

WOLLONGONG COAL WONGAWILLI

QUARTERLY AIR QUALITY AND NOISE MONITORING REPORT

JULY TO SEPTEMBER 2016

1 INTRODUCTION

Pacific Environment provides air quality and noise monitoring at the Wollongong Coal (WCL) Wongawilli Colliery, Wongawilli, NSW using the Envirosuite system.

This report provides a summary of the data collected during the third quarter, July to September 2016. The monitoring network comprises one continuous ambient air quality particulate monitor, one continuous ambient noise monitor and one continuous automatic weather station.

The monitoring network is summarised in **Table 1-1** and presented in **Figure 1-1**.

Table 1-1: Monitoring Network

Description	Site	Address / Location	MGA 56 Easting (m)	MGA 56 Northing (m)
Continuous PM ₁₀ Monitor	BAM	Jersey Farm Road	294129	6182474
Meteorological Station	AWS	Near water tanks on ridge line	293358	6181778
Continuous Noise Monitor	NMT 3	Jersey Farm Road	294137	6182448

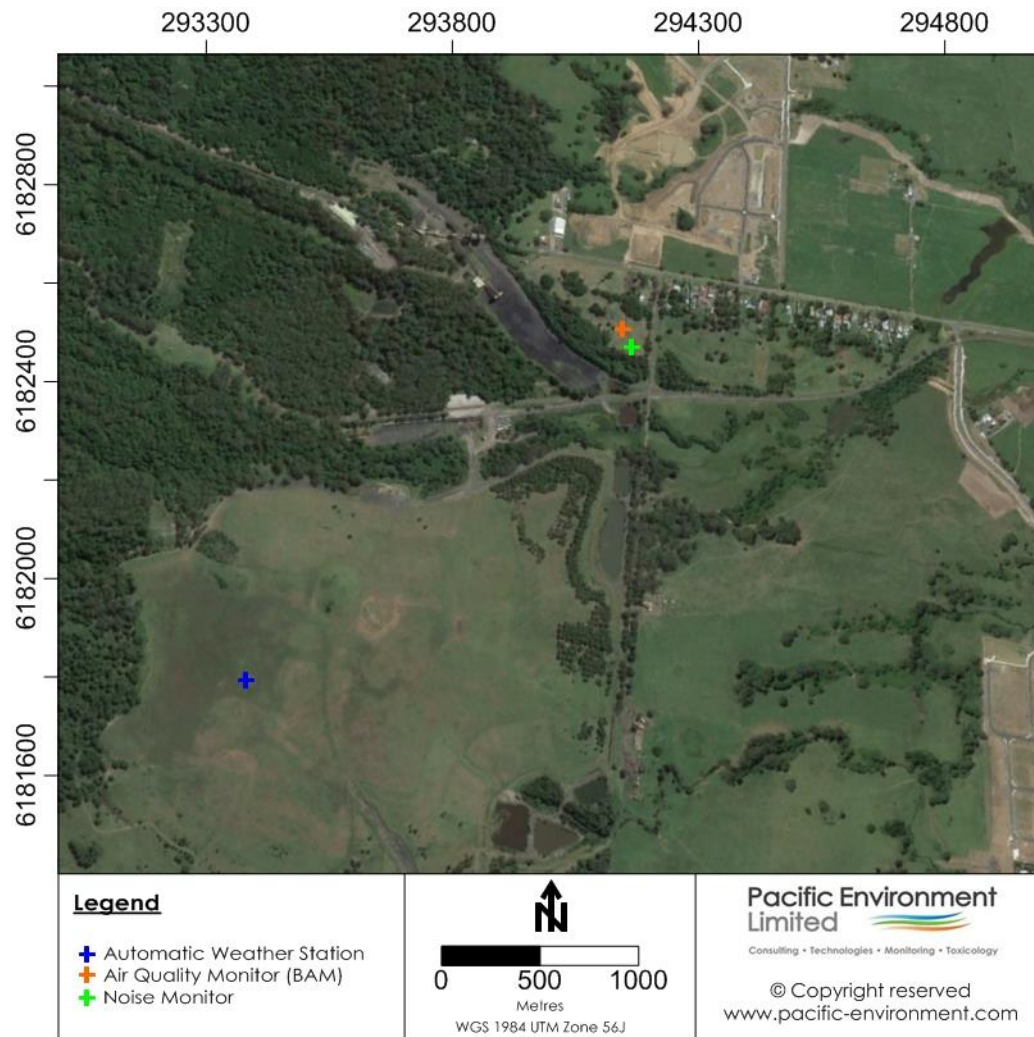


Figure 1-1: Monitoring Locations

2 PROJECT ENVIRONMENTAL CONDITIONS

2.1 Monitoring Requirements

In accordance with Project Approval (09_0161), air quality, meteorology and noise parameters are monitored as summarised in **Table 2-1**.

Table 2-1: Monitoring Summary

Item	Quantity Measured	Unit	Monitoring Frequency
Air Quality	Particulate Matter < 10 µm (PM ₁₀)	µg/m ³	24 h
Meteorology	Temperature at 10m	°C	Real Time
	Temperature at 2m	°C	
	Wind Speed at 10m	m/s	
	Wind Direction	°	
	Standard Deviation of Wind Speed (sigma theta)	-	
	Barometric Pressure	hPa	
	Rainfall	mm	
Noise	15 minute ambient continuous equivalent energy average noise level	L _{Aeq,15min} dB(A)	15 min
	1 minute L _{A1} noise level	L _{A1,1min} dB(A)	1 min
	Period ambient continuous equivalent energy average noise level	L _{Aeq,period} dB(A)	Day, evening, night

2.2 Air Quality

The project is subject to environmental conditions as part of the Approval. For air quality these are summarised in **Table 2-2**.

Table 2-2: Project Air Quality Criteria

Pollutant	Averaging Period	Criterion ^a
Particulate Matter < 10 µm (PM ₁₀)	Annual	30 µg/m ³ ^(b)
Particulate Matter < 10 µm (PM ₁₀)	24 hour	50µg/m ³ ^(b)

- a) Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with OEH.
- b) Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources)

2.3 Noise

The Project Approval states both an amenity and intrusive noise criteria. The intrusive criteria are assessed over a 15 minute period and the amenity criteria are assessed over the relevant period (day, evening and night).

The intrusive criteria are both lower and assessed over a shorter time period, they represent the most onerous criteria and are therefore the limiting criteria.

These criteria are reproduced in **Table 2-3** and **Table 2-4**.

Table 2-3: Noise Criteria dB(A) – Medium term intrusive noise limits as defined in Table 4.3 of the Noise Management Plan

Location		Day	Evening	Night	
Area	Receiver Number	L _{Aeq} (15mins)	L _{Aeq} (15mins)	L _{Aeq} (15mins)	L _{A1} (15mins)
Lot 2410 Smiths Lane	RA1	43	43	43	59
120/130 Smiths Lane					
18 Wongawilli Road	RA2	44	43	43	60
1 Wongawilli Road					
Jersey Farm road	RA3	40	40	38	48
Horsley (closest receiver)					
All other privately owned land		40	40	38	48

Note: Day is defined as 7.00am to 6.00pm, evening as 6.00pm to 10.00pm and night as 10.00pm to 7.00am

Table 2-4: Noise Criteria dB(A) – Amenity Noise Limits as defined in Table 4 of the Project Approval

Receiver Area	Day	Evening	Night
	L _{Aeq} (11hr)	L _{Aeq} (4hr)	L _{Aeq} (9hr)
All privately-owned land	60	50	45

3 METEOROLOGICAL MONITORING RESULTS

A summary of the data collected during the quarter is provided in the following sections. The valid data recovery rate was 100% for all parameters (refer **Table 3-1**).

Table 3-1: Valid data recovery rates - AWS

Parameter	Valid Data Recovery Rate %
Wind Speed	100%
Wind Direction	100%
Temperature – 2 m	100%
Temperature – 10 m	100%
Pressure	100%

A summary of statistics for the data collected during July to September 2016 are shown in **Table 3-2**.

Table 3-2: Meteorology Summary Statistics

Parameter (units)	Statistical measure	Value
Wind Speed (m/s)	Mean	3.3
Temperature (°C) – 10m		14.3
Temperature (°C) – 2m		13.2
Barometric pressure (hPa)		1007.4
Wind Speed (m/s)	Median	2.6
Temperature (°C) – 10m		14.2
Temperature (°C) – 2m		13.1
Barometric pressure (hPa)		1008.0
Wind Speed (m/s)	Standard Deviation	2.5
Temperature (°C) – 10m		3.0
Temperature (°C) – 2m		3.6
Barometric pressure (hPa)		7.8
Rainfall (mm)	Quarterly Total	174
Calms	%	5.4

3.1.1 Wind data

A windrose for the quarter is presented in **Figure 3-1**. The windrose indicates that for the period of monitoring winds from the west were dominant.

