Jackson Environment And Planning Pty Ltd

Kembla Grange RRF
Revised Noise Assessment

October 2018

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Glossary

Term	Description
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
EPA	Environment Protection Authority
Feasible and reasonable (Office of Environment and Heritage definition)	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: Noise mitigation benefits (amount of noise reduction provided, number of people protected). Cost of mitigation (cost of mitigation versus benefit provided). Community views (aesthetics impacts and community wishes). Noise level for affected land use (existing and future levels, and changes in noise levels).
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Noise sensitive receiver	An area or place potentially affected by noise which includes: • A residential dwelling • An educational institution, library, childcare centre or kindergarten • A hospital, surgery or other medical institution • An active (e.g. sports field, golf course) or passive (e.g. national park) recreational area • Commercial or industrial premises • A place of worship
NPI	*Noise Policy for Industry* (EPA, 2017)
Rating background level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes.

1. Introduction

1.1 Introduction

Kembla Grange Recycling Pty Ltd are seeking a development modification under Section 4.55(1a) of the *Environmental Planning and Assessment Act* 1979 to permit operational changes to the Kembla Grange Resource Recovery Facility (RRF) located at 50 Wyllie Road, Kembla Grange.

As part of the development modification application, GHD Pty Ltd (GHD) has been engaged by Jackson Environment and Planning Pty Ltd (JEP) to undertake a revised noise assessment of the site.

A noise assessment of the site was previously undertaken by GHD in 2014 and submitted along with the Environmental Impact Statement (EIS). The noise assessment was subsequently revised during the EIS assessment process and the final report was issued in April 2015 *(Wollongong Recycling Kembla Grange Waste Recovery Facility Noise Assessment*, GHD 2015).

The noise sensitive receivers, applicable noise criteria, proposed site changes, modelling methodology and results at nearby sensitive receivers are detailed below. The updated noise assessment has been based on the final revision of the report issued in April 2015.

1.2 Scope

The tasks undertaken for this assessment included:

- Revision of the original noise modelling scenarios based on modifications to operations. GHD understand that an outdoor picking station (and associated processing equipment) and an indoor crushing plant are proposed as part of a development modification
- Undertaking a review of site aerials to identify any additional sensitive receivers in the area
- Undertaking background noise monitoring at two locations in accordance with the *Noise Policy for Industry* (NPI) (2017). The noise monitoring locations were consistent with the 2015 assessment. Attended measurements were also undertaken to establish existing site contributions at the monitoring locations
- Undertaking noise modelling with the proposed plant modifications
- Assessing compliance against the noise criteria in Condition B20 of the development consent and the NPI
- Preparing a revised noise assessment report summarising the above.

1.3 Limitations

This report: has been prepared by GHD for Jackson Environment And Planning Pty Ltd and *may only be used and relied on by Jackson Environment And Planning Pty Ltd for the purpose agreed between GHD and the Jackson Environment And Planning Pty Ltd as set out in section 1.2 of this report.*

GHD otherwise disclaims responsibility to any person other than Jackson Environment And Planning Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Site conditions (including noise levels) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Existing environment

2.1 Sensitive receivers and land uses

Noise and vibration sensitive receivers are defined based on the type of occupancy and the activities performed in the land use. Sensitive noise and vibration receivers could include both existing and proposed:

- Residences
- Educational institutes
- Hospitals and medical facilities
- Places of worship
- Passive and active recreational areas such as parks, sporting fields, golf courses. Note that these recreational areas are only considered sensitive when they are in use or occupied
- Commercial or industrial premises.

A water treatment facility is located to the west of the site, together with other heavy industrial uses such as 24 hour pipe coating operations, and steel manufacturing. Other uses to the west of the site include a substation and storage facilities and the Wollongong Waste and recovery Park (formerly known as the Whytes Gully Tip). To the east is the Macedonian Orthodox Church, vacant land, open space and the Wollongong Lawn Cemetery. Both adjacent uses are accessed via Wyllie Road.

To the north, buffered by bushland, is the residential neighbourhood of Farmborough Heights. The residences located to the north of the site are sited on an elevated rock shelf that is approximately 15-30 metres up slope above the proposed development site. The nearest residences are approximately 500 m from the proposed area of working. A vegetated buffer separates the closest residences to the north from the proposed development site.

To the south and south-west of the site is the Patrick Autocare Vehicle Storage Facility. Further to the south of the site opposite the Princes Highway is located residential housing of Kembla Grange, approximately 1000 m from the proposal.

Sensitive noise receivers surrounding the RRF are identified in Table 2-1 and shown in Figure 1.

Table 2-1 Noise sensitive receivers

Receiver	Location
Macedonian Orthodox Church	11 Wyllie Road, Kembla Grange
Houses on Fairloch Avenue, Farmborough Heights	Fairloch Avenue, Farmborough Heights
Kingston Lodge	14A Kingston Town Dr, Kembla Grange
Ian McLennan Park	Access off Wyllie Road
Patrick Autocare Vehicle Storage Facility	South and South-west of the site

Figure 1 Noise monitoring locations and sensitive receivers (AERIAL: Google Earth)

2.1 Background noise monitoring

Noise monitoring was undertaken from 11 and 12 September to 24 September, 2018 at two locations near the proposed RRF (refer to Figure 1). The locations were kept consistent with the 2015 assessment.

Noise monitoring was undertaken to determine background noise levels for the noise assessment. Monitoring was undertaken at locations which were secure from theft and vandalism and considered representative of the ambient environment in the vicinity of the proposal site.

Noise monitoring was undertaken using two SVAN977 environmental noise loggers programmed to accumulate L_{Amax}, L_{Aeq} and L_{AN} noise descriptors continuously over the entire monitoring period. Equipment details are shown in Table 2-2.

Prior to deployment, a calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dB(A) at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dB(A).

Table 2-2 Noise monitoring locations and equipment details

Location	Equipment details	Equipment settings
Location 1: 6 Bardess Crescent, Farmborough Heights	SV977 Type 1 SN: 45733	A-weighted Fast time response 15 minute intervals Pre-Cal: 92.82 dB(A) Post-Cal: 93.04 dB(A)
Location 2: Boundary of site and church	SV977 Type 1 SN: 36873	A-weighted Fast time response 15 minute intervals Pre-Cal: 94.37 dB(A) Post-Cal: 94.52 dB(A)

2.1.1 Unattended noise monitoring results

A summary of calculated background L_{A90} and ambient L_{Aeq} (day, evening and night) noise levels for the monitoring periods are provided in Table 2-3 and Table 2-4 respectively. The noise data has been filtered in accordance with the *Noise Policy for Industry*, excluding invalid data. Invalid data refers to:

- when wind speeds are greater than 5 m/s at logger height (corresponding to a wind speed of 7.4 m/s at a height of 10 m for the area)
- when rainfall occurs.

Weather data was sourced from the nearest Bureau of Meteorology weather station at Bellambi Point.

The measured rating background levels are similar or lower at both locations to those measured as part of the 2015 noise assessment:

- At the site boundary, the 2015 rating background levels were 39 dB(A) during the evening and 35 dB(A) during the night time period. The 2018 measured rating background levels are 39 dB(A) during the evening and 32 dB(A) during the night time period
- At 6 Bardess Crescent, the 2015 rating background levels were 33 dB(A) during the evening and 33 dB(A) during the night time period. The 2018 measured rating background levels are 31 dB(A) during the evening and 26 dB(A) during the night time period.

Daily charts of the monitoring results are presented in Appendix A. The peaks in the charts correspond to rail passbys within the rail corridor adjacent to the monitoring locations.

A detailed description of the acoustic terms can be found in the glossary at the start of this report.

Table 2-3 6 Bardess Crescent summary of noise monitoring results, dB(A)

Date	Rating background level 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
11/09/2018	37.5	35.9	26.8	51.6	49.1	50.5
12/09/2018	34.0	28.6	24.5	50.6	44.3	48.2
13/09/2018	34.8	31.6	27.2	52.0	37.2	47.7
14/09/2018	36.1	-	-	51.8	-	-
15/09/2018	37.4	32.9	25.1	50.4	38.9	48.4
16/09/2018	37.8	29.2	28.2	52.0	39.8	47.0
17/09/2018	34.3	31.2	26.5	44.9	43.4	48.3
18/09/2018	39.1	33.6	26.3	49.7	47.3	49.8
19/09/2018	36.6	32.3	23.8	50.7	46.0	52.1
20/09/2018	34.2	27.0	24.6	51.2	38.0	45.9
21/09/2018	33.3	29.8	25.3	48.4	43.9	46.5
22/09/2018	34.2	-	-	47.1	-	-
23/09/2018	39.0			46.8		
24/09/2018	37.5	35.9	26.8	51.6	49.1	50.5
Overall RBL and Leq	**36.1**	**31.4**	**25.8**	**50.3**	**44.4**	**48.8**

Note 1: '-'refers to invalid data that has been excluded from the data set due to adverse weather conditions

Table 2-4 Site boundary summary of noise monitoring results, dB(A)

Date	Rating background level 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day	Evening	Night	Day	Evening	Night
11/09/2018		35.4	30.2		48.8	45.1
12/09/2018	41.3	41.1	32.9	48.7	47.2	45.8
13/09/2018	41.4	40.9	34.5	49.2	47.6	46.4
14/09/2018	38.1	40.3	33.3	47.7	48.7	46.4
15/09/2018	36.8	41.7	35.1	48.2	51.6	44.2
16/09/2018	41.6	37.5	29.7	54.0	45.8	46.1
17/09/2018	40.8	36.1	31.2	48.9	43.7	45.0
18/09/2018	37.4	39.0	33.9	46.3	44.2	46.4
19/09/2018	38.8	38.9	30.6	47.9	44.4	45.0
20/09/2018	45.2	38.5	32.4	49.0	48.8	46.8
21/09/2018	39.6	39.1	31.5	47.3	47.5	45.6
22/09/2018	34.4	37.1	31.2	46.0	43.9	43.7
23/09/2018	41.4	-	-	48.8	-	-
24/09/2018	42.6			47.3		
Overall RBL and Leq	**40.8**	**39.0**	**32.0**	**48.9**	**47.5**	**45.6**

Note: '-'refers to invalid data that has been excluded from the data set due to adverse weather conditions

2.1.2 Attended noise monitoring results

Attended noise monitoring was also undertaken during site visits to supplement the unattended noise monitoring data. A summary of the attended noise monitoring results are shown in Table 2-5.

The noise monitoring site at Bardess Crescent is adjacent the rail line however a large noise barrier is situated between the line and all of the houses in Farmborough Heights. This would mitigate train noise as well as other noise coming from industry in Kembla Grange including the proposal.

Table 2-5 Attended noise monitoring summary

Location	$L_{Aeq,\ 15min}$	$L_{Amax,15min}$	Observations
6 Bardess Crescent	46.9	61.3	Intermittent RRF noise, bird noise
	54.3	65.8	
Site boundary	53.9	74.3	Bird noise, road traffic noise from the Princes Highway, noise from works associated with the renovation of the Macedonian Church
	51.7	73.5	

3. Compliance criteria

3.1 Operational noise criteria

The NPI provides guidance on the assessment of operational noise impacts. The guidelines include both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver. The NPI also provides guidance on sleep disturbance impacts.

The NPI noise criteria are planning levels and are not mandatory limits required by legislation however the noise criteria will assist the determining authority to assess operational noise impacts. Where noise criteria are predicted to be exceeded, feasible and reasonable noise mitigation strategies should be considered. Feasible and reasonable noise mitigation measures should consider the economic, social and environmental costs and benefits of the development against the noise impacts.

The intrusive noise criteria controls the relative audibility of operational noise compared to the background level at residential receivers. The amenity criteria limits the total level of extraneous noise for all receiver types. Both sets of criteria are calculated and, in the case of continuous noise sources, the lower of the two in each time period normally apply. For noise sources with intermittent characteristics both noise criteria should be assessed independently.

3.1.1 Intrusive criteria

The intrusive criteria are determined by a 5 dB(A) addition to the measured (or adopted) background level with the following minimum background levels:

- 35 dB(A) during the day time period
- 30 dB(A) during the evening and night time periods.

The NPI recommends that the intrusive noise criteria for the evening period should not exceed the daytime period and the night-time period should not exceed the evening period. The intrusive noise criteria are only applicable to residential receivers.

3.1.2 Amenity criteria

The amenity criteria are determined based on the overall acoustic characteristics of the receiver area, the receiver type and the existing level of industrial noise.

Residential receiver areas are characterised into ‘urban’, ‘suburban’, ‘rural’ or other categories based on land uses, the existing level of noise from industry, commerce, and road traffic.

Amenity criteria are also provided for other sensitive land uses such as schools, hospitals, places of worship and recreational areas.

The amenity criteria aim to limit continual increases in noise levels from industrial noise sources and apply to all industrial noise sources at the receiver location, rather than just the noise source from the proposed development. The NPI amenity criteria are provided in Table 3-1.

Table 3-1 NPI amenity criteria

Type of receiver	Noise amenity area	Time of day	Recommended amenity noise level $L_{Aeq(period)}$ noise level, dB(A)
Residence	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom	All	When in use (noisiest 1 hour period)	35 (internal)
Hospital w ard	All	When in use (noisiest 1 hour period)	35 (internal) 50 (external)
Place of w orship	All	When in use	40 (internal)
Passive recreation	All	When in use	50
Active recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	5 dB(A) above recommended noise amenity area

3.1.3 Meteorological conditions

Noise propagation can be enhanced by wind conditions and temperature inversions. The NPI states that:

"Two options are available for the proponent to consider meteorological effects:

1. *Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur- a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night* ***OR***
2. *Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time*

period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment."

The noise modelling algorithm used in this assessment takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation. Therefore, this assessment follows the more conservative first approach outlined in the NPI.

