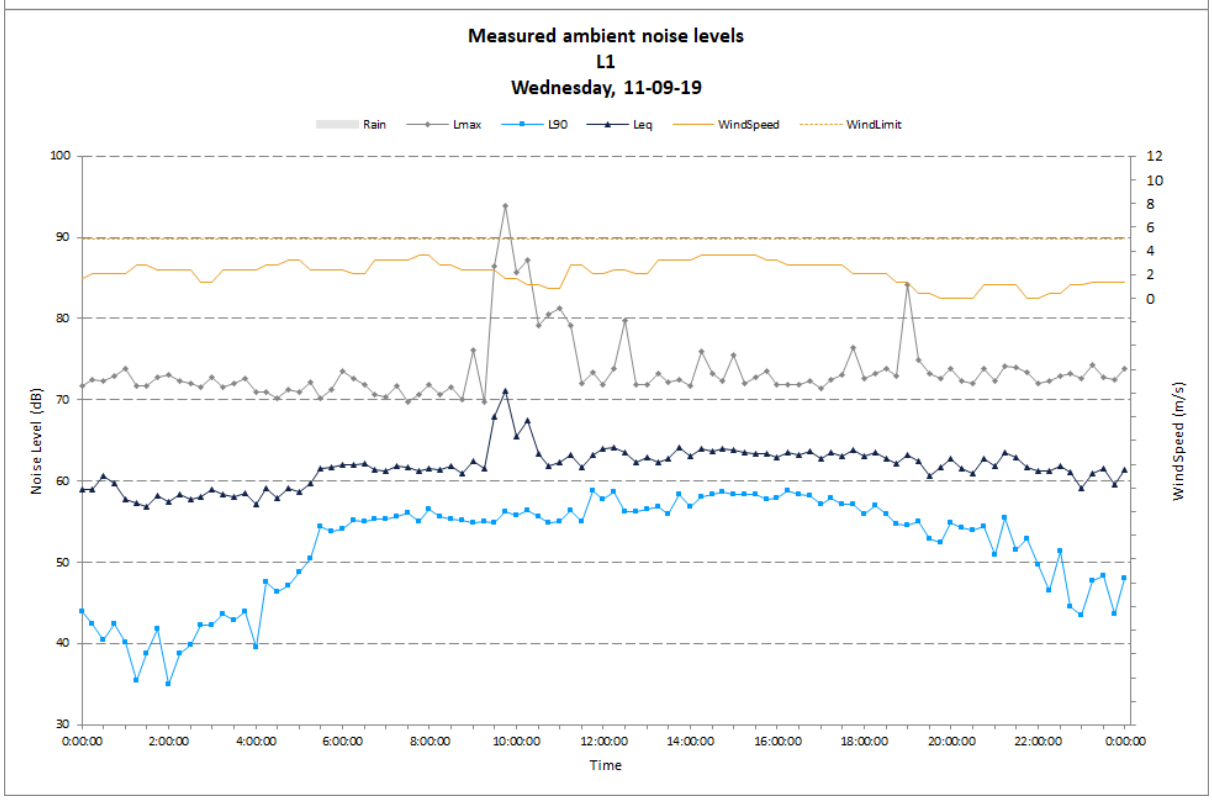
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Rain
Lmax
L90
Leq
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WindLimit
Noise Level (dB)
WindSpeed (m/s)
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0:00:00
2:00:00
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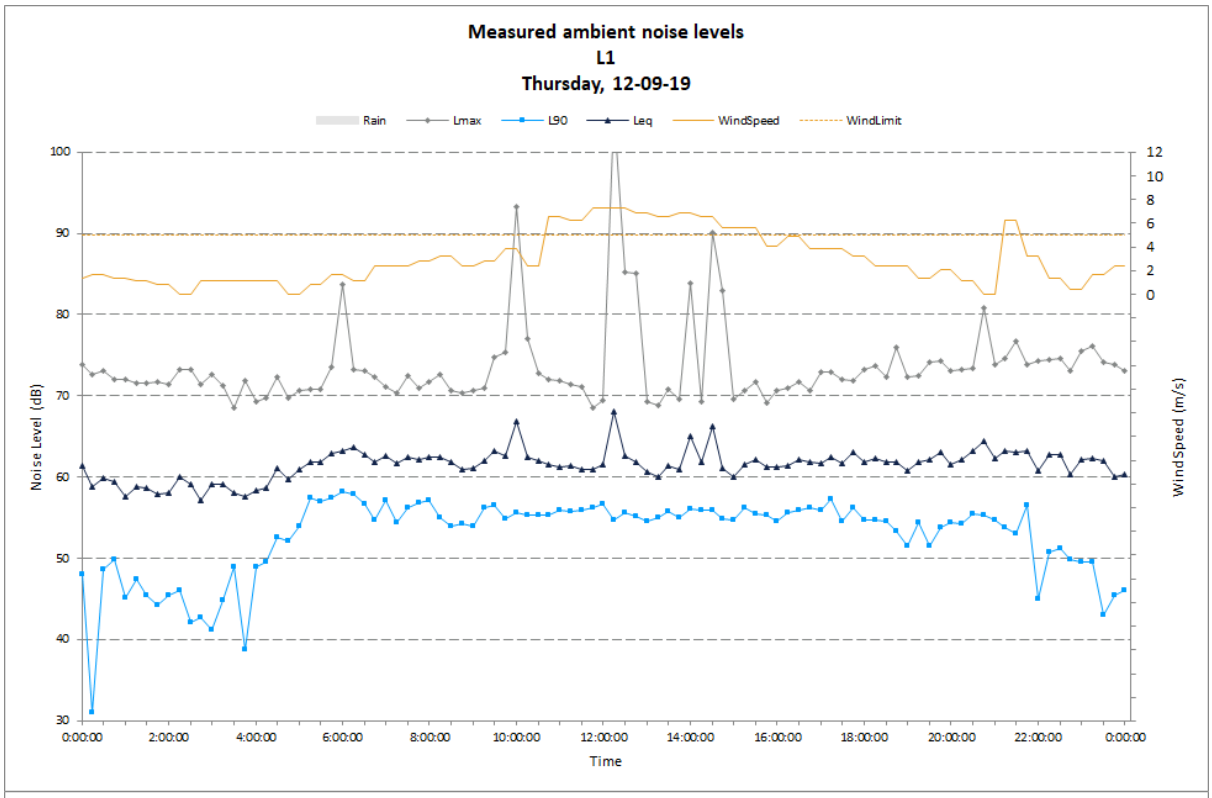
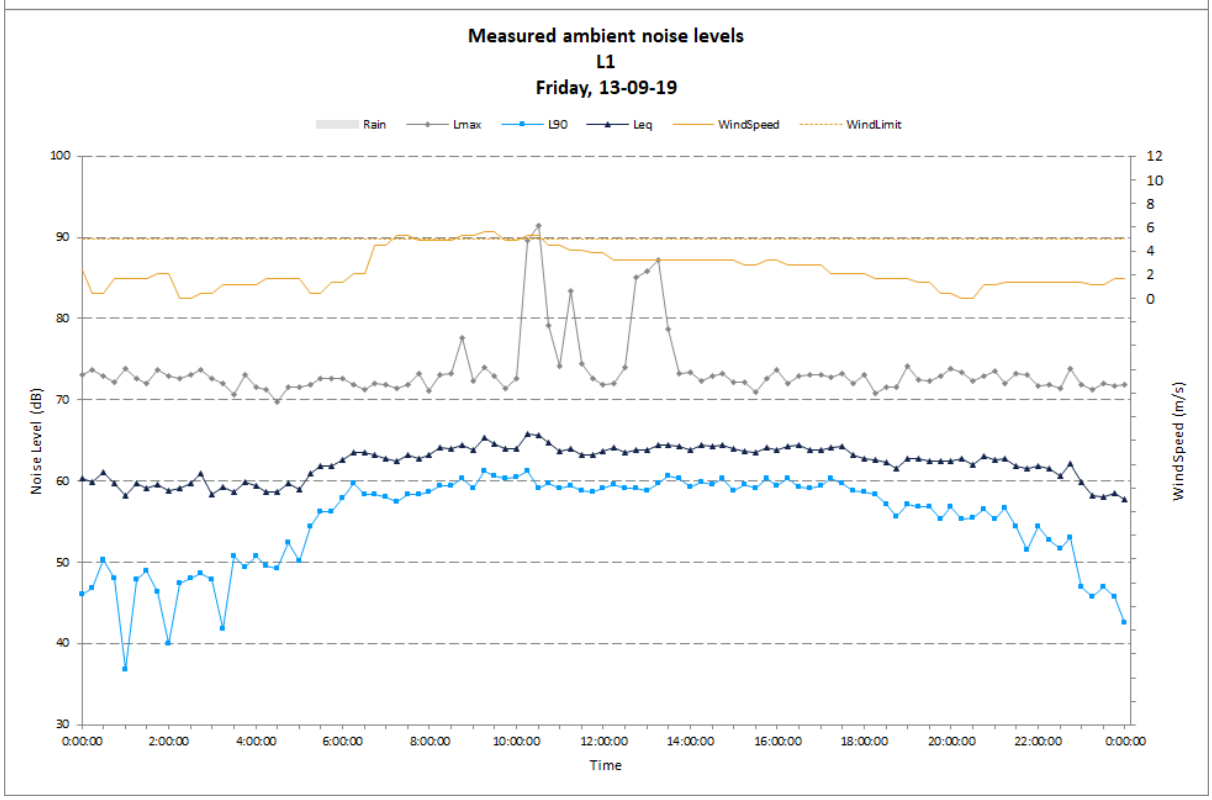
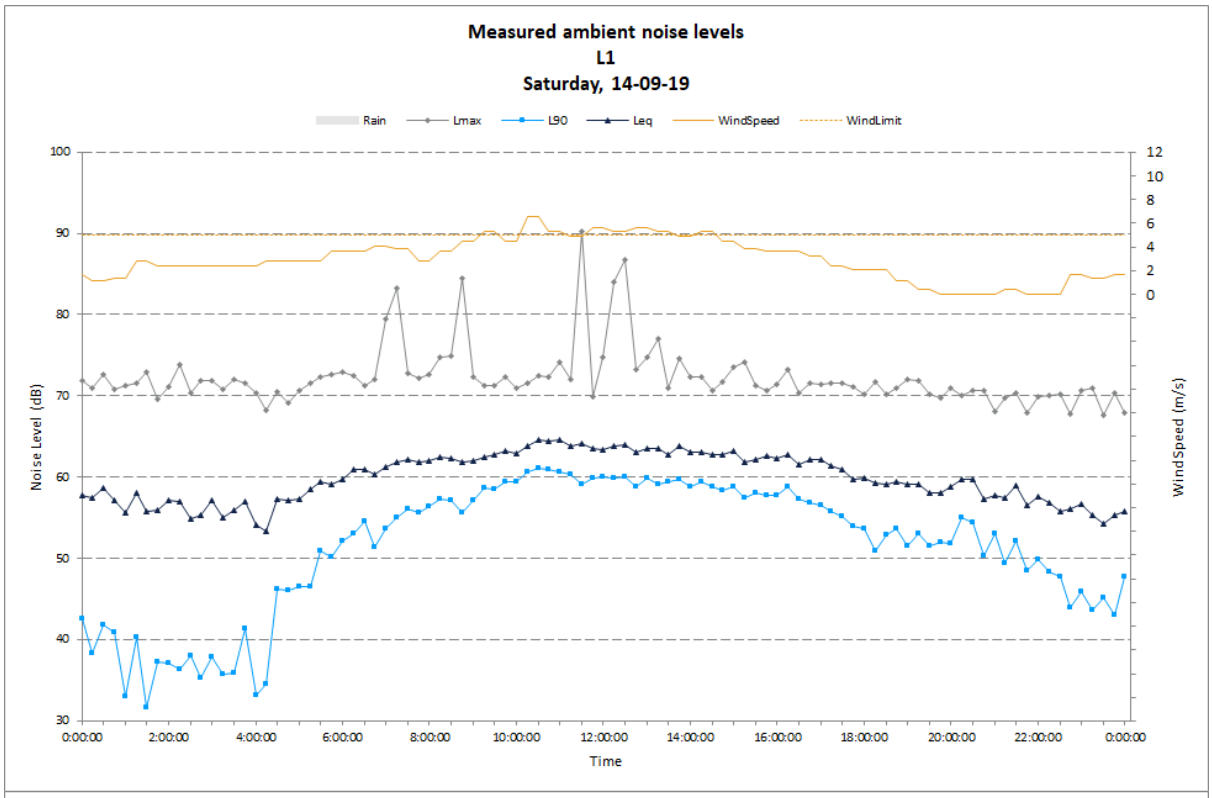
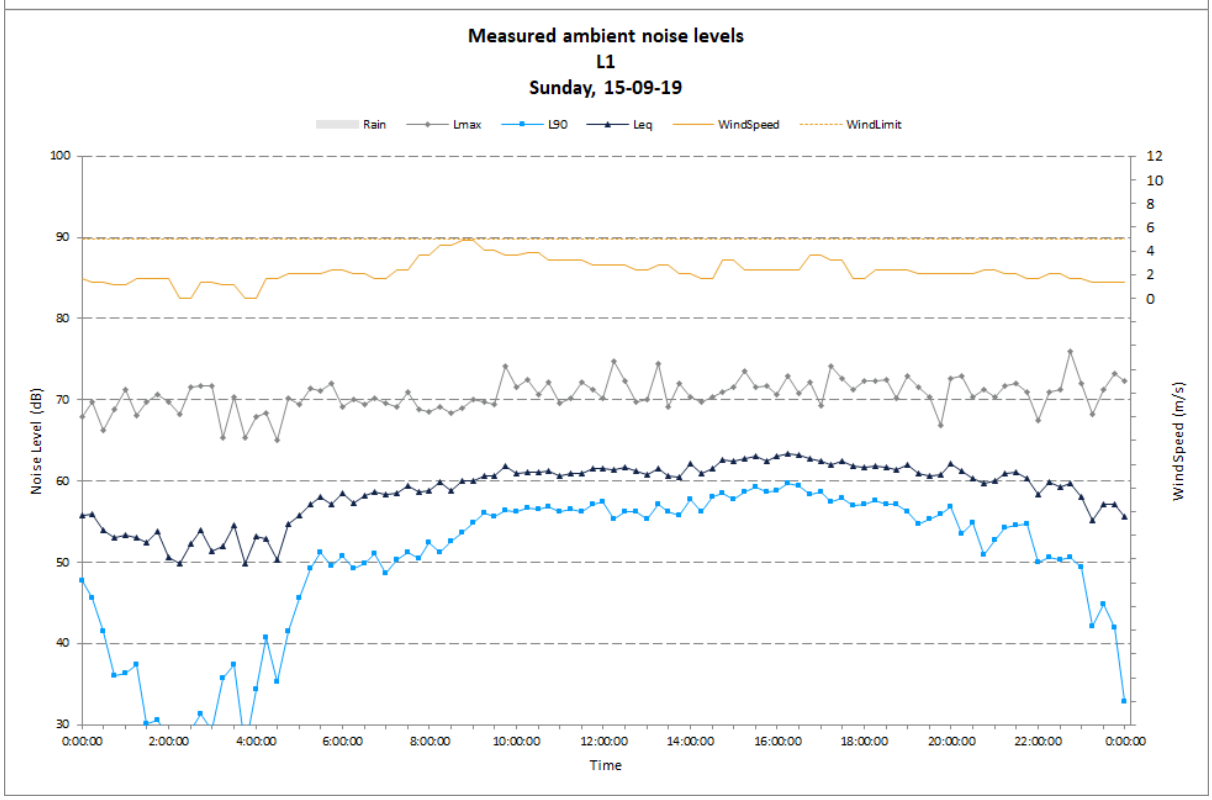
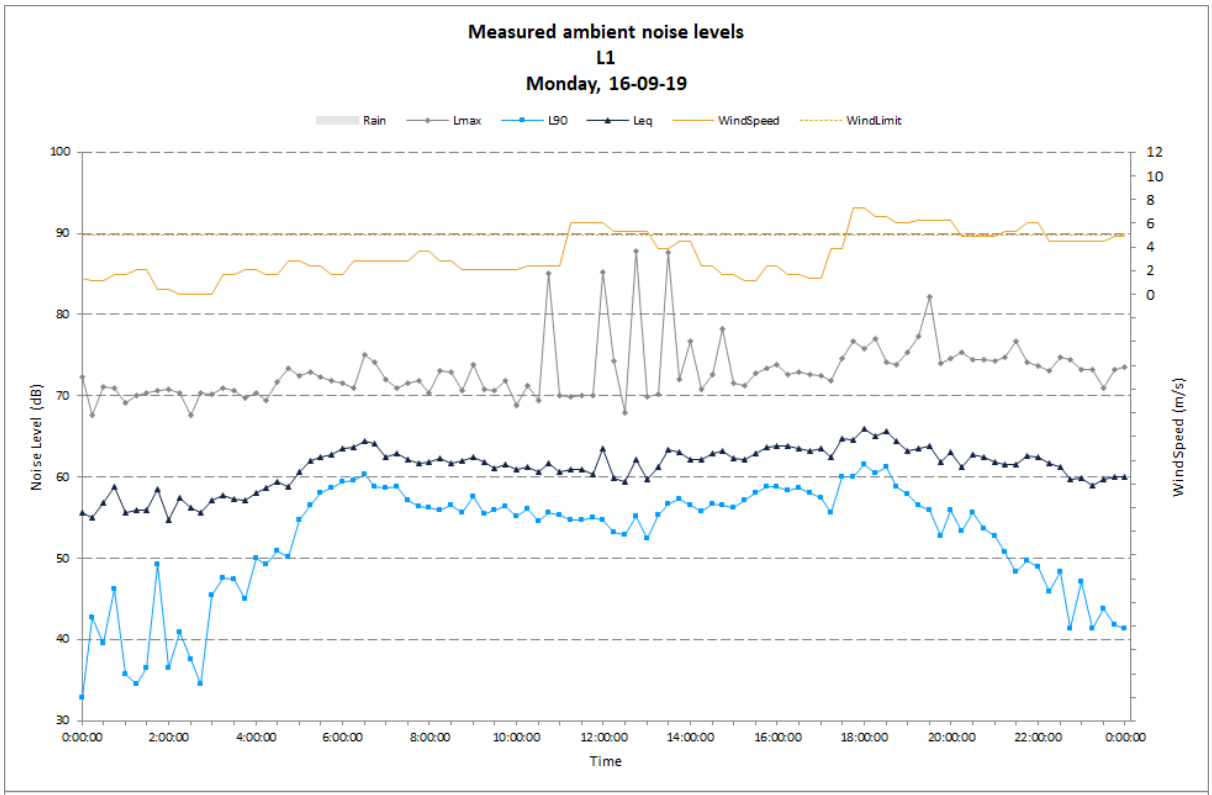
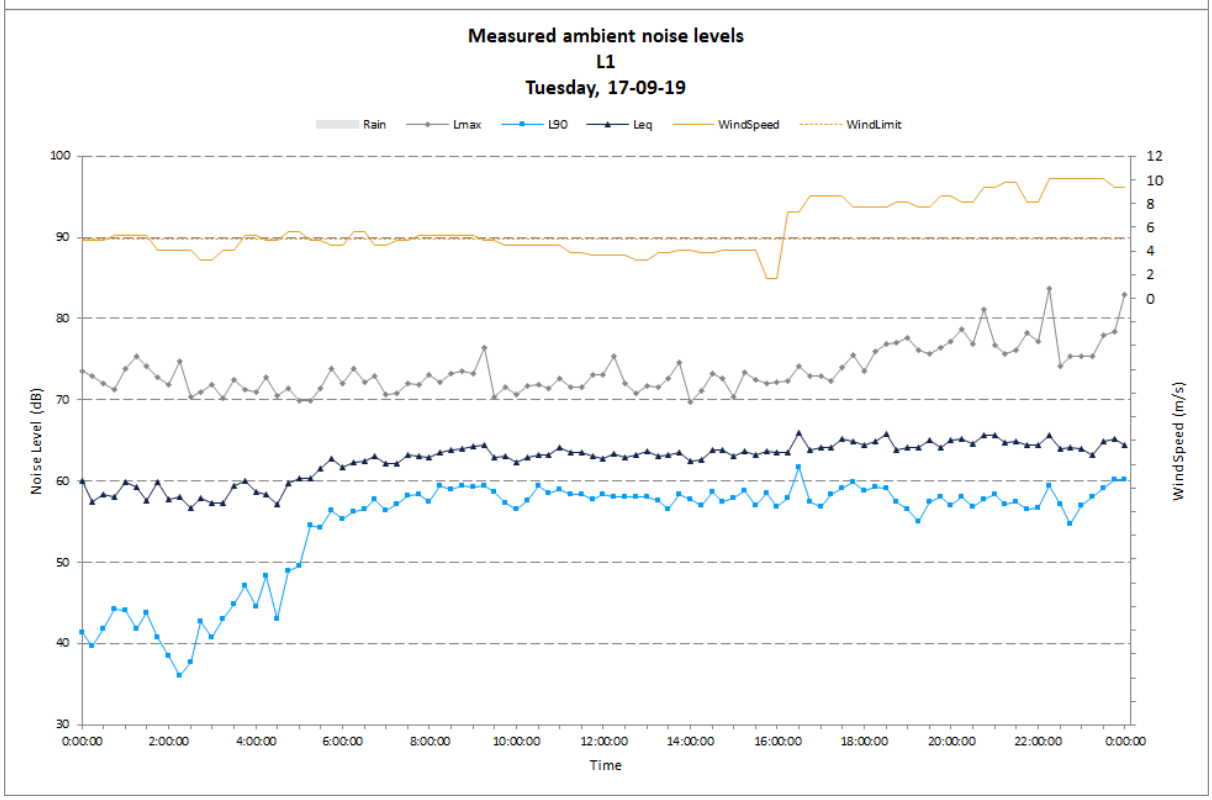