The average wind speed for the period was 3.3 m/s and the percentage occurrence of calm wind conditions (less than or equal to 0.5 m/s) was approximately 5.4 %.

3.1.2 Temperature

A plot of the hourly average temperature, recorded at 2 m and 10 m, is shown in **Figure 3-2**. The daily average temperature at 2 m was 13.2°C. The lowest temperature was 8.25°C degrees recorded on 24 July and a maximum of 18.3°C was recorded 19 July.

3.1.3 Rainfall

A plot of the daily rainfall over the three months period is shown in **Figure 3-3**. The station recorded 174 mm of rain in the quarter. The nearest Bureau of Meteorology site at Wollongong - Albion Park recorded 175.8 mm during the quarter. The highest rainfall recorded on site was on 20 July where 30 mm of rain was reported.

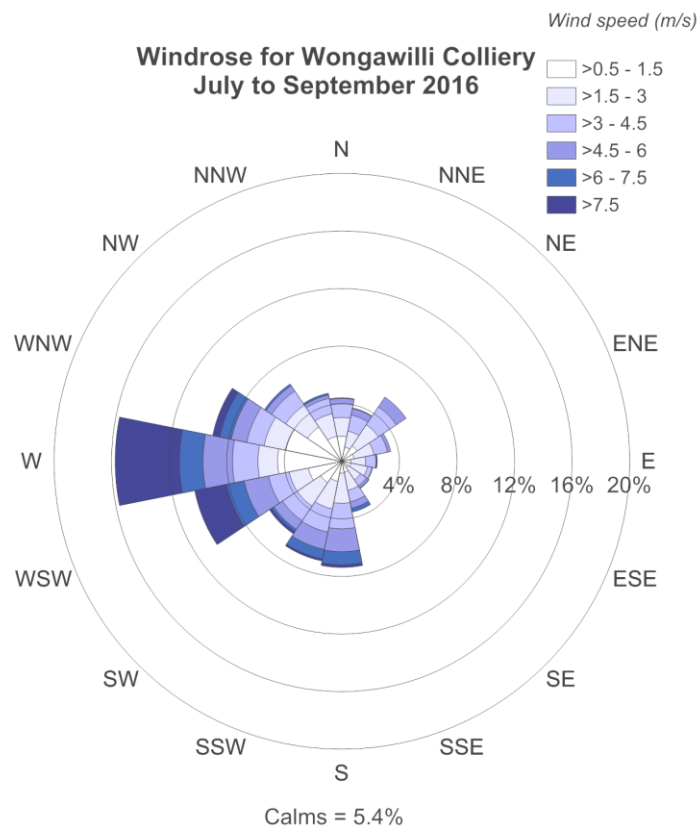


Figure 3-1: Windrose – July to September 2016

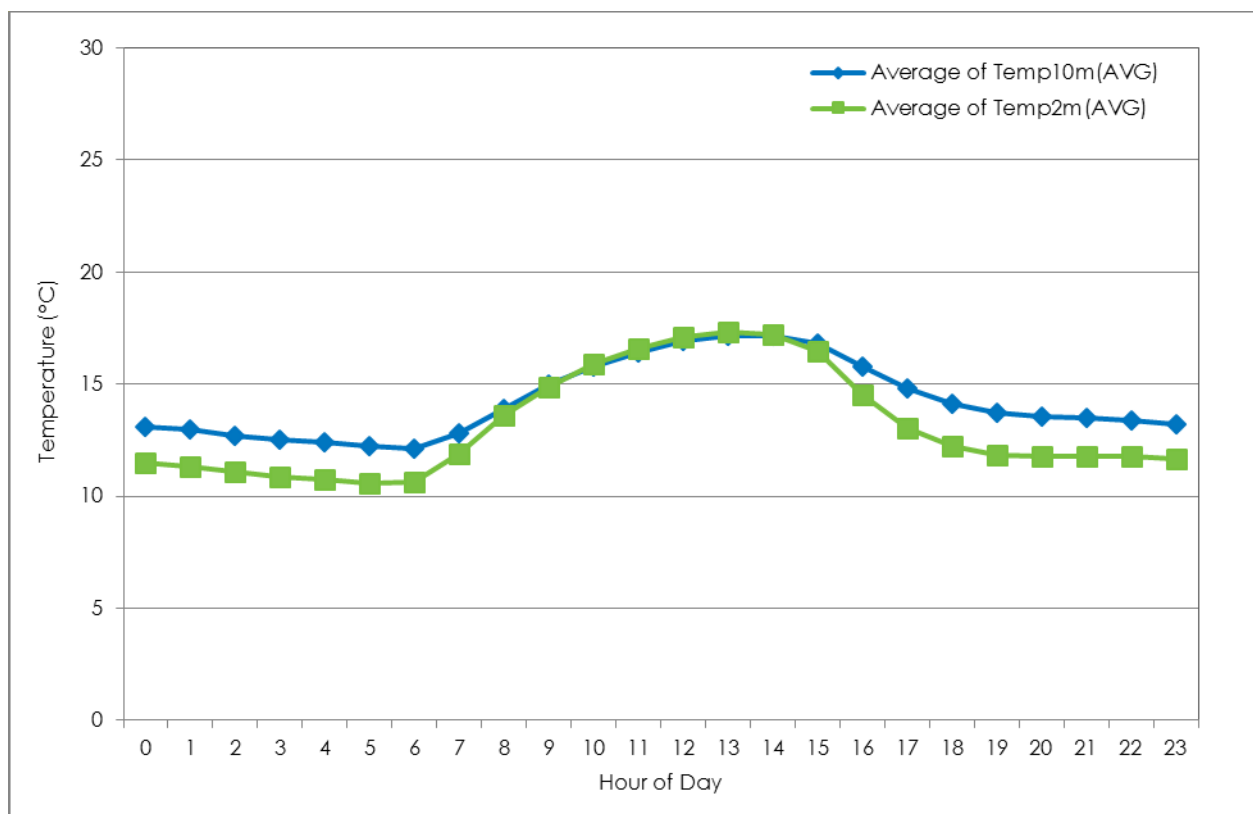


Figure 3-2: Hourly Average Temperature – July to September 2016

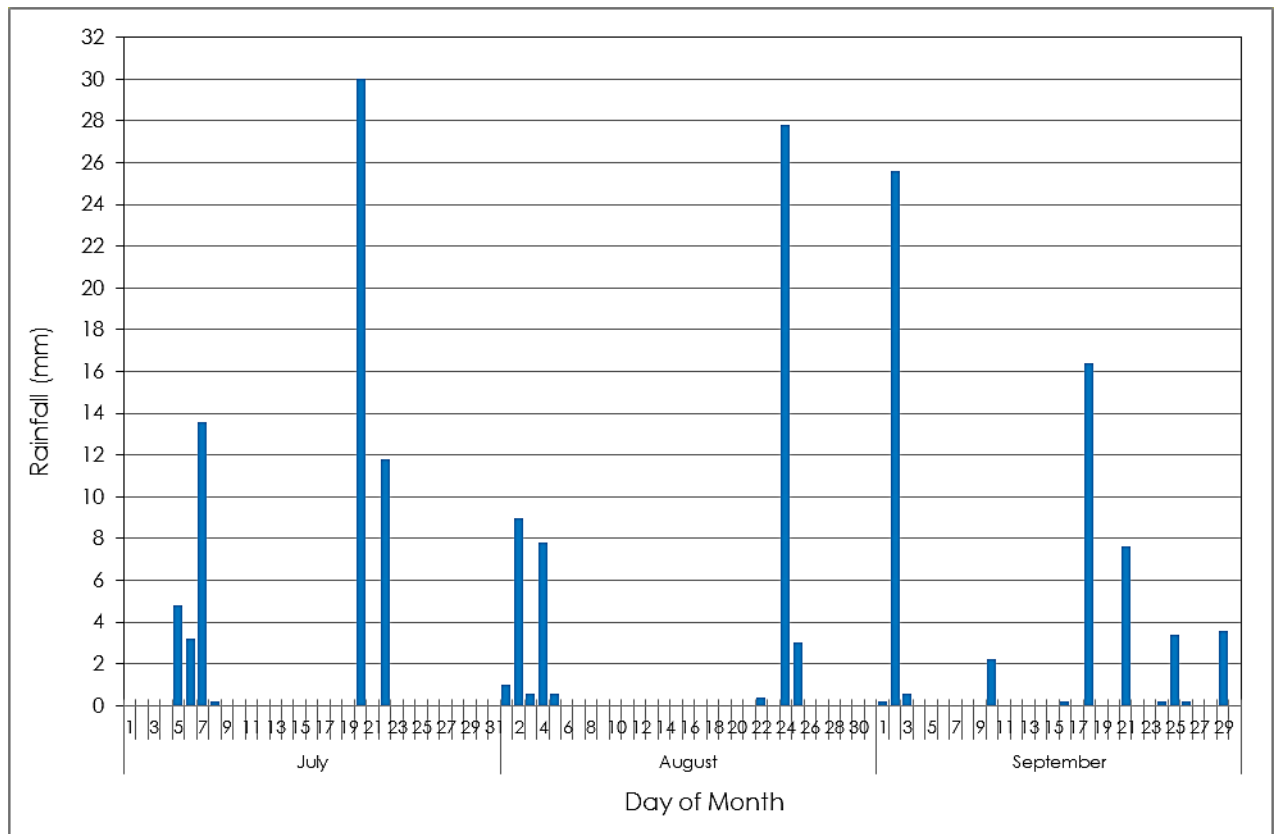


Figure 3-3: Daily Rainfall (July to September)

4 PM₁₀ MONITORING RESULTS

Continuous air quality particulate monitoring is carried out at BAM monitoring station located on or near the site boundary (**Figure 1-1**). The monitor continuously measure airborne particulate matter from all sources.