3.1.4 Modifying factor adjustments

The NPI requires that modifying factor adjustments be added to the measured or predicted noise levels if the noise sources contain tonal, low frequency or intermittent characteristics, which have the potential to increase annoyance. The NPI also provides modifying factor adjustments for duration if a single noisy event duration ranges from 1.5 minutes to 2.5 hours.

The maximum adjustment (where two or more modifying factors are present) is 10 dB(A), excluding the duration correction.

The modifying factor adjustments are summarised in Table C1 of the NPI and further discussed in Section 4.1.3.

3.1.5 Sleep disturbance during operation

The NPI recommends a maximum noise level assessment to assess the potential for sleep disturbance impacts. These impacts include awakenings and disturbance to sleep stages. An initial screening test for the maximum noise levels events should be assessed to the following levels.

- $L_{Aeq(15\ min)}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater.

If the screening test indicates there is a potential for sleep disturbance then a detailed maximum noise level assessment should be undertaken. The detailed assessment should cover 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.

3.2 Existing development consent

The site is subject to an existing development consent (SSD 5300) which prescribes the applicable noise criteria at the sensitive receivers identified in Section 2. The noise criteria is reproduced in Figure 2. The 'dwelling on lot 11 DP 878167' corresponds to the Macedonian Orthodox Church from Table 2-1.

Noise criteria

B20. The Applicant shall ensure that noise generated by the Development does not exceed the noise criteria in Table 3.

Table 3: Noise criteria (dB(A))

Location	Noise criteria (dB(A))		
	Day	Morning Shoulder	
	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (1\ minute)}$
The dwelling on Lot 11 DP 878167	35	35	45
Any dwelling in Farmborough Heights	37	37	47
Any dwelling in the vicinity of Kingston Town Drive	41	41	51

Figure 2 SSD 5300 Condition B20 – Applicable noise criteria

3.3 Proposal specific criteria

The operational noise criteria at the residential receivers surrounding the proposal site are provided in Table 3-2 and are based on criteria discussed in Section 3.1.

It should be noted that the RRF operates during the day-time period. Therefore, to exclude potential noise contributions from the RRF to the background noise levels, the minimum recommended background noise level of 35 dB(A) has been conservatively adopted during the day time period (in accordance with the NPI).

The evening and night time noise criteria for Kingston lodge and other houses in this area have been developed using the noise monitoring data adjacent the church. However, background noise levels at Kingston Lodge would be higher due to the proximity to the Princes Highway; therefore the criterion is considered conservative.

The development consent criteria are also presented in Table 3-2 for the day time period. The consent criteria are generally more stringent than the derived NPI noise criteria.

Table 3-2 Operational noise criteria at sensitive receivers

Receiver	Time period	Amenity criteria (acceptable noise level)[1] $L_{Aeq(period)}$	RBL, $L_{Aeq(15min)}$	Intrusive criteria, $L_{Aeq(15min)}$	NPI noise criteria (external)	Existing development consent criteria, $L_{Aeq(15min)}$ (Day)	Sleep disturbance criteria L_{Amax} (external)
Macedonian Orthodox Church	When in use	50 (external)[3]	-	-	**50 $L_{Aeq(period)}$**	**35 $L_{Aeq(15min)}$**	-
Houses on Fairloch Avenue, Farmborough Heights	Day	55	35[2,4]	40	**40 $L_{Aeq(15mini)}$**	**37 $L_{Aeq(15min)}$**	
	Evening	45	31	36	36 $L_{Aeq(15min)}$	-	
	Night	40	30[4]	35	35 $L_{Aeq(15min)}$	-	48 L_{Amax}
Kingston lodge	Day	55	35[2,4]	40	**40 $L_{Aeq(15min)}$**	**41 $L_{Aeq(15min)}$**	
	Evening	45	39	44	44 $L_{Aeq(15min)}$	-	
	Night	40	32	37	37 $L_{Aeq(15min)}$	-	50 L_{Amax}
Ian McLennan Park	When in use	50	-	-	**50 $L_{Aeq(period)}$**		-
Patrick Autocare Vehicle Storage Facility	When in use	65	-	-	**65 $L_{Aeq(period)}$**		-

Note 1: With consideration to the NPI 'noise amenity area' classification, the residential receivers surrounding the site have been classified as 'suburban'.

Note 2: The RRF operates during the day-time period, therefore to exclude noise emissions from the RRF (in accordance with the NPI) the minimum background noise measurements for the day-time period were used to conservatively establish the day intrusive noise criteria.

Note 3: Assuming open windows provide a 10 dB(A) reduction in noise from outside the building to inside the church.

Note 4: The NPI recommends a minimum background level of 35 dB(A) during the day time period and 30 dB(A) during the evening and night time periods.

4. Operational noise impact assessment

4.1 Operational noise

4.1.1 Noise generating equipment

The 2015 noise assessment considered the following noise sources: the Waste Recovery Facility (WRF) building, construction/demolition waste drop-off area, and construction equipment/vehicles on the site.

As part of the development modification, the following operational changes are proposed:

- **Fixed picking station:** The existing crusher and screen plant will be replaced by a fixed picking station. Additional outdoor noise sources associated with this fixed picking station will include a Terex screen, de-stoning screen and a Cummins diesel generator. The picking station will be fully enclosed and compared to the external noise sources, significant noise from internal picking activities is not anticipated.
- **Indoor crushing plant:** The internal equipment in the WRF building will be replaced. Previously, a slow speed and a high speed shredder were modelled internally. These will be replaced by a 225 tonne/hour horizontal impactor crusher and a deck horizontal screen. Noise contributions from other sources are not expected to be significant.

Based on the proposed changes, the additional noise sources are listed in Table 4-1. All other noise sources and assumptions were as per the 2015 assessment.

Table 4-1 Revised noise sources, dB(A)

Equipment	Sound power level (dB(A))	Source
Terex screen	109	Measured on site, 87 dB(A) at 5m
De-stoning screen	104	Provided by client
Cummins diesel generator	104	Measured on site, 82 dB(A) at 5m
WRF building (Crusher and screen internal)	89 (Internal)	Calculated based on screen and crusher noise levels provided by client. Considered to be conservative based on site measurements.

4.1.2 Modelling methodology

To assess compliance with the noise criteria, noise predictions were undertaken for the proposed operations at the RRF. Noise modelling was undertaken using CadnaA v4.4 and the *ISO 9613-2, 'Acoustics – Attenuation of sound during propagation outdoors'* algorithm. Ground absorption, reflection, terrain and relevant shielding objects are taken into account in the calculations.

The following assumptions and calculation parameters were used in the noise model and are consistent with the 2015 noise assessment:

- Land was modelled assuming a mixture of hard and soft ground with a ground absorption coefficient of 0.5
- The noise model was used to predict noise levels during a typical worst case 15 minute period of operation where all equipment is running at full power

- Atmospheric absorption was based on an average temperature of 20 °C and an average humidity of 70%
- The algorithm also takes into account the presence of a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation
- Foliage to the north of the site has been included in the noise model at a height of 3 m
- The noise barrier between the rail corridor and Fairloch Avenue has been modelled as 3 m high. This is considered conservative as the noise barrier is higher than this
- The WRF building has been modelled with a noise reduction index R_w of 26 to account for the attenuation of noise from inside to outside of the building. This is typical of galvanised steel sheets.

4.1.3 Modifying factor adjustments

The noise modelling undertaken is considered worst-case with all machinery assumed to be operating simultaneously for the entire time period.

Site measurements do not indicate the presence of tonal or low frequency components.

The site does create intermittent noise however the NPI states that a correction is only applied to the night time period. Site operations during the 6am to 7am period fall into the night time period. However, this time period is characterised by increasing noise levels and is a night to day time 'shoulder period' as per the NPI .

Hence, no modifying adjustments have been applied.

4.1.4 Predicted operational noise levels

The predicted noise levels for site operations are shown in Table 4-2. The predicted noise levels from the 2015 assessment are also provided for comparison.

The noise levels from the revised operations are predicted to decrease and are below the NPI and consent noise criteria at all sensitive receivers.

Table 4-2 Predicted day time operational noise levels, dB(A)

Receiver	Noise criteria (NPI)	Noise criteria (Site consent conditions)	Predicted noise level (2015)	Predicted noise level (Revised operations, 2018)
Macedonian Orthodox Church	50 $L_{Aeq(period)}$	35	32	31
Residences on Fairloch Avenue, Farmborough Heights (Ground floor)	40 $L_{Aeq(15min)}$	37	37	35
Residences on Fairloch Avenue, Farmborough Heights (First floor)	40 $L_{Aeq(15min)}$	37	38	37
Kingston Lodge	40 $L_{Aeq(15min)}$	41	36	35
Ian McLennan Park	50 $L_{Aeq(period)}$	-	39	38
Patrick Autocare Vehicle Storage Facility	65 $L_{Aeq(period)}$	-	60	59

4.1.5 Assessment of operational noise levels

The predicted noise levels at all receivers comply with the consent and NPI noise criteria. The predictions are considered to be conservative as per the assumptions detailed in Section 4.1.2. Due to the topography of the site, predicted noise levels at Farmborough Heights and the nearby Macedonian Orthodox Church are within the criteria and the consent conditions. Predicted noise levels during operation at Kingston Lodge and other receivers in Kembla Grange are also below the criteria.

4.2 Operational mitigation measures

The modelling results indicate that the operational noise criteria will not be exceeded at any sensitive receiver. Based on the information provided in this assessment, specific operational mitigation measures are not required.

5. Conclusion

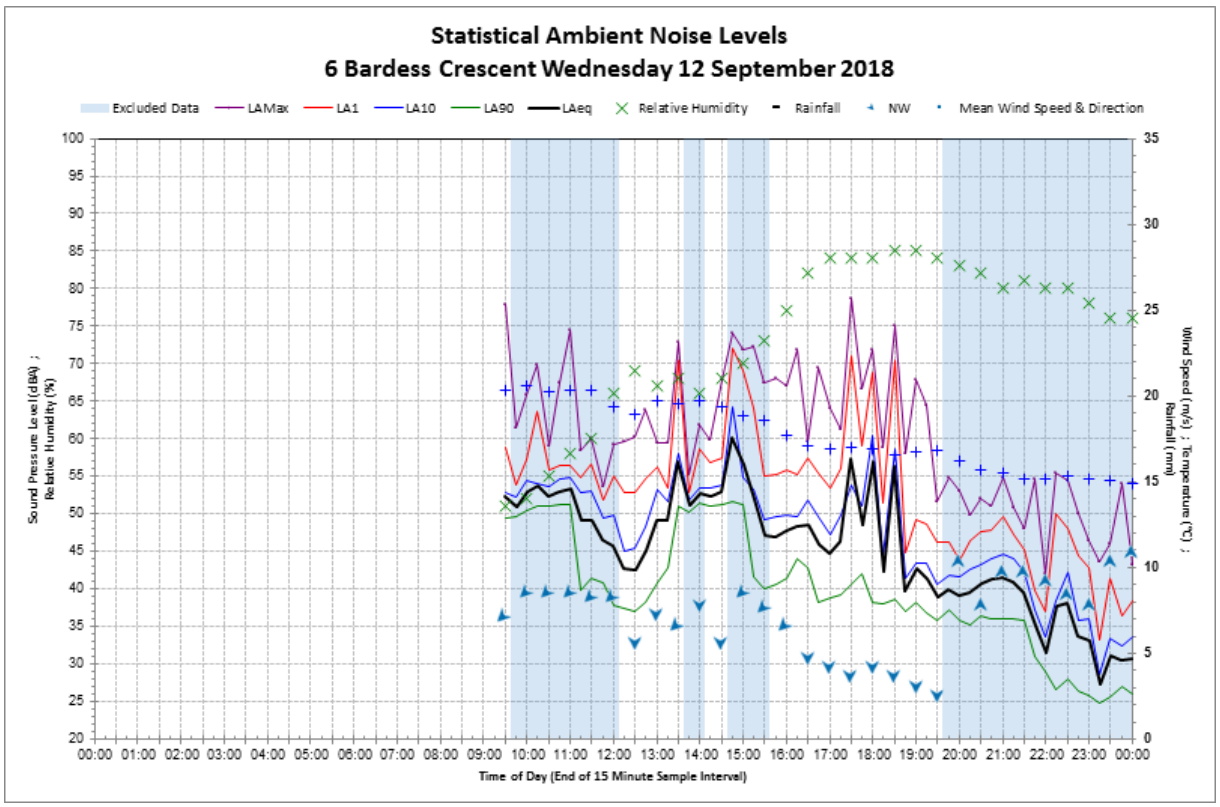
This report was prepared to assess potential noise impacts associated with modifications to the Kembla Grange Resource Recovery Facility. Baseline noise levels were measured at two sensitive receiver locations within the study area. The results of baseline noise measurements, combined with operational information were used to revise predicted noise impacts on key sensitive receivers.