Measured ambient noise levels
L1
Thursday, 12-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time

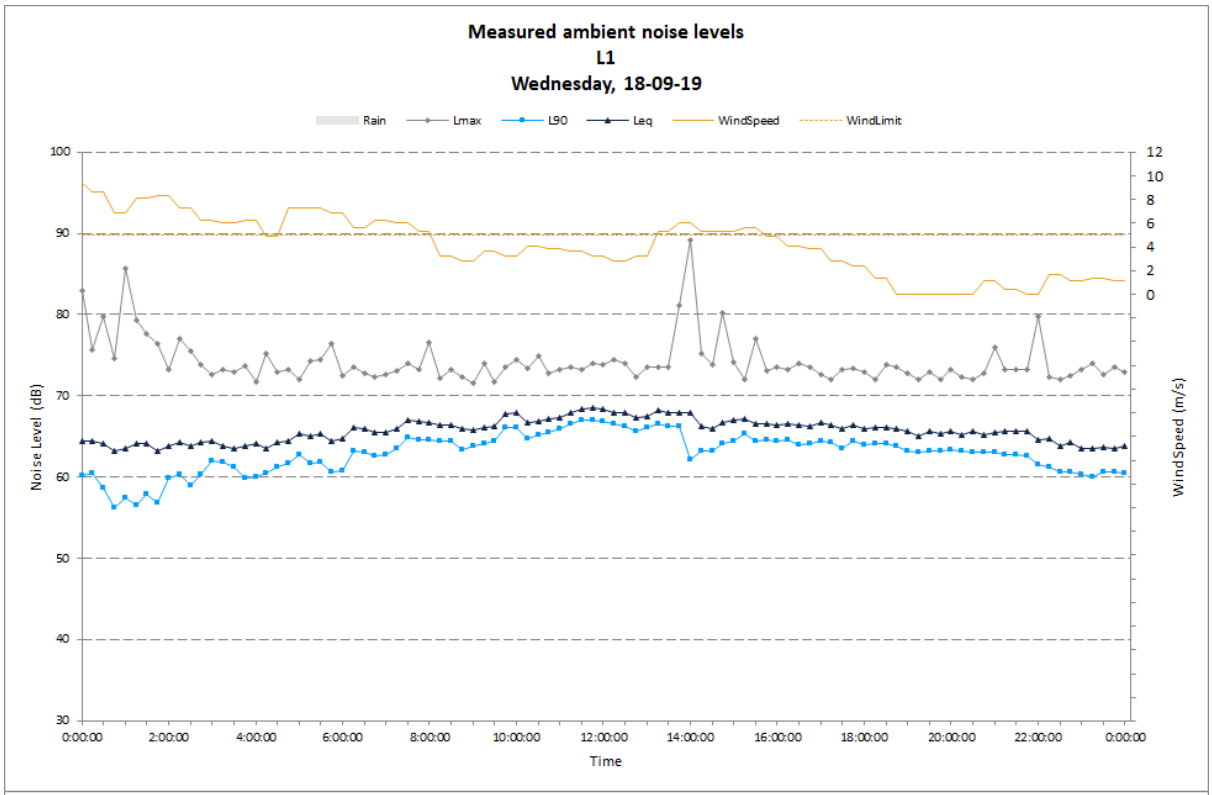

Measured ambient noise levels
L1
Friday, 13-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time

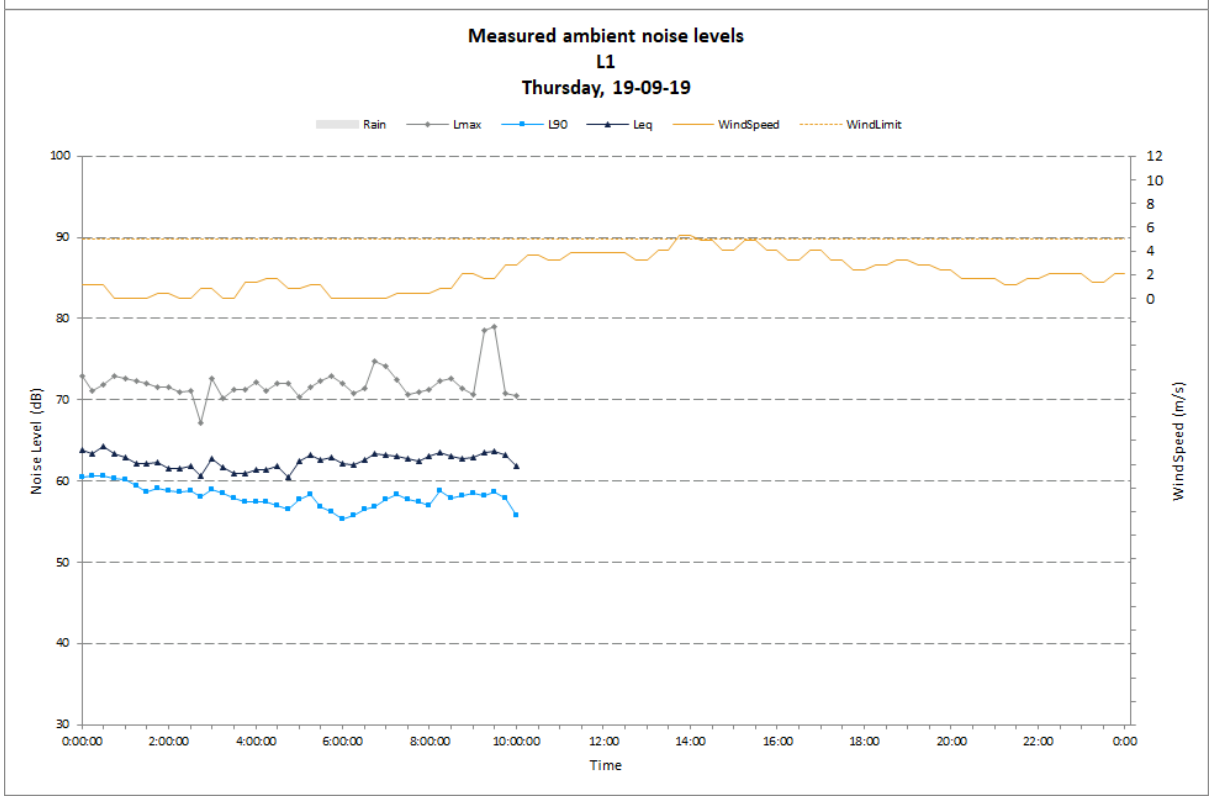

Measured ambient noise levels
L1
Saturday, 14-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L1
Sunday, 15-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L1
Monday, 16-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L1
Tuesday, 17-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00



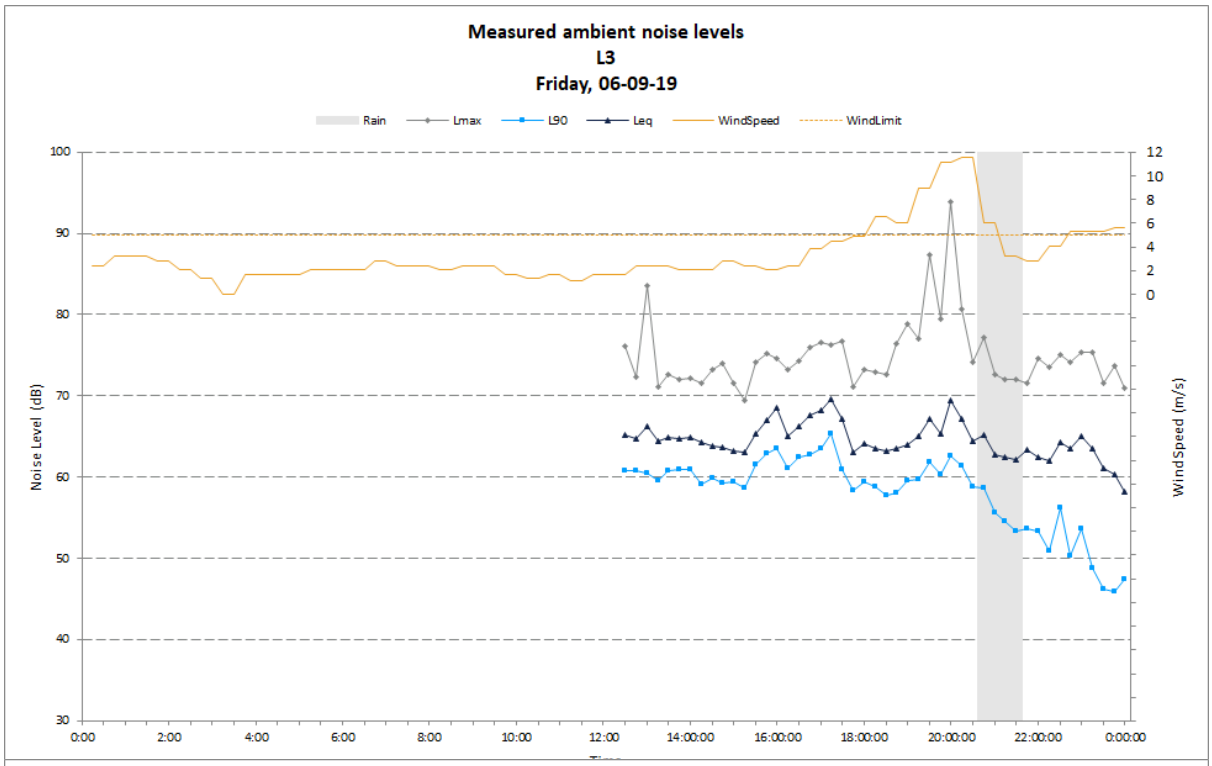


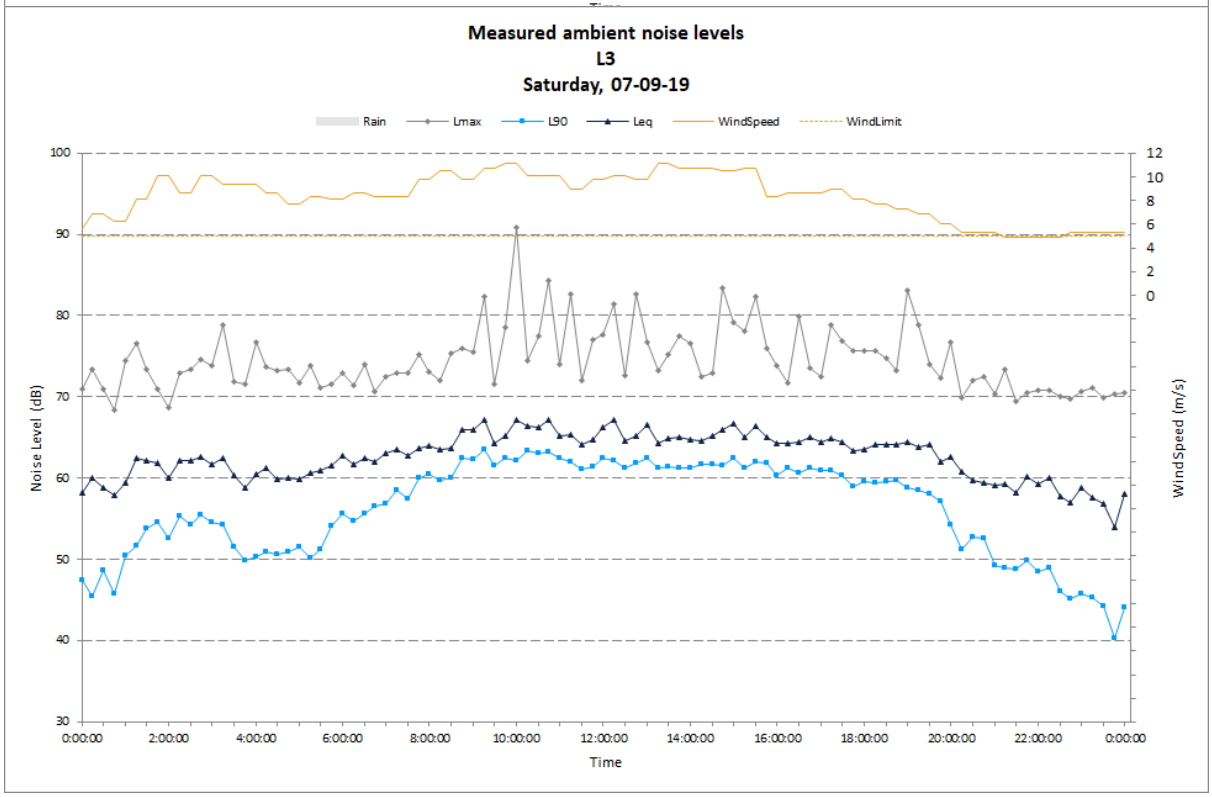
Notes: "0" indicates periods with too few valid samples due to weather or logger operation