The particle size ranges relevant to this report are described as PM₁₀ which refers to all particles with equivalent aerodynamic diameters of less than 10 µm, that is, all particles that behave aerodynamically in the same way as spherical particles.

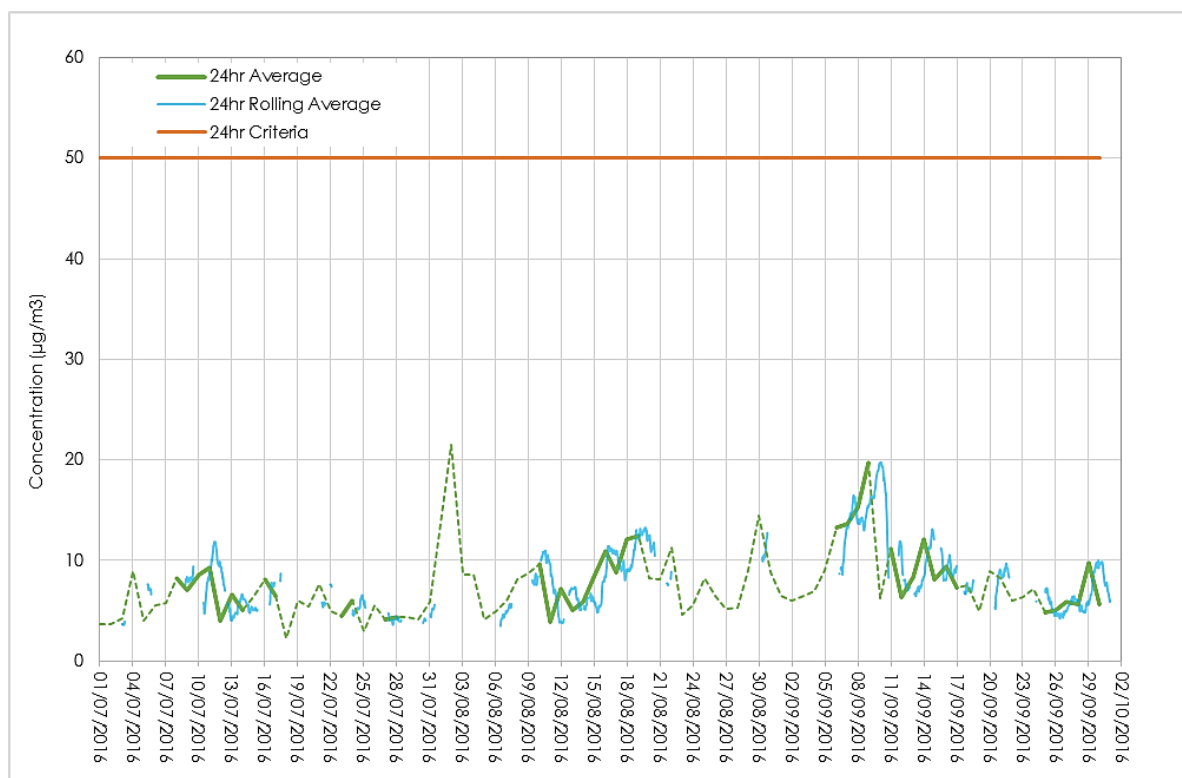
A statistical summary of the 24- hour average monitoring data collected during July to September is provided in **In accordance** with the data validation process, PM₁₀ readings are compared with PM_{2.5} readings for the same period. PM_{2.5} refers to all particles with equivalent aerodynamic diameters of less than 2.5 µm, therefore PM_{2.5} will always be less than or equal to PM₁₀ for the same period. Low data recovery (48%) was a result of excluding 1 hour average PM₁₀ values lower than PM_{2.5} values.

Table 4-1. The data recovery rate was 48%. There were no days over the criteria in the quarter.

In accordance with the data validation process, PM₁₀ readings are compared with PM_{2.5} readings for the same period. PM_{2.5} refers to all particles with equivalent aerodynamic diameters of less than 2.5 µm, therefore PM_{2.5} will always be less than or equal to PM₁₀ for the same period. Low data recovery (48%) was a result of excluding 1 hour average PM₁₀ values lower than PM_{2.5} values.

Table 4-1: Summary Statistics for 24 hour average PM₁₀ (µg/m³)

Statistical measure	July 2016	August 2016	September 2016	Quarter 3 2016
Mean	6.0	7.9	10.8	8.0
Standard Deviation	1.8	2.7	3.8	3.4
Median	4.0	0.0	6.3	7.1
Minimum	3.7	3.9	6.3	3.7
Maximum	9.3	12.5	19.7	19.7
Days over the criteria	0	0	0	0



Note: Dashed line denotes results where less than 75% of the expected samples in the 24 hour averaging period are available.

Figure 3-1: PM₁₀ Monitoring Data

5 NOISE MONITORING RESULTS

Noise is monitored using continuous unattended ambient noise monitoring and attended compliance noise monitoring.

Noise monitoring for compliance was carried out by Pacific Environment during this quarter, details of attended compliance monitoring and rail noise monitoring are included in a separate september noise compliance report.

5.1 Unattended Noise Measurements

One permanent ambient noise monitors continuously monitor noise levels from all sources at the location (**Figure 1-1**) near the site boundary.

Table 5-1 presents NMT1 $L_{A1,15 \text{ min}}$ recovery data percentages for during this quarterly period.

Table 5-1: NMT1 $L_{A1,15 \text{ min}}$ Recovery Data Percentages July - September 16

NMT1	Recovery Data (%)
July	99
August	5 ¹
September	100

Notes: 1. Equipment failures occur during this period

A summary of the unattended noise monitoring is presented in **Table 5-2**. Noise monitoring is expressed in three descriptors as follows:

- c) $L_{eq \text{ AP}}$ - The all-pass equivalent continuous energy average noise level. This descriptor represents the same energy as the actual fluctuating noise level over the measurement period.
- d) $L_{eq \text{ LP}}$ - The low-pass equivalent continuous energy average noise level. This is the same as the $L_{eq \text{ AP}}$ except that a frequency filter has been applied and excludes noise above the 800Hz third octave frequency band.
- e) RBL – The rating background level (RBL) as defined within the Industrial Noise Policy. The RBL is defined as the median of each assessment background level (ABL). The ABL is the lowest tenth percentile L_{90} measurement for each period (day, evening and night) for the duration of the monitoring. The L_{90} is the noise level exceeded for 90% of the measurement period.

The results in are presented in the following time periods:

- Day - 7.00am to 6.00pm;
- Evening - 6.00pm to 10.00pm; and
- Night - 10.00pm to 7.00am.

Table 5-2: July - September 2016 Noise Monitoring Average Summary, dB(A)

NMT1	Day			Evening			Night		
	$L_{eq \text{ LP}}^1$	$L_{eq \text{ AP}}^2$	RBL ³	$L_{eq \text{ LP}}$	$L_{eq \text{ AP}}$	RBL	$L_{eq \text{ LP}}$	$L_{eq \text{ AP}}$	RBL
July	47	52	36	46	50	34	44	49	33
August	43	48	39	42	44	36	43	45	30
September	48	51	38	41	44	36	41	46	35

Note: 1. $L_{eq \text{ LP}}$ is the L_{eq} with a low pass filter applied at the 800Hz third octave band.
 2. $L_{eq \text{ AP}}$ is L_{eq} All Pass with no frequency filter applied.
 3. RBL is the rating background level according to the Industrial Noise Policy.

The daily noise monitoring results for NMT 1 are presented in **Table 5-5**, **Table 5-6** and **Table 5-7**. The daily noise monitoring results are expressed as a logarithmic average of each measured $L_{eq,15min}$ during each period and the ABL.

The unattended noise monitors also record $L_{A1,15min}$ levels continuously at both locations. The $L_{A1,15min}$ represents short noise events and is the noise level exceeded for 1% of 15 minutes. A summary of the $L_{A1,15min}$ levels is presented in **Table 5-3**.