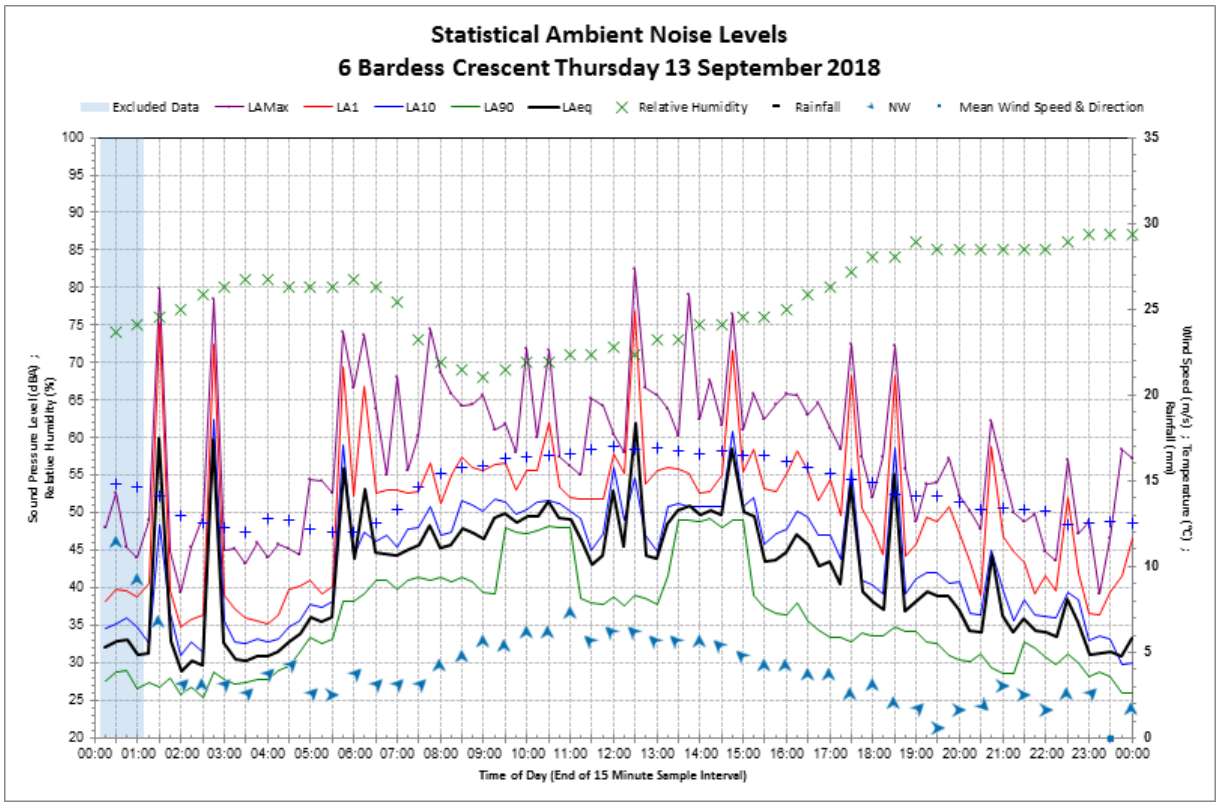
Operational noise from the RRF is predicted to comply with the NPI and consent conditions at the surrounding sensitive receivers.

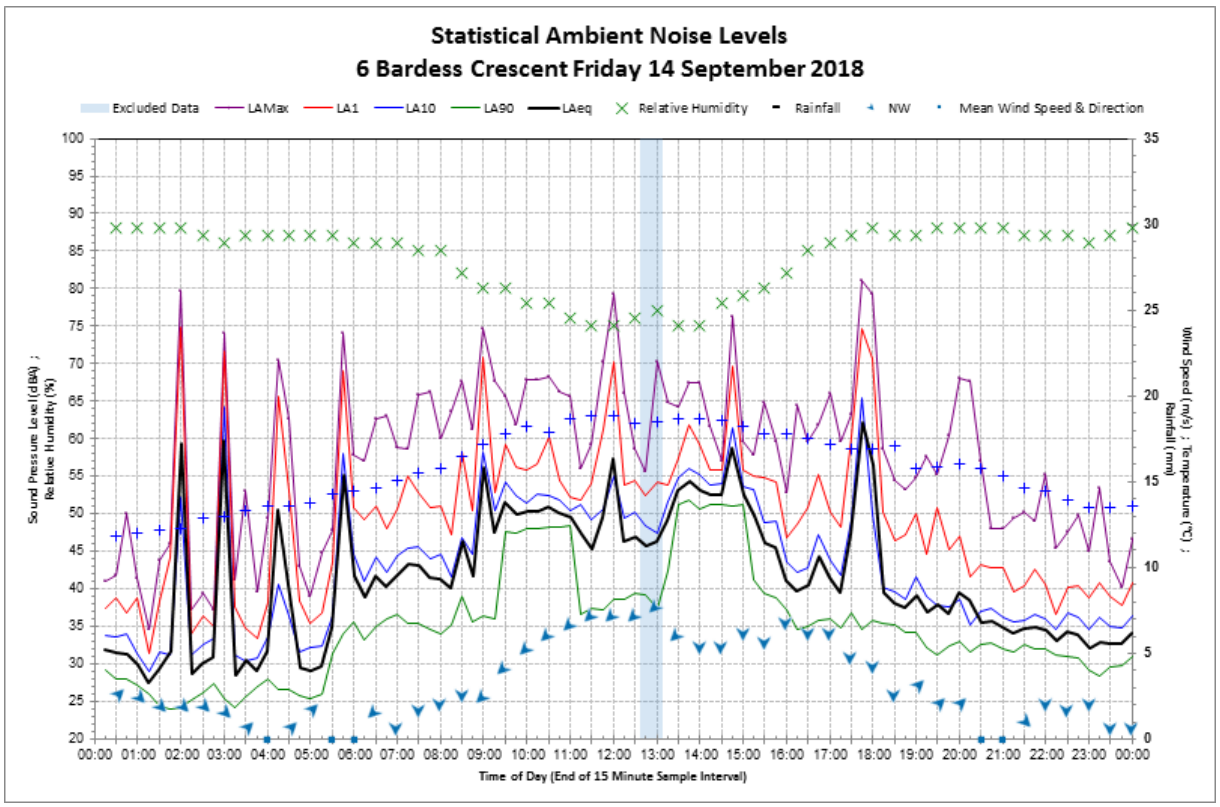
The proposal would be acceptable from an acoustic perspective.

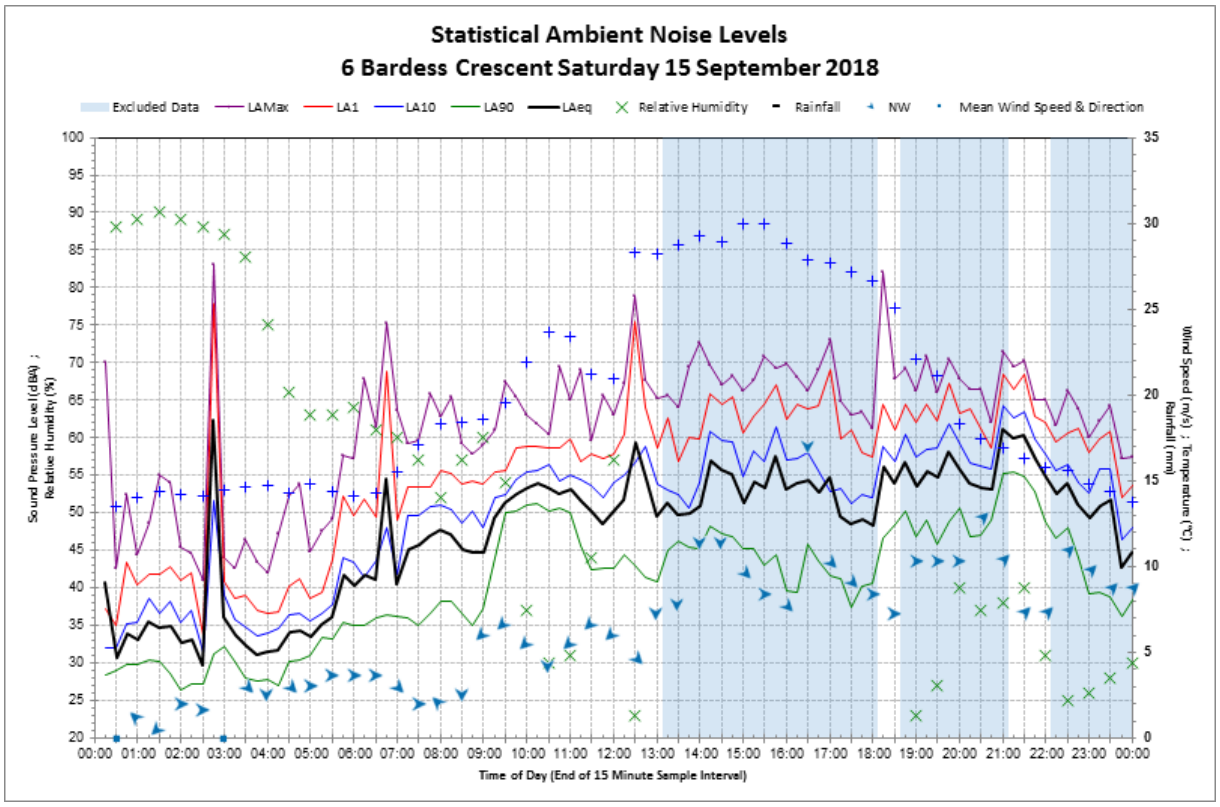
Appendices

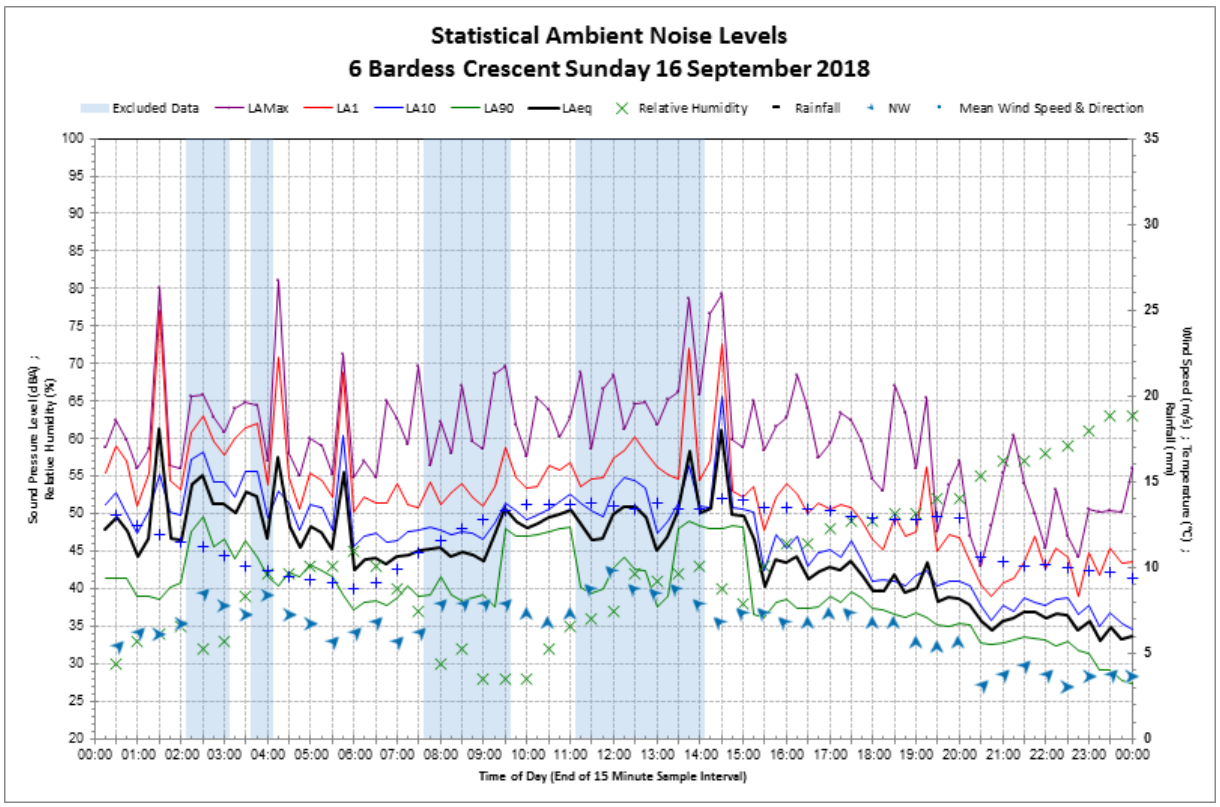
Appendix A – Noise monitoring charts

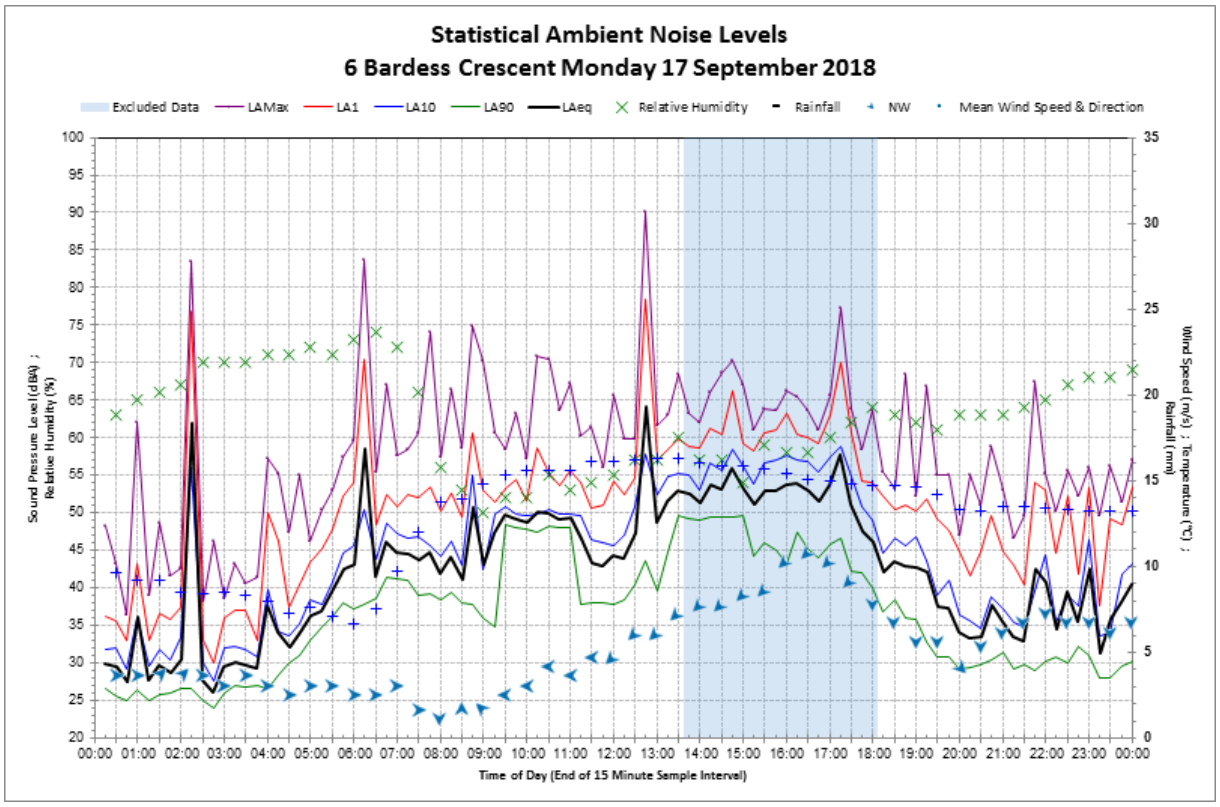

Statistical Ambient Noise Levels
6 Bardess Crescent Wednesday 12 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