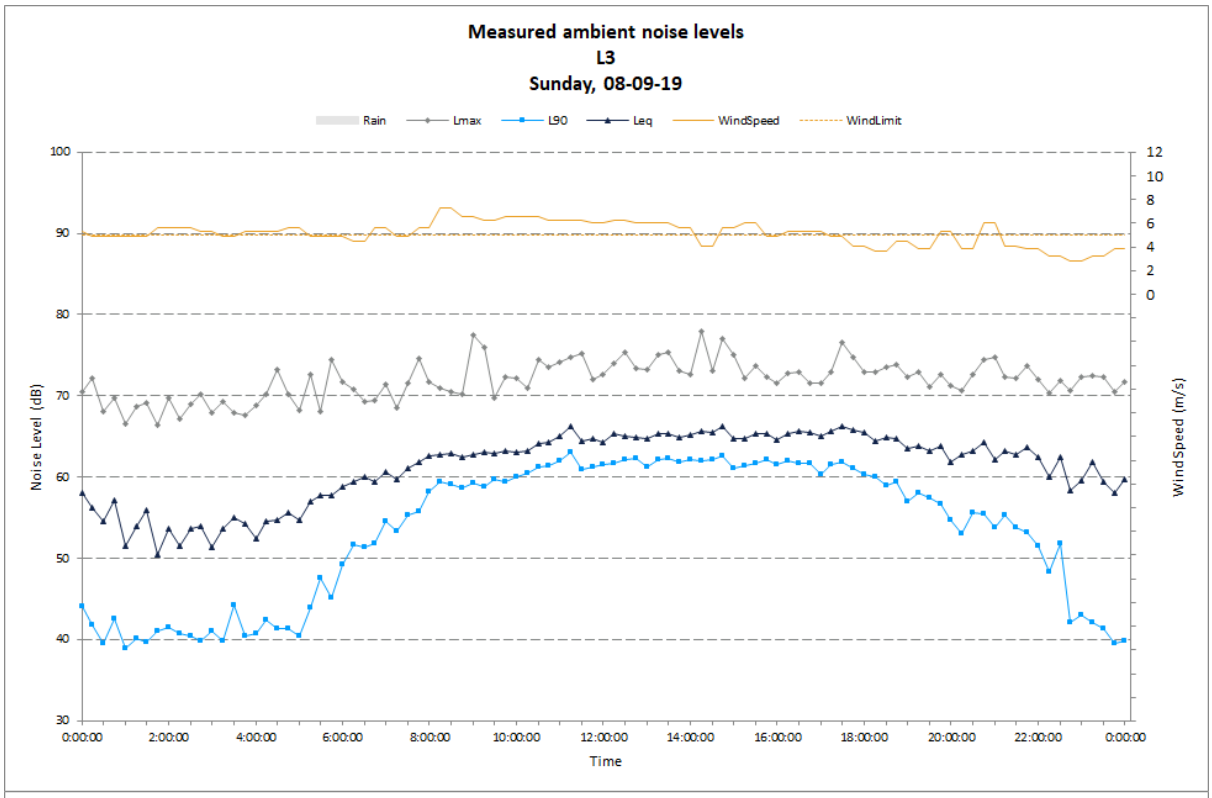
Table A.2 Summary of daily noise logging results – L3

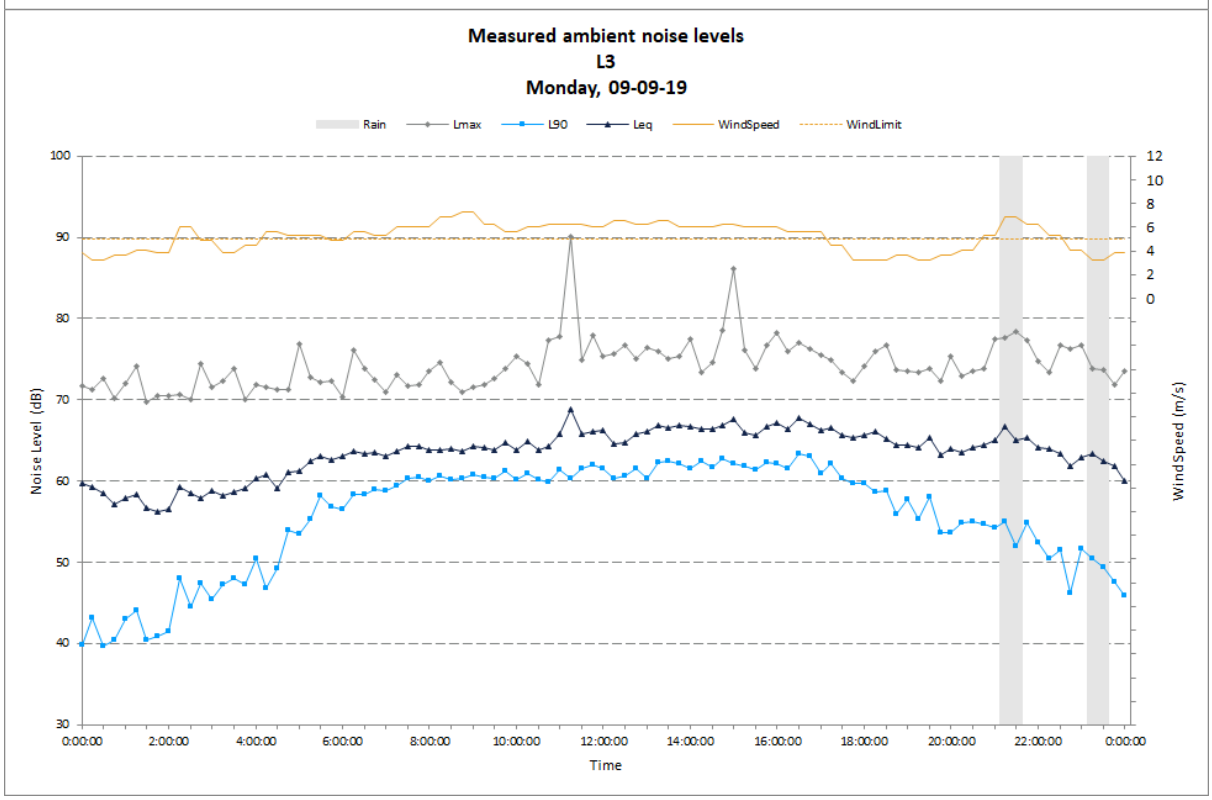
Date	RBL (Day)	RBL (Evening)	RBL (Night)	$L_{Aeq,15\ hour}$, dB (Day)	$L_{Aeq,9\ hour}$, dB (Night)
Thursday, 06-09-18	0	0	46	0	62
Friday, 07-09-18	0	49	40	0	57
Saturday, 08-09-18	59	53	41	64	61
Sunday, 09-09-18	60	54	45	66	63
Monday, 10-09-18	60	0	44	69	63
Tuesday, 11-09-18	57	55	45	66	65
Wednesday, 12-09-18	57	52	48	65	66
Thursday, 13-09-18	61	56	39	66	62
Friday, 14-09-18	59	52	32	64	60
Saturday, 15-09-18	56	55	42	65	64
Sunday, 16-09-18	57	50	0	65	0
Monday, 17-09-18	0	0	0	0	0
Tuesday, 18-09-18	0	54	0	0	0
Wednesday, 19-09-18	0	0	0	0	0
Overall	59	53	43	66	63

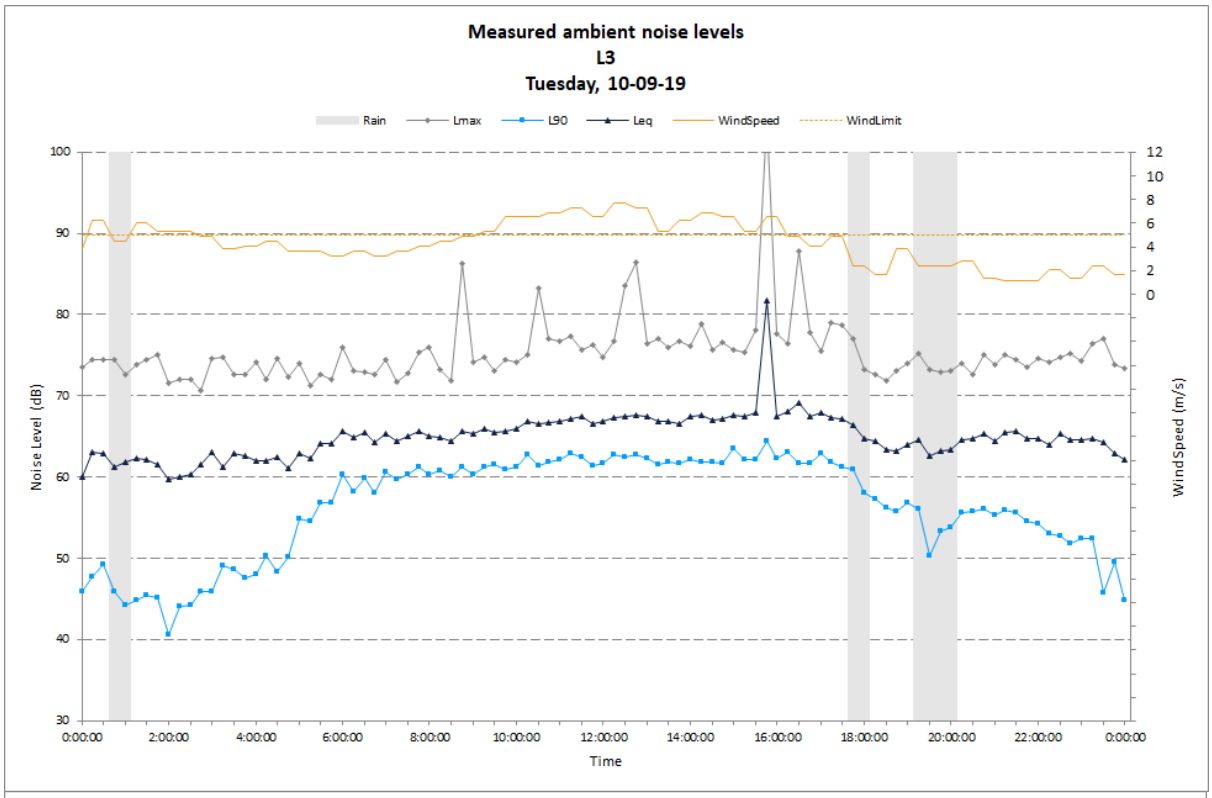
Notes: "0" indicates periods with too few valid samples due to weather or logger operation

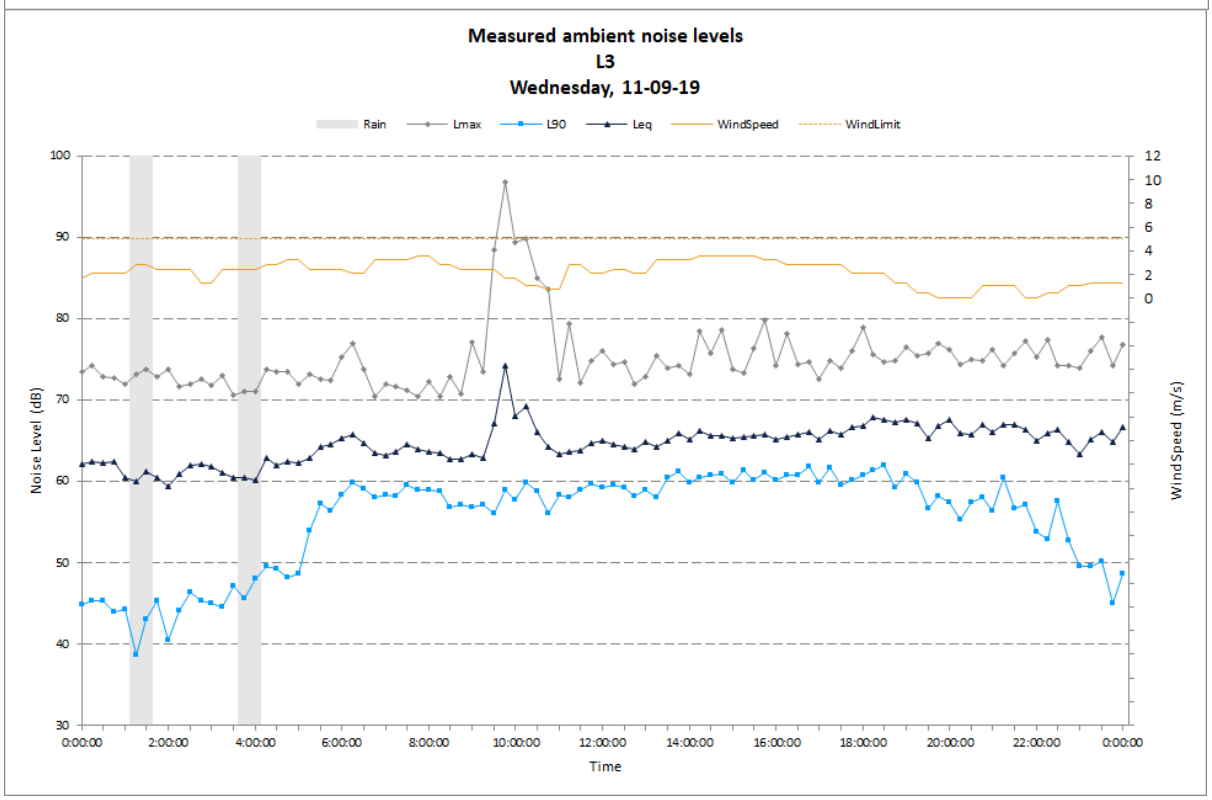

Measured ambient noise levels
L3
Friday, 06-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

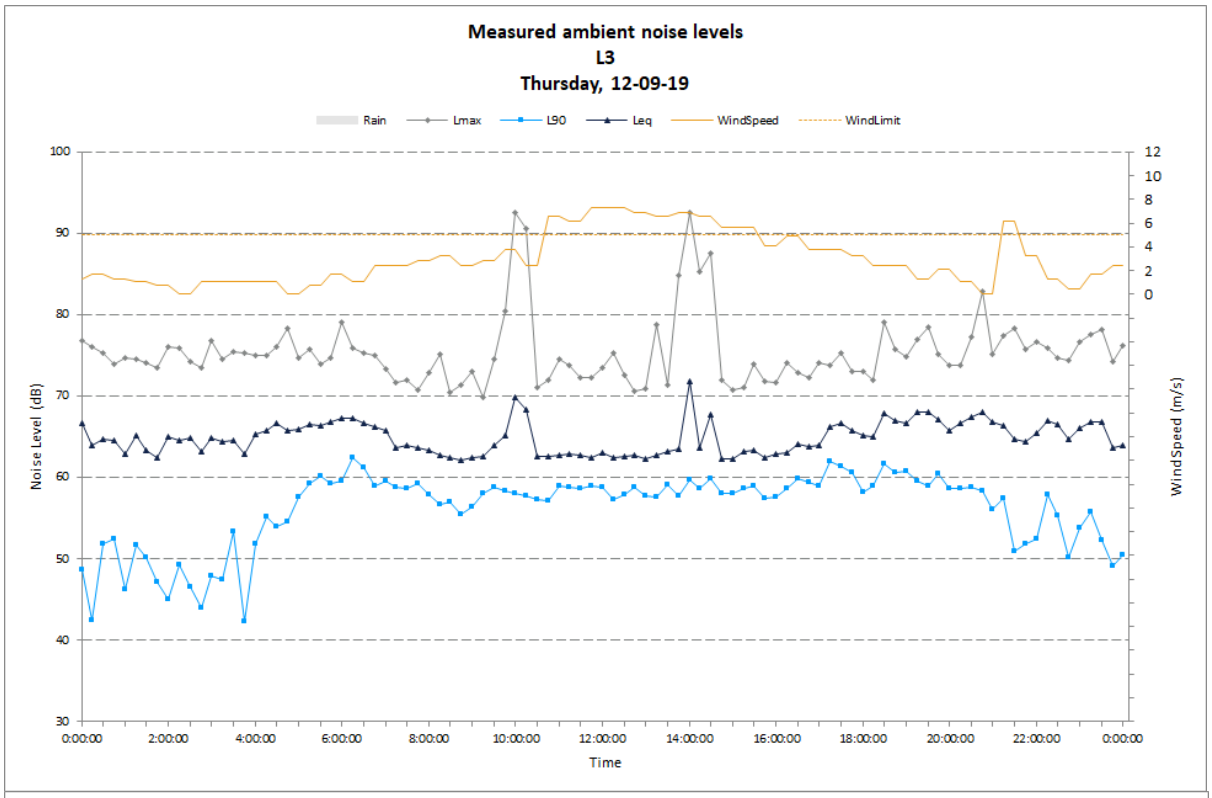

Measured ambient noise levels
L3
Saturday, 07-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00
Time