Table 5-3: January – March 2016 $L_{A1,15min}$ Noise Monitoring Summary, dB(A)

NMT1	$L_{A1,15min}$ Maximum dB(A)	$L_{A1,15min}$ Average dB(A)	$L_{A1,15min} > 52$ dB(A) night time (%)
July	92.9	62.9	90
August	77.1	58.9	50
September	110.7	59.7	57

The noise limits at the site apply for wind speeds less than 3 m/s. **Table 5-4** presents monthly percentages that wind speeds more than 3 m/s occurred from WTX monitoring data during this quarterly period.

Table 5-4: Wind Speed Exceedances Percentages July - September 2016

WTX	Exceedances (%)
July	48
August	46
September	40

Table 5-5: NMT1 July Daily Noise Monitoring Results

Date	Day			Evening			Night		
	Leq,11hr LP ¹	Leq,11hr AP	ABL ²	Leq,4hr LP	Leq,4hr AP	ABL	Leq,9hr LP	Leq,9hr AP	ABL
1/07/2016	49	53	38	48	52	46	48	52	40
2/07/2016	44	49	32	43	47	36	41	45	34
3/07/2016	40	47	33	33	36	32	35	42	31
4/07/2016	45	49	36	46	48	33	34	43	30
5/07/2016	42	48	34	47	51	42	47	51	39
6/07/2016	53	57	47	41	45	37	39	44	33
7/07/2016	42	50	37	38	41	36	36	40	34
8/07/2016	40	49	36	38	42	37	33	42	33
9/07/2016	37	48	34	36	39	33	33	41	31
10/07/2016	38	48	35	34	38	34	36	43	32
11/07/2016	46	51	41	37	41	33	37	43	32
12/07/2016	45	49	35	40	44	33	41	46	31
13/07/2016	57	60	37	54	57	37	52	55	45
14/07/2016	48	52	36	54	57	48	51	55	49
15/07/2016	45	50	36	38	41	34	33	42	31
16/07/2016	38	46	33	34	41	31	33	43	29
17/07/2016	38	47	33	34	40	33	35	44	30
18/07/2016	38	48	34	50	54	34	50	54	42
19/07/2016	46	51	41	45	46	43	42	46	40
20/07/2016	40	49	37	36	41	35	36	41	32
21/07/2016	40	50	35	37	43	37	48	52	43
22/07/2016	41	49	38	40	46	36	42	47	34
23/07/2016	49	53	39	38	41	32	47	51	29
24/07/2016	40	46	34	38	41	33	42	47	33
25/07/2016	49	53	38	34	38	30	38	43	31
26/07/2016	46	50	36	35	38	30	38	43	30
27/07/2016	52	56	44	53	57	39	49	53	36
28/07/2016	46	51	36	50	54	42	41	45	35
29/07/2016	47	51	41	46	49	39	37	43	30
30/07/2016	45	51	38	35	38	33	34	40	30
31/07/2016	38	50	35	-	-	-	-	-	-
Log Avg	47	52	38	46	50	39	44	49	38
Median	45	50	36	38	43	34	39	44	33
Max	57	60	47	54	57	48	52	55	49
Min	37	46	32	33	36	30	33	40	29

Note: 1. LP=Low Pass, AP= All Pass

2. ABL is the Assessment Background Level and represents the lowest tenth percentile L₉₀ measured during the period.

Table 5-6: NMT1 August Daily Noise Monitoring Results

Date	Day			Evening			Night		
	Leq,11hr LP ¹	Leq,11hr AP	ABL ²	Leq,4hr LP	Leq,4hr AP	ABL	Leq,9hr LP	Leq,9hr AP	ABL
1/08/2016	-	-	-	-	-	-	-	-	-
2/08/2016	-	-	-	-	-	-	-	-	-
3/08/2016	-	-	-	-	-	-	-	-	-
4/08/2016	-	-	-	-	-	-	-	-	-
5/08/2016	-	-	-	-	-	-	-	-	-
6/08/2016	-	-	-	-	-	-	-	-	-
7/08/2016	-	-	-	-	-	-	-	-	-
8/08/2016	-	-	-	-	-	-	-	-	-
9/08/2016	-	-	-	-	-	-	-	-	-
10/08/2016	-	-	-	-	-	-	-	-	-
11/08/2016	-	-	-	-	-	-	-	-	-
12/08/2016	-	-	-	-	-	-	-	-	-
13/08/2016	-	-	-	-	-	-	-	-	-
14/08/2016	-	-	-	-	-	-	-	-	-
15/08/2016	-	-	-	-	-	-	-	-	-
16/08/2016	-	-	-	-	-	-	-	-	-
17/08/2016	-	-	-	-	-	-	-	-	-
18/08/2016	-	-	-	-	-	-	-	-	-
19/08/2016	-	-	-	-	-	-	-	-	-
20/08/2016	-	-	-	-	-	-	-	-	-
21/08/2016	-	-	-	-	-	-	-	-	-
22/08/2016	-	-	-	-	-	-	-	-	-
23/08/2016	-	-	-	-	-	-	-	-	-
24/08/2016	-	-	-	-	-	-	-	-	-
25/08/2016	-	-	-	-	-	-	-	-	-
26/08/2016	-	-	-	-	-	-	-	-	-
27/08/2016	-	-	-	-	-	-	-	-	-
28/08/2016	-	-	-	-	-	-	-	-	-
29/08/2016	-	-	-	-	-	-	-	-	-
30/08/2016	43	48	39	38	41	33	38	43	30
31/08/2016	44	49	39	44	46	39	46	46	-
Log Avg	43	48	39	42	44	37	43	45	30
Median	43	48	39	41	44	36	42	45	30
Max	44	49	39	44	46	39	46	46	30
Min	0	0	0	0	0	0	0	0	0

Note: 1. LP=Low Pass, AP= All Pass

2. ABL is the Assessment Background Level and represents the lowest tenth percentile L₉₀ measured during the period.

3. - Monitor offline due to instrument problems.

Table 5-7: NMT1 September Daily Noise Monitoring Results

Date	Day			Evening			Night		
	Leq,11hr LP ¹	Leq,11hr AP	ABL ²	Leq,4hr LP	Leq,4hr AP	ABL	Leq,9hr LP	Leq,9hr AP	ABL
1/09/2016	45	49	40	42	43	38	42	45	39
2/09/2016	44	50	38	39	42	37	38	44	37
3/09/2016	51	55	41	42	45	40	42	47	36
4/09/2016	42	48	36	38	41	35	39	44	31
5/09/2016	43	47	38	39	43	35	37	44	31
6/09/2016	44	48	40	38	43	37	37	42	29
7/09/2016	43	47	39	39	43	40	39	46	35
8/09/2016	43	48	37	39	44	40	37	42	31
9/09/2016	46	51	41	40	45	39	39	45	34
10/09/2016	45	49	38	44	47	41	48	53	37
11/09/2016	40	45	32	36	40	32	37	43	31
12/09/2016	43	48	35	35	40	30	35	41	28
13/09/2016	42	46	37	39	42	37	38	43	35
14/09/2016	57	61	39	40	44	39	40	44	33
15/09/2016	52	55	40	41	43	35	48	51	35
16/09/2016	46	50	38	43	45	32	42	44	39
17/09/2016	45	49	39	43	45	39	40	43	37
18/09/2016	42	47	37	39	40	35	40	44	36
19/09/2016	50	54	44	41	43	36	44	48	39
20/09/2016				38	41	36	38	41	34
21/09/2016	47	52	37	39	41	34	41	44	33
22/09/2016	48	51	41	43	47	41	41	48	36
23/09/2016	45	49	38	39	43	33	36	41	30
24/09/2016	44	47	36	36	43	34	37	41	30
25/09/2016	41	46	32	40	43	36	38	43	36
26/09/2016	45	48	36	46	48	40	43	45	39
27/09/2016	48	51	40	41	44	35	42	45	35
28/09/2016	47	50	39	41	43	38	40	43	36
29/09/2016	43	47	36	37	40	29	38	42	
30/09/2016	47	51	28	47	51	37	44	48	39
Log Avg	48	51	39	41	44	37	41	46	35
Median	45	49	38	40	43	36	39	44	35
Max	57	61	44	47	51	41	48	53	39
Min	40	45	28	35	40	29	35	41	28

Note: 1. LP=Low Pass, AP= All Pass

2. ABL is the Assessment Background Level and represents the lowest tenth percentile L₉₀ measured during the period.

3. - Monitor offline due to instrument problems.