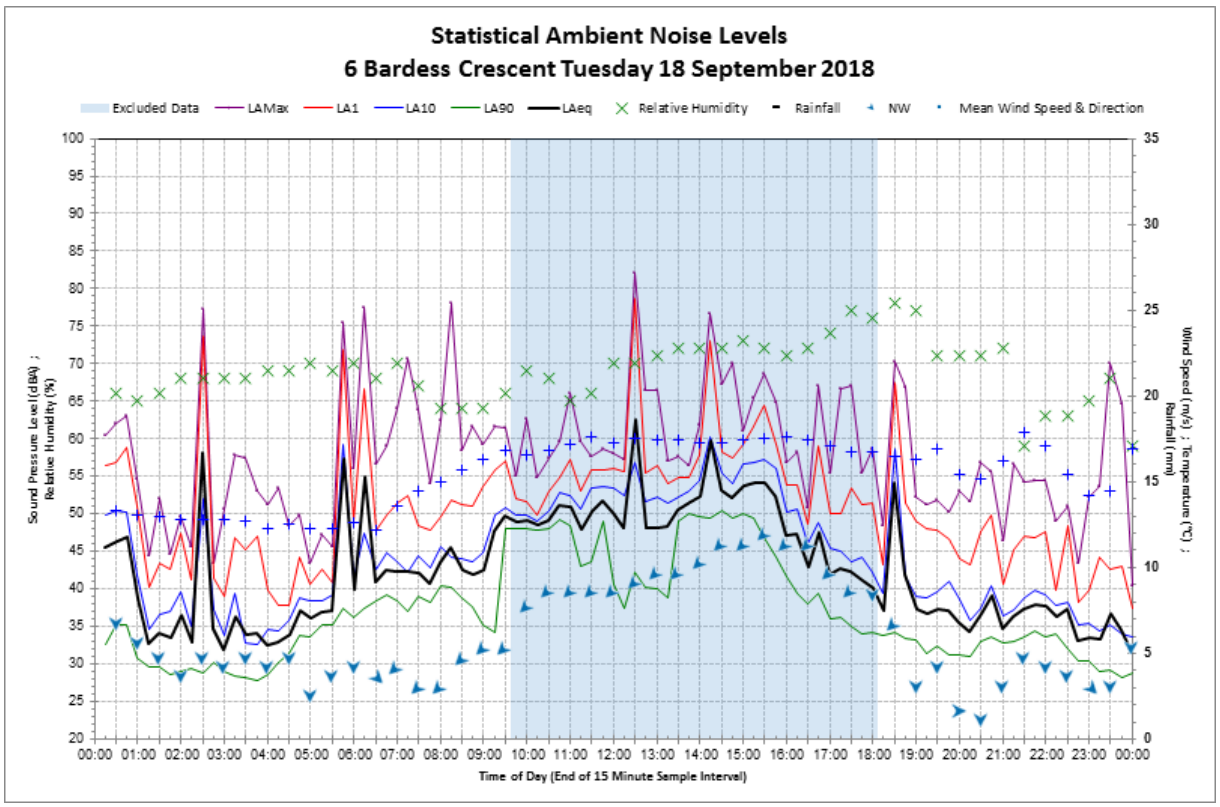

Statistical Ambient Noise Levels
6 Bardess Crescent Thursday 13 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

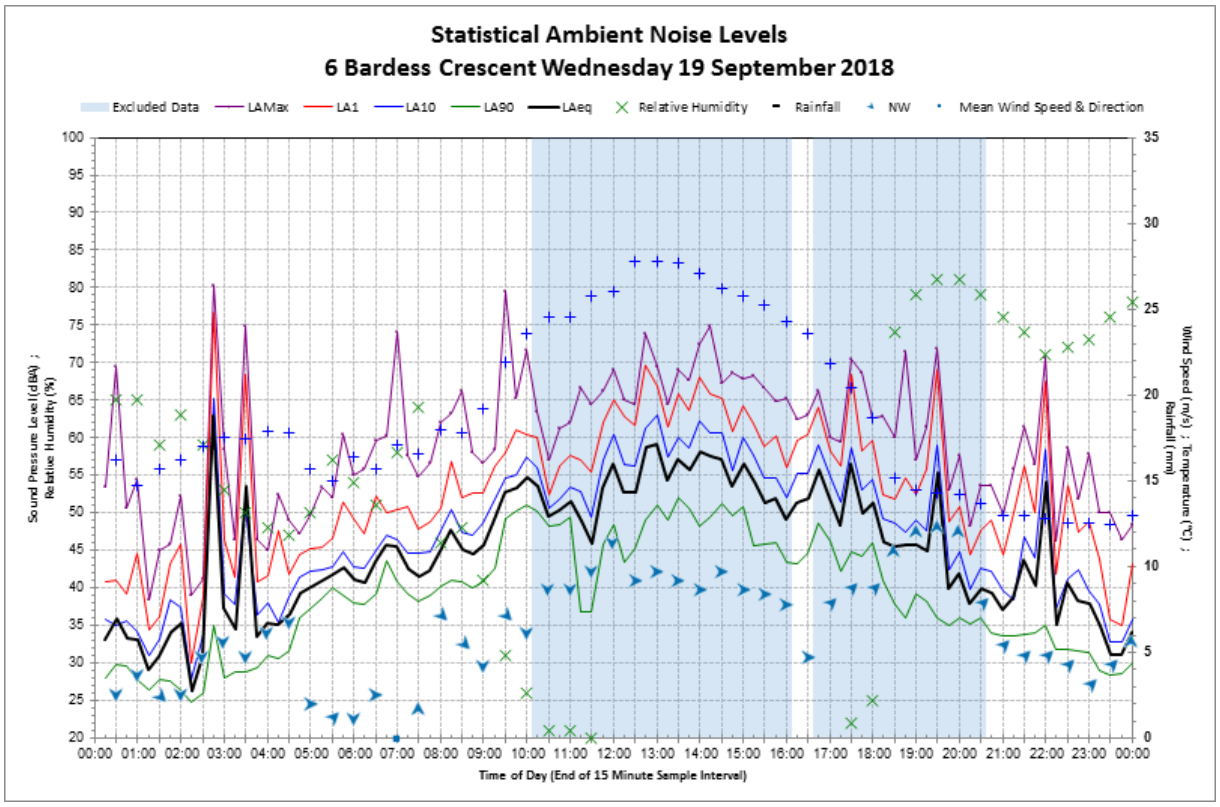

Statistical Ambient Noise Levels
6 Bardess Crescent Friday 14 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