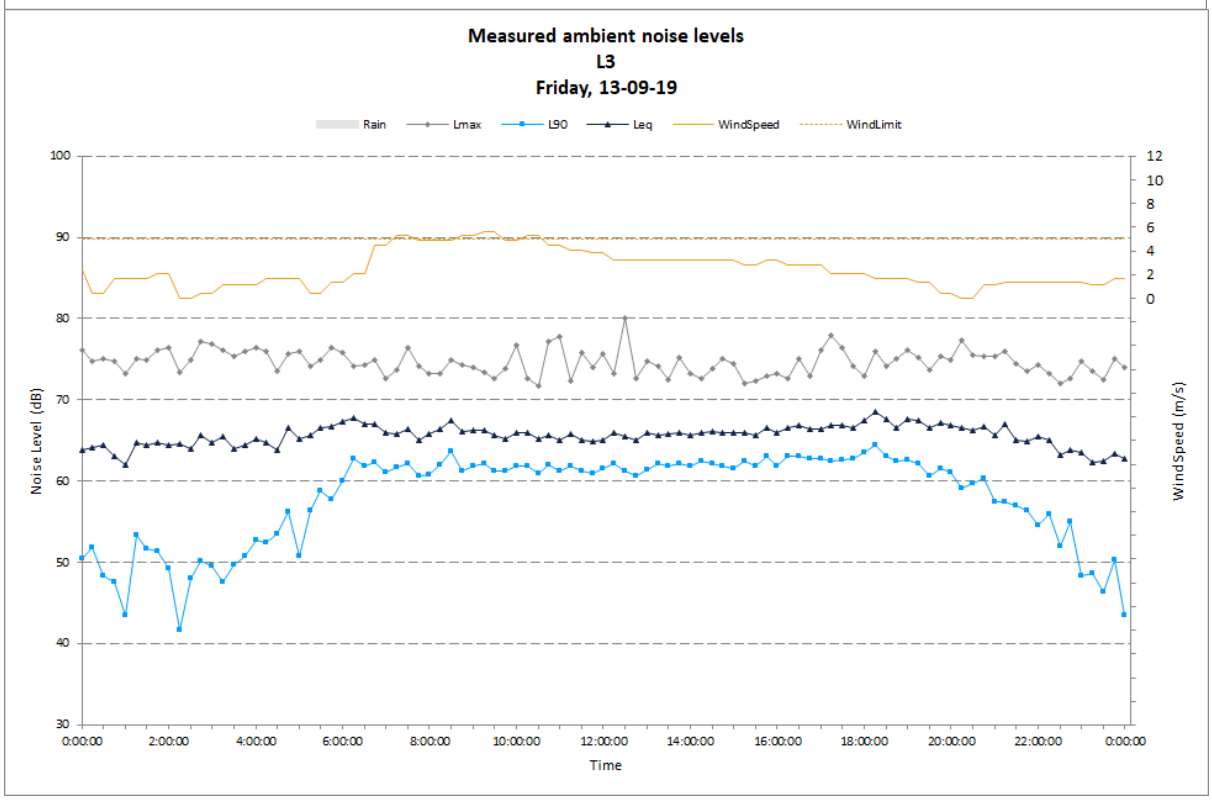

Measured ambient noise levels
L3
Sunday, 08-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

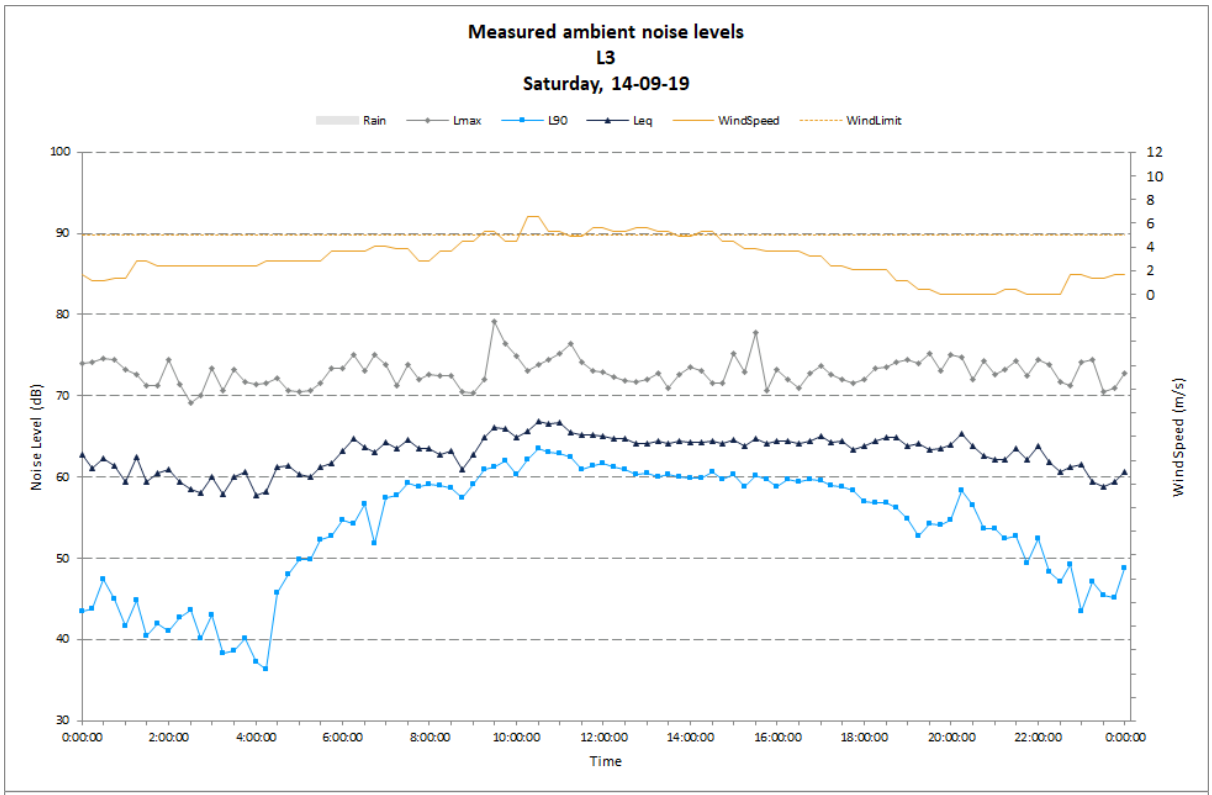

Measured ambient noise levels
L3
Monday, 09-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

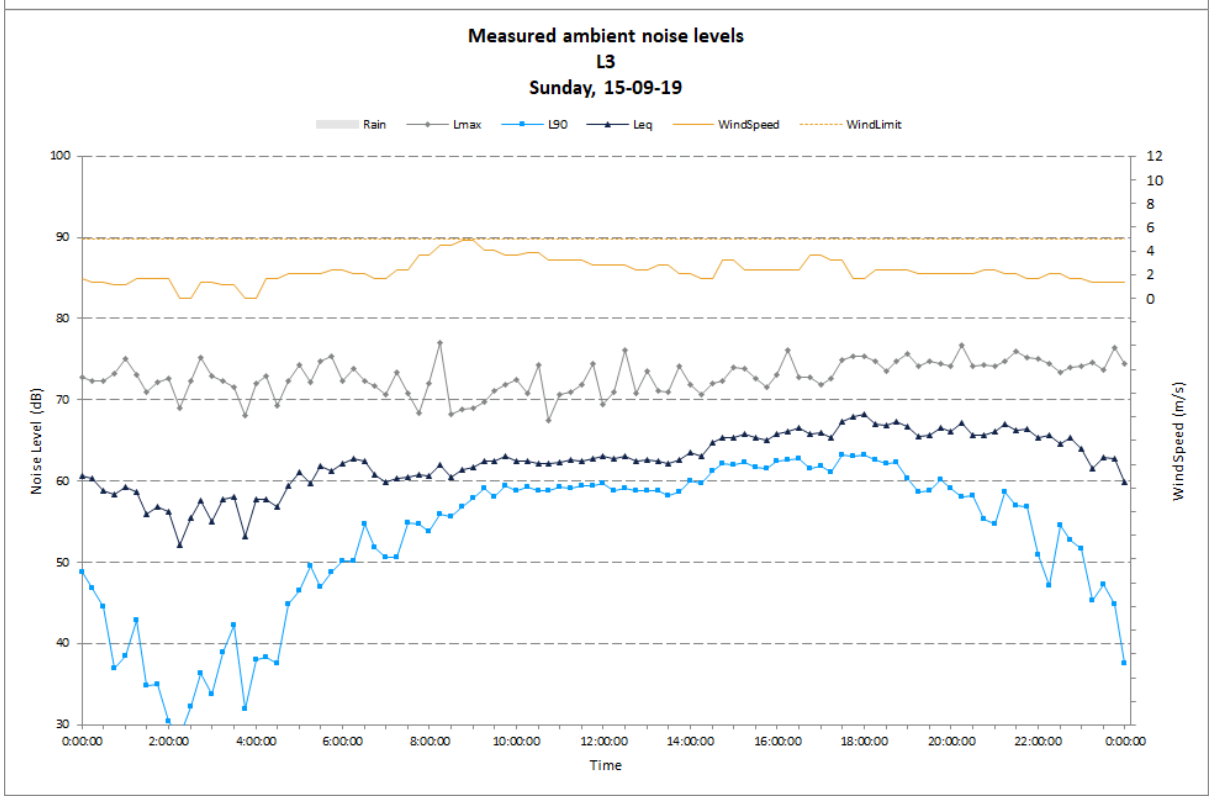

Measured ambient noise levels
L3
Tuesday, 10-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

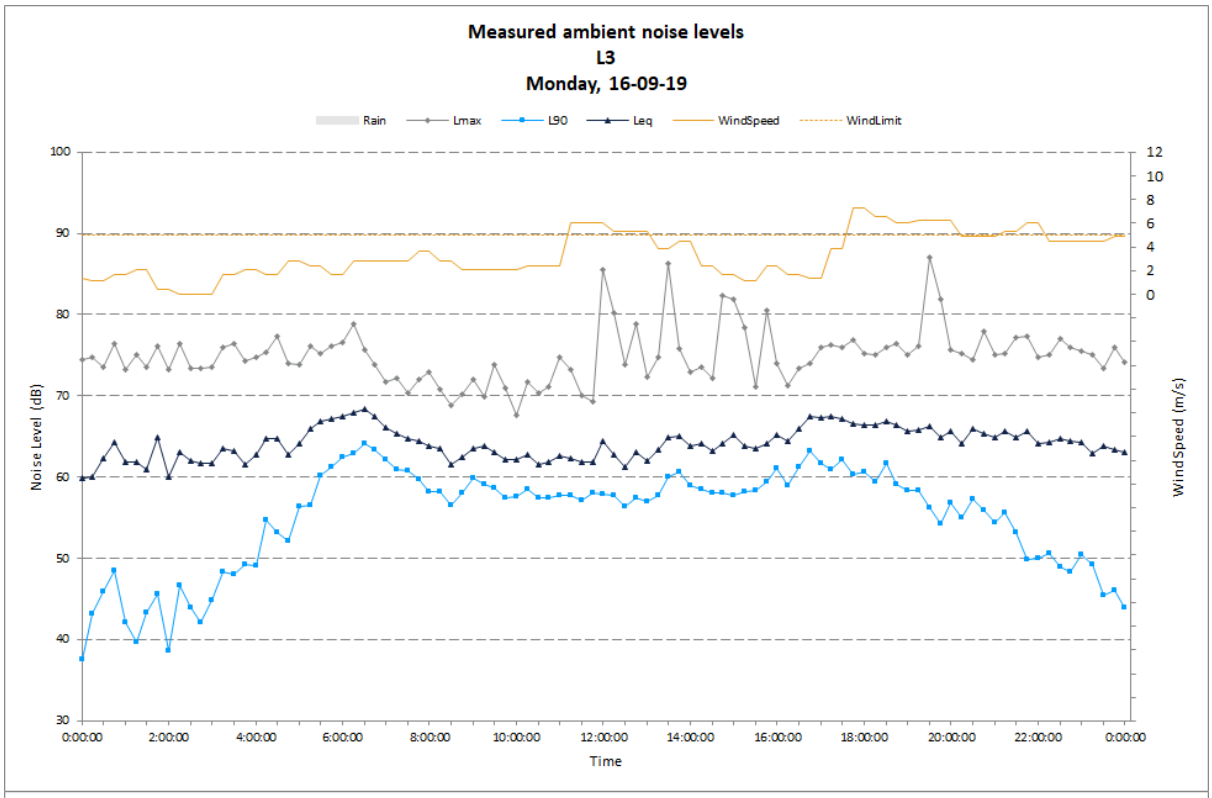

Measured ambient noise levels
L3
Wednesday, 11-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

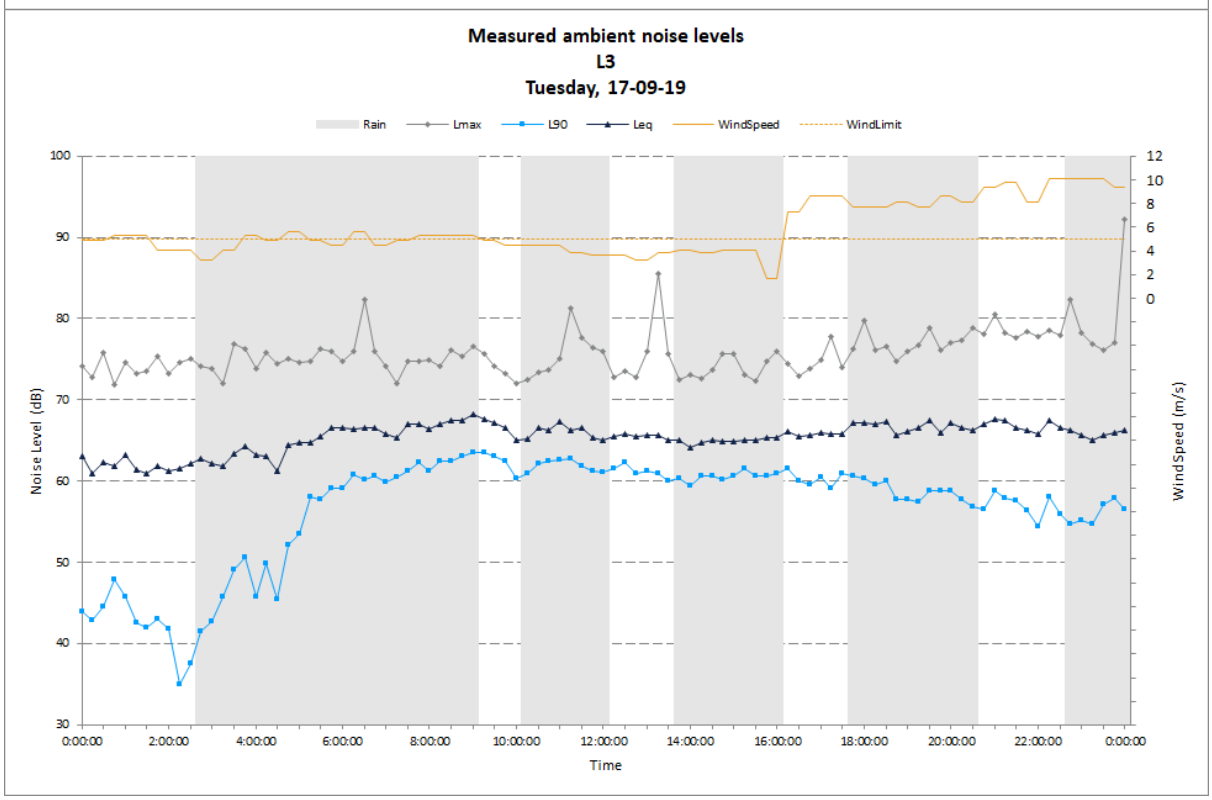

Measured ambient noise levels
L3
Thursday, 12-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time