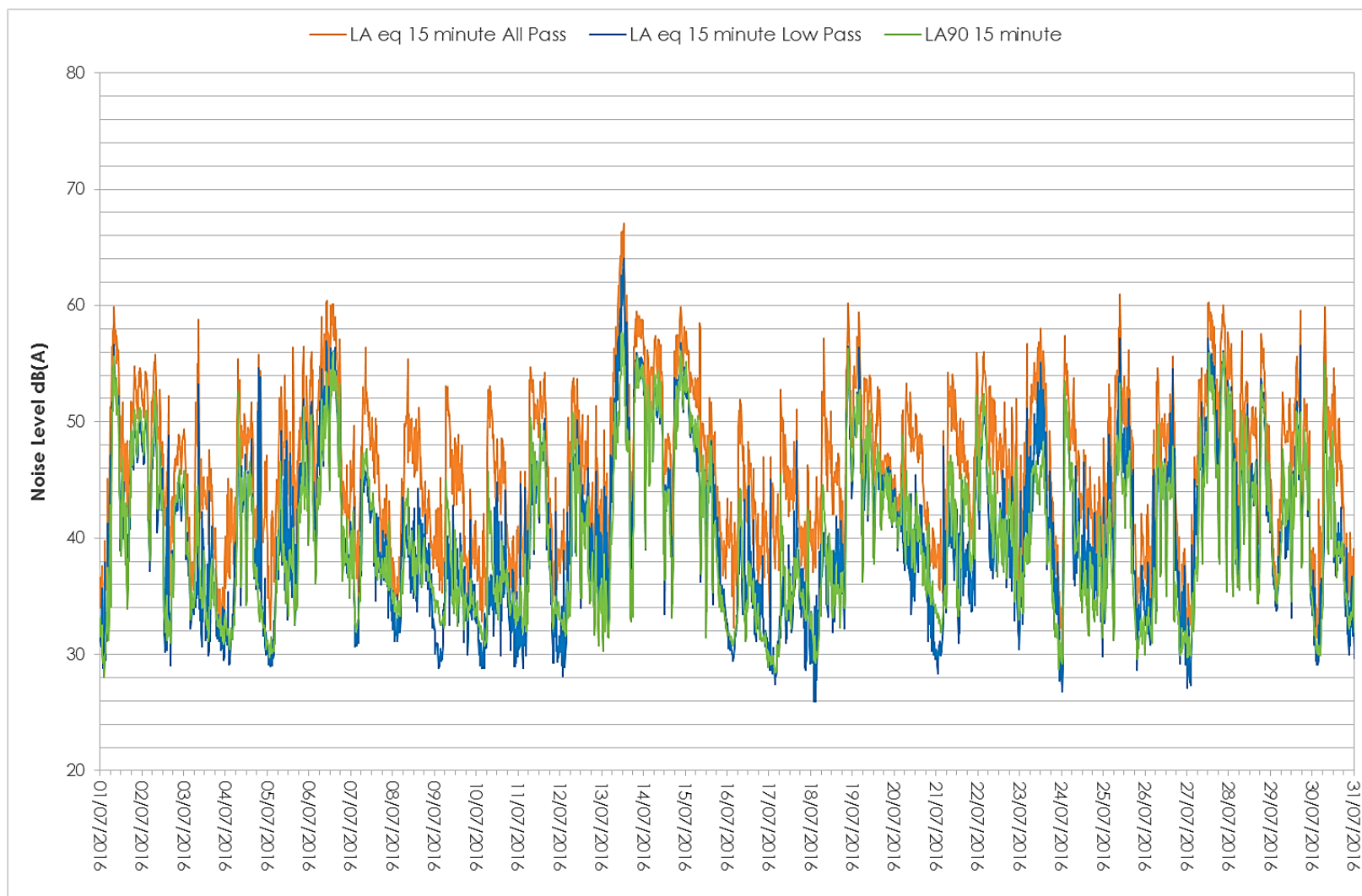


Figure 5-1: NMT3 Noise Monitoring Results – July 2016

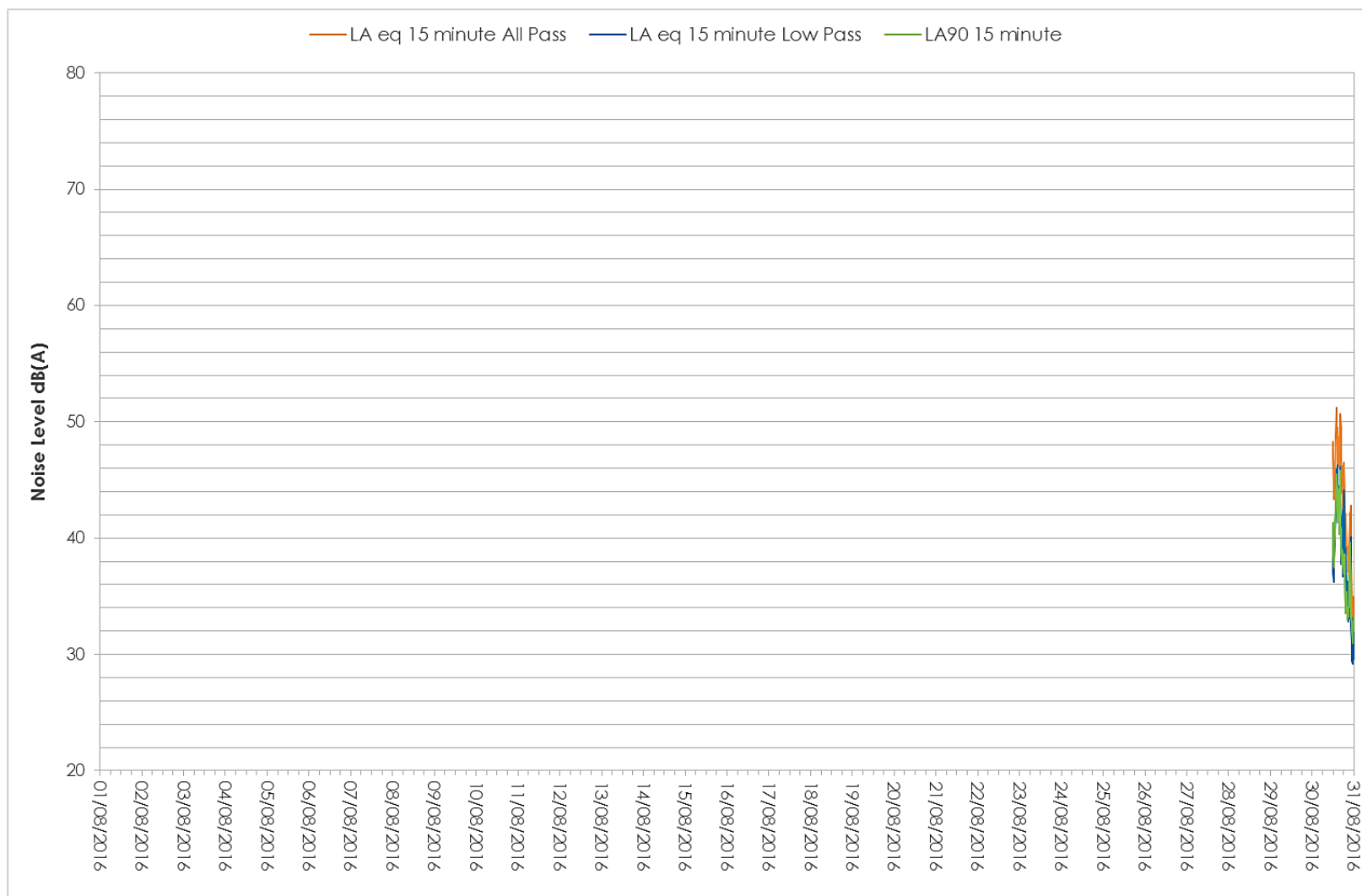


Figure 5-2: NMT3 Noise Monitoring Results – August 2016