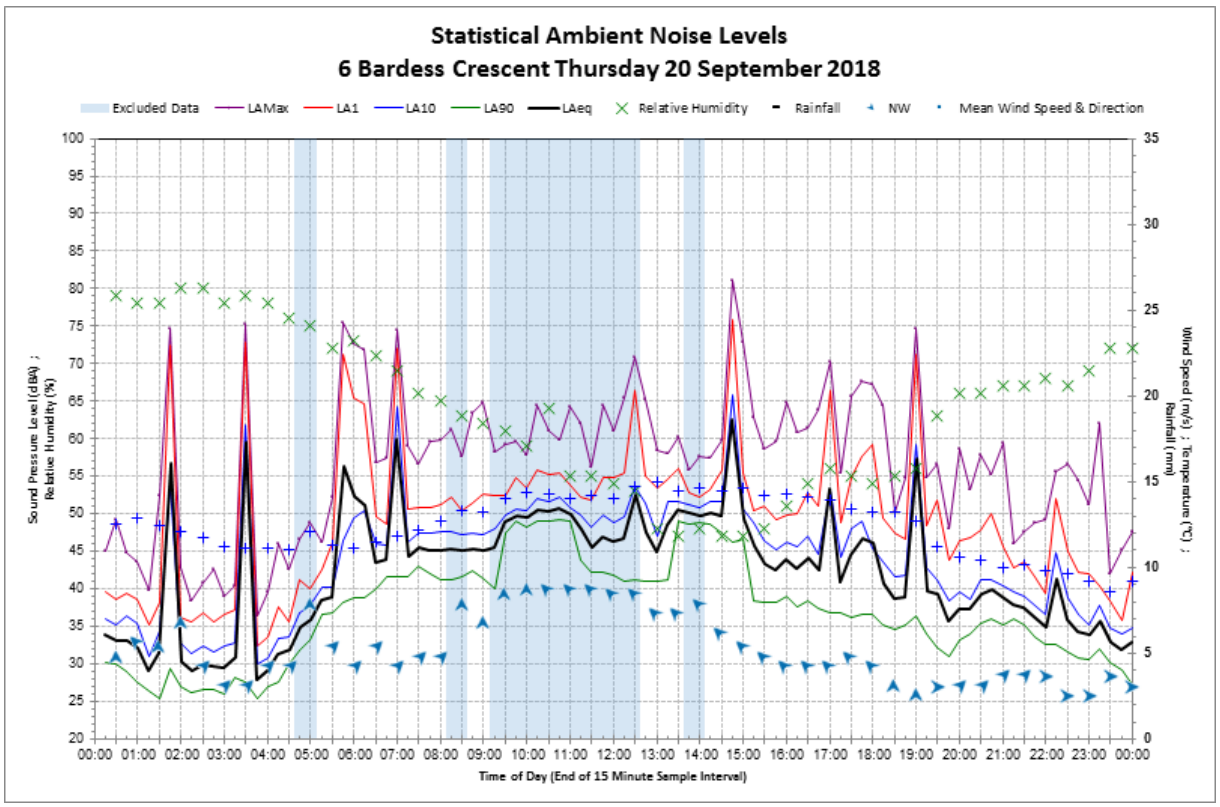

Statistical Ambient Noise Levels
6 Bardess Crescent Saturday 15 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Sunday 16 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Monday 17 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Tuesday 18 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Wednesday 19 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Thursday 20 September 2018
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LA1
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LA90
LAeq
Relative Humidity
Rainfall
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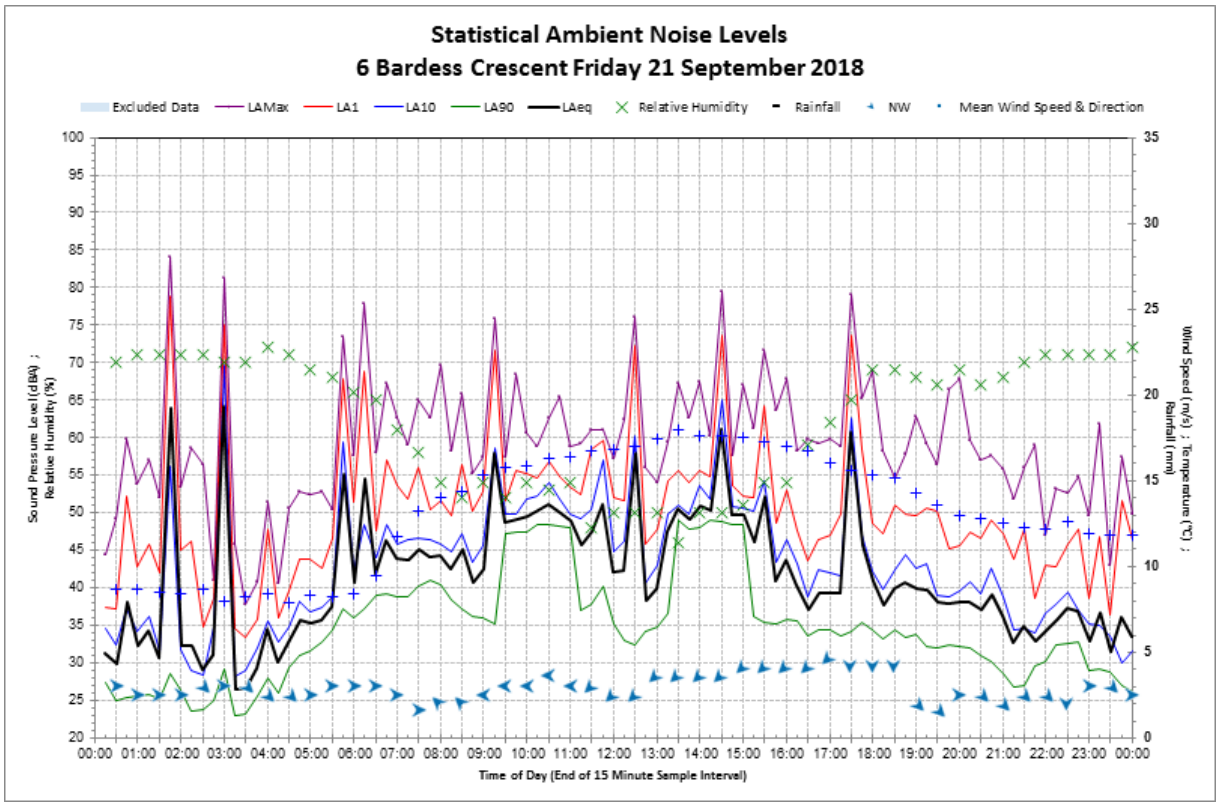
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Rainfall (mm) ; Temperature (°C) ; Wind Speed (m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Friday 21 September 2018
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LA90
LAeq
Relative Humidity
Rainfall
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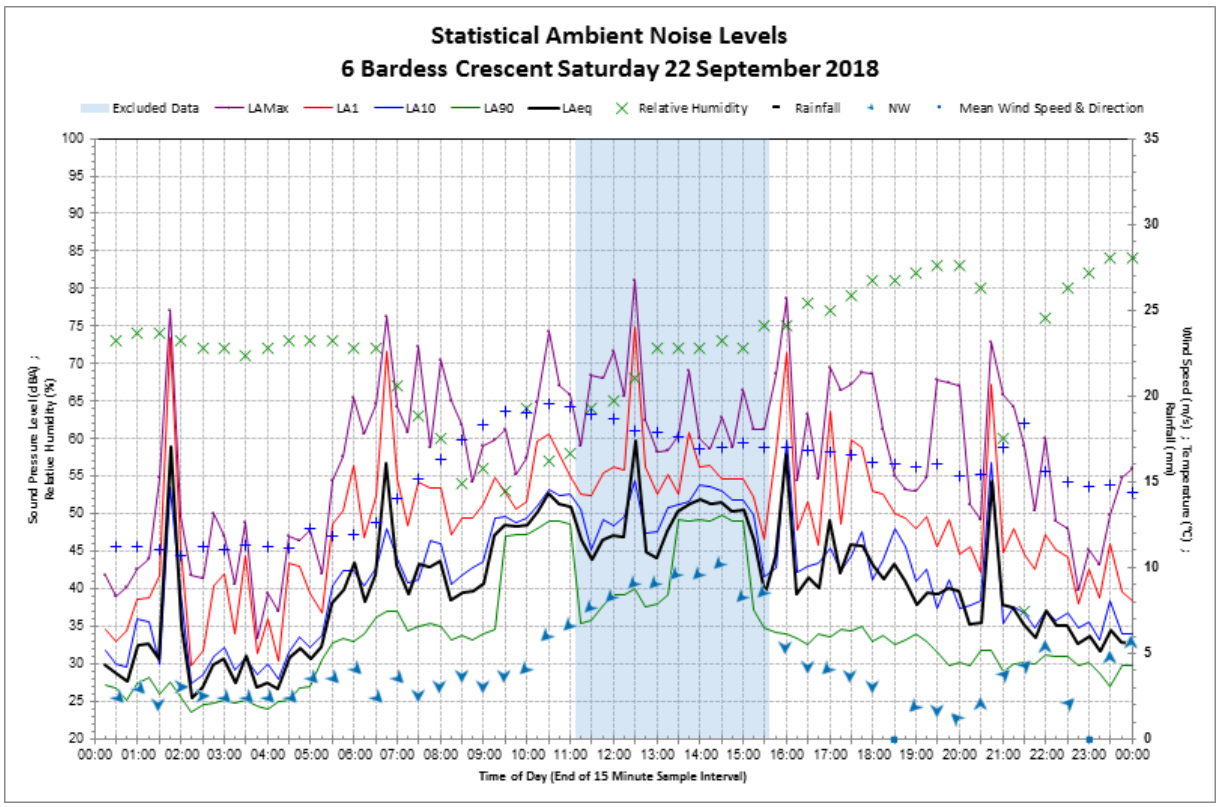
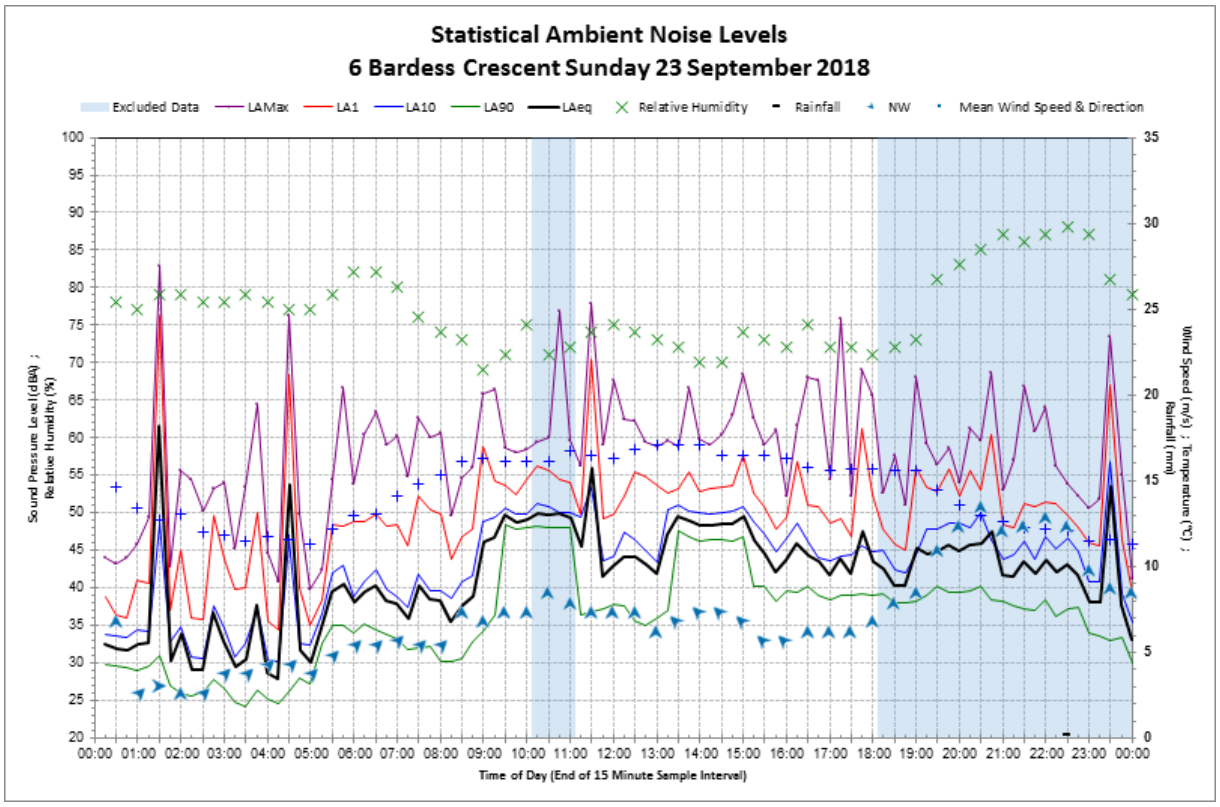
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Rainfall (mm) ; Temperature (°C) ; Wind Speed (m/s)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Saturday 22 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Sunday 23 September 2018