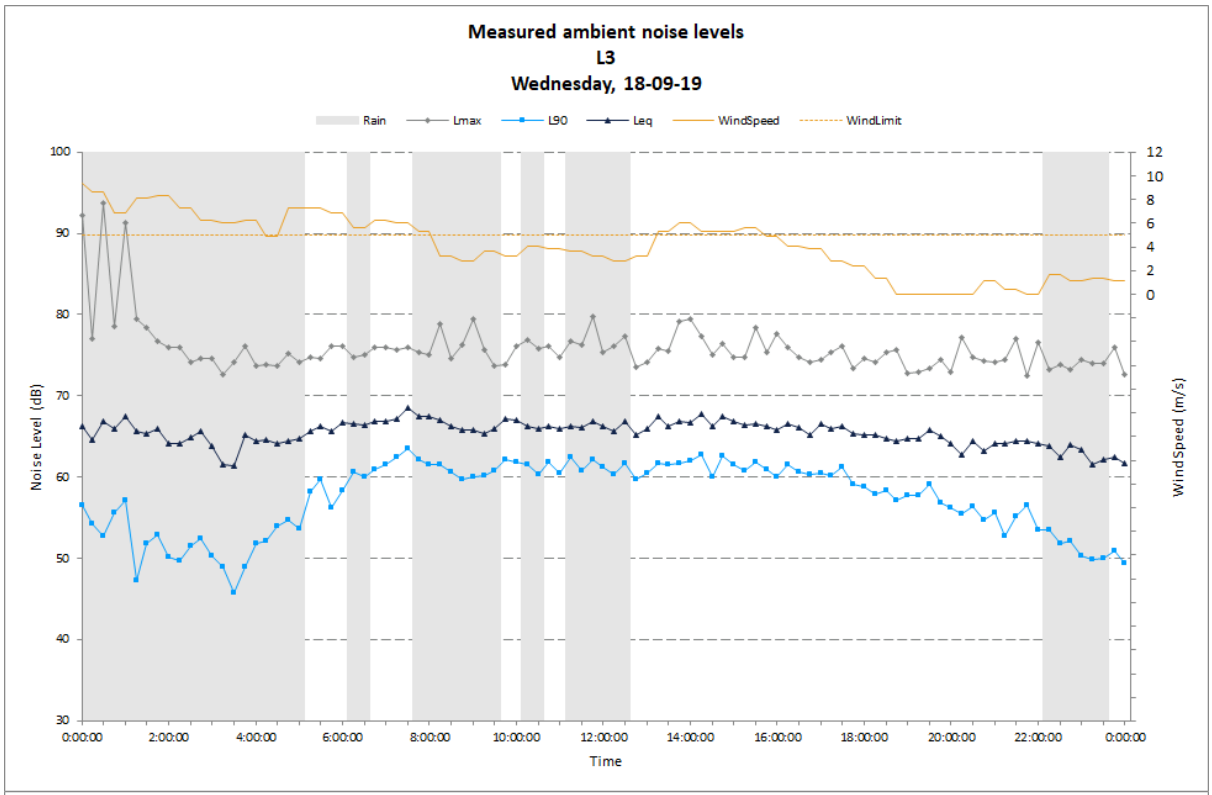

Measured ambient noise levels
L3
Friday, 13-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
L3
Saturday, 14-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
L3
Sunday, 15-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time


Measured ambient noise levels
L3
Monday, 16-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L3
Tuesday, 17-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L3
Wednesday, 18-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

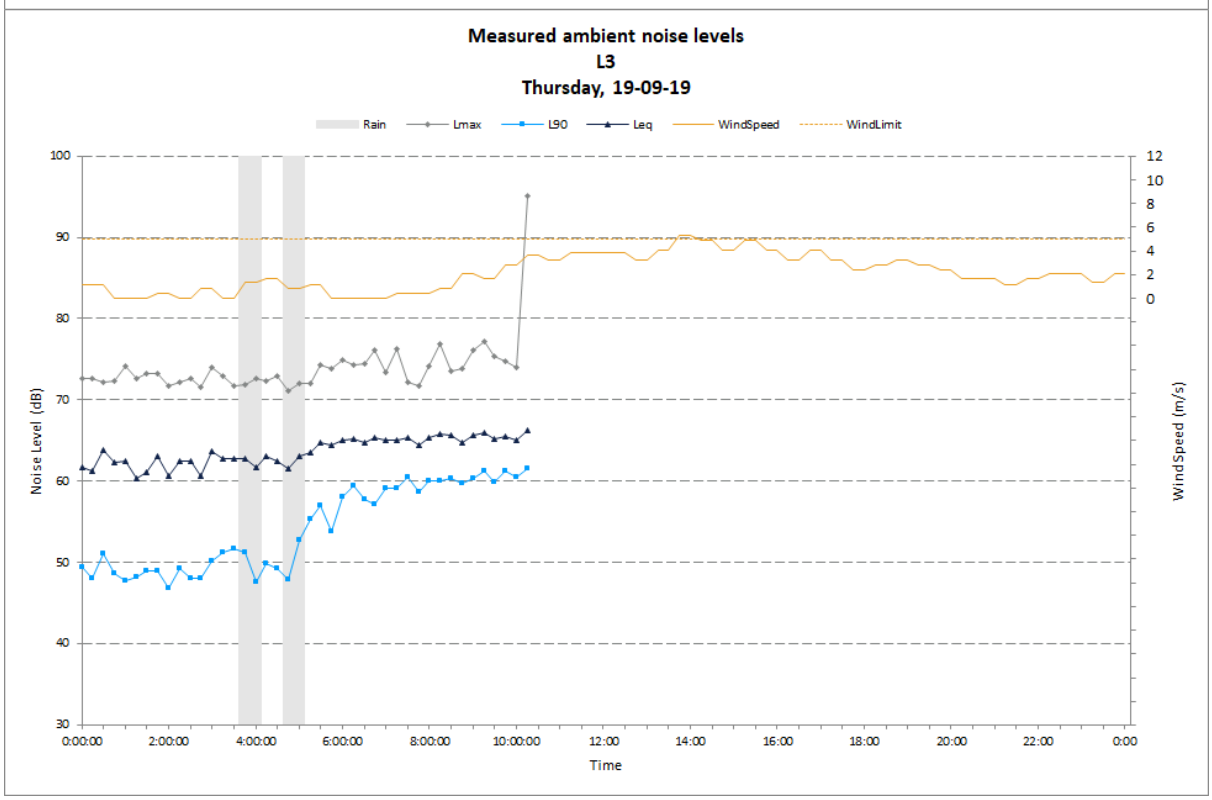
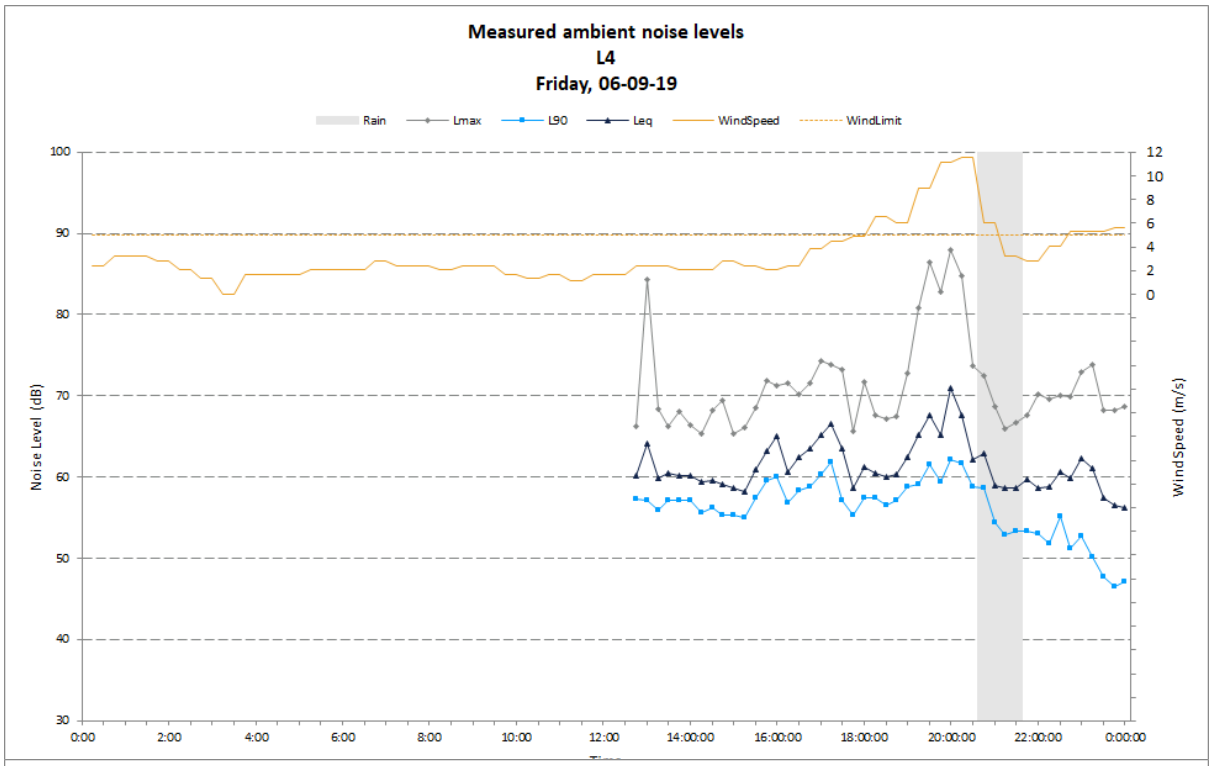
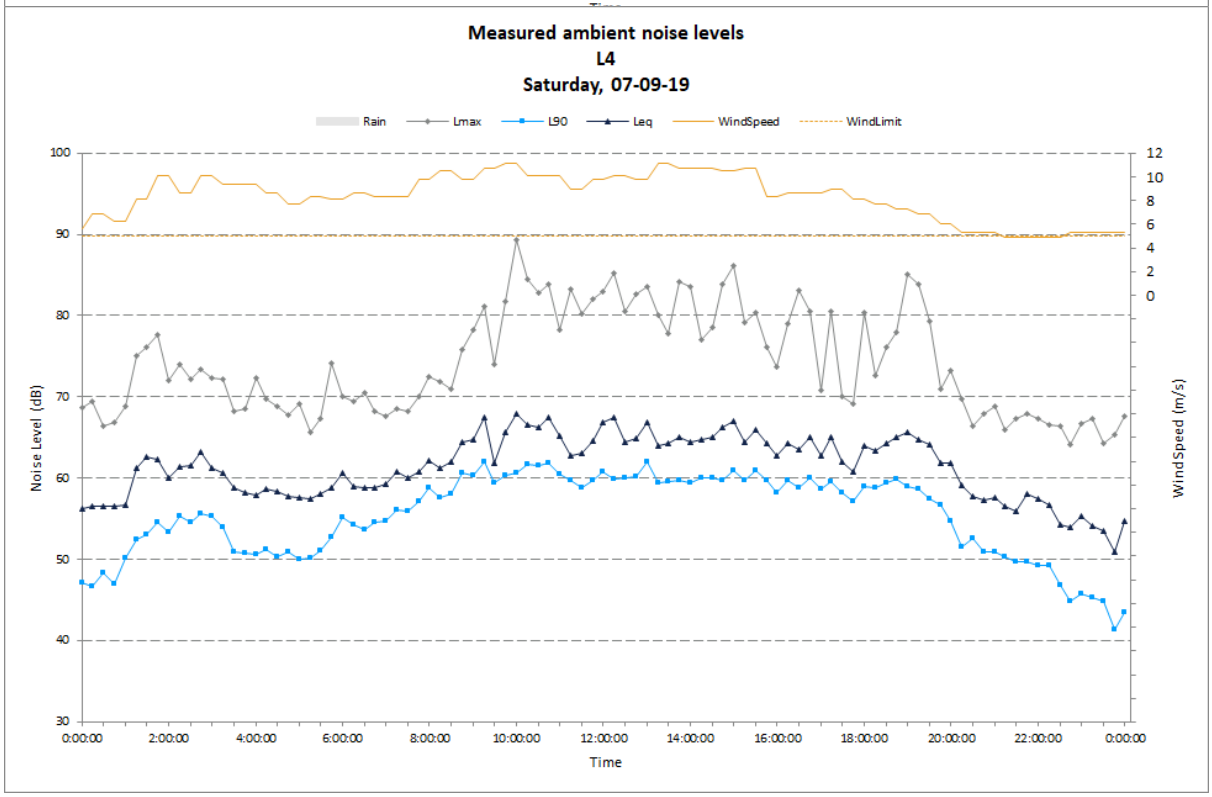

Measured ambient noise levels
L3
Thursday, 19-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

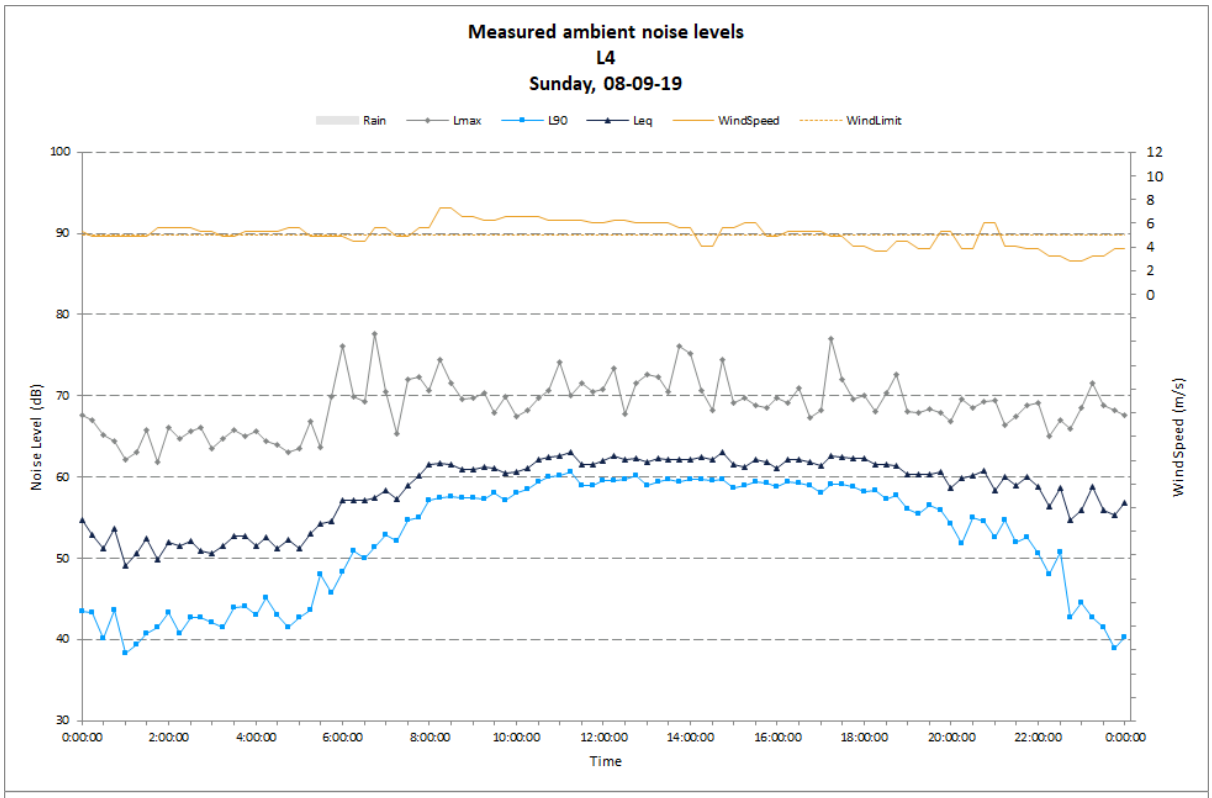
Table A.3 Summary of daily noise logging results – L4

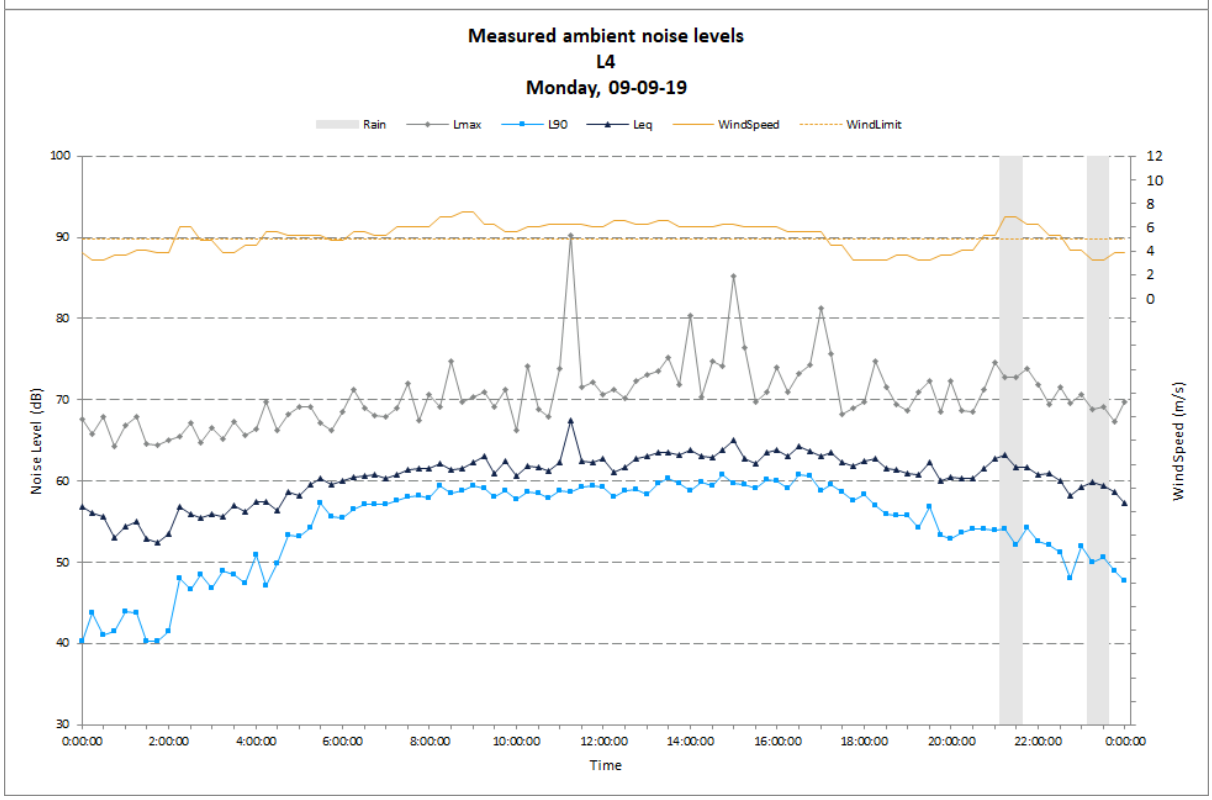
Date	RBL (Day)	RBL (Evening)	RBL (Night)	$L_{Aeq,15\ hour}$, dB (Day)	$L_{Aeq,9\ hour}$, dB (Night)
Thursday, 06-09-18	0	0	47	0	59
Friday, 07-09-18	0	50	41	0	54
Saturday, 08-09-18	57	52	40	61	58
Sunday, 09-09-18	58	53	46	63	60
Monday, 10-09-18	59	0	45	67	60
Tuesday, 11-09-18	55	55	46	64	63
Wednesday, 12-09-18	54	52	47	63	63
Thursday, 13-09-18	58	55	38	63	58
Friday, 14-09-18	56	52	34	61	57
Saturday, 15-09-18	53	53	43	61	62
Sunday, 16-09-18	54	51	0	61	0
Monday, 17-09-18	0	0	0	0	0
Tuesday, 18-09-18	0	57	0	0	0
Wednesday, 19-09-18	0	0	0	0	0
Overall	56	52	44	63	60