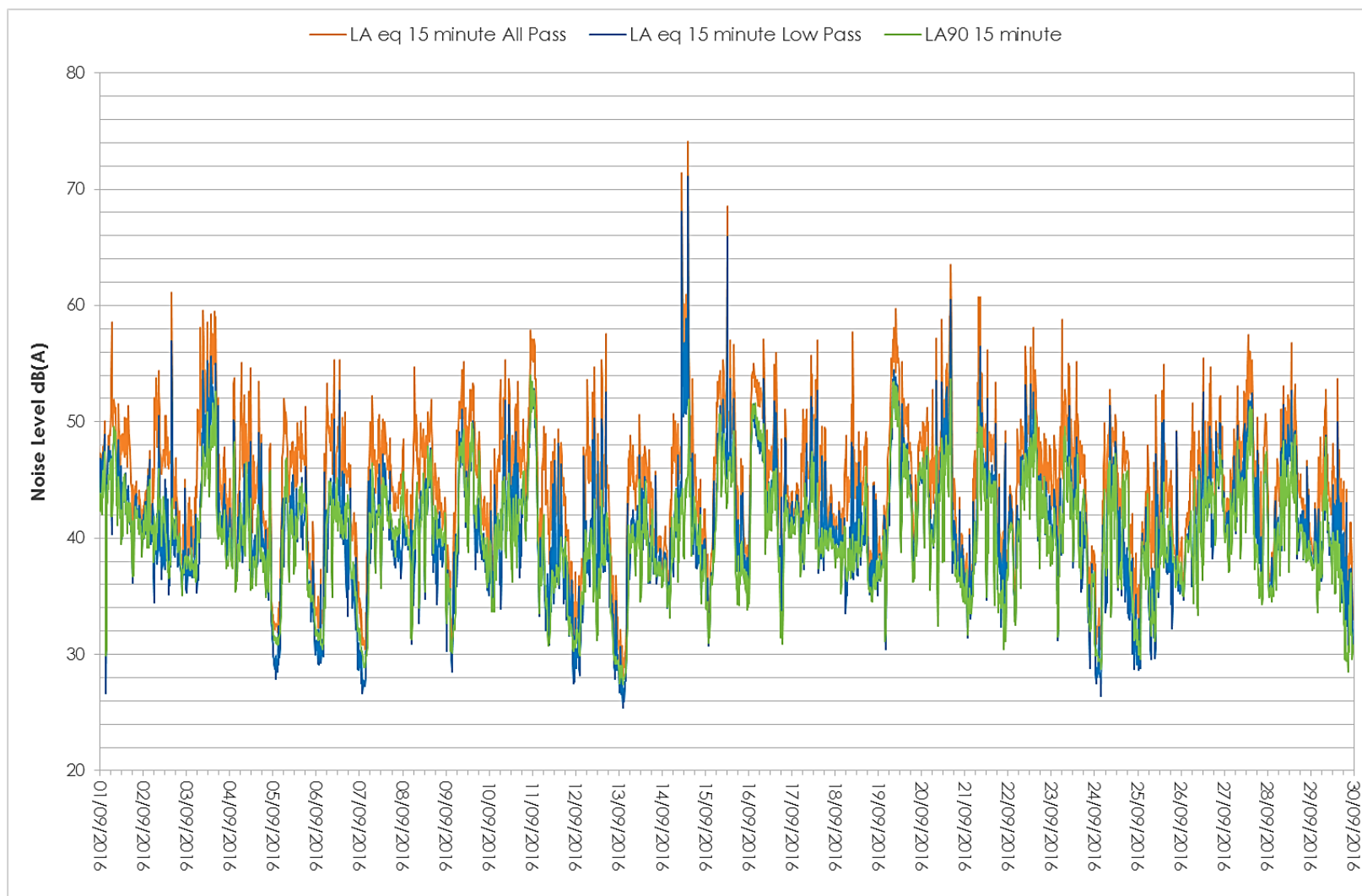


Figure 5-3: NMT3 Noise Monitoring Results – September 2016

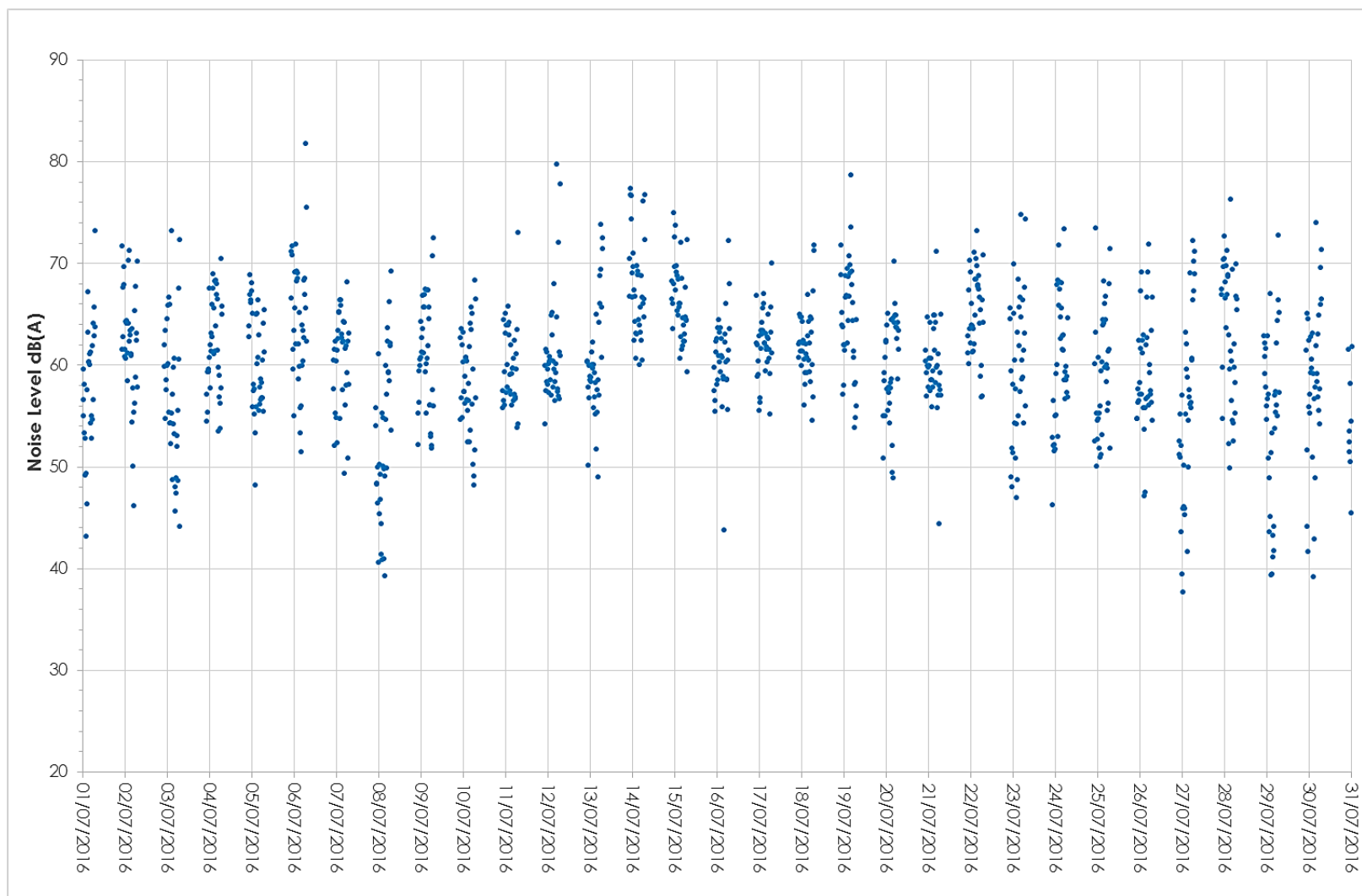


Figure 5-4: L_{1,15minute} (night time only) NMT3 Noise Monitoring Results – July 2016