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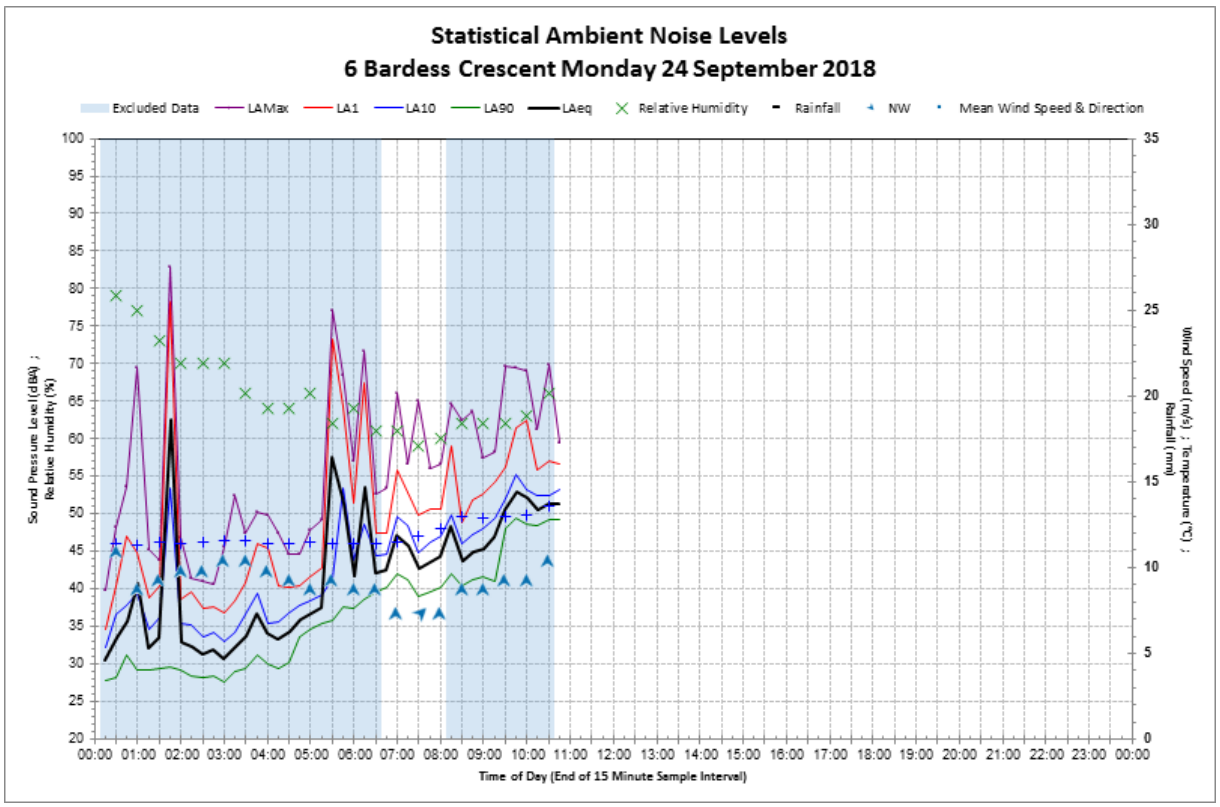
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
6 Bardess Crescent Monday 24 September 2018
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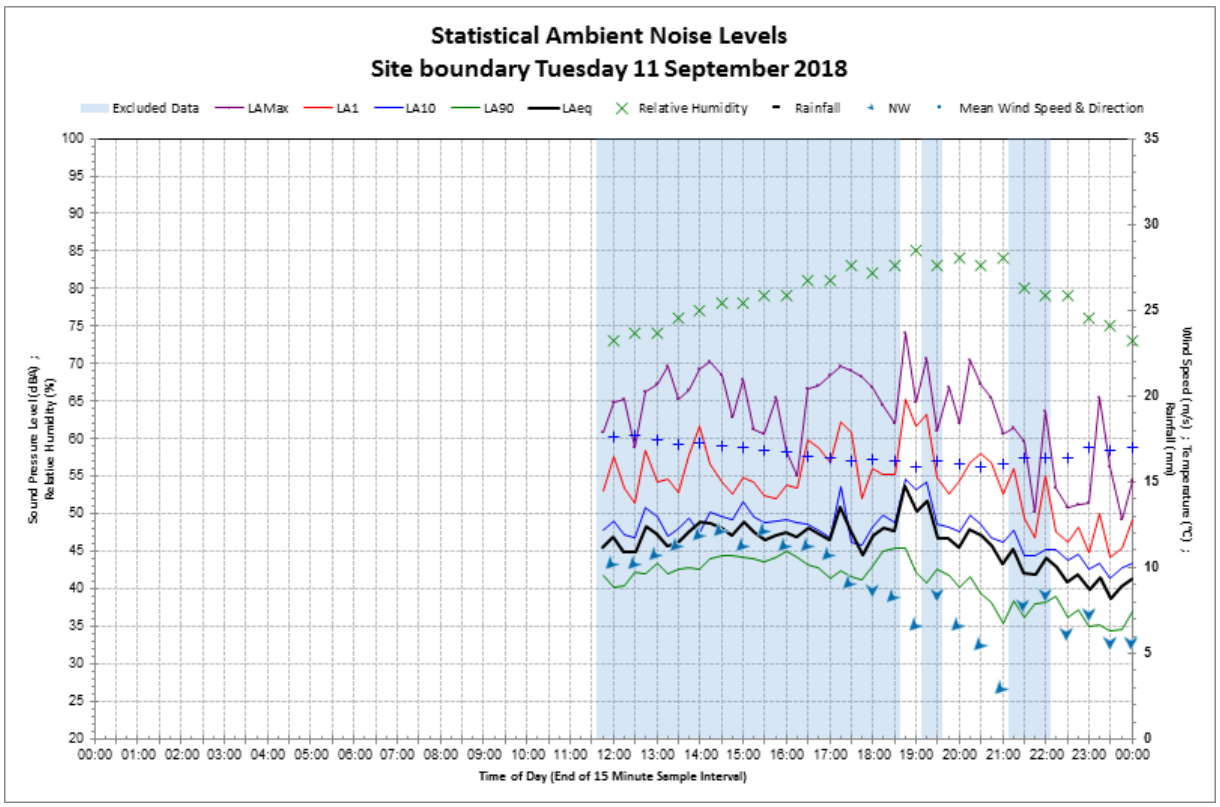
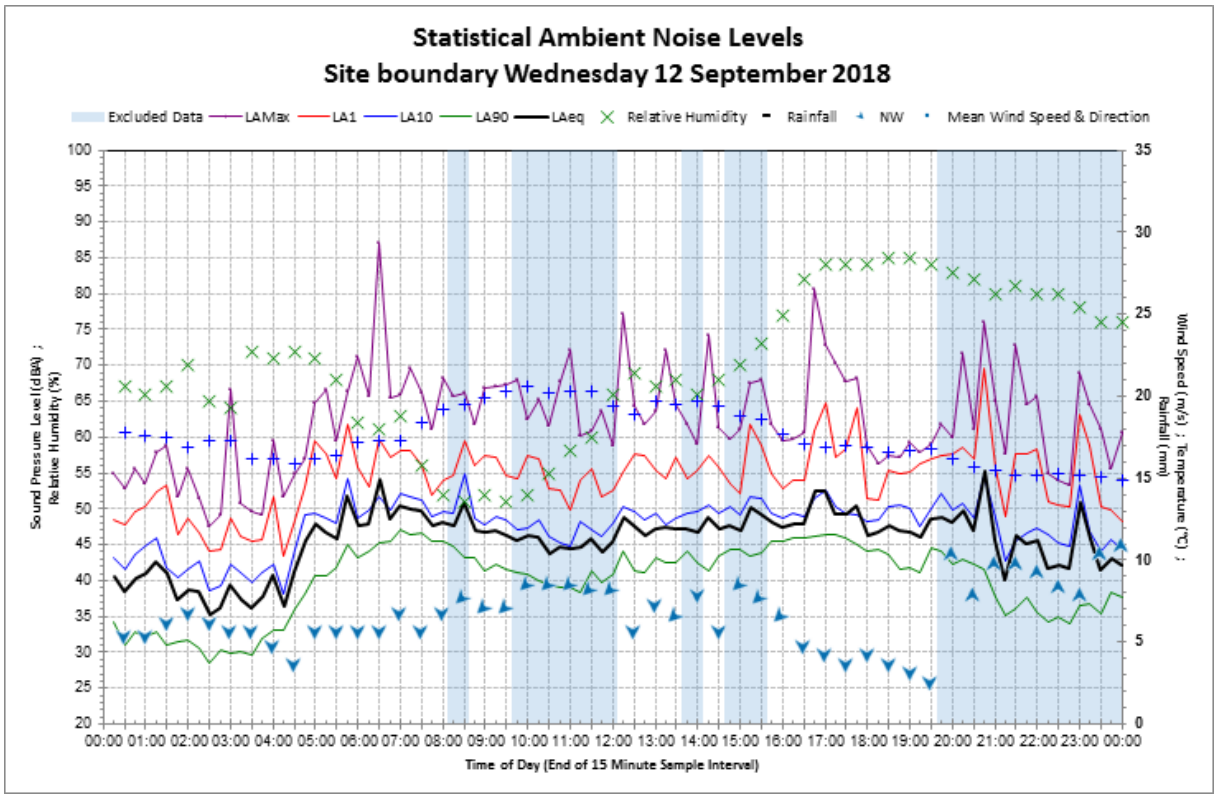
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Tuesday 11 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Wednesday 12 September 2018
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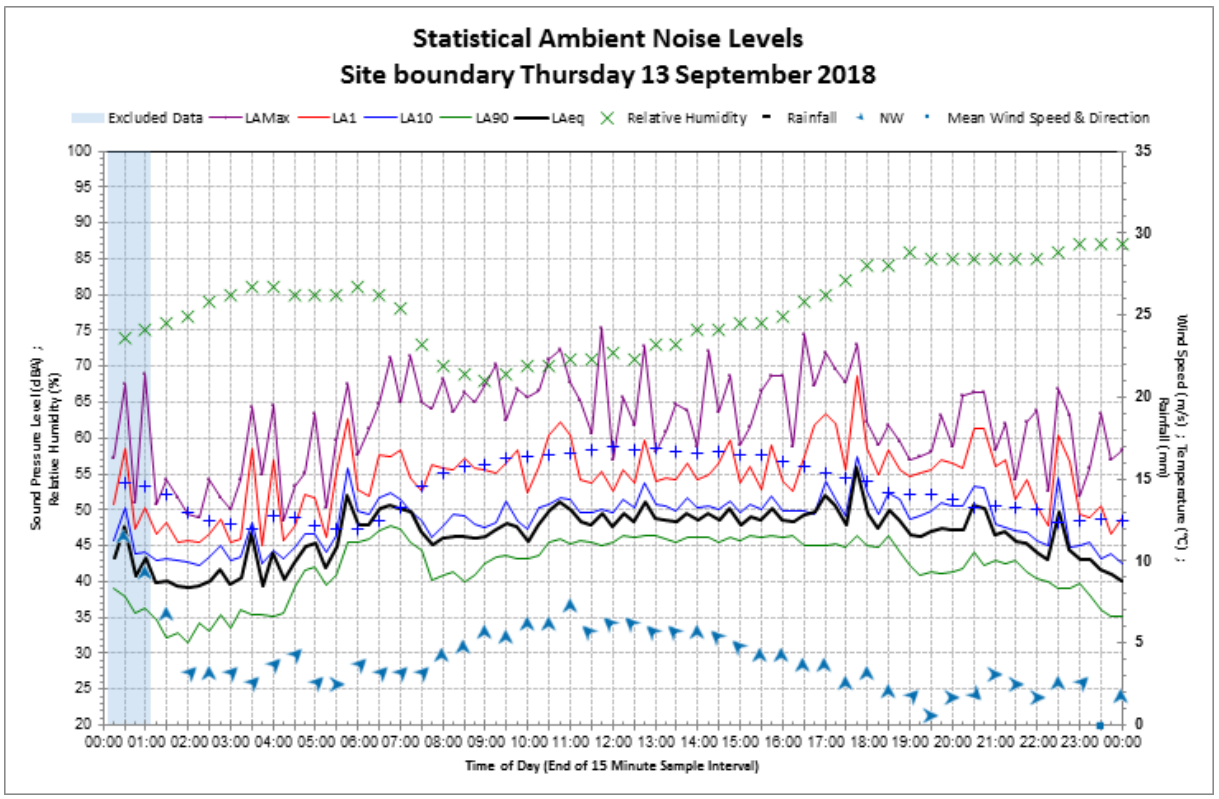
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Thursday 13 September 2018
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LAeq
Relative Humidity
Rainfall
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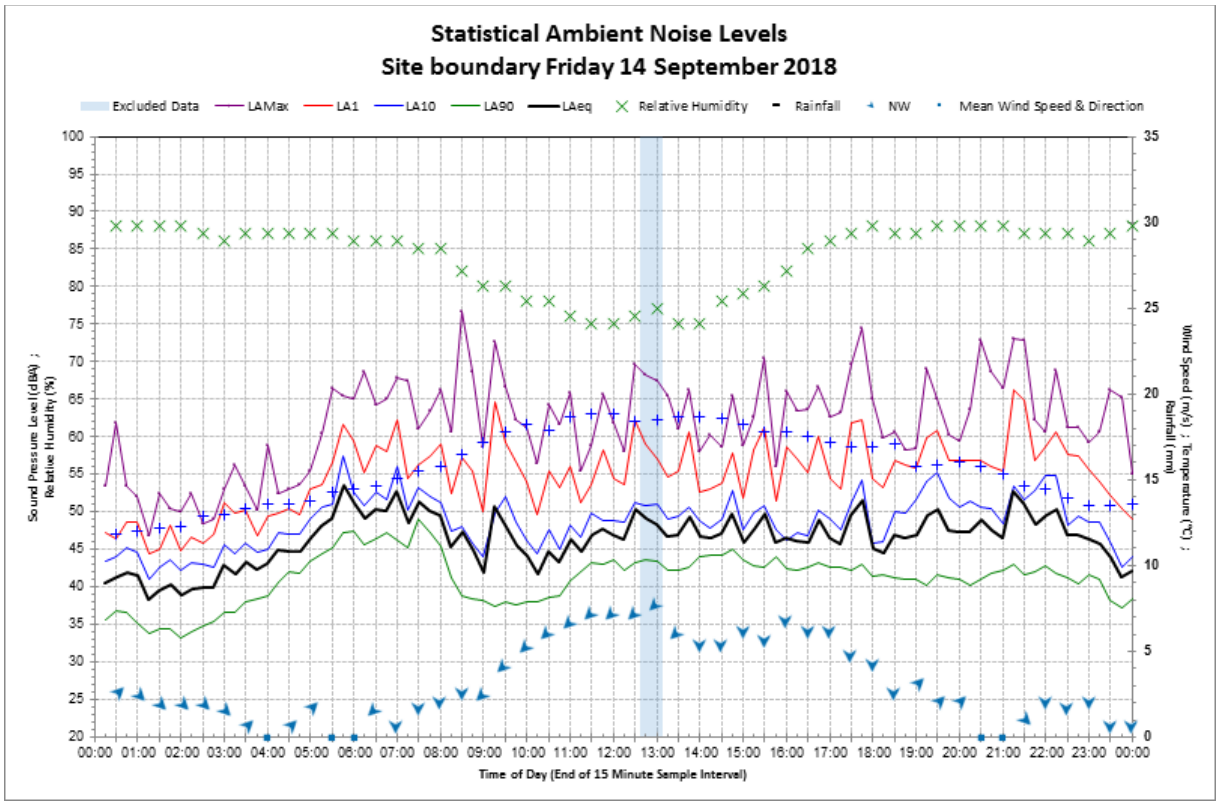
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Friday 14 September 2018
Excluded Data
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LA90
LAeq
Relative Humidity
Rainfall
NW
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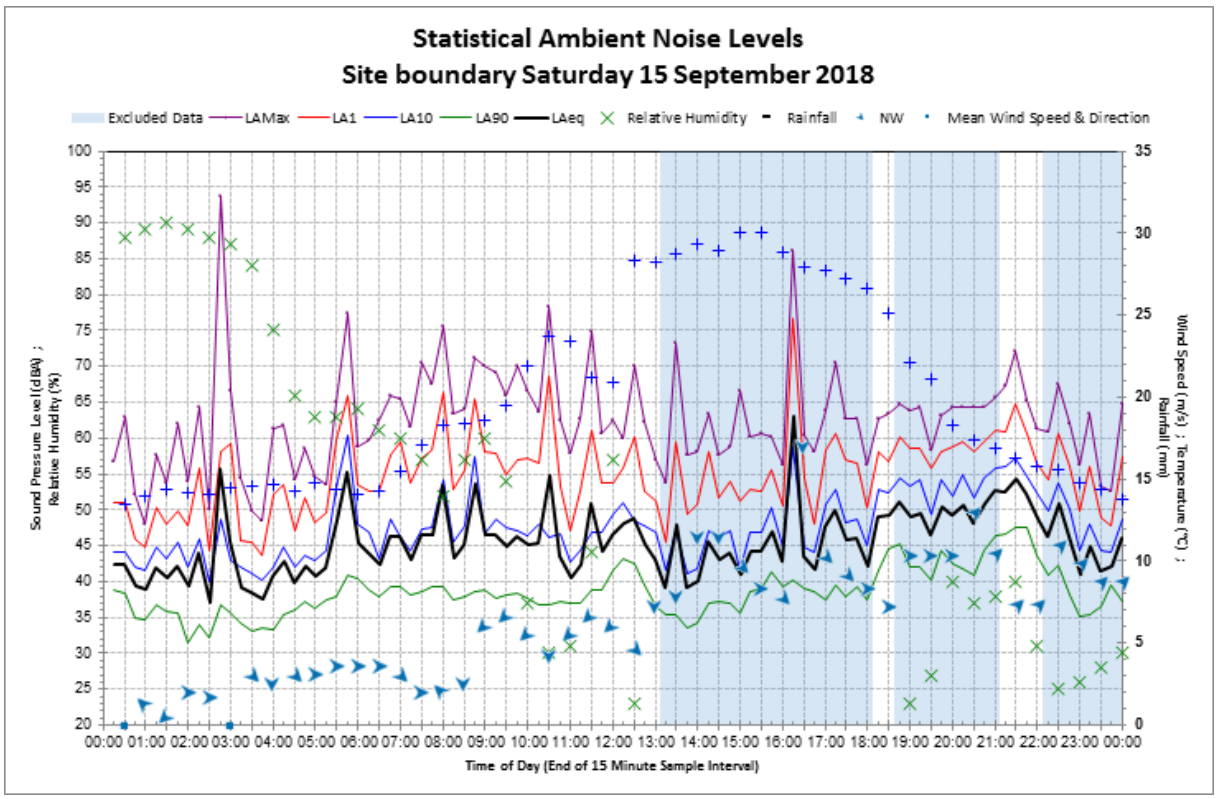
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Saturday 15 September 2018
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LA90