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


Measured ambient noise levels
L4
Friday, 06-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Saturday, 07-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
100
90
80
70
60
50
40
30
12
10
8
6
4
2
0
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00
Time


Measured ambient noise levels
L4
Sunday, 08-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Monday, 09-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
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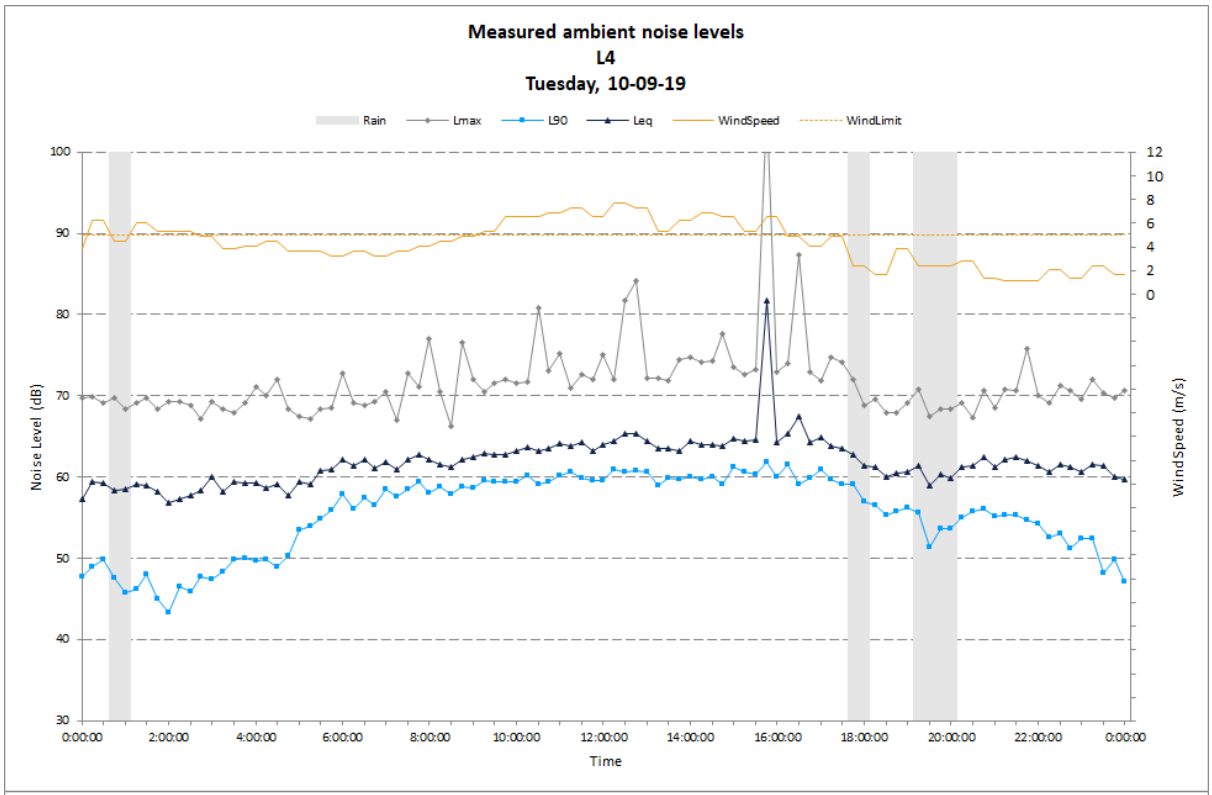
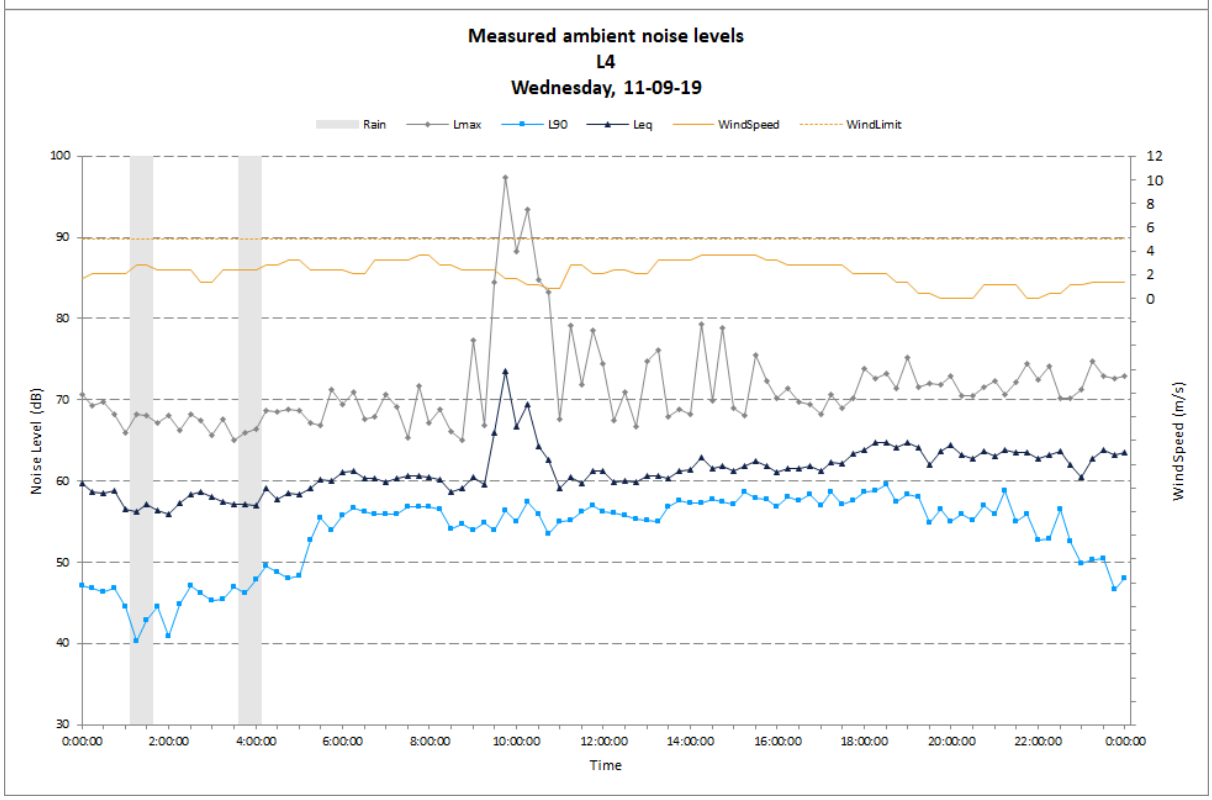
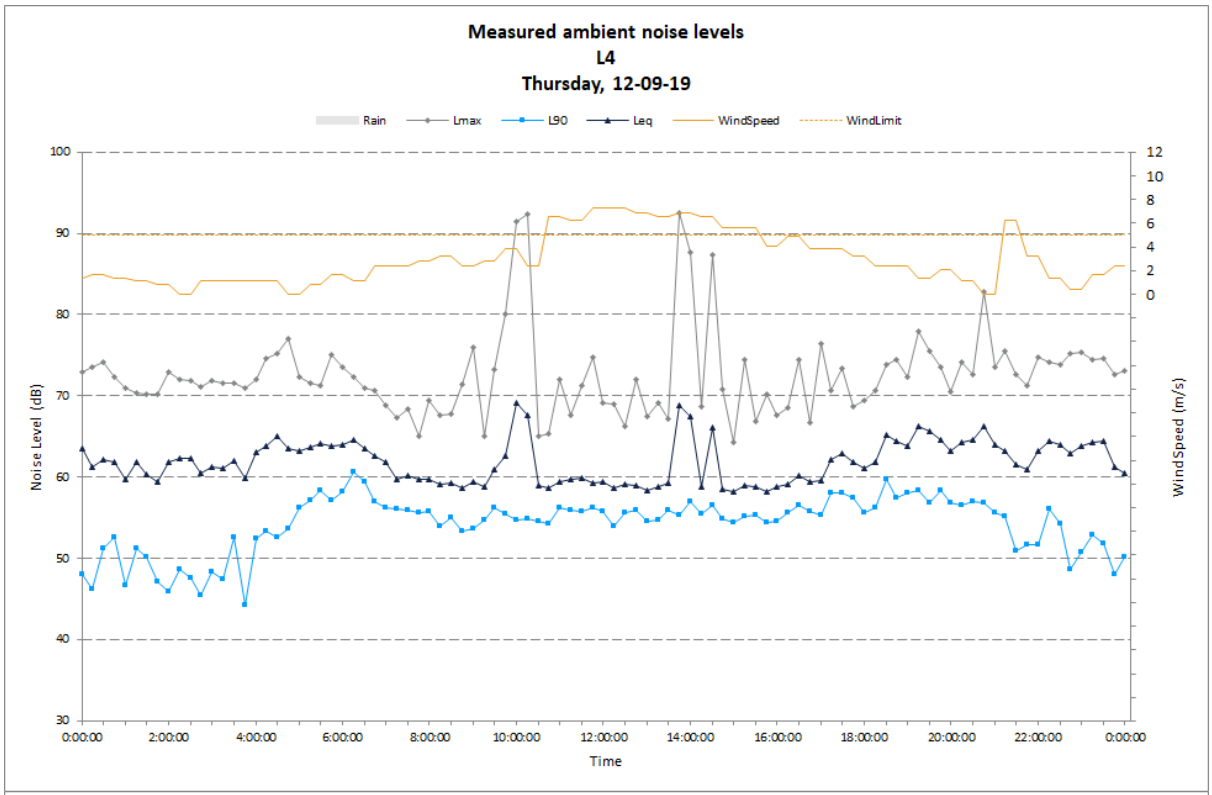
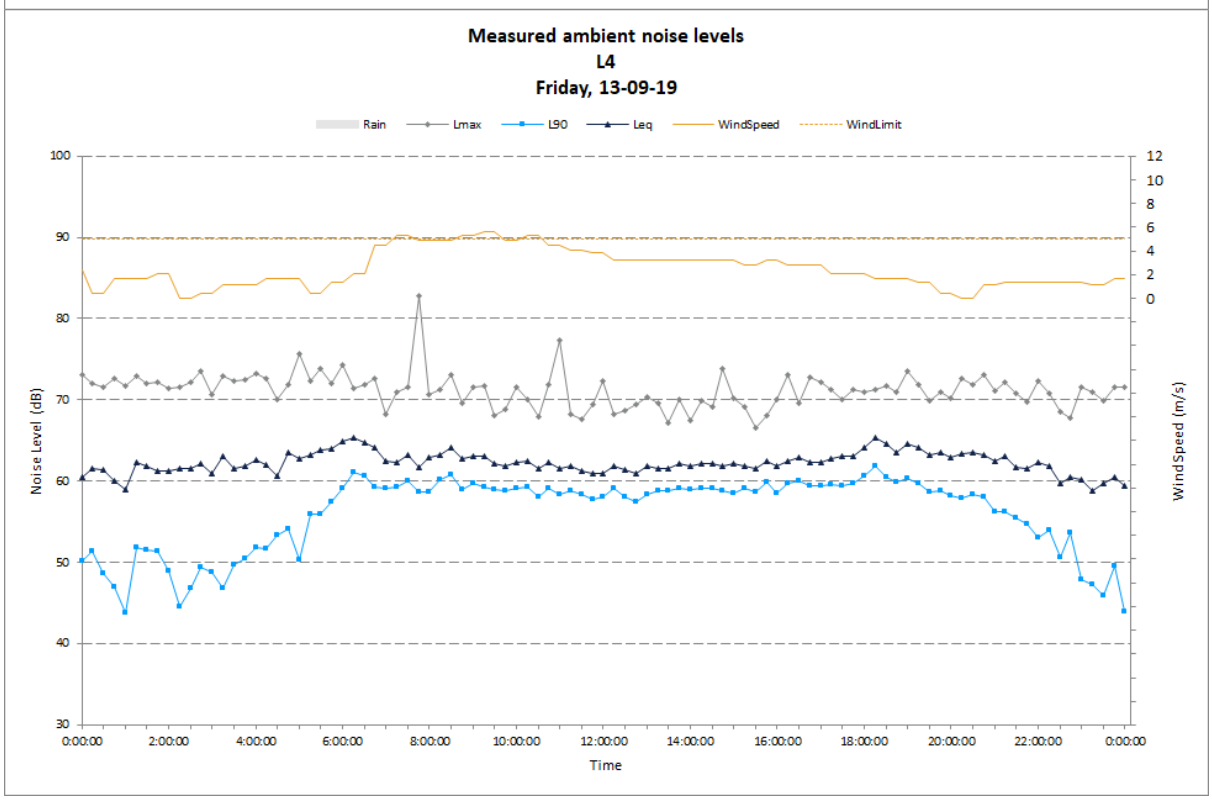
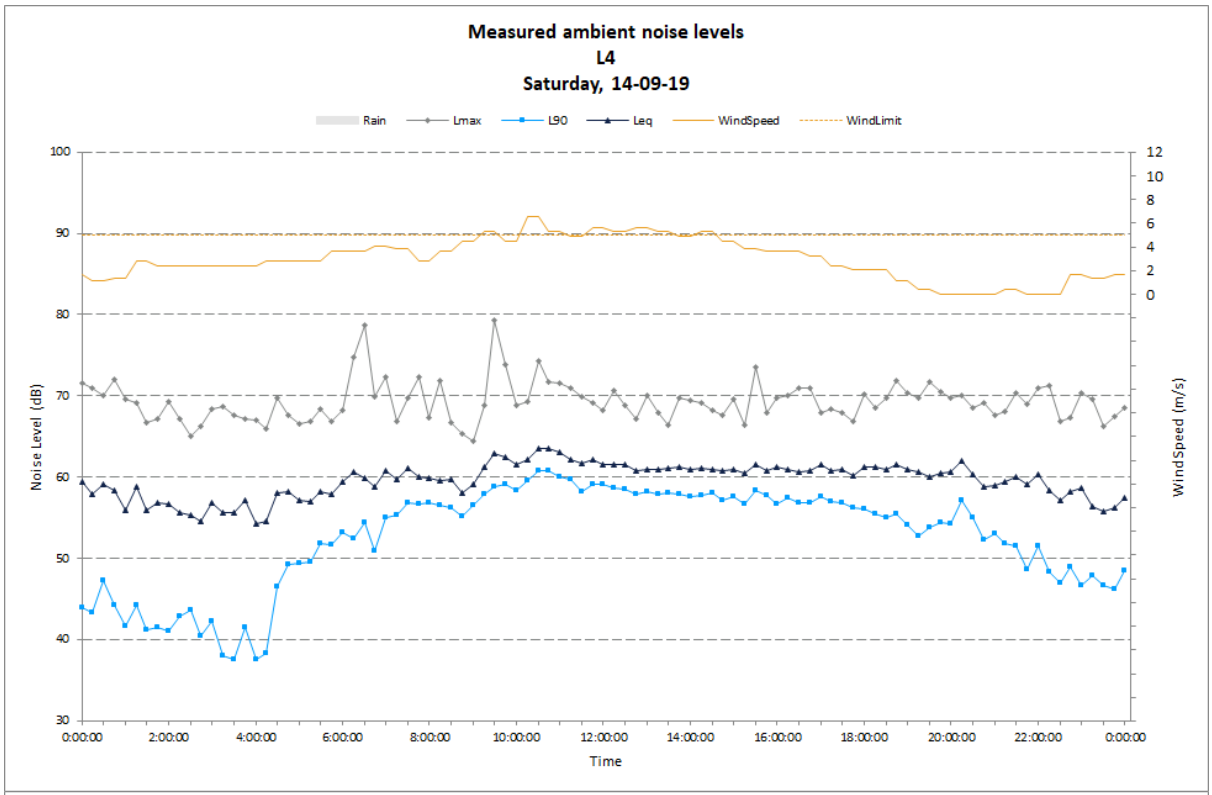
22:00:00
0:00:00