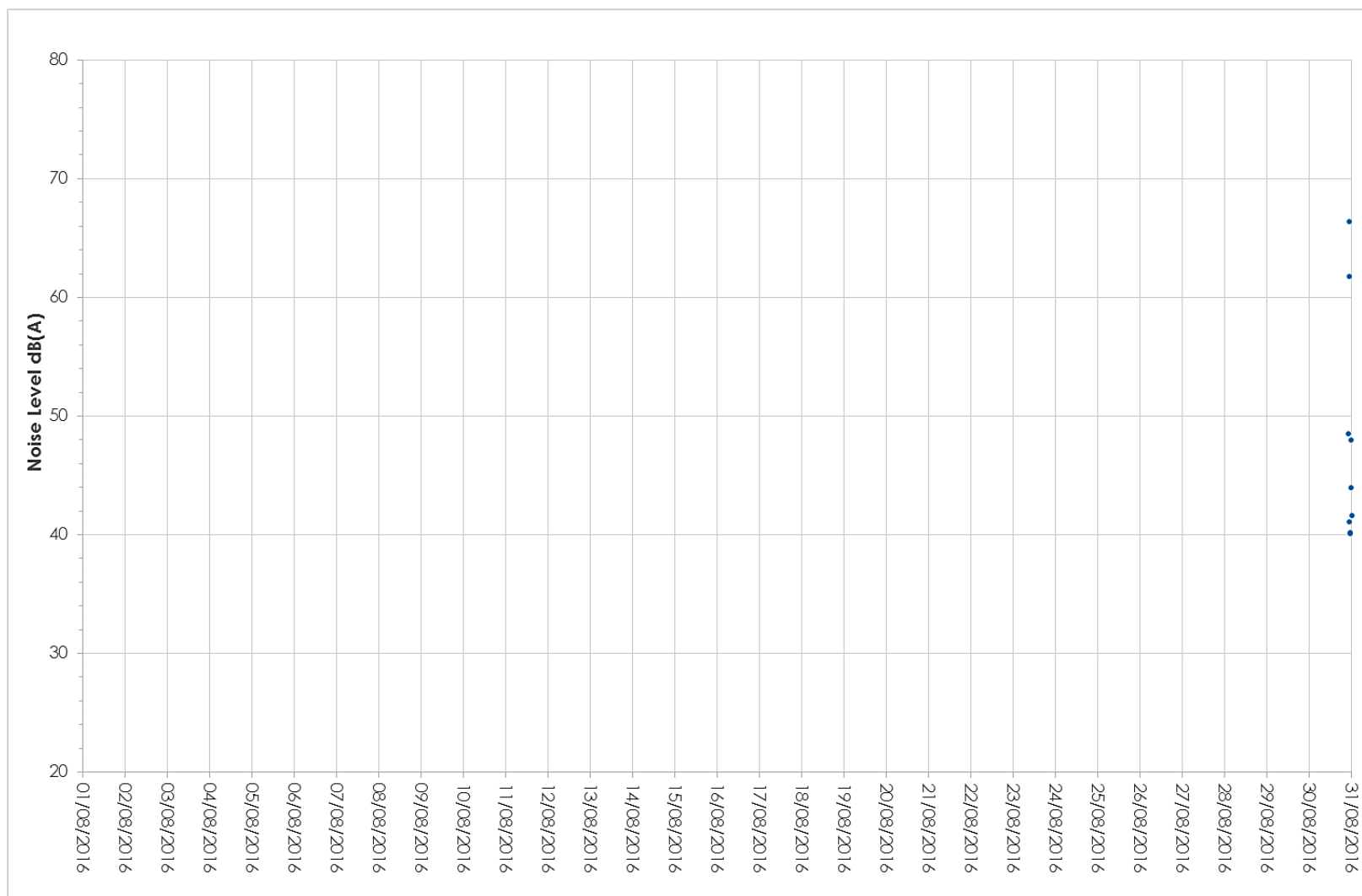


Figure 5-5: $L_{1,15\text{minute}}$ (night time only) NMT3 Noise Monitoring Results – August 2016

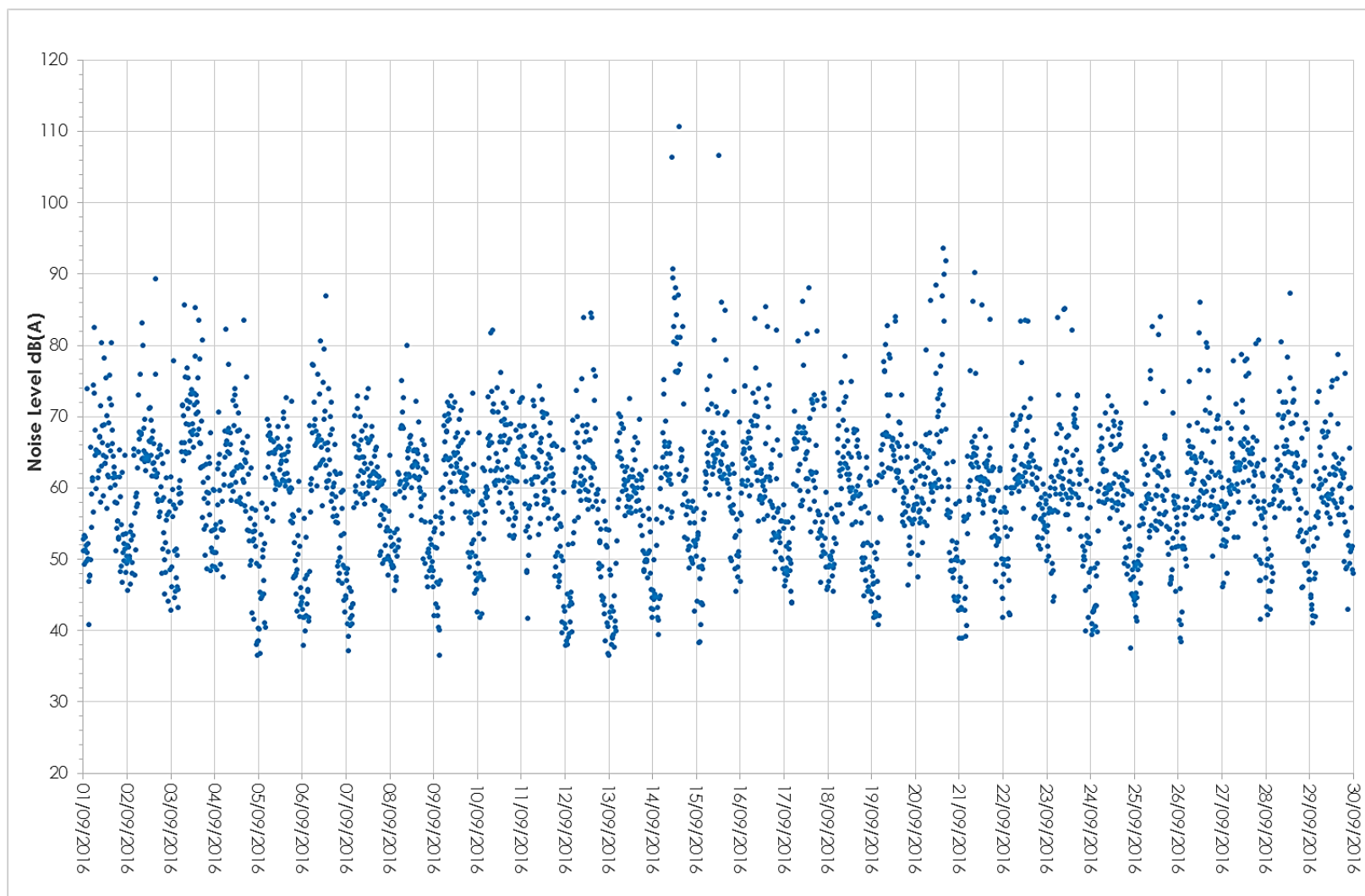


Figure 5-6: L_{1,15minute} (night time only) NMT3 Noise Monitoring Results – September 2016