LAeq
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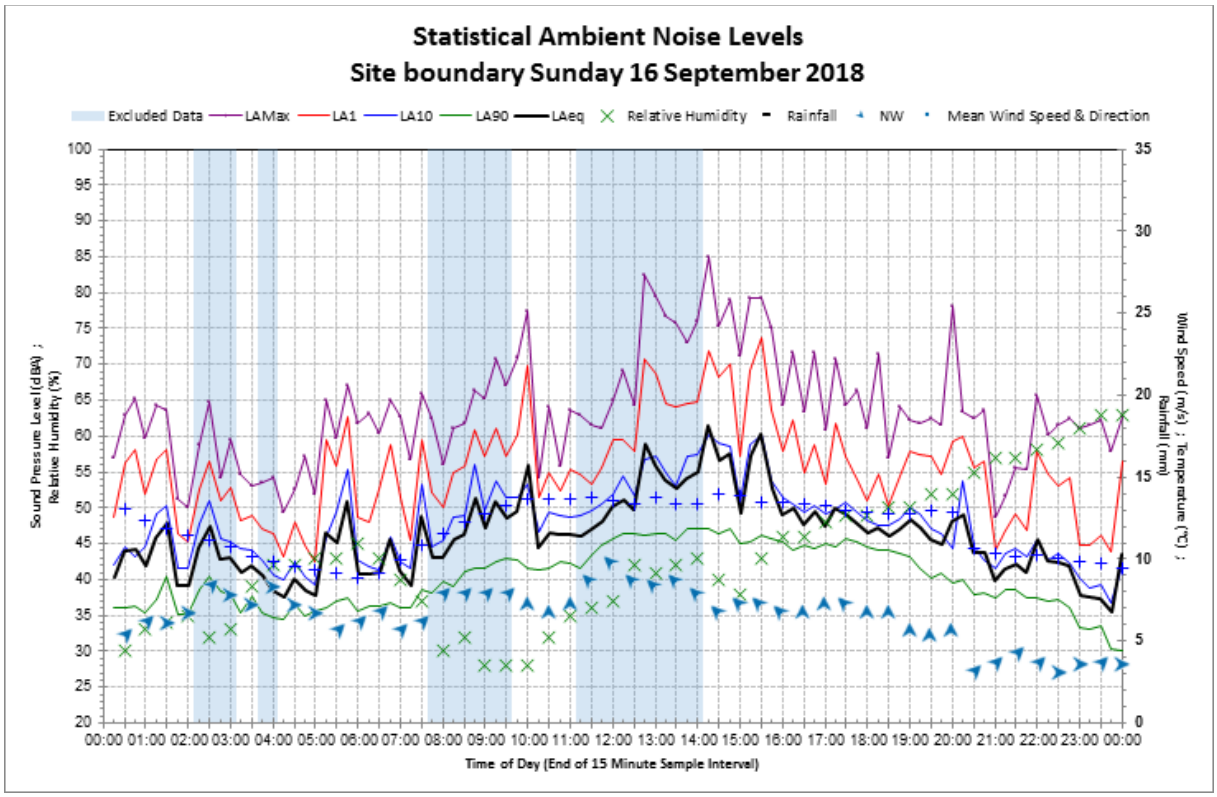
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Sunday 16 September 2018
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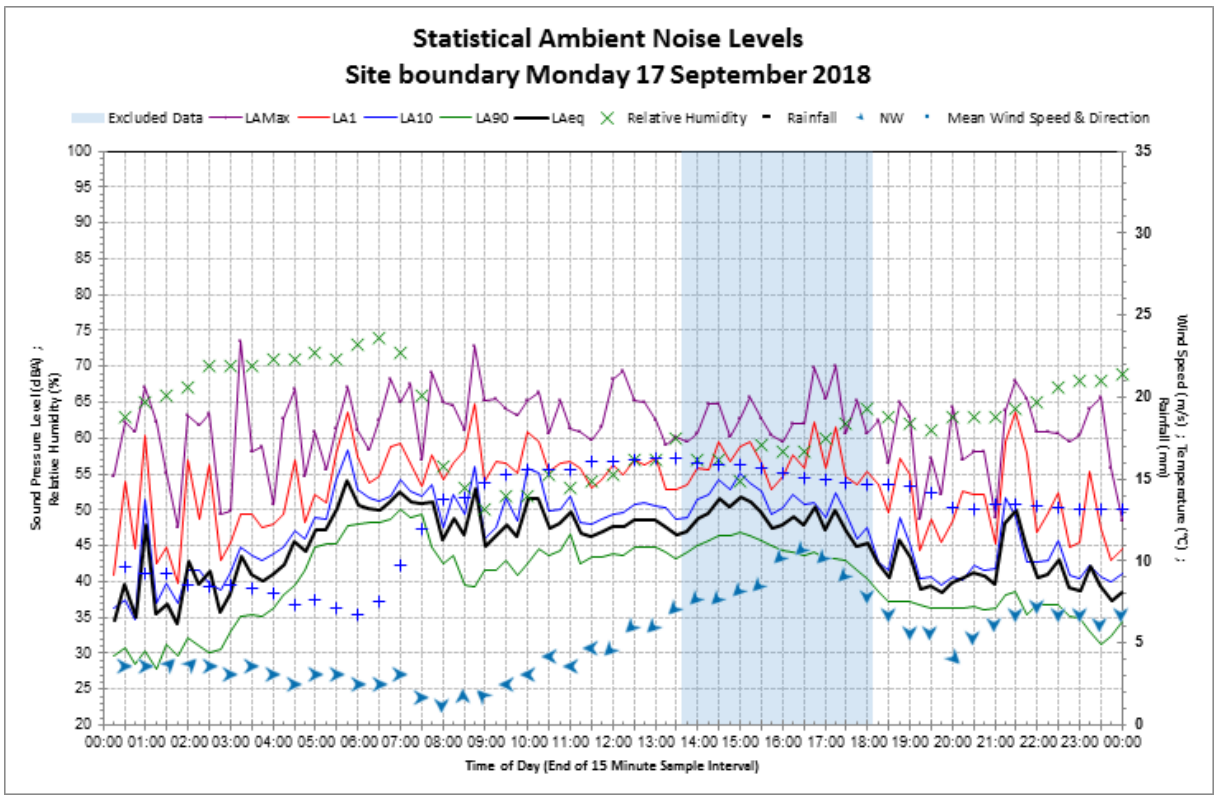
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Monday 17 September 2018
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LA90
LAeq
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Rainfall
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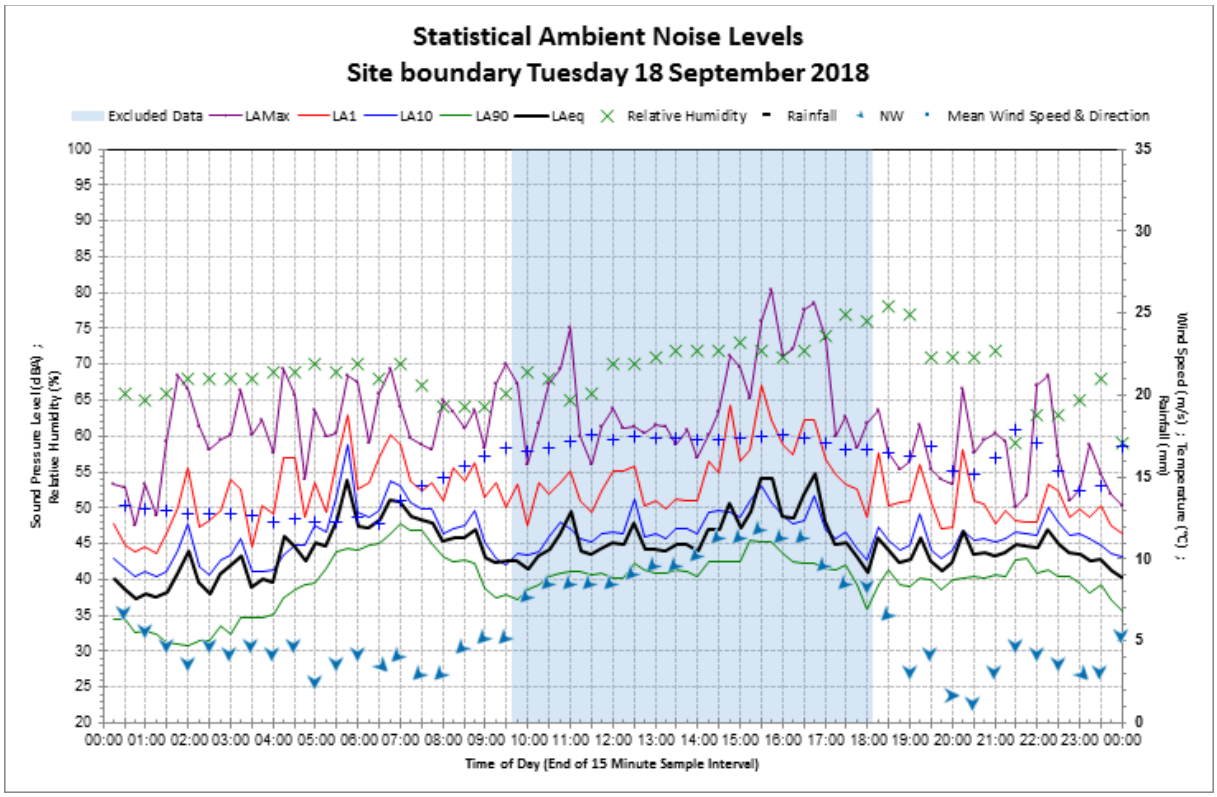
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Tuesday 18 September 2018
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LA90
LAeq
Relative Humidity
Rainfall
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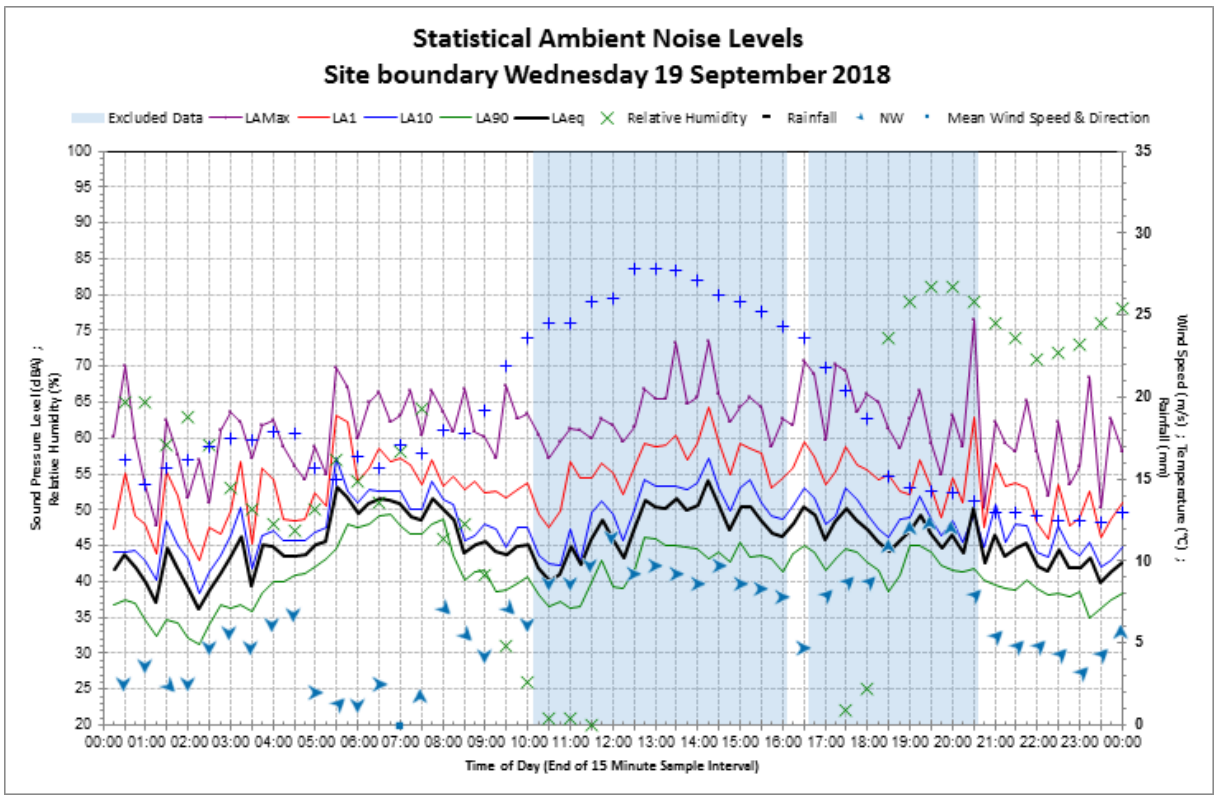
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Wednesday 19 September 2018
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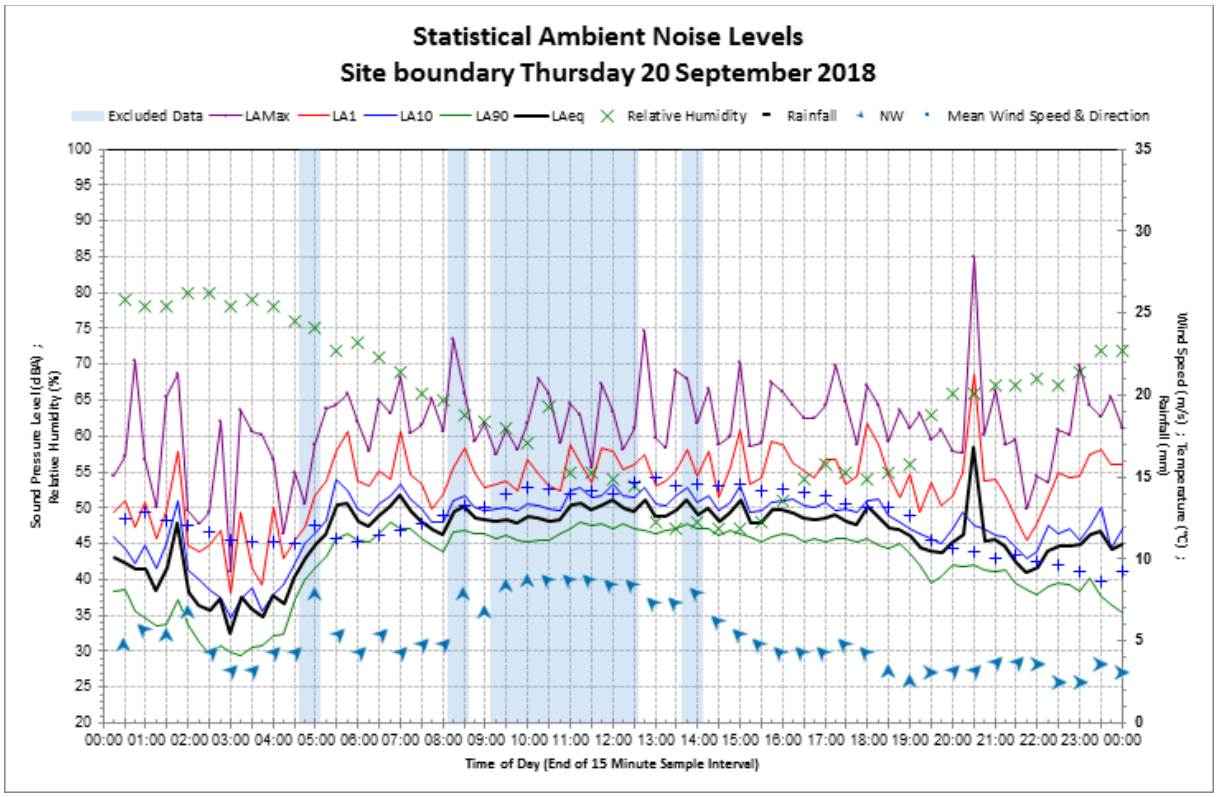
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Thursday 20 September 2018
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LA90
LAeq
Relative Humidity
Rainfall
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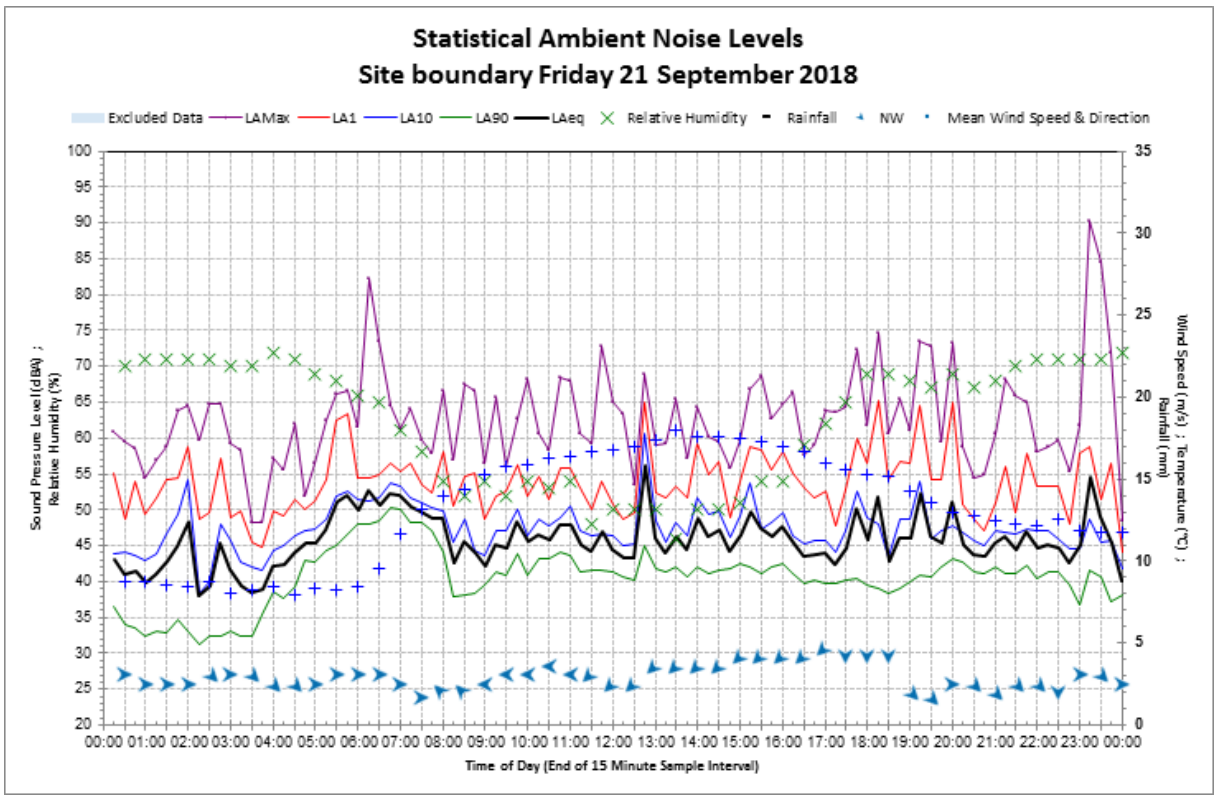