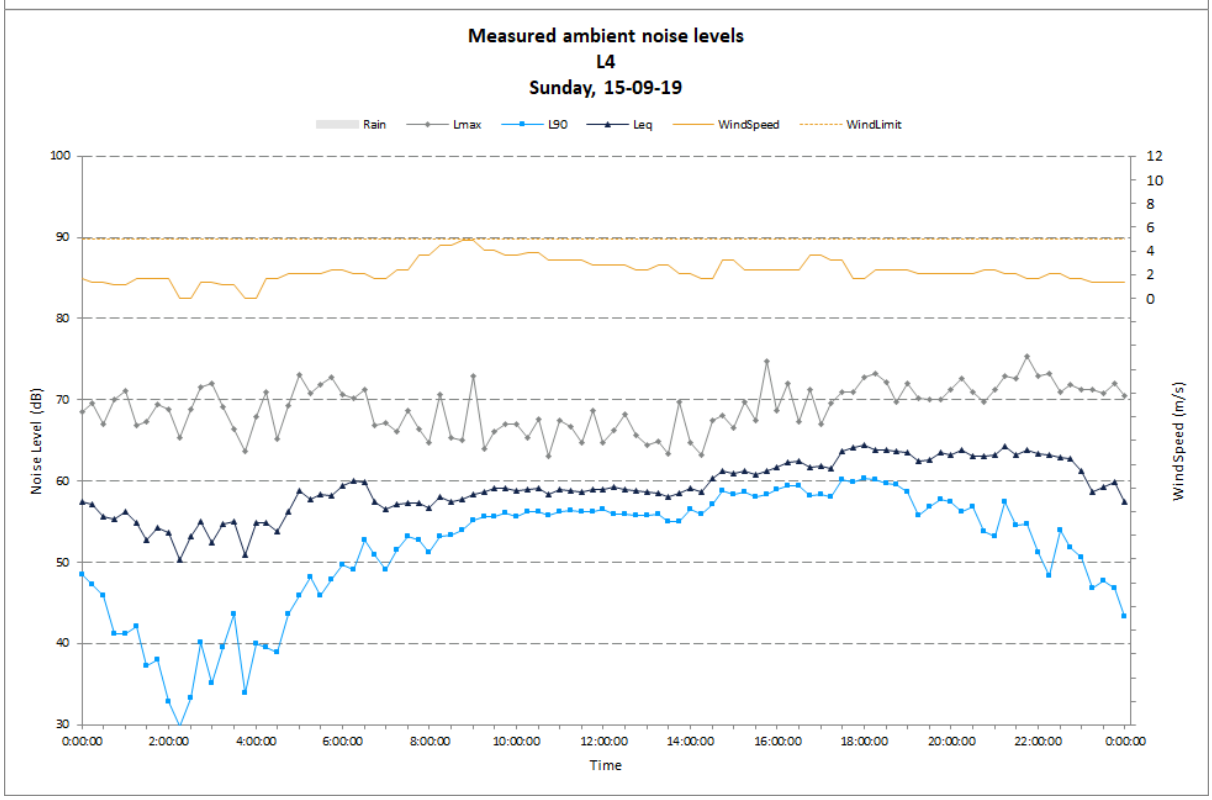

Measured ambient noise levels
L4
Tuesday, 10-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

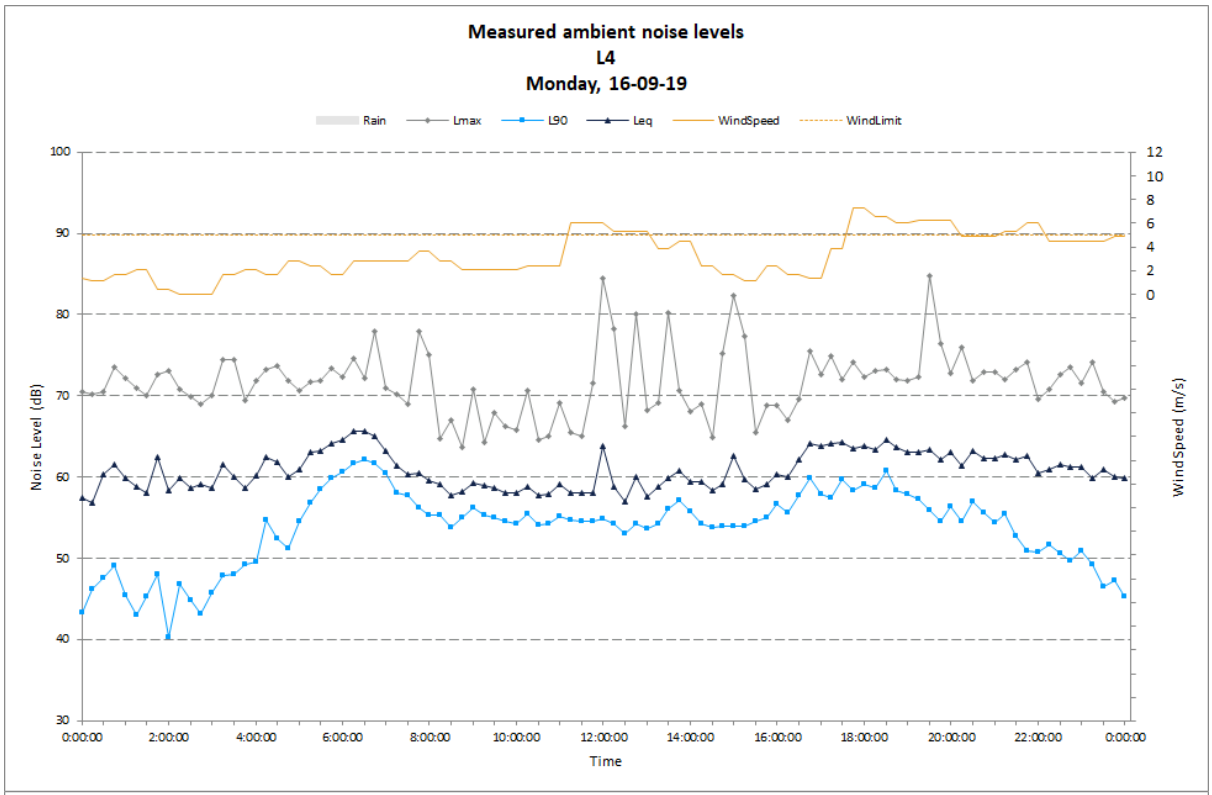

Measured ambient noise levels
L4
Wednesday, 11-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

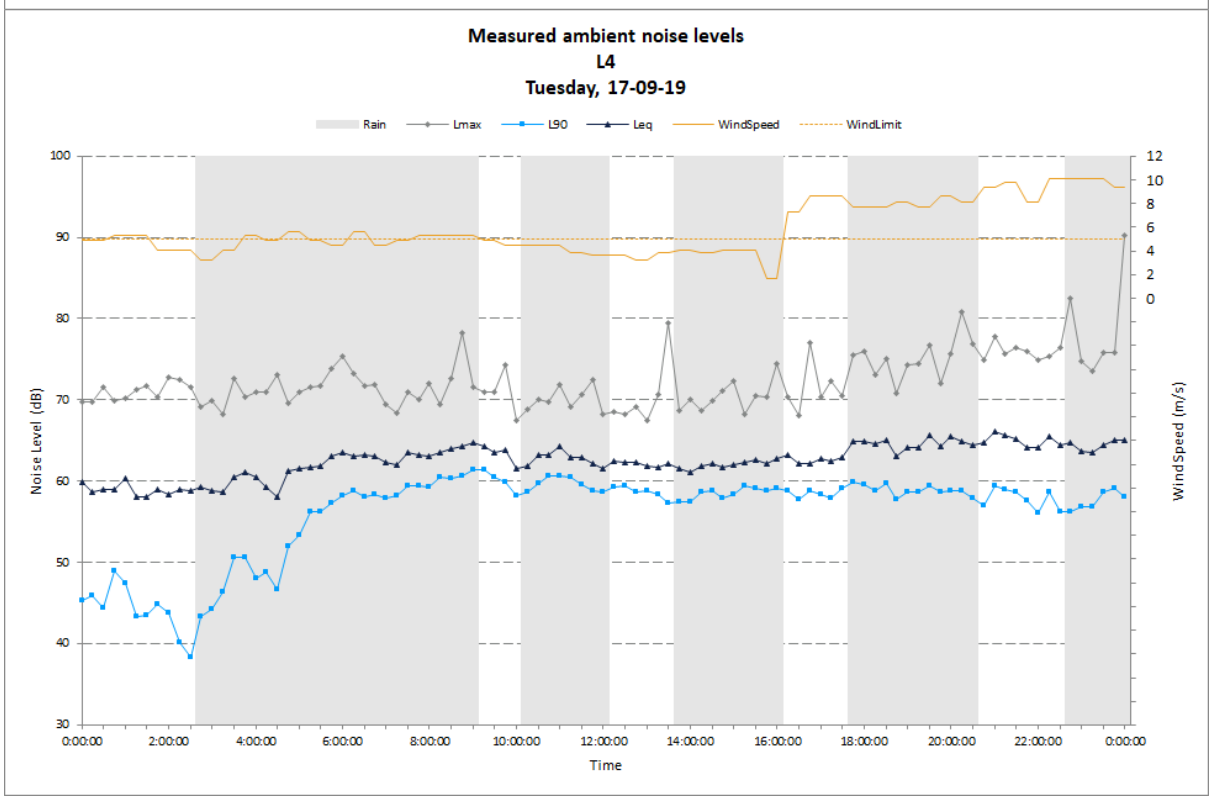

Measured ambient noise levels
L4
Thursday, 12-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

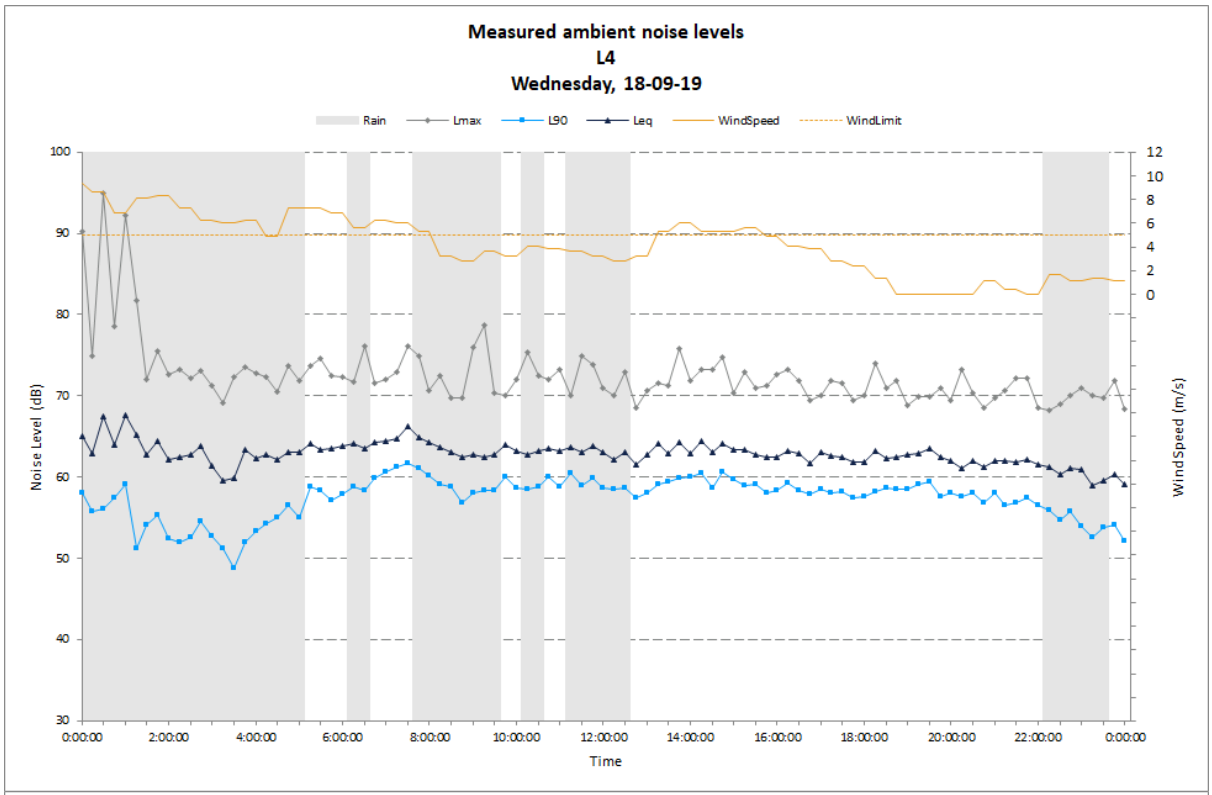

Measured ambient noise levels
L4
Friday, 13-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

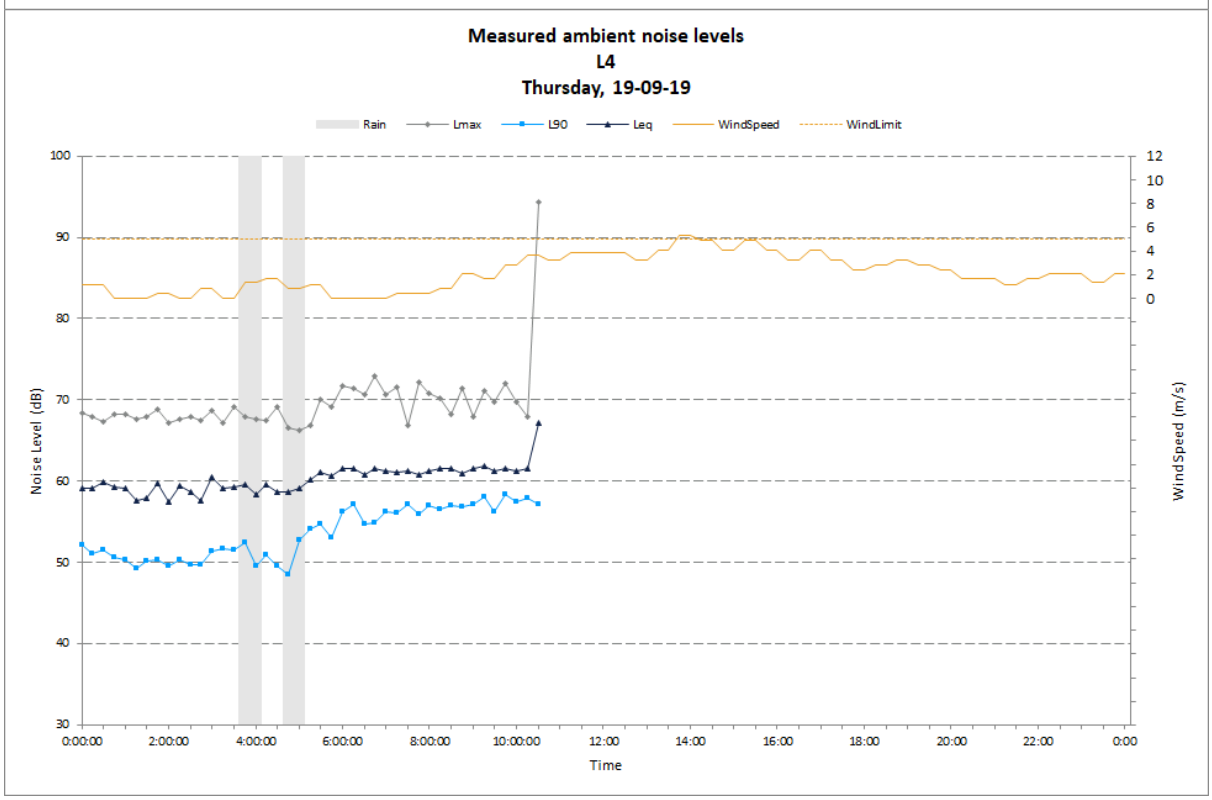

Measured ambient noise levels
L4
Saturday, 14-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Sunday, 15-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Monday, 16-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00