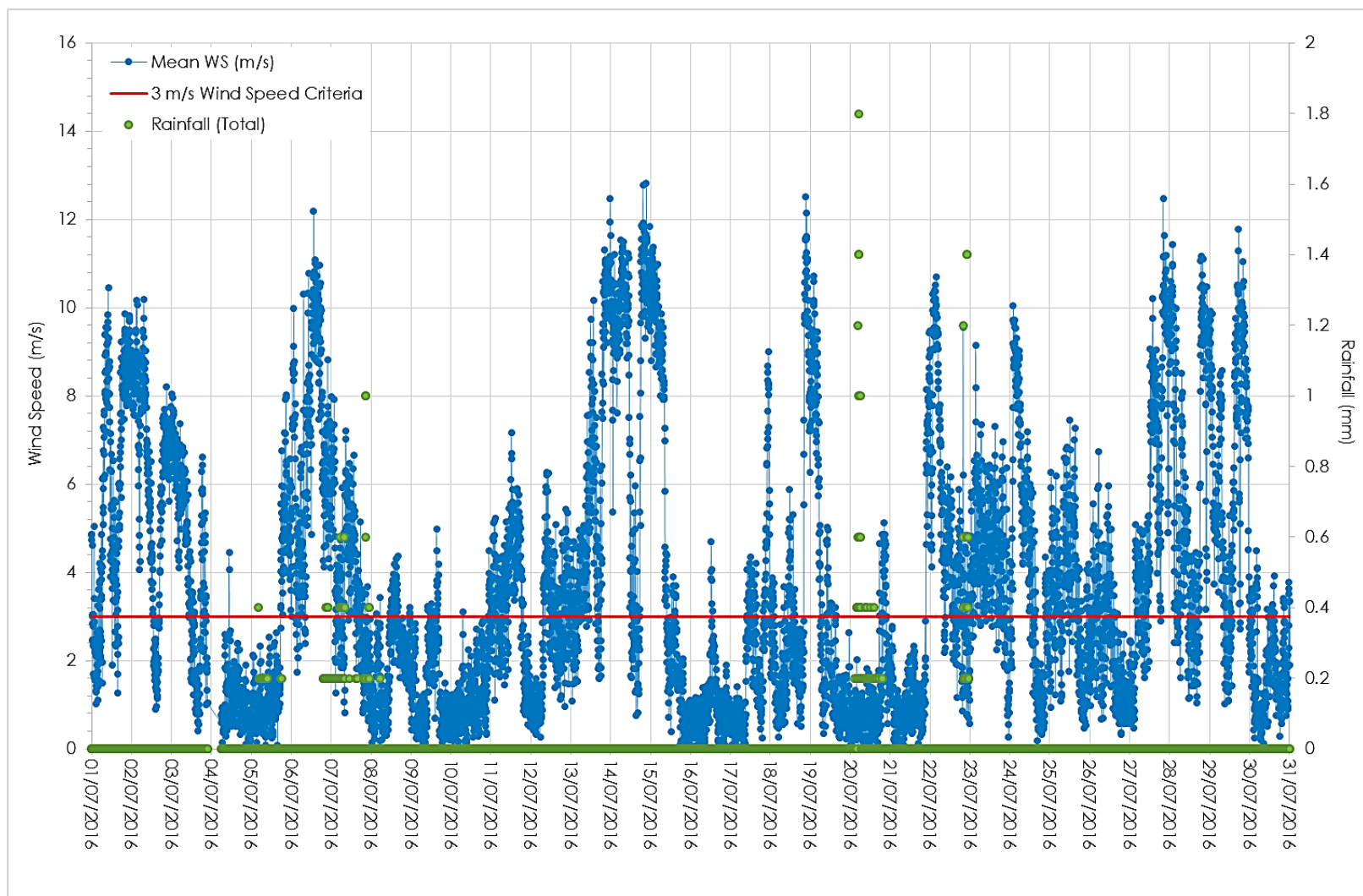


Figure 5-7: Wind Speed and Rainfall Monitoring Data – July 2016

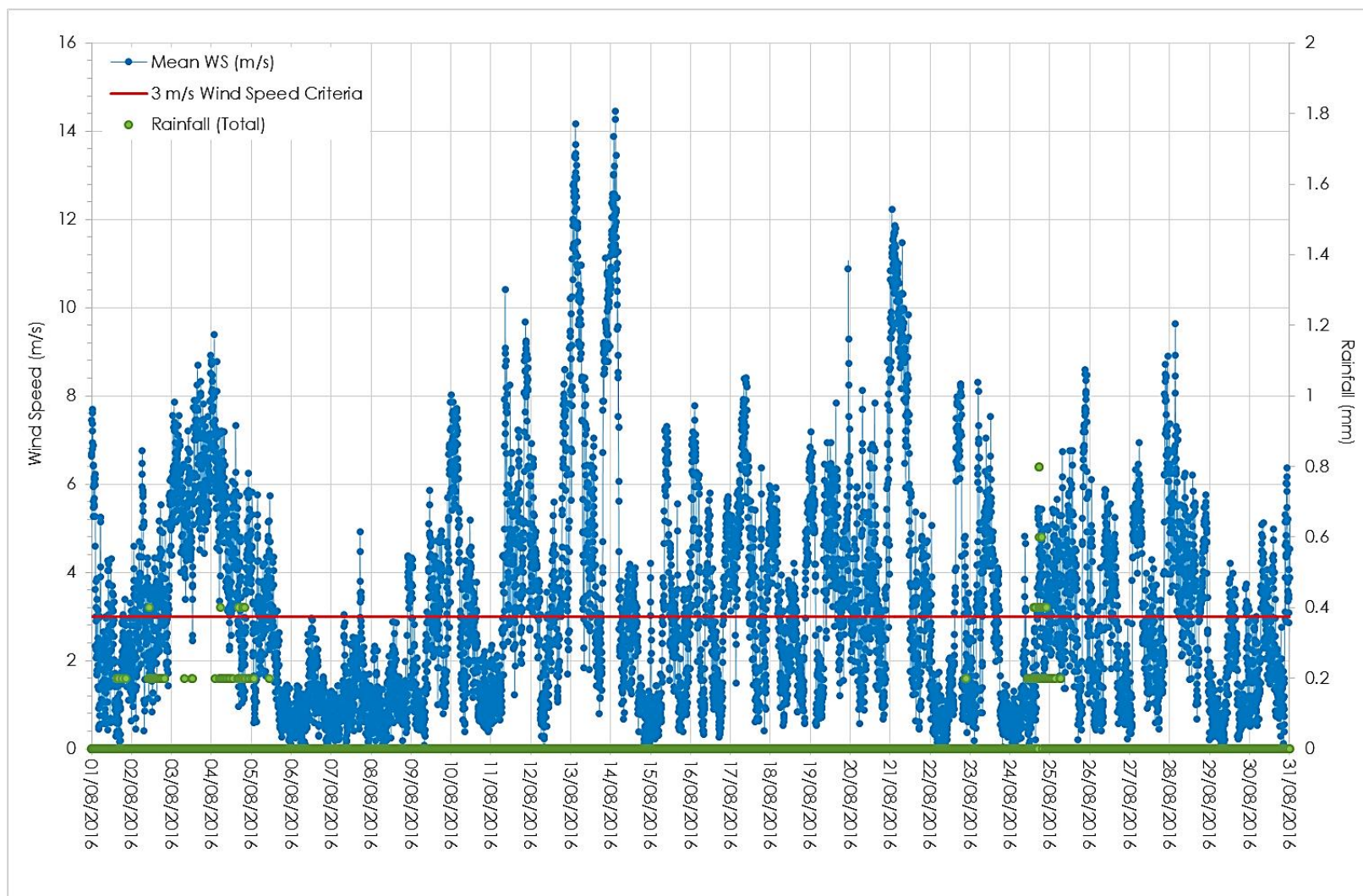


Figure 5-8: Wind Speed and Rainfall Monitoring Data – August 2016

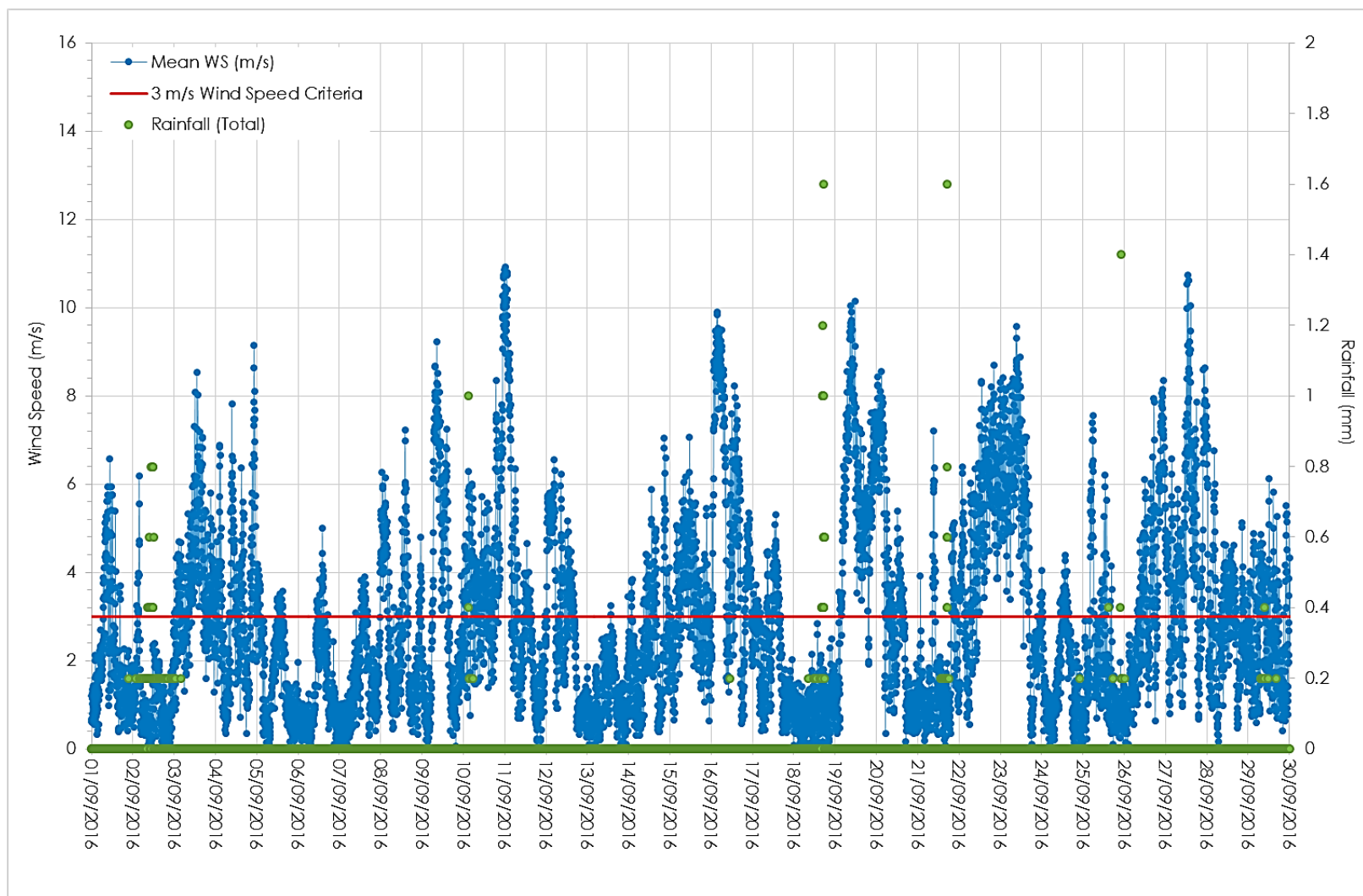


Figure 5-9: Wind Speed and Rainfall Monitoring Data – September 2016

5.2 Attended Noise Measurements and Rail Spur Noise

Whilst operational, attended noise measurements are carried out once every three months to establish compliance with the site's noise limits at compliance locations surrounding the site and adjacent the rail spur during the day, evening and night.

Attended noise monitoring was carried out in September 2016, results of this monitoring are included in a separate noise compliance report.