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Friday 21 September 2018
Excluded Data
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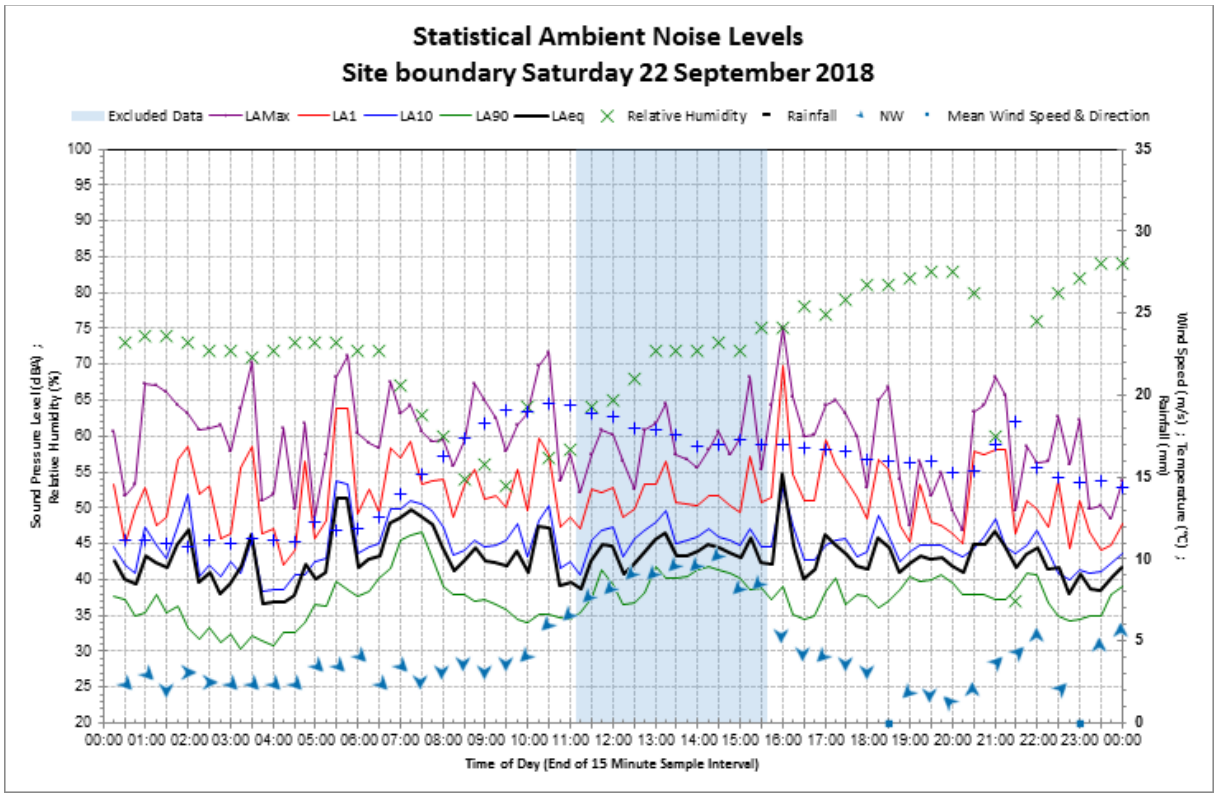
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Saturday 22 September 2018
Excluded Data
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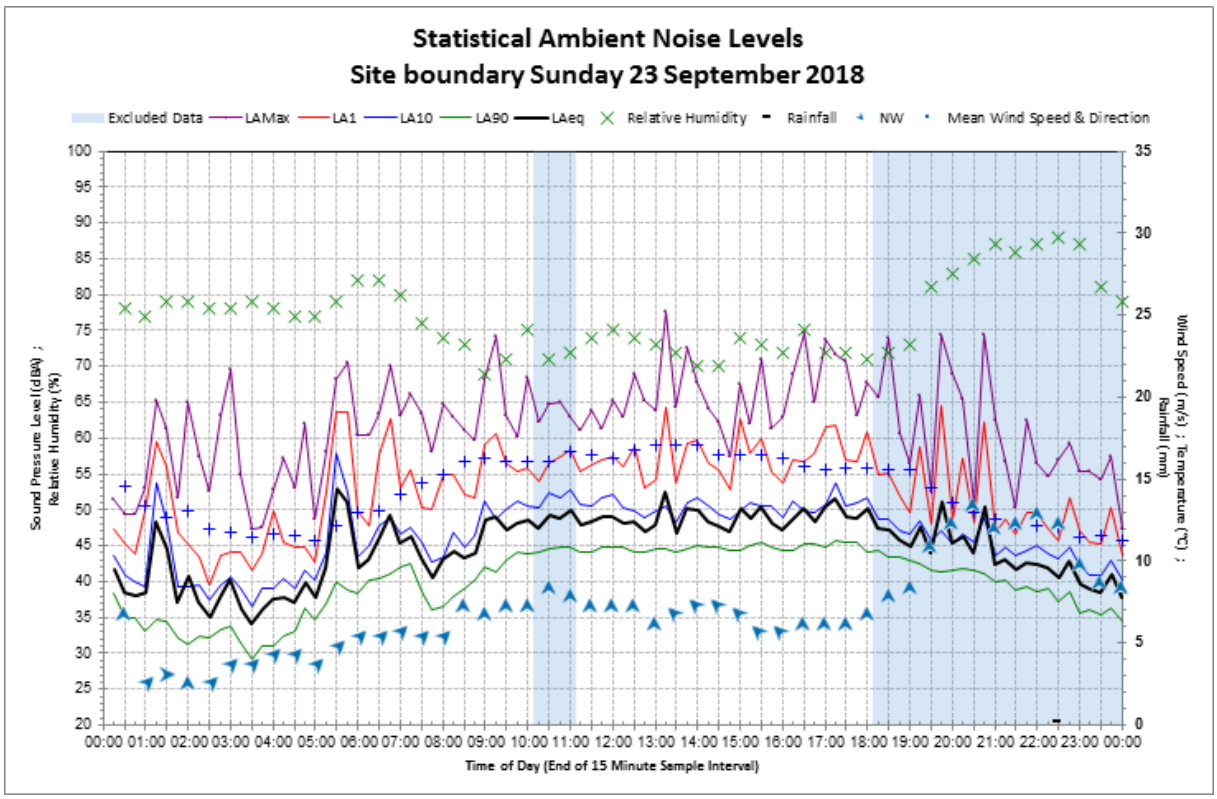
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Sunday 23 September 2018
Excluded Data
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Relative Humidity
Rainfall
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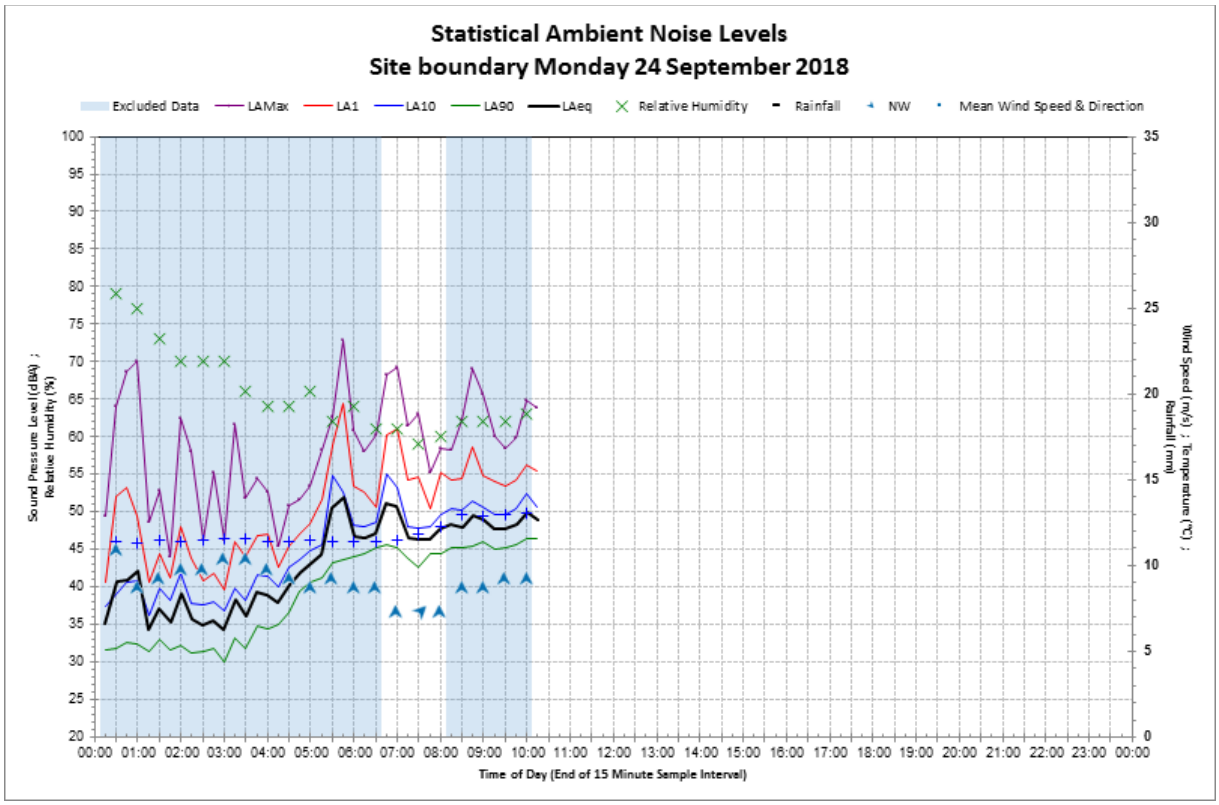
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Site boundary Monday 24 September 2018
Excluded Data
LAMax
LA1
LA10
LA90
LAeq
Relative Humidity
Rainfall
NW
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

GHD

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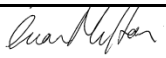
2127596-8707/https://projects.ghd.com/oc/Sydney1/kemblagrangerrfrevis/Delivery/Documents/2127596-REP-Kembla Grange RRF Revised Noise Assessment Stage 2.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P Pandey	E Smith		E Milton		19/10/2018

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