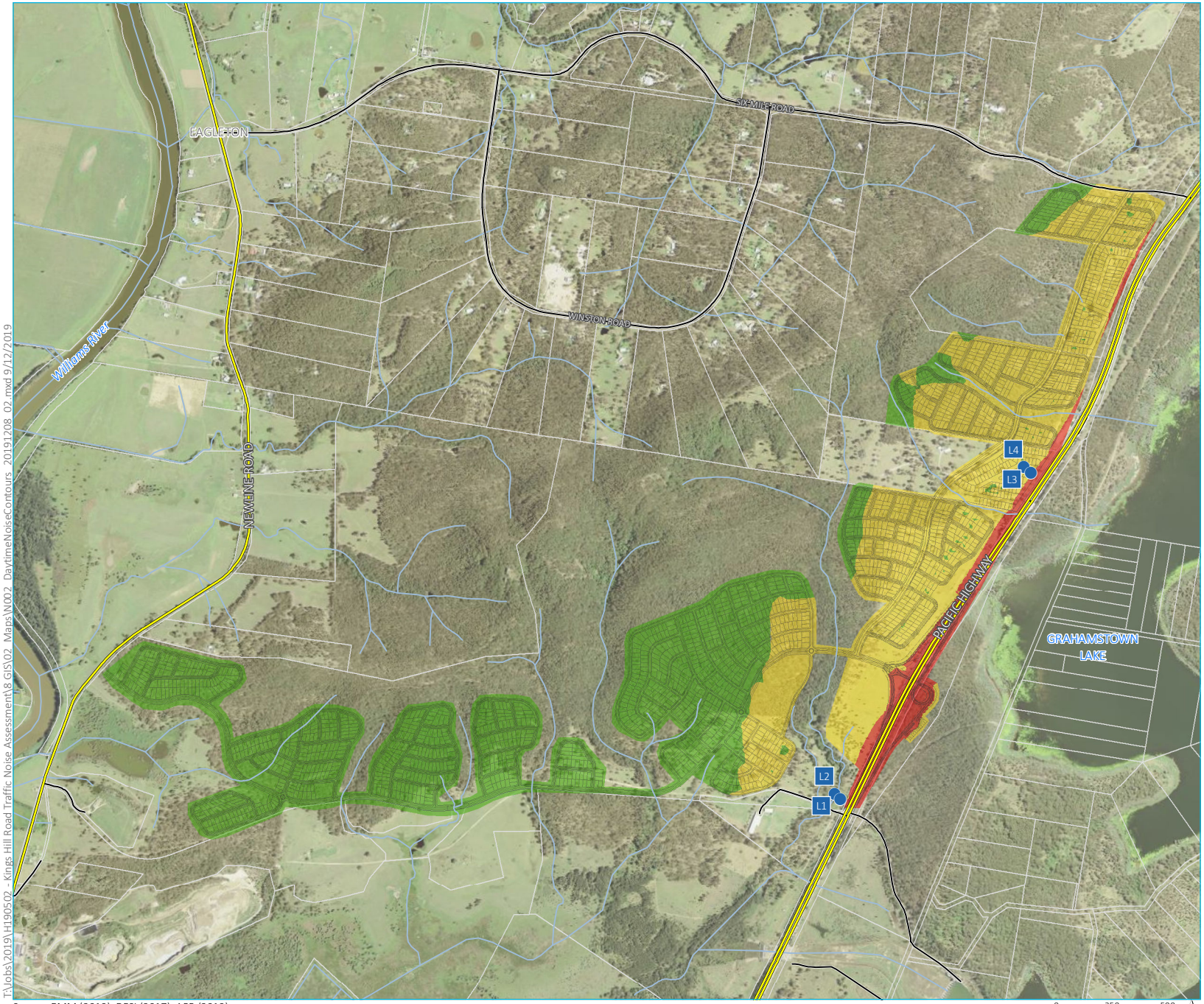

Measured ambient noise levels
L4
Tuesday, 17-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Wednesday, 18-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
0:00:00


Measured ambient noise levels
L4
Thursday, 19-09-19
Rain
Lmax
L90
Leq
WindSpeed
WindLimit
Noise Level (dB)
WindSpeed (m/s)
Time
0:00:00
2:00:00
4:00:00
6:00:00
8:00:00
10:00:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

Appendix B

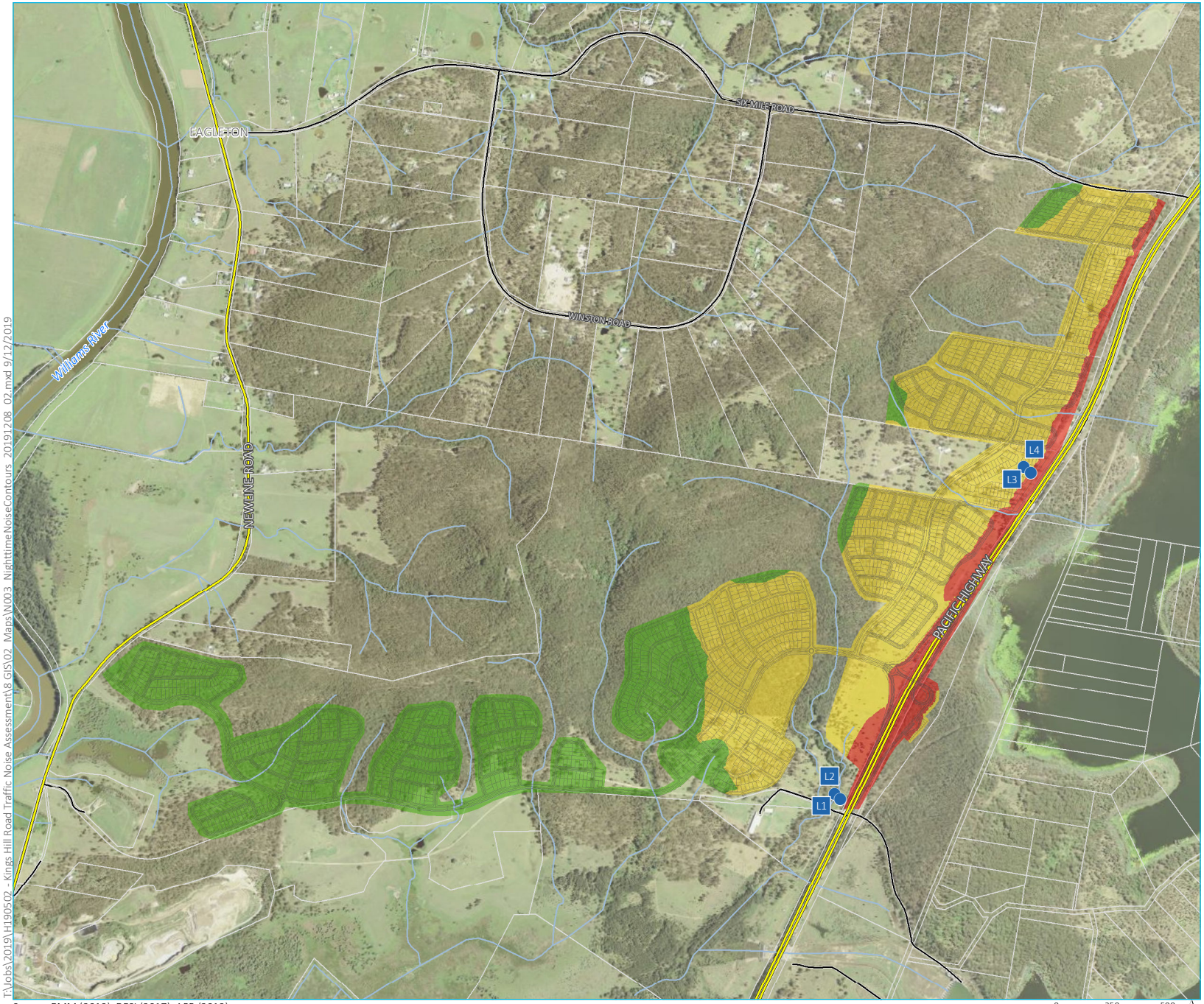
Noise contour figures



Road traffic noise level contours (without mitigation) - Day

Kings Hill Release Area
Road traffic noise assessment
Figure B.1

EMM
creating opportunities



KEY

- Noise monitoring location
- Project layout
- Cadastral boundary
- Main road
- Local road
- Watercourse/drainage line

Nightime noise level (dB)

- 0 - 45
- 45 - 60
- 61+

Source: EMM (2019); DFSI (2017); APP (2019)

0 250 500 m

GDA 1994 MGA Zone 56

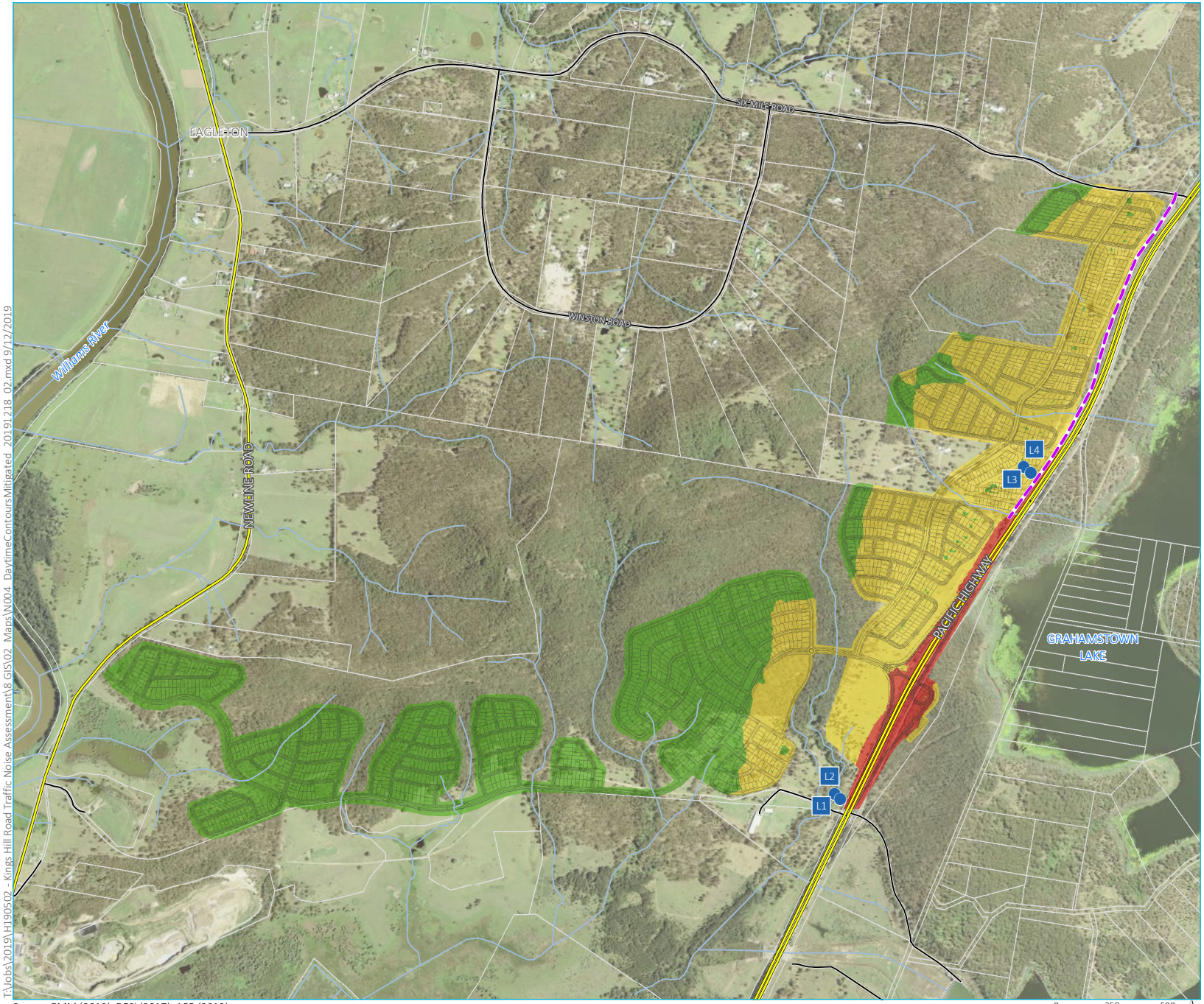
N

T:\Jobs\2019\H190502 - Kings Hill Road Traffic Noise Assessment\8 GIS\02 Maps\N003 NighttimeNoiseContours 20191208 02.mxd 9/12/2019

Road traffic noise level contours (without mitigation) - Night

Kings Hill Release Area
Road traffic noise assessment
Figure B.2

EMM
creating opportunities



KEY

- Noise monitoring location
- Project layout
- Noise barrier
- Cadastral boundary
- Main road
- Local road
- Watercourse/drainage line

Daytime noise level (dB)

- 0 - 50
- 50 - 65
- 66+

Source: EMM (2019); DFSI (2017); APP (2019)

0 250 500 m

GDA 1994 MGA Zone 56

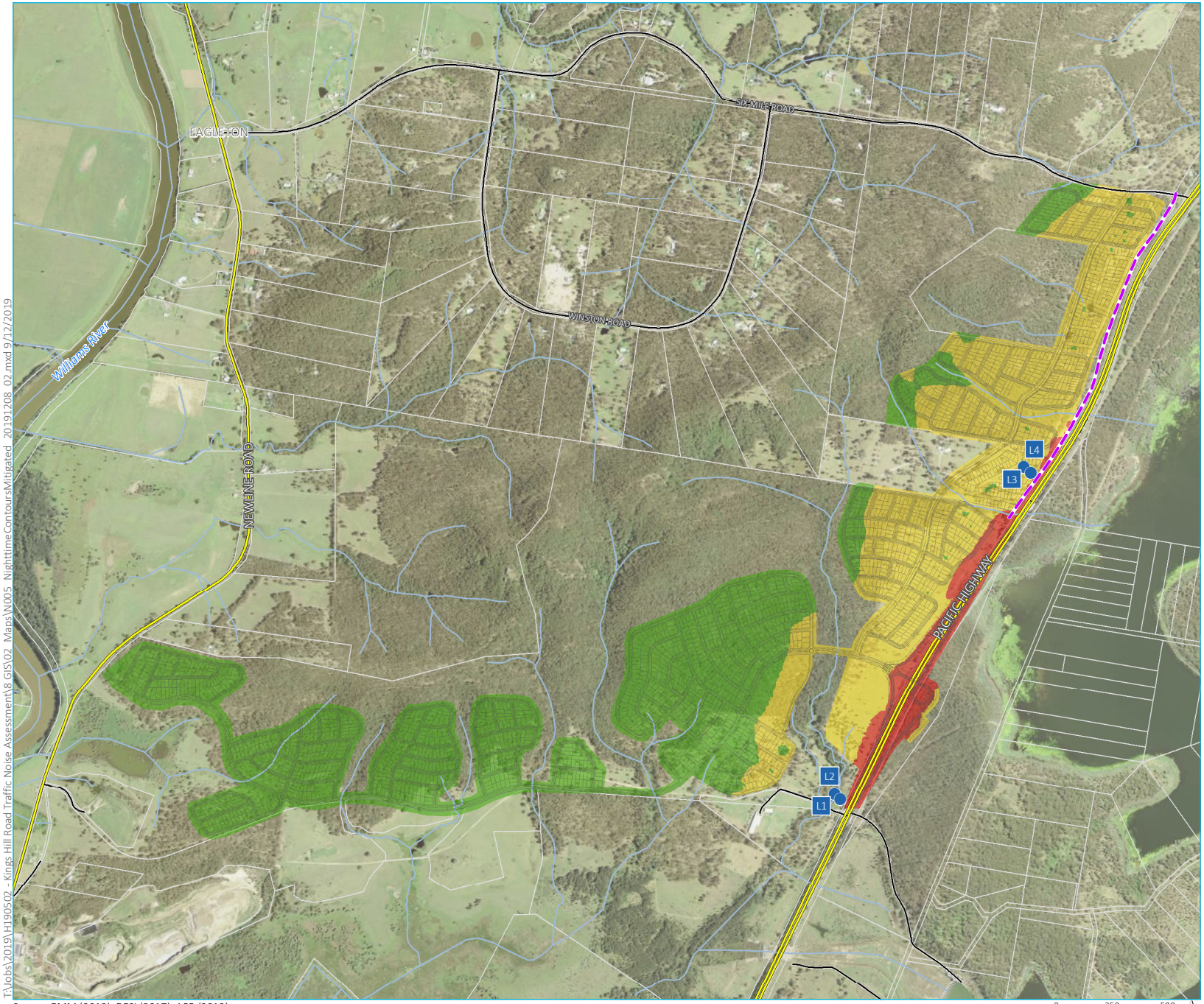
N

T:\Jobs\2019\H190502 - Kings Hill Road Traffic Noise Assessment\8 GIS\02 Maps\N004 DaytimeContoursMitigated 20191218 02.mxd 9/12/2019

Road traffic noise level contours (with mitigation) - Day

Kings Hill Release Area
Road traffic noise assessment
Figure B.3

EMM
creating opportunities



KEY

- Noise monitoring location
- Project layout
- Noise barrier
- Cadastral boundary
- Main road
- Local road
- Watercourse/drainage line

Nightime noise level (dB)

- 0 - 45
- 45 - 60
- 61+

Source: EMM (2019); DFSI (2017); APP (2019)

0 250 500 m

GDA 1994 MGA Zone 56

N

T:\Jobs\2019\H190502 - Kings Hill Road Traffic Noise Assessment\8 GIS\02 Maps\N005 NighttimeContoursMitigated 20191208 02.mxd 9/12/2019

Road traffic noise level contours (with mitigation) - Night

Kings Hill Release Area
Road traffic noise assessment
Figure B.4

EMM
creating opportunities